FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Linksfield

PROPOSED MIXED USE DEVELOPMENT SITUATED ON PORTIONS 87, 148, 149 AND THE REMAINDER OF PORTION 1 OF THE FARM RIETFONTEIN 61 IR

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EXECUTIVE SUMMARY

INTRODUCTION

The Gauteng Department of Human Settlements (The Applicant), in collaboration with a private sector partner, is planning to develop a mixed-use township. Bokamoso Landscape Architects and Environmental Consultants CC was appointed to compile an Environmental Impact Assessment Report (EIAR) for the proposed Linksfield Mixed-Use development and its associated activities. The Report has been prepared to comply with Section 24 of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998). The proposed Linksfield Mixed Use development is situated on the Remainder of Portion 1 of the Farm Rietfontein 61JR, Gauteng Province. The study area is approximately 271,57 hectares, however the actual development area measures approximately 194,99 hectares.

The purpose of the EIA (Environmental Impact Assessment) process was to investigate, analyse and assess the bio-physical, social, economical and institutional environments associated with the proposed development and to identify issues/impacts that require mitigation or potential "fatal flaws" that could prevent the project from happening. We updated the Draft EIA report after we received the comments from the I&APs. This Report represents the Final EIA for the proposed mixed-use development. Major amendments to the report/ additional information added are typed in red and in italics to highlight such changes/additions and amendments (the intention was to make the document more user-friendly and to prevent the wasting of valuable time on the reading of information already supplied in the Draft EIA Report).

The most significant issues that were raised by the public during the scoping and EIA phases include the following:

- Most of the members of the surrounding community are totally against the proposed target market and the high residential density that is proposed. The community is of the opinion that the "low cost housing" will have a negative impact on their

property values and that the development will eventually turn into a slum, where tenants sub-let and where crime originates;

- Lowering of property values, because the development will be a low cost development consisting of 8000 housing units;
- Such developments attract people with no money who turn to petty crime and then violent crime;
- The risks of Anthrax and tropical disease outbreaks if the topsoil and sub-soil layers are disturbed (mainly through air pollution and ground-and surface water pollution);
- Dormant bacteria in the soil;
- The loss of graves with high cultural and historical value;
- The disturbance of hazardous medical waste sites;
- Traffic congestion;
- Additional burden on services that are already stretched;
- Impacts in the already sub-standard roads;
- The development will be a squatter camp;
- Impacts of the construction phase can/will generate dust pollution which will pose a health implications on ill people residing in the area;
- Impacts on businesses and schools in the area;
- Ecological impacts and the potential destruction of wetlands;
- Impacts on the continuous open space system associated with the Jukskei River;
- Visual impacts, especially from the Rand Aid Development; and
- The proposed in-stream storm water attenuation is not regarded as an acceptable practise. On site attenuation is the better option.

In order to conduct a thorough impact assessment and to make informed conclusions and recommendations that promote sustainable development, it is extremely important that the EAP and the specialists appointed to conduct specialist surveys, remain independent at all times. The responsibilities of the EAP and the specialists are however carried-over to the delegated authority once the Final EIA is submitted and therefore it is extremely important that the EIA and the accompanying EMP contain information that will enable

the delegated authority to make an informed decision, which will promote sustainable development.

This complicated project incorporated many challenges and due to the serious nature of many of the impacts raised by the Interested and Affected Parties, it was very important to involve a team of suitably qualified specialists from the outset. The specialist reports and inputs did not only assist with the addressing and elimination of the issues/impacts, but such reports and inputs also contributed significantly to the production of a final development concept and layout for the proposed mixed-use development, which takes all of the environmental issues that were identified into consideration.

For the purpose of addressing the disease and graveyard issues that were raised it was also decided to establish a specialist forum and the purpose of the forum was to address the impacts raised in an integrated manner. The specialists that were appointed to form part of the specialist forum are:

- A pathologist Dr. E.D. Fourie M.B.Ch.B (UP), M Med Pathology (UP), MBL (UNISA) and member of: The South-African Medical Association; Infectious Diseases Society of South-Africa; Gauteng Conservancy and Stewardship Association; Archaeological Society, Transvaal; Paleontological Society, Pretoria (formerly a partner at Du Buisson and Partners Pathologists now retired);
- A soil scientist and wetland specialist for the identification of graveyards and forensic soil investigations into potential pathological risks associated with the development of the Linksfield site- Dr. Johan van der Waals, Senior lecturer at the University of Pretoria and owner of Terrasoil;
- A geotechnical Engineer Dr. J Louis van Rooy (Engineering Geologist PhD (Pret)-assistance with the identification of graveyards, landfill/waste sites and any other form of disturbance underneath the ground surface;
- **A geo-Hydrologist Dr. Mannie Levin** Pr Sci Nat PhD (Geohydrology) Senior geohydrologist at Aurecon Engineering);
- Dr. Henriette van Heerden (BSc Biological with Chemistry, Microbiology and Biochemistry, BSc Hons Microbiology, MSc Microbiology, PhD Plant Pathology (UP) Senior Lecturer at the University of Pretoria, Department Tropical Diseases and

Anthrax Specialist (currently the best in this field in South-Africa, since retirement of Dr. De Vos (also member of this team);

- Dr. Valerius De Vos A qualified veterinarian with a BSc (Honours) Degree in wildlife management. Awarded honorary Professorship at the Department of Tropical Diseases, University of Pretoria (1992-2007), more specifically also an anthrax specialist;
- Cultural and Historical Specialists Leonie Marais-Botes (BA (Cultural History and Archaeology) (UP), BA (Hons) Cultural History (UP), Post Grad Dip Museology (UP), Cert Conservation of Traditional Buildings (Univ of Canberra)Post Grad Dip: Heritage (Wits) in association with **Dr. A.C. van Vollenhoven** (BA, BA (Hons), DTO, NDM, MA (Archaeology) [UP], MA (Culture History) [US], DPhil (Archaeology) [UP], Man Dip [TUT], DPhil (History)[US], L Akad [SA] Identification of graveyards, cultural and historical features and historical buildings of significance

Other specialists, who did not form part of the disease specialist forum were also appointed to investigate the other issues that were highlighted by the Interested and Affected Parties (I&AP's) and relevant organs of state. These specialist reports (which included visual, traffic, biodiversity, wetland, market studies etc.) and findings are also attached as Annexures to this Final EIA Report.

THE MOST IMPORTANT FINDINGS:

GENERAL:

After Bokamoso advertised the project in the Scoping Phase I&APs immediately indicated that they are totally against the development of the study area. In the initial e-mails/ faxes/ verbal communication most of the I&APs stated that they were very concerned about the disease related health risks associated with the development, especially the construction related impacts when the upper soil layers are disturbed. Other parties also regarded the lack of services and the already congested roads in the area as a major problem.

Bokamoso and GDARD regarded the concerns raised by the I&APs as important and the applicant immediately agreed to appoint suitably qualified specialists to investigate and address all the issues raised by the I&APs. The applicant also appointed qualified civil and traffic engineers with many years' of experience to conduct the necessary traffic impact assessments and services reports.

Due to the thorough investigations that were conducted to address the issues raised by the public (many were very scientific of nature), it took more than 8 months to complete all the required specialist studies and inputs.

The appointed specialists eventually managed to prove that there are no or very low risks associated with the disease issue and all disease related specialists recommended that the project receive the go ahead from a disease point of view.

The specialists did not even regard it as necessary to compile separate disease risk management guidelines for the construction and operational phases of the project. GDARD requested in the approval of the Scoping Report that such a risk management plan be compiled, but as mentioned, the specialists did not regard it as necessary and therefore no risk management plan has been included. According to the specialists the risks of contracting diseases on the site are no higher than on the surrounding properties that were also affected by the anthrax outbreaks of the 1920s.

The traffic impact assessment and the services report indicated that it will be necessary to construct a significant number of new roads and many of the surrounding roads also require urgent upgrading in order to improve the road safety conditions and the current and future traffic flow in the area. The traffic impact assessment also proposed the implementation of new off and on-ramps in order to improve access to and from the N3 freeway. The proposed road upgradings will also alleviate the existing traffic conditions.

The services reports also identified all the services upgradings required to accommodate the proposed new development and to address the existing services issues in the area. The developer will be responsible for the upgrading of the roads and the services and the

specialist consultants appointed recommended that the project receive the go-ahead on the condition that the developer implement the roads and services upgradings as stipulated and identified in conjunction with the various authorities.

The nature of the issues raised by the surrounding residents however changed significantly after it was proved in the Draft EIA that it will be possible to mitigate all the potential impacts and issues raised by the I&APs to acceptable levels. The Draft EIA Report was made available to the public on 22 October 2014. Approximately 50 days of review time was allowed to read through the report and the associated specialist reports, which assisted with the addressing of the issues that were raised.

Bokamoso originally afforded the I&APs a comment period of 40 days (in line with the GDARD requirements), but this timeframe was extended in order to grant the I&APs some additional time for the finalisation of the comments after the two public meetings, which took place on 2 December 2014. The public meeting was originally arranged for 19 November 2014, but it was decided to rather re-schedule the meeting, because many of the I&APs complained about the proposed venue and the driving distance to the venue.

The public meeting consisted of both an afternoon and an evening session to allow for the public's different schedules and in order to accommodate the large numbers of I&APs expected to attend the meeting. A focus group meeting was also held at Rand Aid to present the findings to this community and receive their comments.

During the public meetings it became clear that the public's major concerns were not the disease issue or the bio-physical issues. The influx of lower income people into the area and the cumulative impacts of such an influx were regarded as the major issue. The proposed lower income housing raised more concerns than the other land-uses proposed for the study area. The visual impacts on the Rand Aid development, the visual and noise impacts of the north-south link road between the Edenvale Hospital and the eastern boundary of the Rand Aid Development and the lack of services and road capacity and maintenance were also listed. The disease issue, which was originally regarded as the major issue of

concern, did not really feature at the public meetings. Only limited discussions regarding the disease issue took place.

It is also evident from the public meeting as well as comments received from the public that only a small amount of people perused the Draft EIA Report and all the associated specialist reports. This was found very disappointing as a significant amount of work was put into this report and the studies attached thereto in order to address the issues raised by the I&APs.

It is also important to take note of the unruliness and aggression that was experienced from the public during the meetings. In the public meetings that were held, Bokamoso was interrupted whilst trying to describe the EIA process and whilst addressing the disease issue and other issues initially raised by the public.

People insisted that the land-uses proposed for the development rather be discussed. People indicated that they were not interested in the description of the EIA process. It became clear at the meetings that the surrounding residents are very emotional and afraid to agree to a development, which will include high density residential units that will cater for the lower income groups and that will cause the influx of people from a lower income group into the surrounding upmarket neighbourhoods.

According to the residents the proposed development will have a detrimental impact on their property values, the area will turn into a slum, sub-letting and overcrowded residential units with associated noise and air pollution will become a problem and the crime rates will increase. An audio recording of the meeting is available on request and will be attached as part of the Final EIA Report to be submitted to GDARD and the peer review panel.

Copies of the minutes of the meetings are also attached as part of the EIA Report. It was extremely difficult to compile the minutes, because a large number of the community members became aggressive, insulting, rude and refused to obey the rules of the meeting, which was stipulated before the meeting commenced. The presentations were interrupted

on an on-going basis and many personal and general insults against the EAP, specialists, developer and government were shouted out on an on-going basis.

This type of behaviour is regarded as unacceptable and it leaves the project team with no other choice but to restrict the remaining communication to written correspondence, which is limited to the issues associated with the mixed-use development and that are free of personal threats and insults.

The focus group meeting which was held at the Rand Aid development was however a fruitful one and the parties present at the meeting were very co-operative and accommodating.

Rand Aid also indicated that they are concerned about the impacts of the development on the qualitative environment (i.e. visual impacts, especially in the north-western corner of the study area where there is no open space) and the north-south stretching link road which runs in between the Edenvale Hospital and the eastern boundary of the Rand Aid development. A copy of the minutes of the focus group meeting at Rand Aid is also attached to the Final EIA.

To follow now is a brief description of the most important findings of the EIA process.

BIO-PHYSICAL ENVIRONMENT:

The study area is underlain by both mafic and granitic rocks and the excavations become difficult at approximately 1,5m. The main impacts associated with the low excavation depth and geological and soil characteristics of the study area are the possibility of perched water conditions in some areas, the possible need for blasting operations in areas where extensive excavation exercises are required and the fact that it would have been extremely difficult to bury animal carcasses or humans under such challenging geotechnical and soil conditions, especially many years ago when modern day mechanical equipment was not available yet.

After extensive research and surveys, the team of specialists could only identify three graveyards on the study area and it is regarded as highly unlikely that any other graveyards will be identified on the study area. The original hospital site was ±600ha in extent and two thirds of the study area is already covered with urban development.

The possibility of graveyards underneath the existing urban development that already took place on the study area, cannot be excluded, especially if one considers the fact that some of these areas are underlain with deeper soils, which are more suitable (from an excavation point of view) for the establishment of graveyards.

The possible occurrence of anthrax spores, was regarded as the only major disease related risk, but the acidic nature of the soils of the study area is not regarded as favourable for the co-existence of any anthrax spores or animal bones that are common carriers of such spores. Anthrax spores tend to thrive in higher-alkali soils. In order to confirm the possible occurrence of anthrax spores in the soils of the study area, soil samples (sourced from predetermined points on the study area (i.e. in the graveyards and downstream from ground water movement directions)) were tested and no signs of any of the historical diseases that were treated at the hospital, including anthrax were found.

The team of specialists however identified some TB DNA, which is most probably associated with sewer spillages of the existing hospital facility. The TB DNA in the soils, the groundwater (which daylights at the Jukskei River), and the water of the Jukskei River poses health risks to construction workers during the construction phase and it also poses risks to people that are in contact with the water of the Jukskei River, even if the development does not take place. This matter must therefore be addressed by the relevant parties as soon as possible.

The vegetation of the study area is regarded as disturbed, but two small wetland areas and the riparian vegetation adjacent to the Jukskei River were regarded as natural features with some ecological value and potential that are in urgent need of rehabilitation.

The wetland and vegetation specialists recommended that a continuous natural strip, which incorporates the riparian vegetation, the wetland areas and the watercourse buffers be conserved and that this open space strip be linked to the larger Gauteng open space system. When rehabilitated and protected, the seasonal wetland areas can be utilised by Giant Bullfrogs as breeding areas and the riparian zones can be used as movement corridors and linkages to nearby foraging areas associated with grasslands.

The vegetation specialists also identified a few *Trachyandra erythrorrhiza sp.* (according to GDARD records, red data plant species) in the north-eastern section of the study area, but it was recommended that the species be relocated to the riparian/ wetland zone, because the existing habitat is not regarded as ideal (not regarded as a wetland) and it was established that a vegetation specialist managed to successfully cultivate *Trachyandra erythrorrhiza* in his nursery. He confirmed that he also managed to grow many of these species in his garden and that it is possible to relocate the species to more suitable habitats on the study area. There are furthermore questions regarding the conservation status of this species (at the IUCN and GDARD). According to some specialists, this species must be removed from the GDARD list of red listed plant species and it is not listed on the IUCN list of red data species.

In the case of the study area, the social and economical value of the study area (mainly in terms of locality, accessibility, the availability of services, the desperate need for housing within the urban environment etc.) is regarded as equally important or even more important than the conservation of a few *Trachyandra erythrorrhiza sp.*, especially if one considers the fact that this species will eventually be subject to edge effects, the habitat is not regarded as ideal and the species can be relocated with success.

From a faunal point of view, the Half-collared Kingfisher has been observed along the Jukskei River in the past and is known to occur along this river system according to the SABAP2 data. The intention is however to rehabilitate and conserve the riparian zone along the Jukskei River and to link this zone as part of the larger regional open space system. The conservation and rehabilitation of this zone, if well planned and managed, will assist with habitat creation and it will promote the increase in bio-diversity. The Half-collared Kingfisher

will most probably move to the study area after the construction phase if the proposed rehabilitation plan takes the specific needs of this bird species into consideration.

Some mole activity (most probably the African Mole Rat, which is not a red data species) was spotted in the graveyards. The possible occurrence of the Rough Head Golden Mole was also considered, but it was regarded as highly unlikely. It is however not the intention to remove any of the graveyards from the study area. The plan is to renovate and protect the graveyards and to incorporate the graveyards as part of the development (i.e. a memorial garden).

The gardens of the graveyard can be planned to act as habitat for the moles on the study area. We already successfully managed to create a habitat for the Juliana Golden Mole in an office park along Lynnwood Road (to the north of the Bronberg) in Pretoria. Increased mole activity was detected during the last site visit and we can see no reason why this cannot be achieved in the gardens of the graveyard that will be maintained and protected as part of the development.

The continuous strip of natural open space associated with the watercourses on the study area will not be the only open space areas to be provided in the mixed-use development. Landscaped open spaces (i.e. parks, gardens, sport fields etc.) will also be provided in the various land-use clusters and the amount of open space required will be based in the open space determination formulas of the local authority (i.e. the amount of open space required per m² of residential, commercial etc.). The vegetation to be used in the open space areas will be indigenous, hardy and non-invasive.

SOCIAL AND ECONOMICAL ENVIRONMENT:

The most significant negative impacts associated with the proposed development are 1) the impacts on the services that are already stressed, 2) the impacts on the surrounding traffic, which is already congested, 3) the impact of the "lower income" development on the surrounding property values, the surrounding residents' quality of life (i.e. pollution

problems, over-crowded units, increased crime etc.), 4) the possible damage to or relocation of existing graves with cultural and historical value, 5) the possible demolition of historical buildings and structures and 6) the possible health impacts associated with the diseases that could become active once the soils of the study area are exposed.

It was however confirmed in the EIA Report that it will be possible to address/mitigate all the above-mentioned issues/impacts to acceptable and non-live-threatening levels. In fact, in some cases the application of the proposed mitigation measures will lead to long term environmental conditions that will be more advantageous than the current/"no-go" alternative. Diagrams 1 and 2 of this report motivate this statement.

The most significant positive social and economical impacts are 1) the provision of much needed housing within the urban environment, 2) job creation in close proximity of the housing to be provided, 3) the strategic locality of the study area in terms of accessibility and driving distance, 4) the upgrading of existing services and road infrastructure, 5) construction of new roads and the implementation of new services, 6) the optimum utilisation of services, 7) the generation of rates and taxes payable to the local authority, 8) the restoration and conservation of some of the heritage features on the study area; 9) the conservation of the existing graveyards, 10) addressing of all possible soil and water contamination, 11) the "opening-up" of land which has been placed in "quarantine" for many years due to uncertainties associated with the graves and diseases treated at the Sizwe Hospital, 12) social upliftment, 13) the provision of social facilities in close proximity to the residential component and 14) increased security.

From the above, it is clear that the positive socio-economic impacts associated with the proposed mixed-use development by far outweighs the negative impacts listed and which could be mitigated to acceptable levels.

INSTITUTIONAL ENVIRONMENT:

From an institutional point of view, it can be confirmed that the proposed mixed-use development will be in line with the relevant planning frameworks and policies as compiled

on a local and provincial level. The proposed development is furthermore in line with Gauteng's densification strategy, it prevents urban sprawl and it promotes conservation.

The project team appointed by the applicant also identified all the relevant authorisations, permits, licenses etc., which are required in terms of the applicable legislation, by-laws, policies etc. prior to commencement with the project and all the relevant specialists have already been appointed to compile and submit the required applications/ documents.

SUMMARY:

This complicated project incorporated many challenges and due to the serious nature of many of the impacts raised by the Interested and Affected Parties, it was very important to involve a team of suitably qualified specialists from the outset. The specialist reports and inputs did not only assist with the addressing and elimination of issues/impacts, but such reports and inputs also contributed significantly to the production of a final development concept and layout for the proposed mixed-use development, which takes all of the environmental issues that were identified into consideration. After the project team indicated (at the Draft EIA Stage of the project) that the disease, grave and services issues could be addressed, and where required, mitigated to acceptable levels, many of the objectors/surrounding residents were still not satisfied with the efforts made by the EAP, the developer, the project team and the specialists.

The focus of the objections was suddenly redirected and the potential impact of the "nature of the development" (a development that will also accommodate lower income groups) became the main issue of concern. At the public meetings objectors indicated that they were very concerned about the influx of lower income groups into the area. Crime, sub-letting, urban slums, the erection of illegal shacks, noise impacts, visual impacts, littering and the lowering of the surrounding property values are potential cumulative impacts associated with such a high density development, which will include housing units for the lower income market. The financial and ownership model of the developer also raised some serious concerns.

One of the surrounding residents indicated that she and her family were the victims in an armed robbery at their home. They are already very concerned about the security of the area and such a development will only increase the security risks of the area. We promised to meet with this I&AP in order to discuss her issues and concerns in more detail and on a personal level. After the meeting we will propose (if possible) mitigation measures to address the issues raised by this I&AP. A separate letter will be supplied to GDARD within the next 30 days in order to supply feedback regarding the discussions and agreements made with the I&AP. If required, the EMP will also be amended to incorporate additional mitigation measures.

The Rand Aid residents indicated that the development caters for the elderly and that the residents of the development currently enjoy a "crime free" environment with a tranquil atmosphere and attractive views. Elderly people are vulnerable and also very susceptible to dust pollution, noise pollution and other potential impact that could be triggered by the construction phase of the development. Rand Aid requested that the developer implement measures to reduce the visual impacts on their development, especially in the north-western corner of the study area and suitable mitigation measures must also be proposed for the reduction of crime and noise levels. The potential lack of services and the increased traffic on the already congested roads were also serious concerns that were raised from the outset. People have little trust in government's capability to upgrade and maintain services. The current electricity capacity problems experienced at Eskom emphasizes the serious services and maintenance problems experienced and only contribute to the country's services problems.

Obviously the concerns of the surrounding residents cannot be ignored. The tax paying residents also invest substantial amounts of private money into the upgrading of the security of their neighbourhoods and houses and cannot afford developments that increase the crime risks of the area. An aspect that is very concerning is the fact that the development will be implemented in phases over a period of 8 years. Construction activities are often associated with crime, temporary services and access disruptions, dust pollution, noise pollution, visual pollution, illegal dumping, illegal squatters etc. and it will be

a challenge to manage the construction related impacts associated with the various phases throughout the 8 years.

The PPP formed to plan, implement and manage the project however differentiates this project from other public sector housing projects. A private partner will invest large sums of money into the development and will also be responsible for the planning, implementation, management, monitoring and maintenance of the project. The private development will furthermore remain the owner of the residential units and strict security and monitoring measures will be implemented to protect their valuable assets. The developer will also provide the funding for the much needed upgrading of the services and the roads and therefore the upgrading of the services, to acceptable standards, are guaranteed. This action will promote urban renewal and the optimum utilisation of services.

Reality is that government **must** provide a large number of housing units and "lower income residential units" are being erected across Gauteng (with or without private partners). The strategic locality and the size of the Linksfield study area, however creates a unique opportunity for a mixed-use development that will create many jobs and promote sustainable development. The project will however only be successful if it is well planned and managed and government specifically selected a developer with ample development experience to assist with the achievement of the goals and objectives set for the project.

As environmental consultants we can confirm that there are no "fatal flaws" associated with the study area and its surroundings that could prevent the project from happening. We furthermore confirm that we feel confident and satisfied that all the potential negative environmental issues/impacts as listed by the I&APs, the specialists, authorities and Bokamoso can be addressed and mitigated to levels that are acceptable. We also attended the bi-weekly project meetings during which the various layout and land-use alternatives were discussed and it can also be confirmed that all the site sensitivities were taken into consideration with the finalisation of the layout.

If the proposed development is well planned, managed and implemented in accordance with the guidelines and mitigation measures as supplied by the various parties, the positive impacts associated with the proposed development will (in the long term) outweigh the anticipated negative impacts, which are mostly short term in nature and associated with the construction phase of the development.

RECOMMENDATIONS

As environmental consultants we can confirm that we considered all the environments (social, ecological, economical and institutional), which form the crucial building blocks of a sustainable development and we have no doubt that the planned mixed-use development will be sustainable if all the guidelines as supplied by the specialists, the project team, the relevant authorities and Bokamoso are implemented. We therefore recommend that the project receive the "go-ahead" and that the following specific conditions be included as part of the positive Decision to be issued.

- The implementation of the mitigation measures contained in the Environmental Management Plan (Annexure At) to achieve maximum advantages from beneficial impacts, and sufficient mitigation of adverse impacts;
- All the guidelines as supplied in the relevant specialist report must be taken into consideration;
- A construction and operational phase security management plan must be compiled and submitted to the delegated authority for approval. The security management plan must address the on-going security of all 8 the development phases;
- A traffic upgrading management and monitoring plan for all the road upgrading and construction phases. This purpose of this plan must be to address traffic flow throughout the development phases, to promote road safety (for cyclists, pedestrians and vehicles, to mitigate dust pollution and noise pollution associated with the proposed road upgradings, te ensure that road upgrading signage and methods are in line with the local authority and other applicable standards, to

- address construction vehicle and equipment impacts and to address temporary access and accessibility problems;
- The layout plan must be amended to incorporate a visual buffer in the north-western section of the study area;
- The final vertical and horizontal alignment of the link road between the Edenvale
 Hospital and the Rand Aid development must be designed to prevent crime and to
 reduce noise levels associated with the road (i.e. noise barriers/ security wall along
 the eastern boundary of the Rand Aid development);
- The compilation of a construction phase and operational phase storm water management plan that will prevent erosion, pollution and siltation. The storm water management plan and concept must be in line with the standards and requirements of DWS and the local authority. The storm water management concept has already been discussed with DWS and the final storm water drawings as supported by DWS and the local authority must be forwarded to GDARD for record keeping purposes prior to construction;
- A suitably qualified specialist must be appointed to identify and assist with the relocation of all medicinal plants found on the study area. GDARD must be contacted prior to the removal/ relocation of the medicinal plants and GDARD must also be afforded the opportunity to supply inputs regarding the proposed relocation;
- Mr. Ate Berga must be appointed to assist with the relocation of the Trachyandra erythrorrhiza sp. Mr. Berga must contact the relevant official at GDARD prior to the relocation of such species and must afford the official an opportunity to also be involved in the relocation/ transplantation process. This could be regarded as a pilot project to obtain more data regarding the species. According to the GDARD data base, the species must still be assessed;
 - All declared weeds and invaders must be removed from the site on an on-going basis and in phases. In areas below the flood line, where more than 5m³ of soil will be moved, filled, removed etc. the relevant authorities (GDARD and DWS) must be notified of areas that require weed and exotic control programmes. In some cases the removal of weeds will most probably only be allowed once the decision has been issued and once the rehabilitation plan has been approved;

- The applicant will not be allowed to commence with any construction related activities that that require a Section 21 Water-Use Licenses prior to the issuing of such licenses;
- Section 19 of the National Water Act must also be taken into consideration and if required, measures must be added to the management and monitoring plans to ensure compliance;
- The Waste Act (especially Part 8, which deals with contaminated land) must also be taken into consideration if any additional graves or waste sites are exposed during the construction phase of the development;
- If the Giant Bullfrog or any other herpetological species are encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. A permit will be required from GDARD for the relocation of bullfrogs;
- Every effort should be made to retain the linear integrity, flow dynamics and water quality for the Jukskei River and its tributaries. The same applies to the wetlands, and all the water bodies associated with riparian vegetation. The ECO and appointed main contractor must delineate the wetland areas, the riparian areas and the proposed buffer zones prior to the construction phase;
- The areas to be protected must be fenced/ protected in an acceptable manner (as approved by the ECO) prior to the construction phase. The areas to be protected by a conservation line/fence during the construction phase of the development includes the graveyards, the Sizwe Hospital historical buildings and structures and the natural areas associated with the river and the wetlands (as identified by the specialists);
- The proposed demolition of the Sizwe Hospital must be regarded as the final phase of the development. Viable alternatives for the replacement of the existing social services delivered by the hospital must be considered and the preferred alternative, including the details of the historical structures to be conserved, must be approved by the relevant authorities (including SAHRA) prior to commencement with this final phase. The details of the proposed demolition, conservation of the historical structures, replacement of the existing social services delivered by the hospital as well as the relevant approvals, must be supplied to GDARD for record keeping purposes prior to commencement of the final phase;

- A Heritage Management Plan (for the planning, construction and operational phases
 of the development) must be compiled for the management, renovation and
 conservation of the historical structures and features, including the graveyards;
- The management plan must also address the possible discovery of additional graveyards or waste sites;
- A ground water and soil quality monitoring programme for the construction phase must be compiled. This plan must identify sampling points for ground water, surface water and soils. The monitoring intervals must also be prescribed. The monitoring results must be forwarded to Dr. van Heerden, Dr. De Vos, DWS and GDARD;
- In cases where contamination is detected, the relevant specialists (Dr. De Vos, Dr. Van Heerden, Dr. van der Waals and Dr. Mannie Levin) must be notified immediately;
- All ECO reports must be forwarded to Dr. De Vos and Dr. De Vos must be appointed
 to assist if any new graves/ waste sites are discovered during the construction phase.
 He must also supply mitigation measures if any disease associated contamination is
 detected during the ground water and soil quality tests;
- Some major road and services upgradings are required on and around the study area. This could cause major temporary disruptions to the existing services and it could have an impact on the accessibility of properties and the traffic flow. The affected parties must be notified (at least two weeks in advance) of any possible inconvenience that could be experienced; and
- Prove of the relevant GDARD and DWS approvals of the EIA applications and S21 WUL
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Annexure Av: Architect's Artist Impressions – Type of development visible from Rand Aid

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LIST OF ABBREVIATIONS

CBD: Central Business District

C-Plan: Conservation Plan

CoJ: City of Johannesburg Metropolitan Municipality

DEA: Department of Environmental Affairs

DFA: Development Facilitation Act

DWS: Department of Water and Sanitation

EAP: Environmental Assessment Practitioner

ECA: Environmental Conservation Act

EIA: Environmental Impact Assessment

IEMA: Institute of Environmental Management and Assessment

EIAR: Environmental Impacts Assessment Report

EMM: Ekurhuleni Metropolitan Municipality

EMP: Environmental Management Plan

GAPA: Gauteng Agricultural Potential Atlas

GDARD: Gauteng Department of Agriculture and Rural Development

GSDF: Gauteng Spatial Development Framework

I&AP: Interested and affected party

IDP: Integrated Development Plan

NSBA: National Spatial Biodiversity Assessment

NEMA: National Environmental Management Act

ORTIA: O.R. Tambo International Airport

PoS: Plan of Study for EIA

SACLAP: The South African Council of the Landscape Architects Profession

SAHRA: South African Heritage Resources Agency

SR: Scoping Report

SDF: Spatial Development framework

TIA: Traffic Impact Assessment

UNCED: United Nations Conference on Environment and Development

WMA: Water Management Area

WWTP: Waste Water Treatment Plant

GLOSSARY OF TERMS

Agricultural Hub: An area identified for agricultural use by GDARD according to the Draft

Policy on the Protection of Agricultural Land (2006).

Alien species: A plant or animal species introduced from elsewhere: neither endemic nor

indigenous.

Applicant: Any person who applies for an authorisation to undertake an activity or to cause

such activity to be undertaken as contemplated in the National Environmental Management

Act (Act No. 107 of 1998), as amended and the Environmental Impact Assessment

Regulations, 2006.

Biodiversity: The variability among living organisms from all sources including, terrestrial, marine

and other aquatic ecosystems and the ecological complexes of which they are apart.

Conservation of Agricultural Resources Act (Act No. 43 of 1983): This Act provides for control

over the utilization of the natural agricultural resources of the Republic in order to promote the

conservation of the soil, the water sources and the vegetation and the combating of weeds

and invader plants; and for matters connected therewith.

Development Facilitation Act (DFA) 1995 (Act 67 of 1995): This Act formulates a set of general

principles to serve as guidelines for land development.

Ecology: The study of the inter relationships between organisms and their environments.

Environment: All physical, chemical and biological factors and conditions that influence an object and/or organism. Also defined as the surroundings within which humans exist and are made up of the land, water, atmosphere, plant and animal life (micro and macro), interrelationship between the factors and the physical or chemical conditions that influence human health and well-being.

Environmental Impact Assessment: Assessment of the effects of a development on the environment.

Environmental Management Plan: A legally binding working document, which stipulates environmental and socio-economic mitigation measures that must be implemented by several responsible parties throughout the duration of the proposed project.

GDARD Draft Ridges Policy, 2001: According to the GDARD Draft Ridges Policy no development should take place on slopes steeper than 8.8%.

GDARD Draft Red Data Species Policy, 2001: A draft policy to assist with the evaluation of development applications that affected Red Data plant species.

GDARD Requirements for Biodiversity Assessments Version 2 (2012): GDARD requirements for biodiversity assessments.

GIDS: The GIDS focuses on the mapping and management of biodiversity priority areas within Gauteng. The GIDS includes protected areas, irreplaceable and important sites due to the presence of Red Data species, endemic species and potential habitat for these species to occur. GIDS, 2007.

National Environmental Management Act (NEMA), 1998 (Act No 107 of 1998): NEMA provides for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state; and to provide for matters connected therewith.

National Environmental Management: Air Quality Act (Act No. 39 of 2004): The purpose of the Act is "To reform the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures; and for matters incident thereto".

National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004): The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment was developed.

National Environmental Management: Protected Areas Act, 2003 (Act No 57 of 2003): The purpose of this Act is to provide the protection, conservation and management of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes.

National Heritage Resource Act, 1999 (Act No 25 of 1999): The National Heritage Resources Act legislates the necessity for cultural and heritage impact assessment in areas earmarked for development, which exceed 0.5 ha. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA).

National Veld and Forest Fire Act, 1998 (Act No. 101, 1998): The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic. Furthermore the Act provides for a variety of institutions, methods and practices for achieving the prevention of fires.

National Road Traffic Act, 1996 (Act No. 93 of 1996): This Act provides for all road traffic matters which shall apply uniformly throughout the Republic and for matters connected therewith.

National Water Act, 1998 (Act No 36 of 1998): The purpose of this Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled.

Open Space: Areas free of building that provide ecological, socio-economic and placemaking functions at all scales of the metropolitan area.

Study Area: Refers to the entire study area compassing the total area of the land parcels as indicated on the study area map.

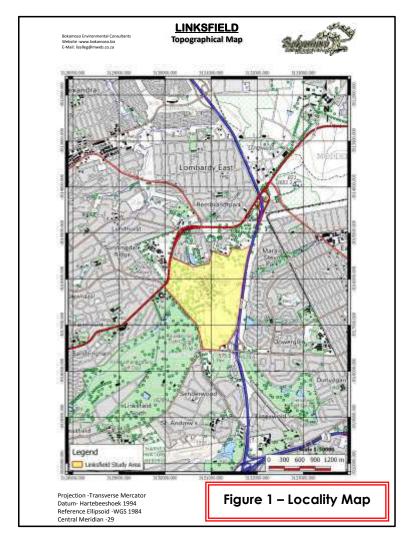
Sustainable Development: Development that has integrated social, economic and environmental factors into planning, implementation and decision making, so as to ensure that it serves present and future generations.

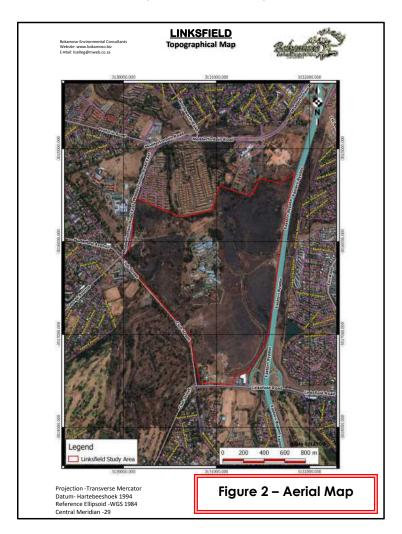
Water Services Act, 1997 (Act No 108 of 1997): The purpose of this Act is to ensure the regulation of national standards and measures to conserve water.

1. INTRODUCTION

1.1 Background and History of the Study Area

The Gauteng Department of Human Settlements (The Applicant) previously known as Gauteng Department of Local Government & Housing in collaboration with private sector partners, is planning to develop a mixed use township comprising of residential uses, educational, commercial, show-rooms, business, retail, shops, places of amusement, restaurants, hotel, offices and associated infrastructure on the Remainder of Portion 1 of the Farm Rietfontein 61 IR, Gauteng Province to be known as the Linksfield Mixed-Use Inclusionary Development. The size of the property is approximately 271, 57ha and the area to be transformed is approximately 194,99ha. (Refer to Figure 1: Locality Map and Figure 2: Aerial Map)





Please note: All figures referred to in this report are included in Annexure A

The Sizwe Hospital, formerly known as the Rietfontein Hospital is located on the site.

The hospital, for which the original construction commenced in 1895, has been treating the ill of Johannesburg (including the underprivileged) for the past 119 years. Sizwe Hospital was originally established to treat diseases such as the plague, smallpox, leprosy and TB. After having treated its last smallpox case in 1965, Sizwe Hospital was treating tropical diseases. The hospital's name was changed to the Sizwe Tropical Disease Hospital in 1995.

Apparently around 2 215 patients, placed into three camps (Lazaretto in Hospital Hill, Geldenhuys Estate and Luipaardsvlei) in Johannesburg were treated for smallpox in 1893.

The residents of Johannesburg at that stage were unhappy about the close proximity of the camps to the growing city and this eventually forced the Transvaal Republican Government to buy the Farm Rietfontein 61IR of approximately 600 hectares in 1895 from a Mr Kieser. At that stage the farm was considered as a sufficient distance from the centre of the town, around 30km from the CBD.

Apparently it is believed that approximately 7 000 victims of smallpox, leprosy, plague and syphilis were buried on the Sizwe Hospital Site and the cemeteries were divided into black, white and Jewish sections. There are also rumours of the hazardous medical waste sites and the burying of the carcasses of animals infected by Anthrax on the larger study area of ±600 ha.

In 1897 a leper asylum was built in the top Northeast corner of the farm, consisting of wood and iron structures, surrounded by a 12-foot iron fence, and patrolled by armed guards. This facility had accommodation for approximately 30 patients. In August 1900 the first leper hospital was closed and 29 patients were moved to Westfort Hospital in Pretoria. Shortly after their departure approximately 20 000 sheep captured by British from the Boere were kept for many months in the deserted enclosure.

In 1904 the plague broke out in Johannesburg and more than 1 000 patients were treated at Sizwe Hospital. Apparently those who died were also buried in a separate plague cemetery in the grounds, in graves demarcated only by numbers.

In 1939 another outbreak of smallpox hit Johannesburg. Patients were dying at the rate of 20-30 a day and according to available information/ articles quick lime was poured into the graves against the disease lingering.

Today only approximately 320 hectares (less than 50%) of the original farm remains and it is completely surrounded by urban development, major roads and infrastructure.

There are no concrete information available regarding the location of the various cemeteries and it was not yet possible for anyone to locate the "so-called" plague, Jewish

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or leprosy cemeteries on the remaining portion of the original hospital site. Apparently the main cemetery at Sizwe was recorded in 1990 by the South East Wits Family History Society and it was updated in 1998. There is furthermore no burial register available for the cemeteries on the farm, because it was apparently destroyed in a fire.

The hospital itself has buildings that are more than 60 years old and therefore subject to the provisions of the National Heritage Act, Act No.25 of 1999.

The site has been subject to a number of proposals in the past. Information at hand suggests that there was a proposal by the Provincial Government in 1996 which was rejected because it did not take into account grasslands as well as concerns regarding possible health risks. Another submission was made for the development of a Medical Park in 1997/8. This was also not implemented. It appears that an EIA was also conducted in 2005/6 for another proposal, but this process was never completed. Mills & Otten, the EAP appointed to comment on the Draft EIA Application on behalf of Rand Aid mentioned that the EIA application for the proposed medical park was never submitted, because the a feasibility study conducted prior to the EIA process identified some "fatal flaws". We take note of this information, but we regard it as historical and academic information and the findings were only based on a feasibility study. This Final EIA Report contains many detailed and scientific specialist studies and the conclusions and recommendations made in this report are based on recent surveys and facts, not on assumptions.

Even though many parties regard the study area as very valuable from a cultural and historical point of view, the same portion of land, which is strategically located in terms of accessibility, service and infrastructure availability and visibility, is also regarded as extremely valuable from a socio-economical/ urban development point of view. As mentioned the study area is now completely surrounded by urban development and if a proposed development on the study area is found to be compatible with the cultural historical, pollution, health and safety risks and cultural and historical challenges of the site, it will without any doubt contribute to the provision of much needed housing and social facilities within the urban edge. This will eventually also promote infill development and the

optimum utilisation of services. It will furthermore prevent development outside the urban development boundaries and within "greenfields" areas.

1.2 Details and Approach of Environmental Assessment Practitioner Appointed for the EIA

The Applicant appointed **Bokamoso Landscape Architects and Environmental Consultants CC in association with Mr. Pirate Ncube of Nali Sustainability Solutions**, to undertake the Environmental Impact Assessment (EIA) Report for the proposed development.

The Application for Environmental Authorisation was submitted on the 26th September 2013 in terms of the Amended NEMA EIA Regulations, 2010, which came into effect on 2 August 2010. The reference number, Gaut: 002/13-14/E 0153, has been assigned to the application.

Take note that the 2010 NEMA EIA Regulations were replaced by the Amended 2014 NEMA EIA Regulations on 4 December 2014, but due to the fact that the application was submitted in terms of the 2010 NEMA EIA Regulations, this application will be dealt with in terms of such Regulations. Once the Decision has been issued in terms of the 2010 NEMA EIA Regulations, such Decision will be regarded as a Decision issued in terms of the New 2014 EIA Regulations and all following procedures (i.e. Amendment Applications, Appeals etc. must be made/submitted in terms of the 2014 NEMA EIA Regulations. Refer to Chapter 8 – Transitional Arrangements and Commencement of the 2014 NEMA EIA Regulations.

Regulation 53 (3) of the 2014 NEMA EIA Regulations furthermore states "Where an application submitted in terms of the previous NEMA EIA Regulations, is pending in relation to the activity of which a component of the same activity was not identified under the previous NEMA Notices, but is now identified in terms of Section 24 (2) of the Act, the

¹ According to the Oxford Dictionary Definition for a "greenfields" area is "sites for commercial/other development on previously undeveloped land". We are of the opinion that study area does not qualify as a "greenfields" site, because there is a hospital, 3 graveyards, services and a nursery on the study area. The study area is furthermore surrounded by urban development.

competent authority must dispense of such application in terms of the previous NEMA regulations and <u>may</u>² authorise the activity identified in terms of Section 24 (2) as if it was applied for, on condition that all impact of the newly identified activity and requirements of these Regulations have also been considered and adequately assessed."

Section 24(2) Activities to be considered by GDARD:

We perused the Amended 2014 NEMA EIA Regulations and decided to list the activities that will most probably be triggered in terms of such Regulations (Refer to Table 128 below). The activities identified are very similar to that activities applied for in terms of the 2010 NEMA EIA Regulations and we therefore feel confident that all the activities as listed have been assessed.

Due to the fact that the 2014 Regulations are still new, we recommend that GDARD rather dispense this application in terms of the 2010 NEMA EIA Regulations.

Table 128: 2014 Amended NEMA EIA Regulations: Listed Activities that will most probably be triggered

Listing Notice 1:			
R.983	Activity 9	The development of infrastructure exceeding 1000 metres in length for the bulk transportation of water or storm water- (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or (b) where such development will occur within an urban area.	
	Activity 10	The development and related operation of infrastructure exceeding 1000 metres in length for the bulk transportation of sewage, effluent, process water,	

² Take Note: This is not a must

		waste water, return water, industrial discharge or slimes (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (a) such infrastructure is for bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve; or (b) where such development will occur within an urban area.
A	ctivity 11	The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or (ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.
	ctivity 12	The development of- (i) canals exceeding 100 square metres in size; (ii) channels exceeding 100 square metres in size; (iii) bridges exceeding 100 square metres in size; (iv) dams, where the dam, including infrastructure and water surface area, exceeds 100 square metres in size; (v) weirs, where the weir, including infrastructure and water surface area, exceeds 100 square metres in size; (vi) bulk storm water outlet structures exceeding 100 square metres in size; (vii) bulk storm water outlet structures exceeding 100 square metres in size; (viii) jetties exceeding 100 square metres in size; (ix) slipways exceeding 100 square metres in size; (xi) buildings exceeding 100 square metres in size; (xi) boardwalks exceeding 100 square metres in size; (xii) boardwalks exceeding 100 square metres in size; (xiii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; - excluding- (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of

	2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; or (ee) where such development occurs within existing roads or road reserves.
Activity 19	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse; (ii) the seashore; or (iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater-but excluding where such infilling, depositing, dredging, excavation, removal or moving- (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.
Activity 23	The development of cemeteries of 2500 square metres or more in size
Activity 27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan
Activity 45	The expansion of infrastructure for the bulk transportation of water or storm water where the existing infrastructure- (i) has an internal diameter of 0,36 metres or more; or (ii) has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more; excluding where such expansion-(aa) relates to transportation of water or storm water within a road reserve; or

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	(bb) will occur within an urban area
Activity 46	The expansion and related operation of infrastructure for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes where the existing infrastructure- (i) has an internal diameter of 0,36 metres or more; or (ii) has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more; excluding where such expansion- (aa) relates to transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes within a road reserve; or (bb) will occur within an urban area
Activity 48	The expansion of . (i) canals where the canal is expanded by 100 square metres or more in size; (ii) channels where the channel is expanded by 100 square metres or more in size; (iii) bridges where the bridge is expanded by 100 square metres or more in size; (iv) dams, where the dam, including infrastructure and water surface area, is expanded by 100 square metres or more in size; (v) weirs, where the weir, including infrastructure and water surface area, is expanded by 100 square metres or more in size; (vi) bulk storm water outlet structure and water surface area, is expanded by 100 square metres or more in size; (vi) bulk storm water outlet structure is expanded by 100 square metres or more in size; or (vii) marinas where the marina is expanded by 100 square metres or more in size; where such expansion or expansion and related operation occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding- (aa) the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such expansion activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of

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		2014 or activity 14 in Listing case that activity applies; (dd) where such expansion area; or (ee) where such expansion or road reserves	
Listing Notice	2:		
R. 984	Activity 15	The clearance of an area of indigenous vegetation, excelearance of indigenous ve (i) the undertaking of a line (ii) maintenance purposes with a maintenance management of the clearance of the cl	luding where such getation is required for- ar activity; or undertaken in accordance
Listing Notice	3:		
R. 985	Activity 12	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of required for maintenance purposes undertaken in accordance with a maintenance management plan.	a) In Eastern Cape, Free State, Gauteng, Limpopo, North West and Western Cape provinces: i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or indigenous vegetation is prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; ii. Within critical biodiversity areas identified in bioregional plans; iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where

		such removal will occur behind the development setback line on erven in urban areas; or iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.
Activity 14	The development of- (i) canals exceeding 10 square metres in size; (ii) channels exceeding 10 square metres in size; (iii) bridges exceeding 10 square metres in size; (iv) dams, where the dam, including infrastructure and water surface area exceeds 10 square metres in size; (v) weirs, where the weir, including infrastructure and water surface area exceeds 10 square metres in size; (vi) bulk storm water outlet structures exceeding 10 square metres in size; (vii) marinas exceeding 10 square metres in size; (viii) jetties exceeding 10 square metres in size; (x) slipways exceeding 10 square metres in size; (x) buildings exceeding 10 square metres in size; (xi) boardwalks exceeding 10 square metres in size; or (xii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs (a) within a watercourse	i. A protected area identified in terms of NEMPAA, excluding conservancies; ii. National Protected Area Expansion Strategy Focus Areas; iii. Gauteng Protected Area Expansion Priority Areas; iv. Sites identified as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) in the Gauteng Conservation Plan or in bioregional plans; v. Sites identified within threatened ecosystems listed in terms of the National Environmental Management Act: Biodiversity Act (Act No. 10 of 2004); vi. Sensitive areas identified in an environmental management framework adopted by relevant environmental authority; vii. Sites or areas identified in terms of an International Convention viii. Sites managed as protected areas by

(b) in front of a provincial authorities, or development declared as nature Setback, or reserves in terms of the (c) if no development Nature Conservation setback has been Ordinance (Ordinance 12 of 1983) or the National adopted, within 32 metres Environmental of a watercourse, measured from the edge Management: Protected of a watercourse Areas Act (Act No. 57 of 20031: excluding the ix. Sites designated as development of nature reserves within infrastructure or structures municipal within existing ports or SDFs; or harbours that will not x. Sites zoned for increase the development conservation or public footprint of the port or open space or equivalent harbour. zoning.

1.2.1 Environmental Assessment Practitioner (EAP) - In Line with Section 32 (2) (a) (i) and (ii)

The new Environmental Regulations require that relevant details of the Environmental Assessment Practitioner be included as part of the EIA. In this regard, attached as **Annexure B**, is a copy of the CV of the EAP for this project, Ms. Lizelle Gregory from Bokamoso Landscape Architects and Environmental Consultants. In summary details of the EAP are indicated below:

- Name: Lizelle Gregory
- Company: Bokamoso Landscape Architects and Environmental Consultants CC
- Qualifications: Registered Landscape Architect and Environmental Consultant (degree obtained at the University of Pretoria) with 23 years' experience in the following fields:
 - Environmental Planning and Management;
 - o Compilation of Environmental Impact Assessments;
 - Landscape Architecture; and
 - Landscape Contracting

Ms. L. Gregory also lectured at the Technicon of South Africa and the University of Pretoria. She is a registered member of the South African Council of the Landscape Architects Profession (SACLAP), the International Association of Impact Assessments (IAIA) and the Institute of Environmental Management and Assessment (IEMA). Her professional practice number is 97078.

Also refer to Annexure C for CV of Mr. Pirate Ncube of Nali Sustainability Solutions

1.2.2 Approach of the EAP (Important to Read This Section!!)

As environmental consultants with many years' experience in the field of Environmental Impact Assessments (EIAs), our team regarded this project as a major challenge. Even though the site appeared to be ideally situated for a mixed-use node in line with the propped development, the site appeared to be rich in history and development/disturbance of the site is furthermore regarded (by many surrounding land-owners and other interested and affected parties) as a major health and safety risk associated with the former diseases and outbreaks that were formerly treated in the hospital.

After Bokamoso and Nali submitted the application at the Gauteng Department of Agriculture and Rural Development (GDARD), the proposed mixed-use development was advertised on site and in a newspaper. Notices regarding the proposed development were also distributed to adjacent land-owners, tenants and organs of state that could be affected.

We received hefty reactions from the public and most of the registered Interested and Affected Parties (I&APs) indicated that they are totally against the proposed development. The most significant issues that were raised by the public are the following:

- Most of the members of the surrounding community are totally against the proposed target market and the high residential density that is proposed. The community is of the opinion that the "low cost housing" will have a negative impact on their

property values and that the development will eventually turn into a slum, where tenants sub-let and where crime originates;

- Lowering of property values, because the development will be a low cost development consisting of 8000 housing units;
- Such developments attract people with no money who turn to petty crime and then violent crime;
- The risks of Anthrax and tropical disease outbreaks if the topsoil and sub-soil layers are disturbed (mainly through air pollution and ground-and surface water pollution);
- Dormant bacteria in the soil;
- The loss of graves with high cultural and historical value;
- The disturbance of hazardous medical waste sites;
- Traffic congestion;
- Additional burden on services that are already stretched;
- Impacts in the already sub-standard roads;
- The development will be a squatter camp;
- Impacts of construction phase such as dust pollution and the effect on ill people residing in the area;
- Impacts on businesses and schools in the area;
- Ecological impacts and potential destruction of wetlands;
- Impacts on continuous open space system associated with the Jukskei River.

After we perused the comments submitted by the registered interested and affected parties, we soon realised that it will be necessary to obtain detailed specialised inputs and opinions regarding the existing graves on the study area and the potential health risks associated with anthrax and the tropical diseases that were treated at the Sizwe Hospital.

In most cases, especially in the urban context, it is possible to mitigate ecological, services and other non-life threatening social impacts, but in this specific case we regarded it as crucial to obtain the opinions of suitably qualified specialists (many that were used are known as the best in their fields of expertise), for purpose of assessing the potential impacts associated with anthrax and the tropical diseases referred to by the I&APs.

In cases where people's health and well-being could be at stake and where liabilities associated with incorrect and uninformed decisions could become applicable, no EAP, specialist or delegated authority can afford it to take any chances or to put his/her professional integrity at stake. The methodology of Bokamoso and Nali (from the outset of the project) was to follow a cautious approach and to investigate all the issues raised by the I&APs in detail and to find concrete answers for all the disease related issues as listed and to base all the findings in the EIA Report on scientific facts³ that are supported and certified by each specialist involved.

As required by the NEMA Regulations the EAP must act as an independent consultant and it was indicated to the applicant and some interested and affected parties, from the outset, that Bokamoso and Nali will only recommend that the project proceeds if the facts on the table turn out to be favourable and if the facts are sufficient to put the delegated authority and the EAP in a position to make informed recommendations and decisions.

The Anthrax, Tropical Disease, Graveyard and Waste Site Matters:

In order to address the anthrax; tropical disease, graveyard and waste site matters in a responsible, holistic and integrated way, we regarded it as prudent to establish a specialist working group consisting of the following list of specialists:

- A pathologist Dr. E.D. Fourie M.B.Ch.B (UP), M Med Pathology (UP), MBL (UNISA) and member of: The South-African Medical Association; Infectious Diseases Society of South-Africa; Gauteng Conservancy and Stewardship Association; Archaeological Society, Transvaal; Paleontological Society, Pretoria (formerly a partner at Du Buisson and Partners Pathologists now retired);
- A soil scientist and wetland specialist for identification of graveyards and forensic soil investigations into potential pathological risks associated with the development of the Linksfield site— Dr. Johan van der Waals, Senior lecturer at the University of Pretoria and owner of Terrasoil;

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³ Take note in the Mills and Otten comments it was stated that the EIA Report must be based on scientific facts. This section of the report confirms that the EIA Report and the findings in the report are based on scientific facts.

- A geotechnical Engineer Dr. J Louis van Rooy (Engineering Geologist PhD (Pret)-assistance with the identification of graveyards, landfill/waste sites and any other form of disturbance underneath the ground surface;
- **A geo-Hydrologist Dr. Mannie Levin** Pr Sci Nat PhD (Geohydrology) Senior geohydrologist at Aurecon Engineering);
- Dr. Henriette van Heerden (BSc Biological with Chemistry, Microbiology and Biochemistry, BSc Hons Microbiology, MSc Microbiology, PhD Plant Pathology (UP) Senior Lecturer at the University of Pretoria, Department Tropical Diseases and Anthrax Specialist (currently the best in this field in in South-Africa, since retirement of Dr. De Vos (also member of this team);
- Dr. Valerius De Vos A qualified veterinarian with a BSc (Honours) Degree in wildlife management. Awarded honorary Professorship at the Department of Tropical Diseases, University of Pretoria (1992-2007), more specifically also an anthrax specialist;
- Cultural and Historical Specialists Leonie Marais-Botes (BA (Cultural History and Archaeology) (UP), BA (Hons) Cultural History (UP), Post Grad Dip Museology (UP), Cert Conservation of Traditional Buildings (Univ of Canberra)Post Grad Dip: Heritage (Wits) in association with Dr. A.C. van Vollenhoven (BA, BA (Hons), DTO, NDM, MA (Archaeology) [UP], MA (Culture History) [US], DPhil (Archaeology) [UP], Man Dip [TUT], DPhil (History)[US], L Akad [SA] Identification of graveyards, cultural and historical features and historical buildings of significance

We provided the challenges of the site to all the specialists in the above listed team and we requested that each specialist investigate the risks associated with the construction and operational phases of the proposed development for the study area. Two formal workshops were arranged during which the specialists discussed and tested their findings with the other members of the team. The minutes of the two workshops are attached as **Annexure D**.

During the workshops it was explained that Bokamoso/Nali (as EAPs) can only recommend that the project receive the "go-ahead" (from a social point of view) if we are convinced that there are no serious health risks associated with the construction and operational

phases of the proposed development. It was furthermore mentioned that Bokamoso/Nali require the integrated inputs of all the specialists and it was requested that the specialists immediately inform Bokamoso/Nali if they regard the proposed project as a risk and if they are of the opinion that the project should not receive the "go-ahead". Red flags raised by any of the above-mentioned specialists would have meant that there were possible "fatal flaws" from a health risk point of view and if this was the case, we would have recommended that the delegated authority issue a negative decision/ we would have advised that the applicant terminates the application process.

This was however not the case. All the specialists confirmed, in writing (and by signing/certifying their inputs) that there are no to limited health risks associated with the construction and operational phases of the proposed project. In fact, Dr. De Vos, Dr. van Heerden and Dr. Johan van der Waals agreed that the long term health risks (if any) will be reduced if the site is covered with concrete. **Refer to Annexure E for inputs received from above listed specialist team**

Based on the above, we are convinced that the tropical diseases issue holds no/very low health risks (according to the specialists, no more than developments on any of the surrounding properties) and that the studies and inputs supplied by the above-mentioned specialists can be regarded as concrete scientific evidence and facts, which confirms that the proposed development can proceed.

The graveyard aspect was also addressed by the team of specialists. According to the geotechnical engineer Dr. J Louis van Rooy and Dr. van der Waals of Terrasoil, there are only three visible graveyards on the study area (the graveyards as indicated in the report compiled by Terrasoil). Terrasoil managed to obtain aerial photographs that date as far back as 1937 and on these aerial photographs the three graveyards as found during the site inspections could also be identified. The geotechnical engineer indicated that the excavatability of the site is very difficult and that it would have been almost impossible in the late 1800s and early 1900s to dig deep graves on the site, which is mainly covered with shallow soils with scattered rocks. Both the geotechnical engineer and the soil scientist agreed that there are only three major graveyards on the study area and they

recommended that the graveyards be conserved and excluded from the development. The cultural and historical specialist also attended these discussions and she also agreed with their findings

After the team of specialists conducted the necessary studies we received a plan from one of the Interested and Affected Parties, which indicated potential additional graveyards and hazardous medical waste sites on the study area. **Refer to Annexure F.** This information was also supplied to the specialist team for purpose of additional investigations and inputs. All specialists agreed that there are no other graveyards on the study area.

During a follow-up site investigation one possible grave was identified adjacent to the nursery. The geotechnical engineers excavated the area adjacent to the possible grave in order to confirm the presence of a grave and in order to determine whether there are any waste sites/additional graves in this area, but no evidence of any additional graves/ waste sites could be detected during the follow-up excavations. Annexure G contains the follow-up opinions of the specialists after the map of the potential gravesites and hazardous waste site was made available to them.

We also investigated the possibility of a Jewish Graveyard on the property, but this exercise also turned out to be fruitless. According to a Jewish connection all Jewish graves and graveyards, which have been established, have been recorded and the information can apparently be obtained at the Jewish Society. We tried to obtain information from the Jewish Society and members of the project team even tried to arrange meetings with the Jewish Society in order to discuss the possibility of graves on the study area, but the Jewish Society refused to meet with us, or to discuss the grave issue with the team, because they indicated that they were already approached to assist the public.

The team was then also referred to the Adler Museum for information regarding the site's history and the potential graveyards and waste sites on the property. When we initially contacted the museum the representative also indicated that they were not willing to supply us with any information, because they were already approached by the objectors. We then confirmed the discussion with the museum in writing. The museum eventually

responded and indicated that they only have limited information available. Refer to Annexure H for correspondence with Adler museum and information supplied by the museum.

During the workshops it was also requested that the specialists assist Bokamoso/Nali with the compilation of mitigation measures that will prevent the spread of diseases during the construction phase. All the specialists agreed that it will not be necessary to apply special mitigation measures to reduce the risks of disease outbreaks. Dr. De Vos also agreed to assist (as specialist advisor) during the construction phase and to compile special mitigation measures if any additional graves/ waste sites are identified during the construction phase.

The Proposed Demolition and Relocation of the Sizwe Hospital:

It is the intention of the applicant to demolish the existing Sizwe Hospital (as the final phase of the development) and to relocate some wards/facilities of the hospital to another site/hospital. The applicant is currently investigating the various options and the relocation details will be supplied to GDARD as soon as available. Please note that the hospital will only be demolished once this matter has been resolved.

The Size Of The Former Hospital Study Area Versus The Study Area Proposed For The Development:

As mentioned under the history and background section of this report the original size of the Sizwe Hospital study area was approximately 600ha and the size of the study area (the remaining undeveloped farm portion) is approximately 272ha. This means that less than 50% of the study area is still undeveloped. More than 300ha have already been covered with urban infrastructure and development and according to the involved geotechnical engineer and soil scientist, the graves referred to (if any) are most probably situated in areas on the farm with deeper soils and that are further away from the hospital. These areas are most probably now also covered with concrete, roads, houses and other urban

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⁴ GDARD requested that a Disease Risk Management Plan be incorporated as part of the EIA Report. The specialists however regarded the compilation of such a plan as unnecessary.

development structures. Refer to Annexure J for historical aerial photograph of the larger farm.

Other Efforts from the EAP and Project Team to Obtain Information Regarding the Sizwe Hospital, the Graves and the Diseases treated by the Hospital:

Apart from the specialist team approach, Bokamoso also had many other meetings and discussions with I&APs, specialists and institutions in order to try and obtain more information regarding the activities that took place on the study area since 1895.

Newspaper Invitation to Supply Information Regarding the Study Area:

As mentioned, all the records of the hospital were apparently destroyed by a fire. We also placed an insert in a newspaper and in this insert we invited any Interested and Affected Party with information regarding the possible graves on the study to come forward and to supply us with more detailed and concrete information. We once again received no tangible feedback or evidence of any graves or of any of the patients or animal carcasses buried on the property. Refer to Annexure K for newspaper invitation

Other Specialists That Were Consulted:

We also had separate discussion meetings with the following specialists/institutions:

The National Institute of Communicable Diseases (NICD) across the road from the study area. We had a meeting with Professor Lucille Blumberg (Contact details: (011) 386-6337.

Opinion/Inputs of Dr. Blumberg:

According to Professor Lucille Blumberg there is no chance of any outbreaks if the development proceeds. The NICD regard the health risks as low. Refer to Annexure L for inputs from NICD

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- Onderstepoort: Dr. Awake

Opinion/Inputs of Dr. Awake:

Dr. Awake comes from Ethiopia and has only been in South-Africa for 5 years.

According to Dr. Awake the anthrax virus can be carried over from animals to

humans. He indicated that people can become infected when inhaling the spores.

If you detect the anthrax at an early stage in humans and animals it can successfully

be treated with anti-biotics.

He indicated that he is aware of research in the Kruger National Park done by Dr. De

Vos (part of our team) and research done in the Northern Cape. Apparently there

are different types of anthrax spores. Those modified for biological warfare and

normal anthrax spores. The modified spores are smaller and one can inhale them.

The normal spores are bigger.

He is not familiar with the Sizwe Hospital. Apparently the depth of an anthrax spore

below ground level makes no difference. Wherever the soil is disturbed the spore

that is lying dormant can become active again. He again referred to the research

of Dr. De Vos in the Kruger National Park.

Spores can move in the ground when ground water movement takes place and

they can gather in areas in groups.

Dr. Awake recommended that thorough studies be conducted by suitably qualified

specialists and if their research is thorough he cannot foresee any risks.

According to Dr. Awake it is not necessary to burn down the hospital to eliminate

the spores/ diseases. He is of the opinion that the buildings can be fumigated prior

to demolition.

- **Dr. Maryke Henten** (Veterinarian specializing in bacteriology and mycology, with

many years of anthrax experience)

Opinion/Inputs of Dr. Henten:

Dr. Henten referred us to Dr. De Vos and Dr. Wouter Basson (Cardiologist and Tropical Disease/ anthrax specialist) and stated that they are the most experienced in the field of anthrax in South-Africa. She referred to a publication of Dr. De Vos named Infectious Diseases of Livestock (ISBN 0195761715 (Volume 3). **Refer to Annexure Am**

Dr. Henten was of the opinion that there are some risks associated with anthrax spores on the site. She stated that Dr. De Vos found spores of ±200 years in the Kruger national Park and suggested that we discuss it with Dr. De Vos. She also mentioned that government developed a shopping centre in the Western Cape across an anthrax grave site. Dr. De Vos was also involved.

According to Dr. Henten the anthrax site can be treated with formaldehyde prior to construction, but this will also have a detrimental impact on the ecological integrity and the hydrology of the study area. This treatment was used on an island in Scotland that was subjected to anthrax spores and it successfully killed the spores.

- Dr. Wouter Basson (Cardiologist and Specialist researcher with regards to tropical diseases for former government)

Due to Dr. Wouter Basson's past apparent involvement in former confidential government related projects, we decided not to make him an integral part of the panel of specialists, but to rather consult with him (as an outsider and objective party) in an attempt to obtain his specialist opinion regarding the tropical diseases that were treated at the hospital, especially since two of the other specialists consulted also referred us to him.

Apparently he did many years of detailed research on anthrax and other tropical diseases and he is most probably one of the best experts to supply an opinion regarding the risks associated with the development of a site, which contains possible anthrax and other tropical disease graves.

The discussion with Dr. Wouter Basson was very interesting and fruitful and to follow now is a short summary of his inputs:

- According to Dr. Basson there are no health risks whatsoever associated with
 the development of the study area for humans. He mentioned that the
 anthrax outbreak that took place occurred across farms in and around the
 Johannesburg area and there are most probably many other anthrax
 carcasses buried in the area and development, most probably already took
 place across such sites.
- According to Dr. Basson the unmodified spores of anthrax are too large to inhale and according to him it is not possible for humans to get infected. At least 1 300 spores per day must be inhaled by a person;
- Apparently there are no records of deaths of humans infected by anthrax since the 1900s;
- Dr. Basson confirmed that he also worked at the Sizwe Hospital and according to him it was general practice at that time to burn bodies and carcasses infected by bacterial diseases;
- The graves of patients that died of viral diseases were usually treated with lime and the graves had to be deeper than 6 feet. In some cases the coffins were also lead-lined;
- Apparently no spores will form if a human die of anthrax;
- Dr. Basson's opinion regarding the risks associated with the following microorganisms/infectious diseases:
 - ♣ Variola major virus (Smallpox, vaccine virus) not a problem since the 1960s and according to Dr. Henriette van Heerden the small pox virus cannot survive for longer than 8 years;
 - Bacillus antracis (Anthrax);
 - Yersinia pestis (plague);
 - Clostridium botulinum toxin (botulism);
 - Francisella tularensis (Tularemia);

- Viral haemorrhagic (fever agents)
 - Arenaviridae (Lassa fever, Junin-Argentine haemorrhagic fever; and Venezuelan haemorrhagic fever);

Gaut: 002/13-14/E0153

- Bunyaviridae (Hantavirus);
- Filoviridae (Ebola haemorrhagic fever and Marburg haemorrhagi fever);
- Flaviridae (St. Louis encephalitis and Japanese B encephalitis)

Of the human diseases mentioned above, only small the pox virus could pose a risk. There were no cases of small pox since the 1960s and therefore Dr. Basson did not regard it as a problem. The small pox virus does not have a long life span.

- According to Dr. Basson your chances of getting anthrax in Botswana, whilst on a safari is bigger than through the development of the study area;
- Dr. Basson is of the opinion that there are no health risks associated with the development of the study area. Refer to Annexure M for minutes of meeting with Dr. Basson.

Also refer to Annexure N for more detail regarding discussions with different parties.

1.2.3 Comments Received Regarding The Draft EIA And Feedback Regarding The Focus Group Meeting Held At The Rand Aid Development And Feedback Regarding The Public Meetings Held On 2 December 2014.

Refer to Annexure An for Updated Issues and Response Report
Refer to Annexure Ao for Minutes of the Rand Aid Focus Group Meeting
Refer to Annexure Ap for Minutes of the Public Meeting

Refer to Annexure Aq for Specialists Response to the Comments of the Authorities and the I&APs

After Bokamoso advertised the project in the Scoping Phase I&APs immediately indicated that they are totally against the development of the study area. In the initial e-mails/ faxes/ verbal communication most of the I&APs stated that they were very concerned about the disease related health risks associated with the development, especially the construction related impacts when the upper soil layers are disturbed. Other parties also regarded the lack of services and the already congested roads in the area as a major problem.

Bokamoso and GDARD regarded the concerns raised by the I&APs as important and the applicant immediately agreed to appoint suitably qualified specialists to investigate and address all the issues raised by the I&APs. The applicant also appointed qualified civil and traffic engineers with many years of experience to conduct the necessary traffic impact assessments and services reports.

Due to the thorough investigations that were conducted to address the issues raised by the public (many were very scientific of nature), it took more than 8 months to complete all the required specialist studies and inputs.

The appointed specialists eventually managed to prove that there are no or very low risks associated with the disease issue and all disease related specialists recommended that the project receive the go ahead from a disease point of view.

The specialists did not even regard it as necessary to compile separate disease risk management guidelines for the construction and operational phases of the project. GDARD requested in the approval of the Scoping Report that such a risk management be compiled, but as mentioned, the specialists did not regard it as necessary and therefore no risk management plan has been included. According to the specialists the risks of contracting diseases on the site are no higher than on the surrounding properties that were also affected by the anthrax outbreaks of the 1920s.

The traffic impact assessment and the services report indicated that it will be necessary to construct a significant number of new roads and many of the surrounding roads also require urgent upgrading in order to improve the road safety conditions and the current and future traffic flow in the area. The traffic impact assessment also proposed the implementation of new off and on-ramps in order to improve access to and from the N3 freeway. The proposed road upgradings will also alleviate the existing traffic conditions.

The services reports also identified all the services upgradings required to accommodate the proposed new development and to address the existing services issues in the area. The developer will be responsible for the upgrading of the roads and the services and the specialist consultants appointed recommended that the project receive the go-ahead on the condition that the developer implement the roads and services upgradings as stipulated and identified in conjunction with the various authorities.

The nature of the issues raised by the surrounding resident however changed significantly after it was proved in the Draft EIA that it will be possible to mitigate all the potential impacts and issues raised by the I&APs to acceptable levels. The Draft EIA Report was made available to the public on 22 October 2014. Approximately 50 days of review time was allowed to read through the report and the associated specialist reports, which assisted with the addressing of the issues that were raised.

Bokamoso originally afforded the I&APs a comment period of 40 days (in line with the GDARD requirements), but this timeframe was extended in order to grant the I&APs some additional time for the finalisation of the comments after the two public meetings, which took place on 2 December 2014. The public meeting was originally arranged for 19 November 2014, but it was decided to rather re-schedule the meeting, because many of the I&APs complaint about the proposed venue and the driving distance to the venue.

The public meeting consisted of both an afternoon and an evening session to allow for the public's different schedules and in order to accommodate the large numbers of I&APs expected to attend the meeting. A focus group meeting was also held at Rand Aid to present the findings to this community and receive their comments.

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During the public meetings it became clear that the public's major concerns were not the disease issue or the bio-physical issues. The influx of lower income people into the area and the cumulative impacts of such an influx were regarded as the major issue. The proposed lower income housing raised more concerns than the other land-uses proposed for the study area. The visual impacts on the Rand Aid development, the visual and noise impacts of the north-south link road between the Edenvale Hospital and the eastern boundary of the Rand Aid Development and the lack of services and road capacity and maintenance were also listed. The disease issue, which was originally regarded as the major issue of concern, did not really feature at the public meetings. Only limited discussions regarding the disease issue took place.

It is also evident from the public meeting as well as comments received from the public that only a small amount of people read through the Draft EIA Report and all the associated specialist reports. This was found very disappointing as a significant amount of work was put into this report and the studies attached thereto in order to address the issues raised by the I&APs.

It is also important to take note of the unruliness and aggression that was experienced from the public during the meetings. In the public meetings that were held, Bokamoso was interrupted whilst trying to describe the EIA process and whilst addressing the disease issue and other issues initially raised by the public.

People insisted that the land-uses proposed for the development rather be discussed. People indicated that they were not interested in the description of the EIA process. It became clear at the meetings that the surrounding residents are very emotional and afraid to agree to a development, which will include high density residential units that will cater for the lower income groups and that will cause the influx of people from a lower income group into the surrounding upmarket neighbourhoods.

According to the residents the proposed development will have a detrimental impact on their property values, the area will turn into a slum, sub-letting and overcrowded residential

units with associated noise and air pollution will become a problem and the crime rates will increase. An audio recording of the meeting is available on request and will be attached as part of the Final EIA Report to be submitted to GDARD and the peer review panel.

Copies of the minutes of the meetings are also attached as part of the EIA Report. It was extremely difficult to compile the minutes, because a large number of the community members became aggressive, insulting, rude and refused to obey the rules of the meeting, which was stipulated before the meeting commenced. The presentations were interrupted on an on-going basis and many personal and general insults against the EAP, specialists, developer and government were shouted out on an on-going basis.

This type of behaviour is regarded as unacceptable and it leaves the project team with no other choice but to restrict the remaining communication to written correspondence, which is limited to the issues associated with the mixed-use development and that are free of personal threats and insults.

The focus group meeting which was held at the Rand Aid development was however a fruitful one and the parties present at the meeting were very co-operative and accommodating.

Rand Aid also indicated that they are concerned about the impacts of the development on the qualitative environment (i.e. visual impacts, especially in the north-western corner of the study area where there is no open space) and the north-south stretching link road which runs in between the Edenvale Hospital and the eastern boundary of the Rand Aid development. A copy of the minutes of the focus group meeting at Rand Aid is also attached to the Final EIA (Refer to Annexures Ao and Ap).

1.3 Activities Applied For In Terms of NEMA

In terms of the Government Notices No. R544, R545 and R546 published in the Government Gazette no. 33306 of 02 August 2010 in terms of the National Environment Management

Act, 1998 (Act No. 107 of 1998), an Environmental Impact Assessment Process is required for the above-mentioned project, due to the fact that the activities listed below will/could be triggered (Also refer to Annexure O for a copy of the Application form that was submitted to Gauteng Department of Agriculture and Rural Development (GDARD)).

Please take note: The Draft EIA Report included some activities that were excluded from the application. This was incorrect, the following listed activities have therefore been removed from the activities applied for:

- Activities 13, 28 and 38 of Listing Notice;
- Activity 5 of Listing Notice 2; and
- Activity 26 of Listing Notice 26.

At the beginning of the process, we identified all the activities as described in the Draft EIA Report as possible activities that could be triggered, but when more detailed information regarding the project became available, it was possible to exclude some of the activities that will not be triggered. The application form was completed correctly, but unfortunately the applicable activities were not removed from the activity list originally compiled by the Bokamoso and it was erroneously incorporated into the Scoping Report and the Draft EIA.

We however regard this a non-issues, because the inclusion of the additional activities in the Draft EIA Report did not have any negative impacts. The removal of the activities from the Final EIA Report is a mere scaling down of the application.

Table 1: Listed Notice 1: Activities in terms of Notice No. R 544

Listing No. 1 R. 544,	Activity 9 The construction of facilities or infrastructure	
18 June 2010		exceeding 1000 metres in length for the bulk
		transportation of water, sewage or storm water –
		(i) With an internal diameter of 0,36 metres or
		more; or
		(ii) With a peak throughput of 120 litres per second
		or more, excluding where:
		a. such facilities or infrastructure are for bulk

		transportation of water, sewage or storm water
		or storm water drainage inside a road reserve;
		or
		b. Where such construction will occur within
		urban areas but further than 32 metres from a
		watercourse, measured from the edge of the
		watercourse.
Listing No. 1 R. 544,	Activity 10	The construction of facilities or infrastructure for the
18 June 2010		transmission and distribution of electricity –
		(i) outside urban areas or industrial complexes
		with a capacity of more than 33 but less than
		275 kilovolts ; or
		(ii) Inside urban areas or industrial complexes with
		a capacity of 275 kilovolts or more.
Listing No. 1 R. 544,	Activity 11	The construction of:
18 June 2010		(i) canals;
		(ii) channels;
		(iii) bridges;
		(iv) dams;
		(v) weirs;
		(vi) bulk storm water outlet structures;
		(vii) marinas
		(viii) jetties exceeding 50 square metres in size;
		(ix) slipways exceeding 50 squares metres in size;
		(x) buildings exceeding 50 square metres in size; or
		more where such construction occurs within 32
		metres of a watercourse, measured from the
		edge of a watercourse, excluding where such
		construction will occur behind the
		development setback line.

Listing No. 1 R. 544,	Activity 18	The infilling or depositing of any material of more than
18 June 2010		5 cubic metres into, or the dredging, excavation,
		removal or moving of soil, sand, shells, shell grit,
		pebbles or rock from:
		(i) a watercourse;
		(ii) the sea;
		(iii) the seashore;
		(iv) the littoral active zone, an estuary or a
		distance of 100 metres inland of the high-
		water mark of the sea or an estuary,
		whichever distance is the greater-
		but excluding where such infilling, depositing,
		dredging, excavation, removal or moving
		(i) Is for maintenance purpose undertaken in
		accordance with a management plan agreed
		to by the relevant environmental authority; or
		(ii) Occurs behind the development setback line.
Listing No. 1 R. 544,	Activity 21	The establishment of cemeteries of 2500 square
18 June 2010		metres or more in size.
Listing No. 1 R. 544,	Activity 37	The expansion of facilities or infrastructure for the bulk
18 June 2010		transportation of water, sewage or storm water
		where:
		(a) the facility or infrastructure is expanded by more
		than 1000 metres in length; or
		(b) where the throughput capacity of the facility or
		infrastructure will be increased by 10% or more –
		excluding where such expansion:
		(i) relates to transportation of water, sewage or
		storm water within a road reserve

	or (ii) where such expansion will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the water course
LN 1, Activity	The expansion of:
39	(i) canals;
	(ii) channels;
	(iii) bridges;
	(iv) dams;
	(v) weirs;
	(vi) bulk storm water outlet structures;
	(vii) marinas
	within a watercourse or within 32metres of a
	watercourse, measured from the edge of a
	watercourse, where such expansion will result in an
	increased development footprint but excluding
	where such expansion will occurs behind a
	development setback line.
	•

Table 2: Listing Notice 2: Activities Listed in terms of Notice No. R 545

Listing No. 2 R.	Activity 15	Physical alteration of undeveloped, vacant or derelict
545, 18 June		land for residential, retail, commercial, recreational,
2010		industrial or institutional use where the total area to be
		transformed is 20 hectares or more;

Table 3: Listing Notice 3: Listed Activities in terms of Notice No. R 546

Listing No.	Activity 4	The construction of a road wider than 4	(b)In Gauteng:
3 R. 546, 18		metres with a reserve less than 13.5	

June 2010		metres.	
			v. Sites identified as
			irreplaceable or
			important in the
			Gauteng Conservation
			plan;
			vi. Areas larger than 2
			hectares zoned for use
			as public open space.
Listing No.	Activity 6	Construction of resorts, lodges or other	(b)In Gauteng:
3 R. 546, 18		tourism accommodation facilities that	
June 2010		sleep 15 people or more.	
			v. Sites identified as
			irreplaceable or
			important in the
			Gauteng Conservation
			Plan;
			vi. Within 100 metres of
			from the edge of a
			watercourse
Listing No.	Activity 13	The clearance of an area of 1 hectare or	
3 R. 546, 18		more of vegetation where 75% or more of	(d) In Gauteng:
June 2010		the vegetative cover constitutes	
		indigenous vegetation, except where	v. Sites identified as
		such removal of vegetation is required	irreplaceable or
		for:	important in the
			Gauteng Conservation
		1. The undertaking of a process or	Plan

		activity included in the list of waste	
		management activities published in	
		terms of section19 of NEM: Waste Act,	
		2008 (Act No. 59 of 2008);	
		2. the undertaking of a linear activity	
		falling below the thresholds	
		mentioned in Listing Notice 1 in terms	
		of GN No. 544 of 2010.	
Listing No.	Activity 16	The construction of:	(b) In Gauteng:
3 R. 546, 18			
June 2010		(iii)buildings with a footprint exceeding 10	v. Sites identified as
		square metres in size; or	irreplaceable or
		(iv) infrastructure covering 10 square	important in the
		metres or more	Gauteng Conservation
			Plan
		where such construction occurs within a	
		watercourse or within 32 metres of a	
		watercourse, measured from the edge of	
		a watercourse, excluding where such	
		construction will occur behind the	
		development setback line.	
	i e	1	

1.4 **The Town Planning Process**

The Town Planning Application was made in terms of Section 96(1) of the Town Planning Ordinance (Ordinance 15 of 1986)

Refer to Annexure P for a copy of the Town planning Application compiled by Urban **Dynamics Town and Regional Planners**

1.5 Scope of Work and General Approach to the Study

An application form for environmental authorisation of the relevant activities as well as an Environmental Scoping Report has already been submitted to GDARD for consideration. An investigative approach was followed and the relevant physical, social, economic and institutional environmental aspects were assessed.

The scope of work includes the necessary investigations, to assess the suitability of the study area and the surrounding environment for the proposed activities. The scoping exercise identified the anticipated environmental aspects in an issues matrix and it also supplied a preliminary significance rating for the impacts identified. The scoping process also assessed the possible impacts of the proposed development on the surrounding environment (including the interested and affected parties).

This document represents the EIA for the proposed development. The EIA must be in line with Section 32 of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) and the Approved Plan of Study for EIA that was submitted and approved as part of the Scoping Report.

The EIA takes into consideration the environment that may be affected by the various listed activities and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed development. A description of the property on which the activity is to be undertaken and the location of the activity on the property are described. A description of the proposed development, relevant development activities and any feasible and reasonable alternatives were identified. In addition, a description of the need and desirability of the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have, on the environment and community that may be affected by the activity are included.

An identification of all environmental related legislation and guidelines that we are currently aware of are also considered in the preparation of this EIA Report. Furthermore, a description of environmental issues and potential impacts, including cumulative impacts,

are identified and discussed. Information on the methodology that will be adopted in assessing the potential impacts is furthermore identified, including any specialist studies or specialised processes that were/should be undertaken.

The EIA Report eventually determines whether a proposed project should receive the "go-ahead" or whether the "no-go" option should be followed. If the EAP recommends that the project receive the "go-ahead", it will (in most cases) be possible to mitigate the issues identified to more acceptable levels. Reference is also made to the mitigation of identified impacts or for further studies that may be necessary to facilitate the design and construction of an environmentally acceptable facility.

Details of the Public Participation Process (in terms of Sub-Regulation 1) are also included. Sub-Regulation 1 requires that the following information be included as part of the Public Participation Section of the EIA report:

- (i) The steps undertaken in accordance with the Plan of Study For EIA,
- (ii) A list of persons, organisations and government organs that were registered as interested and affected parties;
- (iii) A summary of comments received from, and a summary of issues raised by the interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments;
- (iv) Copies of any representations, objections and comments received from the registered interested and affected parties.

The mitigation measures and guidelines that are listed in the EIA Report are also summarised in a user-friendly document named an Environmental Management Plan (EMP). A Draft EMP is also a requirement of the EIA Process (Section 32 and 34 of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998)). **Refer to**

Annexure At for EMP

REGISTERED OWNERS AND TITLE DEEDS 2.

The Linksfield site consists of a combination of farm portions. The mixed-use development will however take place on the Remaining Extent of Portion 1, Ptn 137, Ptn 148 and Ptn 149 Rietfontein 61 IR. Portions 137, 148 and 149 were subdivided but not registered at the Deeds Office and therefore still form part of the Remaining Extent of Portion 1 of the farm Rietfontein 61 IR. As such, the content of this report focuses on the Remaining Extent of Portion 1 Rietfontein 61 IR.

Portion 87 of the Farm Rietfontein 61-IR (Edenvale Hospital) adjoins farm portions and forms part of the precinct area that will be impacted by the proposed development.

Based on the Land Surveyor's diagram and Title Deed (T1329/1895), the total site area is 271.5712ha in extent. However, the actual development area only measures approximately 194.99 ha.

The ownership vests with the Gauteng Provincial Government.

3. LOCALITY OF THE PROPOSED DEVELOPMENT - In line with Section 32 (c)

The Linksfield site is strategically and ideally located, especially with regards to location, surrounding land-uses, availability of services and infrastructure, visibility and accessibility along the N3 economic corridor between the Modderfontein and Linksfield off-ramps. The site is situated within 10km of the Sandton CBD, 13km from the Johannesburg CBD and 16km from OR Tambo Airport and development on this large property will be regarded as infill development.

Its location and other development/socio-economic orientated attributes are similar to that of the existing mixed-uses of the Greenstone Retail Node, Longmeadow and Linbro Business Parks, the Edenvale Hospital, various schools and a variety of extensive recreational uses such as the Royal Johannesburg and Kensington Golf Club and Huddle

Park. The site falls within the City of Johannesburg Metropolitan Municipality, Administrative Region E.

The N3 highway and the main arterial connector routes around the development site creates an edge condition that defines the boundaries of the proposed Linksfield Node. The property is surrounded by Sandringham, Glenhazel, Sunningdale, Lyndhurst, Corlett Gardens, Rembrandt Park, Edenvale Ext 1, Marais Steyn Park, Dowerglen, Senderwood and the golfing ground, Huddle Park. Approximately 15 hectares of the site is occupied by the Sizwe Hospital, which will be demolished and sections thereof eventually relocated to another hospital/ site. The demolition of the hospital is regarded as the final phase of the development and this phase will only commence once the applicant found a viable alternative for the existing social services delivered by the hospital.

Please note that the Sizwe Hospital is older than 60 years and valuable facades/ parts of the hospital structure will be conserved, renovated and incorporated as part of the development (as a memorial in remembrance of the Sizwe hospital and the many patients that were treated at the hospital). Refer to the Cultural and Historical Report (Annexure Q) for more detail.

4. EXISTING ZONING AND LAND USE AND THE PROPOSED LAND-USE

4.1 Existing Zoning and Land Use

The site area is mostly undeveloped, with the exception of approximately 15 hectares occupied by the Rietfontein (Sizwe) hospital, which currently specialise in the treatment of Tuberculosis (Multidrug-Resistant Tuberculosis and Extensively Drug-Resistant Tuberculosis), HIV testing/counselling and tropical diseases. Approximately 10ha of the site is occupied by cemeteries and three hectares by personnel accommodation. The study area is currently zoned "agricultural" with the following development controls:

Table 4: Existing zoning and development controls		
Use Zone	Agricultural	
Height Zone	Zone 0 (Four storeys)	
Floor Area Ratio	1.5	
Coverage	66%	
Density	No Density	
Building Line	10m street boundaries and 5m all other boundaries	

4.2 Proposed Land Use

The Proposed Linksfield Mixed use development site forms part of the densification strategy in the Greater Johannesburg Metropolitan Municipality. Due to the development being initiated by the Gauteng Provincial Government, **Inclusionary Housing** is considered the central theme of the development. The development is envisioned as a high quality services and multi-faceted living environment, which will include the following land uses:

- Residential Apartments;
- Offices & Business Parks:
- Convenience Retail
- Entertainment & Restaurants;
- Commercial and Light Industrial uses;
- Hotels & Conference Facilities:
- Show Rooms:
- Gymnasium;
- Educational Uses including Schools and Tertiary Education, and
- Active and Passive Recreational Space.

With the above development proposal the existing cemeteries will be conserved, renovated and included as part of the development (as a memorial site contributed to the

deceased). Discussion of the other various development components of the proposed mixed use inclusionary development is presented below.

5. ALTERNATIVES IDENTIFIED – (In line with Section 32 (f) and (h))

Alternatives should be considered as a norm within the Scoping and Environmental Impact Assessment Process. These should include the No-Go Option, locality alternatives, land use alternatives and layout alternatives. There were a lot of project meetings held regarding the alternatives that were considered. The alternatives below are the final alternatives identified:

5.1 The "No-Go" Alternative

The "No-Go" option was considered given that the Regulations prescribe that it be considered. The no-go option implies the consequences of not developing the township and the implications on the sustainable development.

The following table below consists of the preliminary issues for the "No-Go" Option:

Diagram 1: Preliminary Issues- "No-Go" Option

Issue	Short term	Medium term	Long Term	Impact
Geology and				Positive
soils				Neutral
				Negative
Conclusion	The geology and soils will be neutral, because without the development there will be no construction which means there wi be no digging into ground. The soils and geology will not be affected. It is however the opinion of many specialists consulted that the sit which currently incorporates many exposed areas, are more		means there will will not be Ulted that the site,	

	dangerous (with regards to the spreading of diseases) if it is left undeveloped. Many children, squatters/vagrants and other parties currently dwell across the study area and the site is also often used for recreational bike rides, which causes dust and noise pollution and soil degradation.		
	There are also some sewage spills on the study area and some TB DNA was found in the soil samples. This poses a health risk to people (mainly illegal occupants) that currently reside on the study area or that use water from the river for bathing and drinking purposes.		
Hydrology	Positive		
	Neutral		
	Negative Negative		
Conclusion	The soil and water samples taken during the specialist surveys indicated that there are some TB DNA in the soil. There are currently some sewage overflow from the hospital on the site and if this problem is not addressed, the soil and ground water quality will deteriorate even more. This poses a health risk to people (mainly illegal occupants) that currently reside on the study area or that use water from the river		
Vegetation	for bathing and drinking purposes. Positive		
vogeraneri			
	Neutral		
	Negative Negative		
Conclusion	Due to the fact that there is a stigma associated with anthrax and death around the study area, people tend to avoid the study area. Only vagrants and illegal occupants roam the study area.		
	No maintenance is currently done on the study area and exotic invaders are taking over. There are also some exposed areas on the site and erosion problems are also increasing.		
	The invaders are also impacting on the ecological value and potential of the riparian zone along the Jukskei River and in the long term it will also have negative impact on the larger open space system to which it is linked (cumulative impacts).		
	Some intervention is urgently required to prevent the spreading of invaders and to curtail erosion, siltation and pollution.		

Fauna		Positive
		Neutral
		Negative
		Negalive
	As mentioned, the natural ecological functioning of is already disturbed and exotic invaders are spreadirate.	-
	This leads to the loss of habitat for fauna species and in the bio-diversity of the study area and eventually spaces to which it is linked.	
	If no ecological management is applied on the stud will deteriorate even more and this will eventually ho irreversible negative impact on the fauna species.	•
Social	P	ositive
	N	leutral
	N	legative
	around the study area. The people in the surroundin the study area and most of the comments received people prefer it if the study area remains untouched from society, due to the possible contamination of the structures and groundwater with DNA of diseases. At present most of the parties that raised concerns in disturbance of the soils during the construction phase anthrax spores and that the anthrax spores and other viruses to be released will enter into people's lungs of cause outbreaks that will infect thousands of people from a social environmental point of view this matter questions regarding the develop-ability of the study made it necessary to conduct intensive research and field of tropical diseases and all other health risks asset the study area. As environmental consultants we do not regard the and avoidance of the study area as a sustainable so problem must always be addressed and resolved armentioned suitable qualified specialists were appoint conduct studies that will enable and the EAP and the authorities to make informed, factual and scientific lidecisions.	indicated that d and isolated he soils, andicated that se will activate er bacteria and and this will e. er raised serious area and it and surveys in the sociated with a sociated with a sociated with a sociated to and as a sociated to and a sociated to a socia

	No former development applications submitted for the development of the study area were successful. This is unfortunate, because the study area is ideally situated in terms of accessibility, availability of services, visibility etc. and it is completely surrounded by urban development. The studies and research conducted however eventually proved that it will be better to develop this deteriorating and isolated site. With no development the condition of the study area will deteriorate even further. The metal markers of the graves and the stone-work around the graves have already been vandalised to such an extent that many of the graves are not recognisable anymore.	
Economic		Positive
		Neutral
		Negative
Conclusion	At present, the status quo of the study area is detrapid rate. The study area is being avoided by the public and placed in "quarantine". This is unfortunate, because is strategically situated for development and the of a mixed-use development on this property will far-reaching. The existing hospital on the study area furthermore dilapidated and TB and HIV patients are currently facility, which can easily be replaced with a small functional facility. This large unutilised vacant property in the middle of Gauteng's economical hub is regarded as a togovernment regarded it as high time to address to matter in a responsible way.	d it is almost use the study area economic value be immense and e appears treated at this ler and more e of the urban fibre otal waste and
Agricultural		
		Neutral
		Negative
Conclusion	At present the agricultural potential of the study of soils are very shallow and scattered rock in the up common phenomenon. This makes the study area unsuitable for the planting of crops or for the usage equipment.	pper soil layers is a a totally

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	From a grazing point of view, the study can be regarded as suitable. The grazing potential is however compromised by various other factors such as theft, the lack of fences and the potential of flies and odours associated with the animals that will roam the site.	
Infrastructure		Positive
		Neutral
		Negative
Conclusion	As stated in the comment of many of the objectors, the road infrastructure and services in the area are on capacity/ "stretched" and without any development or upgradings in the area, such infrastructure will deteriorate even further. As mentioned in the soil survey report, the existing infrastructure of the hospital is also very old and some sewage spills/leaks were detected on the site. The proposed development will contribute significantly to the services and infrastructure in the area.	
	From a services and infrastructure upgrading point of view the 'go" option is most definitely not regarded as the preferred option	

Finding:

From the short analysis as set out above, it is evident that the "no-go" option in the case of this specific study area, is not the preferred option. Most of the environments/ environmental aspects as discussed above are in a negative state and the negative impact will only increase if no development/human intervention takes place on this site.

The uncertainty and health rumours associated with the development of the study area caused the total isolation and avoidance of the study area over the years. People are scared to move across the study area and to commence with any excavations, including the upgrading of services on and around the property, because the general public seems to be of the opinion that the study area is contaminated with anthrax spores and other life threatening diseases that can become active and cause outbreaks once the soil on the property is disturbed, especially during windy periods.

Our scientific research and evidence (included as part of this EIA Report) however confirmed the contrary. According to the appointed anthrax and tropical disease

specialists the contamination risks associated with the development (especially the disturbance of the soils) are low to none. In fact, they regard the risks on other surrounding properties as similar/ even higher, because the anthrax outbreak affected all the farms in the Johannesburg area and animal carcasses were also buried on surrounding farms.

All experts involved regarded the development option as the preferred option for the study area and their short 2 pager summaries (certified by each expert) confirms this statement. **Refer to Annexure E for summaries compiled by specialist forum** appointed to assist with this crucial issue. More detailed specialist reports compiled by the experts are also attached as part of this EIA Report and will be referred to when the environmental aspects are assessed and discussed.

5.2 Land Use Alternatives

5.2.1 The Conservation of the Study Area and the Development of the Study Area into a Memorial Park/ Recreational Park/ Golf Course (as an extension of the existing one to the south-west of the study area)

Manicured landscaped gardens and a golf course (as recommended by some of the I&APs) will require regular maintenance and it will also include many planting beds/bunkers with exposed soils. Such gardens require landscaping and the maintenance workers will thus be exposed to the "so-called" polluted soils (if anthrax is regarded as an issue) on a daily basis. According to the experts it will be better (if the diseases and health risks remain an issue) to rather cover as much of the study area as possible with concrete. Anthrax is however not regarded as an issue anymore. The only reason why we included this paragraph is due to the fact that some of the parties that objected to the development due to the disease risks, proposed that the study area rather be developed as a golf course, park, Memorial Park. This reasoning does not make any sense.

The development of a park will furthermore fail to stimulate any major economical activities and it will therefore not justify the much needed upgrading of the surrounding road network and services. The park will furthermore require a significant amount of maintenance and management and the owner does not have the funds or the capacity to operate this area of almost 220 ha as an open space. This will not be a sustainable solution.

The proposed mixed-use development or a development, which will only consist of mixed density residential uses, are regarded as the only two viable development alternatives for the study area.

5.2.2. Agricultural

At present the agricultural potential of the study area is low. The soils are very shallow and scattered rock in the upper soil layers is a common phenomenon. This makes the study area totally unsuitable for the planting of crops or for the usage of any farming equipment. The study area is furthermore surrounded by urban structures and this will make it extremely difficult to apply pesticides and fertilisers to the land. Surrounding land-owners will raise concerns regarding the odours and potential health impacts associated with the application of pesticides, especially during the windy periods. This issue is a common phenomenon at small towns with agricultural land immediately adjacent to the town.

From a grazing point of view, the study can be regarded as suitable. The grazing potential is however compromised by various other factors such as theft, the lack of fences and the potential of flies and odours associated with the animals that will roam the site.

As environmental consultants it is also important to compare the socio-economic values of the various potential land-uses for the study area with one another. In the case of the study area, the socio-economic value of the proposed mixed-use development on the study area is regarded as much higher than the socio-economic value of agricultural activities. It is also important to note that the study area is not situated within any of the 7 agricultural hubs identified by GDARD.

5.2.3 The Development of another Hospital/ Medical Facilities

This option was also investigated and it does make sense to upgrade the existing hospital/ to replace some of the hospital functions with a new facility close-by, but as mentioned, the site is large and it will not be economically viable to allocate the entire developable site (almost 200ha) for medical related land-uses. It does however make sense to incorporate some medical functions and services as part of a larger development.

As mentioned, the existing hospital is in a dilapidated state and it will be better to demolish it and to redevelop another similar facility on the property or in close proximity of the study area.

The cultural and historical specialist confirmed that most of the hospital structures are older than 60 years, even though major alterations/expansions and upgradings took place over the years. It was however recommended that certain sections of the hospital remain on the site and be incorporated as part of the proposed development for the study area. The structures to be conserved must be renovated and must eventually act as memorial in remembrance of the patients that were treated at the hospital, the dedicated staff that worked at the hospital and all other functions and services delivered by the hospital since 1895. The grave yards on the property must also be renovated and conserved as memorials. The rich history of the site must be reflected across the study area and a small museum/ exhibition can even be established in one of the historical structures that will be conserved.

5.2.4 Only A Low-Cost and High Density Residential Development

Gauteng Province is obliged to supply a certain amount of housing within the province and this study area, which is currently strategically situated and unutilised, is regarded as an ideal site for such as housing development. If the entire site is developed with affordable residential units of various densities, the government will most probably be able to supply between 18 000-30 000 residential units on the property. Even though this

development will contribute significantly to the housing demand in Gauteng, such a development will not be sustainable.

People need jobs in close proximity of their homes. They also require educational facilities, shops, clinics, police stations, libraries and many other social facilities within a certain radius from their homes and in order to achieve this, a large portion of land with a variety of land-uses/zonings is required. If the social facilities are not provided in close proximity of the residential development, the situation will become problematic because the residents will flood other social facilities in the area and there is even a risk that the residents will eventually establish their own social and economical facilities (in an informal way) in and around the study area.

Based on the above and other research it was decided that a mixed-use development will be the best development option for the study area. Also refer to the Annexure P for Town Planning Memorandum and Annexure Ad for Market Study

5.2.5 Mixed-Use Development (The Preferred Alternative)

The Linksfield site is ideally and strategically located between Linksfield Road (M16) in the south, the N3 highway to the east, Modderfontein Road to the North and Club Street to the west. The densification strategy of the Greater Johannesburg Metropolitan Municipality earmarks the study area for development.

The proposed mixed use development consists of residential, retail, offices, business, commercial, light industrial, educational, hospitality facilities and social amenities. This development will also create a large amount of employment opportunities in close proximity of residential, whilst contributing to economic growth and development in the area.

A significant amount of thought and work went into the finalisation of the proposed development layout and land-use combinations. In order to achieve a well-designed, high

standard and quality project on the study area, the Department of Human Settlement approached a reputable private developer to assist with the development. A Private-Public Partnership (PPP) was established and the PPP invited (as part of a design competition) well known and highly experienced urban designers and architects to compile development master plans for the proposed development on the study area. The purpose of the competition was to stimulate and incorporate fresh and innovative ideas into the development concept and to eventually put a unique development concept acceptable to the surrounding residents, the residents of the development and all other parties that could have an interest in the project, on the table.

If the Department fail to provide housing, the homeless will simply settle illegally on vacant properties that are in close proximity of the study area. In most cases these properties are not serviced and the situation eventually creates unhygienic conditions and security problems in an area. If the study area is not developed, informal settlement will most probably establish over the next few years. We already came across some illegal squatters that reside on the study area during some of our site visits. Once informal settlements commence on a property, more illegal residents are drawn to an area and the situation eventually becomes unmanageable and re-active planning in the form of service delivery often becomes urgent. If required, we can provide examples of such problems already experienced on various sites (some with dangerous living conditions) in Gautena.

The purpose of this project is to promote pro-active planning and to provide the development and surrounding area with upgraded services and roads. All the houses/units to be developed on the property will appear attractive and will be serviced.

Some of the objectors raised concerns regarding the type of people that will be accommodated in the development. It was mentioned that the people will have no money and that their circumstances will lead to petty crime and eventually to serious crime in the area.

Fact is that there are many people in desperate need of housing across South Africa and more specifically Gauteng, the economical hub of South Africa. These people must stay in

areas that are within the urban boundary or in close proximity of urban areas, because most of the jobs are generated in the urban areas. The lack of transport and housing close to urban areas eventually lead to the formation of informal settlements on vacant sites similar to the study area. Serious crime often takes place on such sites.

The Department of Human Settlement regard the proposed development as an ideal opportunity to develop something that will not only uplift the living conditions of previously disadvantaged individuals, but it will also improve the services provision and road conditions of the existing residents and the area. The security of the area will furthermore be improved by this controlled development and this pro-active planning action will prevent land-invasion problems on the specific land that will most probably occur in future if no formal development takes place. Once informal settlements established on a property, it is extremely difficult to relocate the people on the land and it will not be possible to implement a well-planned, managed and serviced development with increased security.

Diagram 2: Preliminary Issues/Impacts Associated with the Proposed Development

Issue	Short term	Medium term	Long Term	Impact	
Geology and				Positive	
soils				Neutral	
				Negative	
Conclusion	excavations and waste sites are exwill have to be statests (from a head view). According to son the soils of the state will become activisoil layers are distagravely and samples that wer graveyards. Appears	the soil and geology cutting and filling exposed during the dopped in order to all the and safety and content of the objectors of the objectors of the and cause anoth or the dopped in order to all the and cause anoth or the sted. Soil tests we arently the pH of the on the study area) of the on the study area.	evelopment pho low for further in ultural and histor and people that ninated with ant her anthrax outbron. According to und in any of the ere also conducts soil on the study	gravesites/ ase, construction vestigations and rical point of were consulted hrax spores that reak when the o the team of e soil or water ted in the y area is very low	

bones in the graves with acid soils will decompose fast and the possibility of finding bones of animal carcasses (animal bones are the carriers of the anthrax spores) that were buried in the 1920s are extremely low.

In the medium term (after development took place) large sections of the study area will be covered with concrete features and structures and a well-planned storm water management system will be in place to prevent erosion, siltation and water pollution.

Some areas (above the floodline and outside of the natural open spaces) will be covered with landscaped gardens with a ground-coverage of more than 75%. Where necessary natural areas will be rehabilitated and on-going weed-control programmes will be implemented.

The actions as listed above will eventually have a positive impact on the soil quality and the geology of the study area.

Hydrology

Positive

Gaut: 002/13-14/E0153

Neutral

Negative

Conclusion

As mentioned under the "no-go" option, the current status of the hydrology of the study area is negative. Some TB DNA was found in the soil samples in the vicinity of the river. The specialists are of the opinion that the sewage spillages of the Sizwe hospital cause the pollution.

If the development takes place, the Sizwe Hospital will be closed and sections of the hospital will be accommodated in a newly developed facility with new and high quality services.

It is however true that the construction activities will (if not well managed) have a temporary detrimental effect during the construction phase.

Such construction related impacts can however be mitigated to acceptable levels (i.e. through the implementation of a construction storm water management plan).

One of the main concerns raised during the public participation process is the possible re-activation of anthrax spores when the soil is disturbed and moved. This aspect was discussed with various experts and according to the experts the health risks associated with the tropical diseases as listed are none or very low.

The soils scientist and the geotechnical engineer indicated that the larger portion of the study area is covered with shallow and rocky soil layers and excavations in the underlying greenstone layers are very difficult and they cannot imagine how graveyards could be established in such difficult soil conditions, especially at the time of the outbreaks, because mechanical equipment would have been required for the digging of the graves. The experts are of the opinion, if there are more graves, that such graves would have been excavated on portions of the larger farm with deeper soils. As mentioned, more than 50% of the original farm has already been covered with urban structures and infrastructure. Geo-hydrologists already took samples of the ground water and the surface water associated with the study area. Surrounding boreholes were also tested and no signs of graves could be detected in the samples. The samples were however also taken to act as baseline samples for reference purpose during and after construction. Even though no other graveyards or waste sites than the sites identified by the experts were found on the study area, the regular monitoring of the ground water during the construction phase will indicate any signs of contamination and if any contamination is detected, the matter will be investigated immediately. It is however foreseen (if the proposed development is well-planned and managed) that the long-term impacts of the development on the hydrology will be positive. The wetland and riparian areas will be protected, the disturbed areas adiacent to the river will be rehabilitated and stabilised and the sewer spillages of the hospital will no longer be a problem. On-going water quality tests (mainly during the construction phase and immediately after completion of construction) will also assist with the monitoring of the water quality of the Jukskei River and the around water resources. We are thus of the opinion that the long-term impact of the proposed development on the hydrology will be positive. Vegetation Positive Neutral Negative Conclusion As mentioned, the vegetation of the study area is already disturbed by human activity. The study area is also infested with weeds and exotic invaders. There are however some medicinal plants on the study area that should be removed prior to development.

At present the study area is vacant and neglected and no/limited maintenance is taking place on the study area. There is a stigma of death and disease around the study area and in general people are cautious to enter the site. The study area is currently almost isolated and placed in "quarantine" and people regard any possible disturbance of the study area as a possible health threat. The cultural and historical value of the property has also been emphasized by many parties and the potential loss of the remaining graves is also regarded as a major issue.

Our investigations proved that the disease outbreak risks associated with the development of the study area are no higher than the risks on other properties in the Johannesburg area that were also affected by the anthrax outbreak of 1923. In fact, the specialists indicated that the risks of getting anthrax on farms, when doing excavations, are similar than the risks associated with the study area. Apparently there are no recorded deaths of humans that died of Anthrax in South Africa. There are however recorded cases in Zimbabwe. Furthermore. anthrax spores cannot be released by human remains. It only survives in animal carcasses. Apparently the spores are heavy and difficult for humans to inhale. Humans need to be exposed to at least 1 300 spores per day to be infected. According to Dr. De Vos they found only one anthrax spore on the site in Cape Town that was the burial site for animals that died of anthrax. A shopping centre was successfully developed across this old burial site and today most of the site is covered with concrete. According to Dr. De Vos it is better to cover such a site with concrete. Anthrax is also regarded as the only disease that could still be a potential low risk threat when excavating.

The possibility of rehabilitating the study area and to utilise it as a park, golf course/memorial park was investigated and considered, but in this specific case the development of the site was regarded as the preferred alternative. The specialist recommended that large portions of the study area rather be developed and covered with concrete.

The development will thus cause the loss of large sections of disturbed natural vegetation. The applicant is however also willing to contribute to environmental management and conservation through the rehabilitation and on-going maintenance of the riparian and wetland areas and to ensure links with the larger regional open space system. The rehabilitation and management of the remaining open spaces will assist with the eradication of weeds and invaders, habitat creation, erosion and siltation control and increase of bio-diversity. The rehabilitation and on-going maintenance and management of the open spaces will also contribute to improved water quality and security in the area.

be negative. Once exotic invaders and weeds are removed and the remaining open spaces are rehabilitated, the fauna species (adaptable to the urban environment) will most probably move back to the study area. If the new habitats are created the bio-diversity will increase and this could have a long term positive impact (also cumulative impact) on the larger Gauteng open space network system to which the study area is linked. Social Positive Neutral Negative Conclusion As mentioned, a stigma of death and disease outbreaks currently hangs around the study area. Some former developers already tried to develop the study area, but the grave and anthrax aspects prevented any development on the property. When we first became involved with the project, we regarded the potential graves and the risks associated with the diseases treated at the hospital and the anthrax aspect as possible "fatal flaws" that		The long term impact fauna is regarded as significant portions of	positive, even th	nough it will lead to			
Conclusion The short term impact (mainly during the construction phase) will also be negative. Once exotic invaders and weeds are removed and the remaining open spaces are rehabilitated, the fauna species (adaptable to the urban environment) will most probably move back to the study area. If the new habitats are created the bio-diversity will increase and this could have a long term positive impact (also cumulative impact) on the larger Gauteng open space network system to which the study area is linked. Social Positive Neutral Negative Conclusion As mentioned, a stigma of death and disease outbreaks currently hangs around the study area. Some former developers already tried to develop the study area, but the grave and anthrax aspects prevented any development on the property. When we first became involved with the project, we regarded the potential graves and the risks associated with the diseases treated at the hospital and the anthrax aspect as possible "fatal flaws" that could prevent the project from happening, especially since we were (at that stage) environmental consultants with limited knowledge regarding the diseases and graves referred to. We however decided to commence with the application and the approach was to base all our recommendations and findings on concrete scientific facts obtained from various specialists (the best in their fields). The recommendations to be made by Bokamoso and No and the appointed specialists were regarded as very important, especially since people's lives could be at stake. We indicated (from the outset) that it will not be possible for us as the EAP to recommend	Fauna				Positive		
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a position to recommend that the project receive the go-ahead. In fact all the experts agreed that the development option will be the preferred alternative for this specific site.

From a cultural and historical point of view, we are convinced that there are no other graves or waste sites on the study area. The geotechnical conditions and the shallow soils on the site are not regarded as suitable for any more graves or waste sites. The graves of infected patients that died of viral diseases had to be deeper than 600mm and the conditions on the study area are not suitable for such deep graves/ for medical waste sites. The specialists are of the opinion that the other graves (if there are any) are most probably situated on the portions of the larger farm that are underlain by deeper soils. These areas will be difficult to identify, because these areas are already developed. We will however still follow the cautious approach and suitable measures will be put in place (during the construction phase) to investigate any possible graves/ waste sites to be discovered during the construction phase.

There will be a negative impact on the social in short term due to the construction there is a possibility that the crime may increase. In medium term the social impact will neutralise and over long term the impact will be positive due to the development there will be security over the area to protect the people in residential area as well as in the work place. There may also be noise impact during construction but mitigation measures will be implemented.

Other main issues that were raised by the surrounding land-owners and I&APs related to the services, roads and the possible impact of the proposed development on the surrounding property values.

Apparently there is already heavy traffic congestion on the roads in the area and the conditions of the roads are also poor. The parties also indicated that the existing services in the area are already stretched and they cannot see how the existing services and infrastructure will be able to accommodate 8000 more houses.

Some parties also mentioned that they regard their suburbs as upmarket suburbs and the development of low-cost housing in the area will cause a decrease in the surrounding property values. It was also mentioned that the people that will reside in the development area will be poor and this will lead to an increase of petty crime in the area and eventually to an increase in serious crime. Some children in the neighbourhoods walk to school and their safety will be at stake.

The above listed issues represent the major issues raised by the I&APs. All the issues were considered and addressed and as environmental consultants we are convinced that the proposed development will have numerous significant positive socio-economic impacts. The

proposed development will contribute to major services and road upgradings in the area that will not only accommodate the additional capacities required for the mixed-use development. Other developers and residents in the area will also benefit.

Many new roads will be constructed and the existing sub-standard roads will be upgraded. This will not only increase the traffic flow in the area, but it will also increase the existing road safety conditions.

The proposed development will be a formal mixed-use development that will appear attractive and that will be fully serviced. The development will not only consist of housing. The development will also aim to provide additional social facilities (as required for such large development) and new businesses (managed and owned by the private sector) will contribute significantly to job creation. The aim is to establish a sustainable development unit on the study area. With such a sustainable development unit in place, safety and security will be improved and crime will be reduced. All environments (social, economic, institutional and ecological) will be in balance and the development scenario will without any doubt be more beneficial.

The fact that the project will be driven by a PPP, makes a major difference in the project approach and possibilities. The private sector currently drives the project and is motivated to make a success of this unique opportunity on the strategically situated study area.

As mentioned the project will be based on pro-active planning and the developer wants the entire area to benefit from the project. The project must be successful and it must eventually become an integral part of the surrounding land-uses and developments.

Fact is, Gauteng has a large housing back-log that must be addressed. The preferred land for housing are vacant land within the urban areas and if such vacant and unutilised areas are not developed/ managed the land will eventually be covered with informal housing, that are un-serviced and unpatrolled. Some signs of illegal squatters were already detected on the study area during the site investigations. The graveyards on the study area also show signs of major vandalism and some urgent interventions are required to protect the cultural and historical assets of the study area from total destruction. As mentioned, most of the history and evidence associated with the Sizwe Hospital had already been destroyed by a fire.

Land within the urban areas are already surrounded by services and is in close proximity of job opportunities. Development of such properties will promote the upgrading and optimum utilisation of services and it

	will also broaden the tax base and economic opportunities of the city.					
	If well planned and managed, the long terms impact on the social environment will be positive.					
Economic	Positive					
	Neutral					
	Negative					
Conclusion	At present most of the surrounding land-owners have the perception that the proposed development will be a "squatter camp" or a low cost housing development that will only bring trouble into the area.					
	Please note that the developer is very sensitive to the surrounding urban areas and the PPP already put an enormous amount of effort into the aesthetical and land-use planning of the project.					
	For purpose of finalising the PPP's development vision for the study area, professional urban designers and architects were invited to take part in a competition. The purpose of the competition was to incorporate innovativeness and creativity into the project and to combine and integrate new concepts into a unique and workable development concept that will not only uplift the area and its associated infrastructure, but that will also fulfil in much needed housing and job creation needs of previously disadvantaged individuals.					
	The intention was furthermore to broaden the economical base of the city and to generate additional rates and taxes payable to the local authority. The development model that was followed proved that this can only be achieved with a PPP and if commercial, business and other business related land-uses are incorporated as part of the development. A stand-alone residential development was not regarded as socially or economically viable.					
Infrastructure	Visual images of the project concept are attached as Annexure R Positive					
	Neutral					
	Negative					
Conclusion	At present the services and infrastructure in the area are stretched. Many of the objectors complaint about the services and the fact that upgrades are urgently required. The government does not have the necessary funding to upgrade the services and the road infrastructure and usually turn to developers to assist with the required upgradings. Without development, the required services and road upgradings					

most probably will not be regarded as a priority. Funds will rather be allocated to other areas that have no services or infrastructure.

If the development takes place the construction phase could have a temporary negative impact on the infrastructure, because it could cause the temporary disruption of services/ the need for service or alternative access roads to properties.

The long term impact will however be positive and all surrounding land-owners and the wider public that will use the upgraded roads and infrastructure will benefit from the services and road upgradings. The ecological environment will also benefit, because he substandard leaking sewer system of the Sizwe Hospital that currently causes major soil and ground water contamination, as well as health threats, will be replaced with high standard facilities and processes that are environmental friendly.

There will be negative impacts on the infrastructure in short term during construction, because some of the infrastructure may be damaged during this phase. The infrastructure will be positive through the long term because of the new development and the maintenance of the new infrastructure.

Agriculture

Positive

Gaut: 002/13-14/E0153

Neutral

Negative

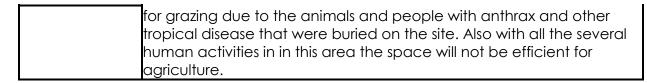
Conclusion

The proposed development will take place on a portion of farm land that is only suitable for grazing, but livestock often attract flies and other insects to the area. Manure associated odours can also have an impact on the qualitative environment.

The land is not regarded as suitable for the cultivation of any crops, because the study area is covered with shallow and rocky soils. The shallow and rocky nature of the soils make the use of farm implements such as ploughs almost impossible. The risks of the spreading of anthrax spores (if there are any on the study area) are also higher if the soil layers are disturbed on a continuous basis.

The study area is furthermore surrounded by urban development and the spraying of pesticides and fertilisers will create health concerns and unpleasant odours will also be carried over the developed area, especially in the direction of the prevailing winds. It is also important to note that government earmarked the study area for development and the study area is not situated within any of the 7 agricultural hubs identified for agricultural land-uses by GDARD.

The site area has enough space for grazing but the site is not suitable



Note: From the preliminary investigations that were conducted, it is anticipated that the proposed development option is predominantly negative in the short term, due to construction phase, but turns neutral in the medium term and then positive in the long term for most of the issues.

5.3 Locality Alternatives

The locality of the study area is regarded as desirable for the proposed development due to the following reasons:

- The site is well located from a connectivity point of view. The N3 highway bordering the eastern side of the site gives it exposure and provides access from the Modderfontein and Linksfield off-ramp to connect the site to the national grid;
- The development will contribute to the urban infill strategy utilizing connections to the various nodes;
- The location of the site enables its development to contribute to urban corridor development;
- The study area is in close proximity to various other townships such as Sandringham, Glenhazel, Sunningdale, Lyndhurst, Corlett Gardens, Rembrandt Park Edenvale Ext 1, Marais Steyn Park, Dowerglen, Senderwood and the golfing ground, Huddle Park, which will be beneficial to the creation of employment opportunities;
- Some of the sensitive environmental attributes can be integrated with the development of the site;
- Existing road network provides ease of access;
- Engineering services are within easy reach;
- The site is owned by government.

The Department of Human Settlement constantly searches for land that is suitable for the development of the much needed housing in Gauteng Province. This site is one of many

sites that were identified for development, but the excellent locality and the developable size of the study area makes this property a prime development site for the proposed PPP mixed-use development as described in this EIA report.

5.4 Layout Alternatives

As mentioned many layout and land-use combination alternatives have been considered for the proposed mixed-use development. The initial alternatives were already considered after the receipt of the proposals that were submitted as part of the design competition. (The brief and submissions for the design competition is available on request).

After the project was awarded to the successful tenderer the designer become part of the a large project team, which gathered every two weeks to discuss the results of the specialist report and the potential impacts of such specialist findings on the final layout and land-use proposals. *Minutes of the bi-weekly project integration meetings are also available on request.* Bokamoso and Nali Sustainability Solutions also attended the bi-weekly meetings in order to ensure that holistic and integrated planning takes place and that all the environmental issues identified are investigated, addressed and taken into consideration in the final layout and land-use proposal. The environmental aspects and issues associated with the study area and its surroundings were regarded as the form giving element for the proposed development concept and layout.

The following environmental aspects had a major impact on the layout of the proposed development and the proposed layout was amended on several occasions to accommodate/ incorporate such aspects: Refer to Annexure W for other layouts alternatives that were considered and that were amended to take the specialist recommendations and findings into consideration

• The grave yards – The team of specialists identified x3 graveyards on the study area. The graves will remain on the study area and the layout was amended to avoid the graves and to incorporate the graveyards as memorial in remembrance of the people that were buried there and the associated history of the Sizwe Hospital (Refer to Annexure Q for Cultural and Historical Investigation and Annexure Qi for

SAHRA Comments also Refer to Annexure Aq for Cultural and Historical Specialist's response to the I&AP comments)

- The Sizwe Hospital according to the cultural and historical surveys some of the structures of the Hospital, which have been altered and extended on various occasions, are older than 60 years and have some cultural and historical value. The specialist identified the structures that should remain on site for incorporation as memorials / a possible museum. The layout was amended to incorporate such structures. (Refer to Annexure Q for Cultural and Historical Investigation)
- The Riparian and floodline areas associated with the well-known Jukskei River. The ecological systems associated with the riparian areas of the Jukskei River have already deteriorated to such an extent that the entire system is stressed.

Water pollution, the loss of natural vegetation, the spreading of exotic invaders and weeds and erosion are common phenomenon. Bad planning, unsympathetic developments, illegal settlements below the flood line area and a lack of maintenance are the main causes of the current deteriorating riverine system and water quality issues.

The flood line areas, the wetland areas and the riparian zone associated with the Jukskei River were identified as areas with high ecological potential and value and therefore it was proposed that these areas be conserved and incorporated as natural open spaces in the final development layout. The intention is to rehabilitate the areas and to implement an on-going weed control programme to remove the exotic invaders and weeds from these areas.

The rehabilitation of the open spaces areas will eventually assist with habitat creation and an increase in bio-diversity. In the long term (if the open space system is well maintained and managed) the open space, which is linked to the larger Gauteng open space system will contribute to a healthy/more sustainable continuous regional open space network (as cumulative effect).

In terms of Section 144 of the National Water Act, the 1:100 year flood line must be indicated on all development plans. The involved engineers therefore determined the 1:100 year flood lines prior to the development as well as the impact of the development on the pre-construction flood lines. Apart from some infrastructure that will have to cut through watercourses/ flood line areas, no other development apart from natural open spaces adaptable to the urban environment are planned for the areas below the flood line. The development layout was amended to avoid the watercourses and areas below the flood line. Also Refer to Annexure Au for Wetland Rehabilitation Plan and Monitoring Plan

A Section 21 Water-Use License application in terms of the National Water Act (NWA), 1998 has already been prepared and submitted to The Department of Water and Sanitation (DWS) for consideration. The Section 21 Water-Use License will be required for the services that will encroach into the watercourse areas and into the flood line areas and for development within 500m from a wetland. The rehabilitation of the areas below the flood line will also trigger activities (c) and (i) as listed in Section 21 of the NWA. Some of the I&APs are concerned about the storm water management concept supplied by the storm water engineers, because it includes in stream measures and it does not propose an on-site attenuation. Dr. Johan van der Waals and the involved storm water engineers will discuss the measures in more detail with the City of Johannesburg and DWS, and if required, the storm water management concept will be altered in order to also allow for some on-site attenuation. The storm water management will be designed to be in line with the requirements and standards of the local authority and DWS. The only reason why the engineers proposed the concept as supplied in the EIA Report is due to the fact that the applicant already implemented this system elsewhere in the Johannesburg area and the results are very positive. Refer to Annexures S and T for Fauna and Flora and Wetland Reports, Refer to Annexure U for Flood line Drawings and Refer to **Annexure Ah for Storm Water Management Conceptual Design**

A vulnerable plant species named the *Trachyandra erythrorrhiza* has been identified in the north-eastern section of the study area. In terms of the GDARD bio-diversity requirements and the Fauna and Flora specialists that conducted the relevant surveys for the study area, a 200m must be applied around such species within urban areas. This natural habitat of this specific species is associated with clayish soils and it usually occurs in wetter zones.

The result of the application of the bio-diversity requirement, which is only a guideline, is that almost the entire north-eastern portion of the development will be sterilised from development.

We already formerly applied for developments on other study areas that contain the *Trachyandra erythrorrhiza* species. This species is endemic to Namibia and it is qualifies for vulnerable under the criteria A3 + 4 and C. According to the IUCN Red List of Threatened Species 2014.2 (a citation) the species is still classified as vulnerable, but apparently the annotations need updating. What is however confusing is the fact that the same IUCN website states that "the taxon has not yet been assessed for the IUCN Red List, but that it is in the Catalogue of Life" Refer to Diagram 3 below for insert as obtained from the website.

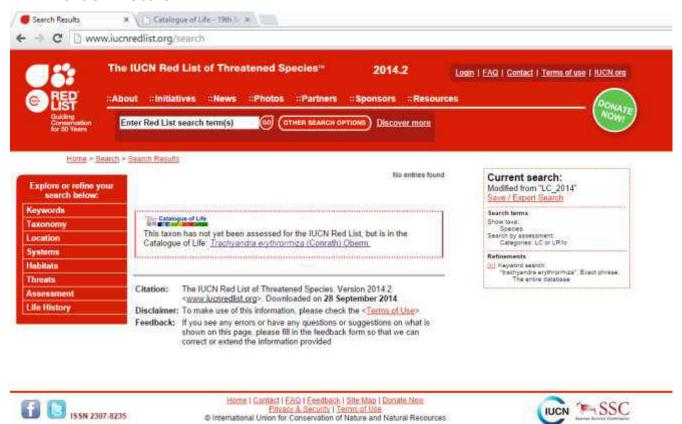
Another important factor to take into consideration is that more than 1 000 *Trachyandra erythrorrhiza individuals* were found on the farm Grootfontein in Gauteng Province (just to the east of the Rietvleidam Nature Reserve) and the occurrence of this group of plants were not recorded or supplied in IUCN's citation's species locality description.

When we formerly required information regarding the protection status of this species, we were informed that the authorities were considering it to remove the species from the vulnerable list, because of the fact that more species were recorded in Gauteng. The current status of the species and opinion of the Department could however not be determined yet.

We also applied for a development in the Sunderland Ridge area where another red data species (with a higher protection status) were found and where the GDARD agreed to the relocation of the species to a more protected habitat. In our opinion the same principle should be applied on this site, because only a few species were identified and an area not regarded as an ideal habitat.

We furthermore located a botanist Mr. Ate Berga, who successfully managed to grow this specific species in his nursery. During our conversation with Mr. Berga we learned that he has done numerous successful relocations of this species and he also easily cultivated the *Trachyandra erythrorrhiza* species from seeds and plants with a very high success rate.

Diagram 3: More Information regarding the *Trachyandra* species as obtained from the IUCN Website



There was furthermore a dispute between the specialists that conducted wetland studies for the study area. Galago Environmental CC classified the area where the Trachyandra erythrorrhiza was found as a wetland area. This wetland classification was mainly based on the fact that the Trachyandra erythrorrhiza usually grows in marshy areas. The applicant however disagreed with this way of reasoning and decided to appoint another wetland specialist with a soil science background to confirm whether he agrees with the fact that the area in which the species were found should be classified as a wetland. Dr. Johan van der Waals conducted various soil surveys and applied the DWS 2005 guidelines for the classification of a wetland and his finding was that the area in which the Trachyandra erythrorrhiza species was found cannot be classified as a wetland, because it did not contain all the required characteristics of a wetland.

Our conclusion was thus that the area where the *Trachyandra erythrorrhiza* species was found is not a typical habitat for the species and it is therefore not regarded as crucial that the specific habitat be protected by a 200m buffer.

The *Trachyandra erythrorrhiza* was found in a disturbed area and due to the fact that the project is a government driven project, it is recommended that the species be relocated to a more suitable habitat in a nature reserve or to one of the marshy and clayish riparian areas on the study area that were earmarked for open space and conservation purposes.

The relocation of the species can be treated as a pilot project in order to determine whether the plant can be successfully transplanted. It is thought best that Mr. Ate Berga, who has experience in the relocation and cultivation of the *Trachyandra* erythrorrhiza species, should conduct a site visit and identify the area in the wetland/habitat that is the most suitable for the relocation of this species.

The species currently present on the site will then be relocated to the allocated position and additional seeds could also be planted to ensure a viable population. As the current location of *Trachyandra erythrorrhiza* is not thought to be the species'

typical habitat, it is in our opinion a major advantage for the species to be relocated onto more suitable marshy soils in the delineated wetland area. This wetland area is planned for open space and will not be developed, thus the plant species will be conserved there and will have the corridor of the Jukskei River to colonise.

When the conservation value of this site is weighed up against the economical and social value of a much needed housing development within the urban development boundary, the social and economical aspects will be regarded as equally important or even more important. Especially if one considers the fact that the plant species in its current locality is unprotected, data regarding the specific plant species require updating, the fact that only a few species were found and the fact that the species was not found in an ideal/typical habitat.

The fauna and flora specialists also found some medicinal plants on the study area and it will be recommended that the medicinal plants also be relocated (under the supervision of a suitably qualified specialist) to the open space areas adjacent to the river. Another option will be that GDARD's own specialists remove the medicinal plants and *Trachyandra sp.* prior to the construction phase for their own purposes.

Refer to Annexure Si for correspondence with Mr. Ate Berga regarding the Trachyandra erythrorrhiza species.

• Noise impacts: The appointed acoustical engineer investigated the potential impact at residential areas in terms of acoustics as described in SANS 10328:2003. According to such guidelines the maximum acceptable noise level for a residential area in an urban environment is 55dBA. The noise impact study indicated that some of the residential areas as proposed in the development layout will be situated in areas where noise levels exceed 55dBA. The noise levels are mainly associated with the busy roads that border the study area. The layout was amended to ensure that the noise levels of the proposed residential areas will be within the acceptable limits. The anticipated noise impacts of the proposed development on the surrounding

environment during the construction and operational phases of the development were also addressed in the Environmental Management Plan (EMP). **Refer To Annexure V For Noise Impact Assessment**

The Lack Of Services And Traffic Capacity

Many of the I&APs mentioned that the services in the area are already stretched and that the existing services will not be able to accommodate the new development. This matter was investigated and the appointed civil engineers managed to identify the existing problems and the required upgradings that will enable the municipal services to accommodate the development and other developments and existing capacity problems in the area. The developer discussed the proposed upgradings with the relevant authorities and it was agreed that the developer will fund and drive the separate services applications for upgradings in the area, on behalf of the relevant authorities, who currently do not have the capacity to address the specific services issues in the area. The upgradings will thus not only make provision for the services requirements of the mixed-use development, but it will also address and resolve most the existing services problems in the area.

According to the I&APs traffic congestion and the standard of the roads are also major problems in the area.

From a traffic point of view the development layout was also amended on several occasions in order to address the existing and future traffic congestion problems. According to the appointed traffic engineers the traffic flow through the area will be better after the implementation of the development than the current situation.

Visibility:

As mentioned, the study area is strategically situated in terms of visibility and accessibility. The visibility creates an ideal opportunity for the exposure of advertisement boards and commercial, business, retail, industrial etc. land-uses from the adjacent freeway. The layout was amended to allow for maximum exposure of

certain land-uses and for the visual and acoustical screening of other land-uses such as the proposed residential land-uses.

The proposed development will be the most visible from the existing Rand Aid Development and the Rand Aid Residents raised their concerns regarding this matter at the focus group meeting. The residents requested that the applicant consider the extension of the open space buffer area associated with the watercourse along the northern boundary of the study area to the north-western section of the site, because this will assist in the "screening off" of the residential units to be developed in this corner.

During the focus group meeting and the public meetings some artistic architectural impressions of the types of units to be constructed in the north-western section of the study area were presented. The noise and visual impacts on the proposed link road that runs in between the Rand Aid Development and the Edenvale Hospital were also regarded as an issue.

The developer undertook to consider the inclusion of the buffer zone in the north-western corner of the study area to assist with visual screening and the developer will also mitigate noise and visual impacts associated with the link road. The mitigation measures will only be determined when during the detail design stage of this road.

A plan with the final layout and the proposed mitigation measures for the link road will be communicated with Rand Aid as soon as completed.

5.4.1 The Proposed Final Layout:

As illustrated above, the proposed final a layout is a product of an integrated and holistic design and planning approach. Various disciplines attended the bi-weekly project team workshops in order to ensure that all the disciplines (i.e. traffic, services, environmental

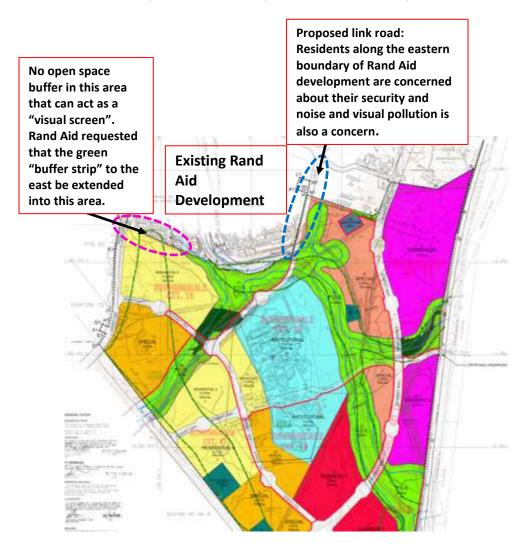
aspects, land-use planning and feasibility etc.) are already addressed and incorporated at the early stages of the project.

The layout as inserted as **Figure 3** below and **Annexure X** represents the proposed final layout, which has been amended to incorporate the issues as discussed above. **Refer to Annexure A for Issues Map (Figure 4)**, **Sensitivity Map (Figure 5)** and the **Proposed Final Layout Overlaid across the Issues Map (Figure 6)**. The most significant issues that had an impact on the final layout were the following:

- The Graves and the cultural and historical features to be conserved;
- The ecological environment (i.e. the identification of open space areas to be conserved i.e. the areas below the flood line, wetland areas, riparian zones etc.);
- Noise impacts;
- Visibility;
- Traffic (the inclusion of new roads and the upgrading of existing roads in order to accommodate the traffic of the new development and to alleviate the existing traffic congestion and road quality problems). The alignments of the proposed new roads and the accesses changed several times and this had an impact on the final layout and the land-parcels in between the roads; and
- Services (i.e. services servitudes).

The residents of the Rand Aid Development to the north-west of the study area (immediately adjacent to the northern boundary of the site) requested during the focus group meeting held in November 2014 that the green strip along the river be extended to the west. This will assist with visual screening. Security along the northern boundary of the development and along the proposed link road between the Edenvale Hospital and the eastern boundary of the Rand Aid development is also an issue of concern. **Refer to Figure 27 below**

Many pensioners reside in this development and it is recommended that the developer implement high standard security along this boundary. The security measures must already be implemented during the construction phase.



It is also recommended that the layout be amended to incorporate the proposed extended "green buffer" to the west. The horizontal and vertical alignments for the proposed link road must take the potential visual and noise impacts into consideration. The cutting-in of the road/ a visual and noise buffer to the west of the road (i.e. a solid concrete wall with electrical fencing) could assist with the mitigation of noise, visual impacts and it will also contribute to increased security.

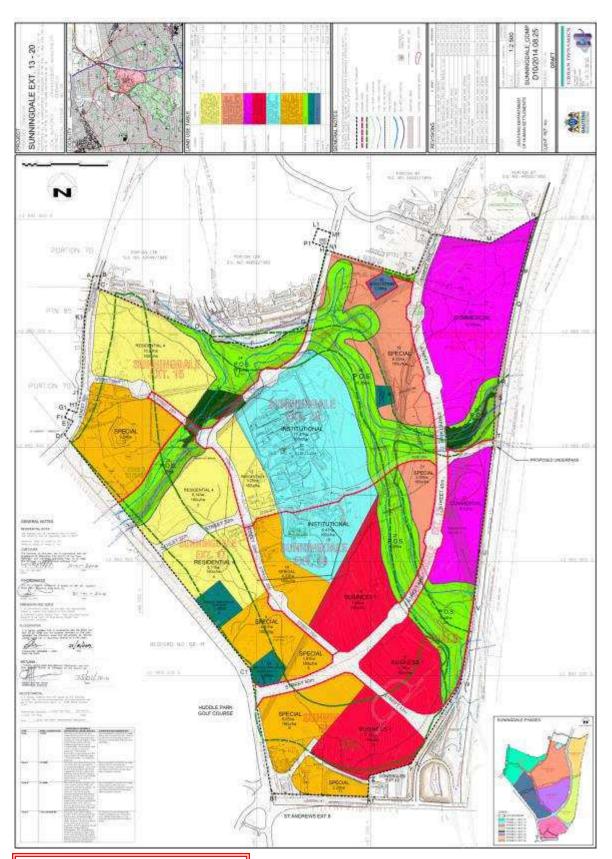
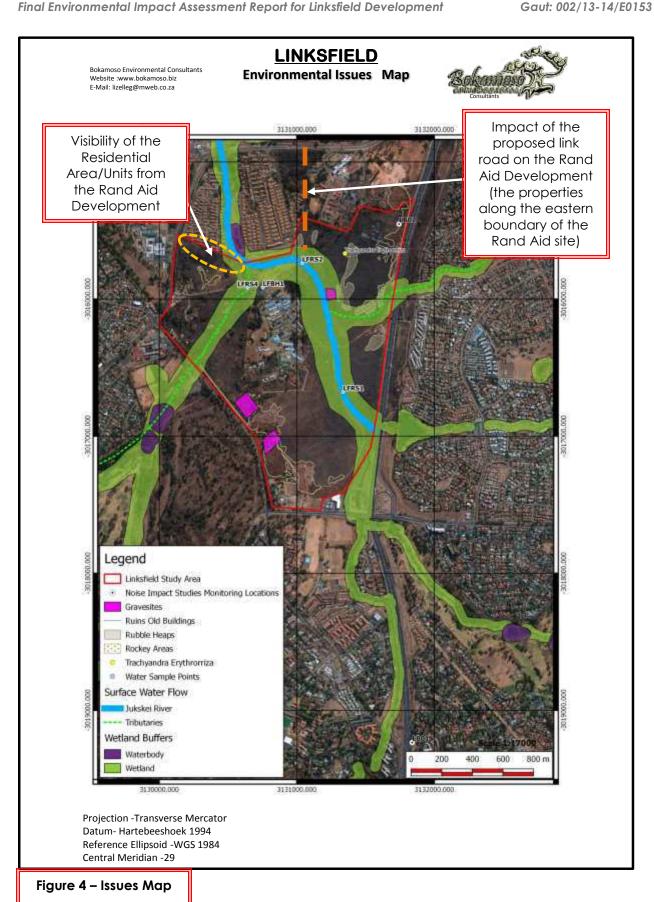


Figure 3 – Proposed Final Layout

Diagram 4: Land-uses Proposed Final Layout

LAND USE	ΓABLE				
ZONING	LAND USE	ERF NUMBERS	No. OF STANDS	AREA OF STANDS& STREETS	% OF AREA
RESIDENTIAL 4	DWELLING UNITS, RESIDENTIAL BUILDINGS, PLACES OF PUBLIC WORSHIP, PLACES OF INSTRUCTION PUBLIC OPEN SPACE, PRIVATE OPEN SPACE, PUBLIC AND PRIVATE ROADS, MUNICIPAL, RETAIL AND THE FOLLOWING USES SUBSERVIENT TO THE PRINCIPLE RESIDENTIAL USE: SHOPS, PLACES OF REFRESHMENT, OFFICES, SPECIAL BUILDINGS, PUBLIC GARAGE ONLY ON ERVEN	1,3,4,12	4	26,33	13,57
SPECIAL	DWELLING HOUSES, BLOCK OR BLOCKS OF FLATS (AT A MAXIMUM DENSITY OF 1801/Ho), RESIDENTIAL BUILDINGS, INSTITUTIONAL USES, SHOPS, OFFICES, COMMERCIAL PURPOSES, PLACE OF PUBLIC WORSHIP, PLACE OF AMUSEMENT, PLACE OF REFRESHMENT, PUBLIC STREET, PRIVATE OPEN SPACE INCLUDING SUCH SUPPORTIVE USES AS MAY BE SUPPORTED BY COUNCIL, SELESTORAGE UNITS ONLY ON	19,21	2	11,55	5,64
COMMERCIAL	COMMERCIAL USES AS PER SCHEME, MUTOR RELATED USES AND OFFICES SELFSTORACE UNITS AND PUBLIC GARAGE ONLY ON EAR 25	22,23	2	23,13	11,92
BUSINESS 1	SHOPS OFFICES PETALL AND HUSINESS PARK, MAREHOUSES AND DISTRIBUTION HUSINESS SUILBINGS, DIFFICES, PRIF FESSIONAL ROOM: HASES OF AMUSEMENT BOCKMENT HOLDING EXCEPT ON GROUND FLOOR.	10,16,17	3	21,48	11,07
INSTITUTIONAL	INSTITUTIONS, PLACE OF PUBLIC WORSHIP, PLACES OF INSTRUCTION, DWELLING HOUSES, SPECIAL BUILDINGS, SOCIAL HALLS, RETAIL, SHOPS, PLACE OF REFRESHMENTS AND RESIDENTIAL BUILDINGS FOR STUDENTS TYPE HOUSING	13,15	2	23,94	12,34
SPECIAL	DWELLING HOUSES, BLOCK OR BLOCKS OF FLATS (AT A MAXIMUM DENSITY OF 160U/Ho), RESIDENTIAL BUILDINGS, INSTITUTIONAL USES, EDUCATIONAL USES, SHOPS, OFFICES, PLACE OF PUBLIC WORSHIP, PLACE OF AMUSEMENT, SHOWROOMS, MOTOR RELATED AND COMMERCIAL, PUBLIC STREET, PRIVATE OPEN SPACE INCLUDING SUCH SUPPORTIVE USES AS MAY BE SUPPORTED BY COUNCIL.	2,6,8,9,11,14	6	28,18	14,52
PRIVATE OPEN SPACE	PARK	24 - 30	7	33,91	17,52
	CEMETERY	5,7,20	3	2,91	1,50
MUNICIPAL	SUBSTATION	18	1	0,59	0,56
STREETS				22,03	11,36
TOTAL			30	194,05	100%



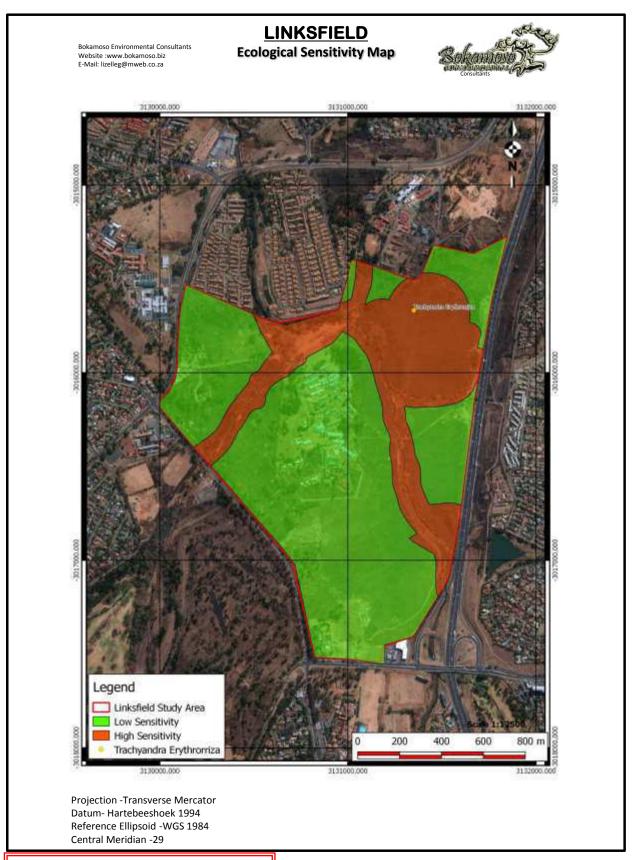


Figure 5 – Ecological Sensitivity Map

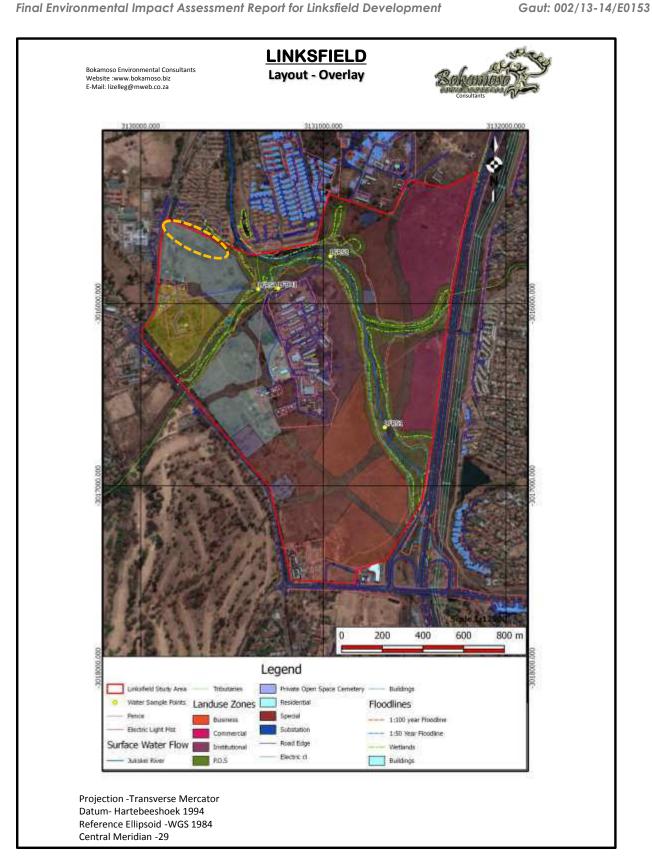


Figure 6 – Proposed Final Layout Overlaid across the Issues Map

5.5 Planning Approach

As already explained, an urban design team has been appointed and their design approach adopted for the Linksfield development is that hard commercial and business activities be situated on the edge of the development while soft residential and community uses are to be located at the "screened" inside. The Urban Design approach is an inclusionary development that provides for all levels and requirements of urban life. The integration of socio economic, gender and racial predispositions lies at the heart of the intervention. Transport integration and inclusionary housing forms the basis of the proposed urban form and connectivity to the greater Johannesburg.

6. THE DESCRIPTION OF THE BIOPHYSICAL AND SOCIO-ECONOMICAL ENVIRONMENTS – In line with Section 32 (d)

This section briefly describes the biophysical and socio-economical environments. It also lists the anticipated adverse and beneficial impacts of the proposed development on the environment. Where possible, mitigation measures were supplied for the adverse impacts and the significance of the impacts listed was also indicated in specific impact tables. In some cases the impacts have already (during the planning phase) been addressed to such an extent that it was not regarded as necessary to carry the impacts over to the significance rating section of the report.

Although it was not necessary to mitigate the positive impacts listed in the impacts tables, the positive impacts identified in this section of the report will also automatically be carried over to the significance rating section of the report to indicate the specific benefits associated with the proposed development. This will also make it possible to compare the severity of the adverse impacts with the advantages of the beneficial impacts and to eventually make an informed decision regarding the proposed development.

The following section incorporates the most important information supplied by specialist studies and reports.

THE BIO-PHYSICAL ENVIRONMENT 6.1

The biophysical environment is the biotic and abiotic surrounding of an organism or population, and includes the factors that have an influence in their survival, development and evolution. The term environment can refer to different concepts, but is often used as a short form for the biophysical environment.

6.1.1 The Physical Environment

The site earmarked for development comprises of ±223 ha of prime land surrounded by Sandringham, Glenhazel, Sunningdale, Lyndhurst, Corlett Gardens, Rembrandt Park, Edenvale Ext 1, Marais Steyn Park, Dowerglen, Senderwood and the golfing ground, Huddle park. Approximately 15 hectares of the site is occupied by the Sizwe (former Rietfontein) Hospital. The N3 Highway and the major arterial connector routes around the development create hard edge conditions that define the boundaries of the proposed Linksfield Mixed-use development.

6.1.1.1 Geology and Soils

6.1.1.1.a Geology

6.1.1.1.a.i Geotechnical Investigations to Determine the Development Potential and Restrictions of the Study Area

Note: The information as inserted below was obtained from the Geotechnical Report included as Annexure Y

Geology:

According to Dr. J Louis Van Rooy (Engineering Geologist) the site is located in an area underlain by both mafic and granitic rocks. The north-eastern corner of the development area is underlain by granitoid rocks as well as the southernmost part of the site. In the

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southeast of Johannesburg Granite Dome there are greenstone present, surrounded by trondjemitic and tonalitic granitoids (Anhaeusser, 2006). The site is, however, underlain by soils with possible geotechnical constraints that will warrant precautionary foundation measures.

The site is not underlain by dolomitic bedrock and a stability investigation is therefore not required.

According to the geotechnical engineer no specific mineral deposits are present on the site and no shear zones, faults or any other linear structures are indicated on the map within the boundaries of the site.

Groundwater:

No groundwater seepage was encountered in any of the excavated trail pits, but the mottled appearance and occasional presence of ferruginised soils in some of the profiles are indicative of seasonal saturated soil profile conditions.

In general the groundwater movement on the site will be towards the streams and rivers or percolate downwards towards the regional groundwater table.

The higher sections of the study area will encourage precipitation to runoff or to seep away as shallow interflow and to eventually emerge as seepage water within the flood plain area. Surface drainage is mainly regulated by the road orientation and generally there is no evidence of erosion in roads parallel to the slope in the area underlain by greenstone bedrock. Regions underlain by granitic bedrock however show some signs of erosion.



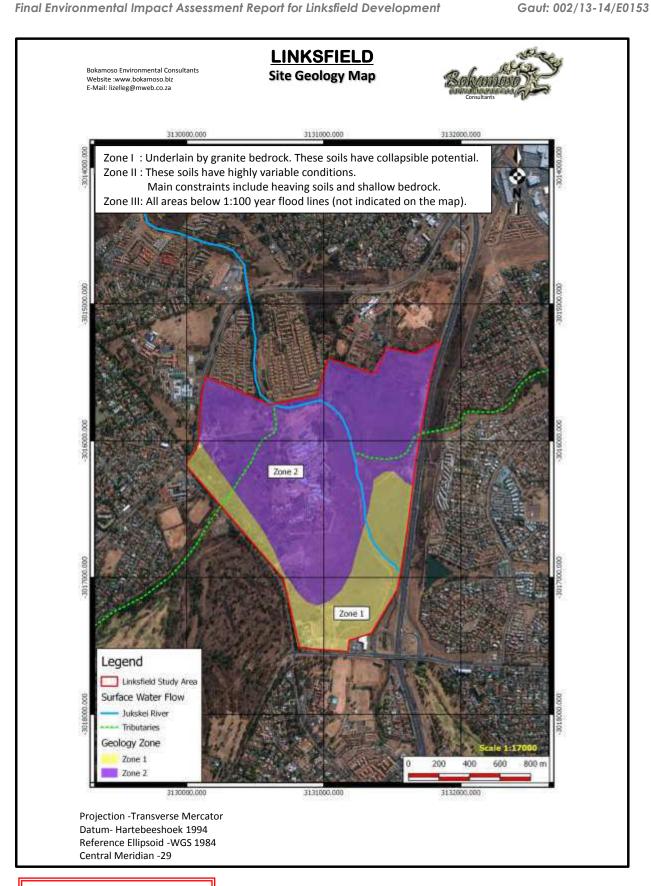


Figure 8: Site Geology

6.1.1.1.a.ii Geotechnical Inputs to Assist with the Addressing of the Graveyards and Diseases Issues Associated with the Study Area (Dr. J.L. van Rooy was the specialist geologist appointed as part of the specialist forum appointed to address the graveyard and disease issues)

Due to the fact that many concerns were raised regarding the potential contamination of the soils and ground and surface water of the study area with the Anthrax spores and the DNA of other diseases (i.e. tropical diseases) treated at the hospital, it was decided to appoint a specialist forum (details of specialists selected to form part of such forum are supplied in Chapter 1.2.2. of this report and in Annexure E) to assist with detailed investigations and opinions regarding the possibility of graves and waste sites (including the burial grounds for animal carcasses of anthrax infected livestock, other possible grave yards (i.e. the alleged Jewish graveyard and medical waste sites etc.).

Dr. Louis van Rooy was approached to assist with the determination of the possibility of graveyards and waste sites from a geotechnical point of view. Dr. van Rooy worked in close collaboration with Dr. Johan van der Waals (Soils Scientist and wetland specialist) and the cultural and historical specialist (Leonie Marais-Botes) during his investigations.

In his findings he stated that the study area is underlain by greenstone, which showed significant refusal to the TLB that were used for the excavation of the test pits. The soils that cover the greenstone (which underlies most of the study area) are shallow soils and according Dr. Louis van Rooy it would have been difficult to dig graves on the study area in the early 1900s, because sophisticated mechanical excavation equipment were not yet available for such difficult excavation exercises. The refusal was already experienced in the upper 1,5m of the profile.

According to Dr. Wouter Basson and Dr. Eugene Fourie the corpses of people that died of diseases had to be buried at least 600mm or more below ground level. On large sections of the study area the soil layers are even less than 600mm and most of the soil layers also incorporate some scattered large rocks.

At a stage we also proposed that radar equipment, which has been developed to identify bones and other solid features below the ground be utilised in order to assist with the identification of graves and waste sites, but Dr. Louis van Rooy indicated that such an exercise will be futile, because the rocks in the soil layer (which is scattered across the site) will also be regarded as solid features.

At the end of Dr. Louis van Rooy's investigations, he agreed with Dr. Johan van der Waals and the cultural and historical specialist (Leonie Marais-Botes) that there are only three graveyards on the study area and some random dumping (mainly builders rubble and industrial waste), which had to be investigated in more detail during the construction phase of the development.

After the specialists agreed that there is no possibility of other graveyards or waste sites on the study area, one of the I &APs supplied a map, which indicated possible additional graveyards and hazardous medical waste sites on the study area. We requested that the specialist forum members peruse the new information and that they investigate (if regarded as necessary) the accurateness of this new graveyard and waste sites. Apart from one possible grave/graveyard that was identified during a follow-up site visit, Dr. Louis van Rooy and the specialist forum members did not regard any follow-up investigations as necessary. All confirmed that they still regard their original findings as accurate. Please find attached as Annexure G the follow-up opinions of the specialist forum members. Take note that we requested that the I&APs that provided the new information regarding the graveyards and waste sites supply the sources used for purpose of compiling the map, but we have not received any accurate references to sources yet. Any I&AP/ member of the public that can assist with more information regarding the possible additional graveyards and waste sites as indicated on the map supplied by the I&AP is invited to come forward and to supply any information that could assist with this matter. The EIA Report is still in a Draft Format and therefore there are still opportunities for valuable inputs that could eventually assist with informed and responsible recommendations and decisions.

We did however request that another trail pit be excavated in the area where the possible additional grave (only one grave) was identified and that the soils scientist conduct soils

tests in order to confirm whether the feature identified is a grave/ to test for any other signs of human remains/ anthrax/diseases in the soil. The results of the tests will be supplied as soon as available. As mentioned the specialist forum is still convinced that they indicated all the possible graveyards on the study area.

6.1.1.1.b Soils

6.1.1.1.b.i Geotechnical and Soil Investigations to Determine the Development Potential and Restrictions of the Study Area (Conducted by Dr. Louis van Rooy Engineering Geologist - Refer to Annexure Y for Geotechnical Report)

Soils:

The generalised soil profile found on site consists of the following:

- Transported soils comprising colluvium as well as alluvium adjacent to the drainage channels;
- Residual granitic soils with underlying transported colluvial soils. These residual soils
 generally consisted of light pinkish to greyish brown, loose to medium dense and
 dense at depth, intact to fissured, silty to gravelly sand;
- Residual greenstone soils were described as greenish-grey to pinkish brown and light brown, medium dense to dense, foliated, silty sand. Residual soils were not exposed in all test pits and in some instances weathered bedrock underlay the transported soils; and
- The residual soils generally grade into weathered bedrock. Weathered greenstone
 was typically described as greenish grey banded dark brown, completely
 weathered to moderately weathered, foliated, very soft to medium hard rock

The site is zoned into the following designation classes:

Zone I: C/2ABF

This zone covers the north and north-eastern portion.

Most of the profiles exposed transported and residual soils that are slightly voided and pin

holed with moderate collapse expected as well as compressibility characteristics, and a

low to medium soil heave expected. Intermediate excavation is expected due to the

refusal of the TLB within the upper 1.5 m of the profile, on weathered bedrock.

Recommended foundations for single storey masonry structures are: Normal construction

(strip footing or slab-on-the ground foundation) with good site drainage.

Closer to the floodplain boundary and drainage channels, seepage conditions whereby a

permanent or perched water table less than 1,5 m below ground surface could be

present.

It will be necessary to implement specific site drainage measures and plumbing

precautions across the entire site to prevent large seasonal soil moisture changes and to

control surface runoff. Perching of groundwater and seasonal surface wet conditions are

also expected across the largest part of the site, but especially near the drainages.

Drainage measures may include upslope cut off trenches, diversion of run off from the site

and storm water reticulation to prevent surface ponding as well as concentrated run off.

Present marshy areas should especially be addressed if the existing housing units in these

areas are to be left in place. Drainage trenches and pipes decanting into the lower lying

drainage channels may also keep some of these areas dry.

Zone II: C1/2AB

This zone covers the central portion of the site up to the river and its surrounding floodplain.

Most of the profiles exposed transported and residual soils that are voided and pinholed

with moderate collapse expected as well as compressibility characteristics, and a low soil

heave expected.

Gaut: 002/13-14/E0153

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Recommended foundations for single storey masonry structures are: modified normal,

compaction of in situ soils below individual footings, deep strip foundations, soil raft.

Closer to the floodplain boundary and drainage channels, seepage conditions whereby a

permanent or perched water table less than 1,5 m below ground surface could be

present.

It will be necessary to implement specific site drainage measures and plumbing

precautions across the entire site to prevent large seasonal soil moisture changes and to

control surface runoff. Perching of groundwater and seasonal surface wet conditions are

also expected across the largest part of the site, but especially near the drainages.

Drainage measures may include upslope cut off trenches, diversion of run off from the site

and storm water reticulation to prevent surface ponding as well as concentrated run off.

Present marshy areas should especially be addressed if the existing housing units in these

areas are to be left in place. Drainage trenches and pipes decanting into the lower lying

drainage channels may also keep some of these areas dry.

Zone III: C1/2ABE

This zone covers the southern and south-western portion of the site adjacent to the site

boundary. The zone is underlain by granitic bedrock.

Most of the profiles exposed transported and residual granitic soils that are voided and pin

holed with moderate collapse expected as well as compressibility characteristics, and a

low soil heave expected. It is evident from the surficial soils that the soil profile has erodible

characteristics.

Recommended foundations for single storey masonry structures are: modified normal,

compaction of in situ soils below individual footings, deep strip foundations, soil raft.

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Closer to the floodplain boundary and drainage channels, seepage conditions whereby a permanent or perched water table less than 1,5 m below ground surface could be present.

It will be necessary to implement specific site drainage measures and plumbing precautions across the entire site to prevent large seasonal soil moisture changes and to control surface runoff.

Perching of groundwater and seasonal surface wet conditions are also expected across the largest part of the site, but especially near the drainages.

Drainage measures may include upslope cut off trenches, diversion of run off from the site and storm water reticulation to prevent surface ponding as well as concentrated run off.

Present marshy areas should especially be addressed if the existing housing units in these areas are to be left in place. Drainage trenches and pipes decanting into the lower lying drainage channels may also keep some of these areas dry.

Zone IV: P (Uncontrolled fill)

This zone covers only localised portions in the northern part of the site as well as along the edges of all the major roads. Due to the large volumes of dumped material in the north, the extent and properties of the underlying natural soils were not quantified or investigated.

The variability and random dumping of builder's and other industrial wastes will warrant special measures that may include the removal of the material prior to any development taking place.

It is therefore recommended that further investigation be conducted when detailed site inspections are executed during the final site layout phase.

The entire site is covered by transported soils with a sandy nature in the south and north on the granite bedrock. The soils will be permeable but the granite bedrock is expected to be impervious.

The transported soils as well as the residual greenstone soils are expected to be clayey and possible impervious. These very low permeability values imply that surface water will rather runoff than infiltrate when the clays are slightly moist to moist. The initial precipitation after the dry months will infiltrate due to the open desiccation cracks on surface.

The presence of outcrops and sub-outcrops will depend on the elevation on site with the higher lying parts expected to be underlain by shallow bedrock but the variable weathering pattern in the greenstones will cause localized shallow bedrock across the entire area underlain by these rocks.

6.1.1.1.b.ii Geotechnical Inputs to Assist with the Addressing of the Graveyards and Diseases Issues Associated with the Study Area (Dr. Louis van Rooy was the specialist geologist appointed as part of the specialist forum appointed to address the graveyard and disease issues)

The Graveyard Sites (soils studies conducted in collaboration with:

The soil sampling process in the graveyard was restricted due to different sets of legislation (such as the National Heritage Resources Act – Act no.25 of 1999) that govern the disturbance of such sites that precluded unauthorised digging and auguring.

Overburden material: The entire site is underlain by transported soils with a sandy nature in the south and north on the granite bedrock.

Soil sampling

The soils in the graveyard area are predominantly of the Glenrosa form. These soils have a sandy orphic A horizon overlying a varyingly weathered serpentine/greenstone rock subsoil that is often red in colour.

The depth of the weathered rock profile leads to an additional postulation that the graves were not 1.8m deep. The postulation is confirmed by the lack of weathering greenstone/serpentine rock material on the surface amongst the quartz pebble marker material.

According to specialist forum the graves are at best only 0.6- 0.7m deep. Under these conditions it is entirely plausible that human remains would have been brought to the soils surface by mole activity, which was noticed on site during the site investigations.

Also Refer to Annexures E and Y for inputs supplied by Dr. Louis van Rooy

6.1.1.1.c Implications for Development (Geology and Soils)

- The site is underlain by soils with possible geotechnical constraints that will warrant precautionary foundation measures. The recommendations should be according to the NHBRC Home Builders Manual (1999) for single storey masonry structures (Table 4, Table 5 and Table 6, Appendix A). The specific structures to be erected on site will also determine the foundation measures needed.
- The main geotechnical constraint at this site will be:
 - Potential moderate heave of transported and residual greenstone soils;
 - Collapse settlement in the loose colluvium and residual granite horizons;
 - Difficult excavation (1,5m deep) in areas of shallow bedrock, hardpan ferricrete and where large core stones are present;
 - Heaving conditions on site will need appropriate foundation solutions as listed in the tables as provided in the geotechnical report;
 - The areas below the 1:100 year flood line have a site class designation of P (Flooding) – Periodic undulation and flooding. These areas are not regarded as suitable for development;
 - ❖ A suitably qualified engineer must be appointed to confirm the 1:100 year flood line zone;

- Seasonal shallow groundwater, perched water and seepage near the flood plain;
- Moderate erodability of surficial soils;
- Good drainage will be required as the occurrence of season perched water tables is possible, especially in the shallow bedrock drainage areas. This may cause problems with dampness in surface structures and with installation of services;
- Wet surface conditions and seepage may also occur and special drainage measures should be implemented. Surface water runoff should be controlled to prevent erosion of the surficial soils;
- The three historic cemetery sites will most probably warrant a separate zone where no development may take place;
- Ideally the clayey soils should be removed below roads and paved areas and replaced with inert materials;
- The foundation measures listed in the tables (included in the geotechnical report) will most probably be necessary to deal with the problem soils;
- The large volume of dumped material will also pose a problem due to the uncontrolled manner and variability in properties of this material;
- The soils on the site is not regarded as suitable for usage as construction materials;

6.1.1.1.d Issues and Impacts – Geology and Soils

Table 5: Issues and Impacts – Geology and Soils

Issue/ Impact	Positive/ Mitigation Possibilities
	Negative/ Neutral ± High ⊕ Medium ⓒ Low ■
	Positive Impact - Not
	Necessary To Mitigate

1)	Stockpile areas for construction materials and	-	©
	topsoil		
2)	Erosion	-	©
3)	Potential moderate heave of transported and	-	•
	residual greenstone soils		
4)	Collapse settlement in the loose colluvium and	-	•
	residual granite horizons		
5)	Difficult excavation (1,5m deep) in areas of shallow	-	©
	bedrock, hardpan ferricrete and where large core		
	stones are present		
6)	The areas below the 1:100 year flood line have a	-	•
	site class designation of P (Flooding) – Periodic		
	undulation and flooding. These areas are not		
	regarded as suitable for development		
7)	A suitably qualified engineer must be appointed to	±	•
	confirm the 1:100 year flood line zone		
8)	Seasonal shallow groundwater, perched water and	-	©
	seepage near the flood plain		
9)	Moderate erodability of surficial soils	-	(
10)	Good drainage will be required as the occurrence	-	
	of season perched water tables is possible,		
	especially in the shallow bedrock drainage areas.		
	This may cause problems with dampness in surface		
	structures and with installation of services		
11)	Wet surface conditions and seepage may also	-	©
	occur and special drainage measures should be		
	implemented. Surface water runoff should be		
	controlled to prevent erosion of the surficial soils		
12)	The three historic cemetery sites will most probably	±	•
	warrant a separate zone where no development		

	may take place		
13)	Ideally the clayey soils should be removed below	-	©
	roads and paved areas and replaced with inert		
	materials		
14)	The large volume of dumped material will also pose	-	(
	a problem due to the uncontrolled manner and		
	variability in properties of this material		
15)	The soils on the site is not regarded as suitable for	-	©
	usage as construction materials		
16)	Siltation problems	-	(
17)			
17)	Possible contaminated soils on the study area	_	(
	(associated with bacterial and viral diseases		
	treated and the Sizwe Hospital and possible		
	anthrax spores in animal apparently carcasses		
	buried in the area but not found.		
18)	Current soil and water pollution caused by the	-	•
	sewage spillages of the Sizwe Hospital		
19)	Acidity (pH) of the soils	<u>±</u>	•
20)			
20)	Blasting could be required in areas where	_	(
	excavation difficulties are experienced		

Table 6: Comments of the I&AP's regarding the geology and soils

Issue:	I&AP	Issues Addressed in Report √/X
With regard to the Linksfield Mixed Use Development Project Scoping Report I have the following queries:	Elizabeth Cooper – Kia arabeth@hotmail.com	√ Refer to Diagram 4, page 72: Geology and Soils Conclusion
The figures in the scoping report are rendered useless as they are illegible in the pdf. Please can you provide legible figures to		

accompany the scoping		
report?		
Secondly, in section 6.1 the		
diagrammatic comparison		
between the alternatives it is indicated that the long-term		
impact of not developing is		
negative for geology and		
soils, hydrology, vegetation,		
and fauna. Please can you		
explain why these aspects		
will be negatively affected in the long term by a		
continuation of the status		
dnoś.,		
The vacant land which the	Yusuf Desai –	,
Gauteng Government wants to develop for low	Yusufdesai42@gmail.com	V
cost housing.		Refer to Issue 15, page 114
a) There are 7000		
graves in the area;		
b) People have died		
with leprosy and anthrax;		
c) To develop this		
land, you have to		
incinerate the		
bodies or skeletons;		
d) To develop this land you have to		
incinerate the soil		
and put new soil,		
which is expensive		
project.		
e) When you have the		
public meeting, we need to be advised		
a week or two in		
advance to invite		
the residents to		
attend, and not the		
very few that you have handed		
pamphlets.		
I await your favourable		
reply, also I would like you		
to obtain the "Podcast of the talk show regarding the		
above area		

6.1.1.1.e Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

1) Stockpile areas for construction materials and topsoil.

Designated areas for stockpiling of construction materials must be specified by the Environmental Control Officer in an area that is already disturbed. Stockpiling in the wrong areas might be detrimental to fauna and flora and will deplete the soil quality. Topsoil should be stockpiled as specified in the EMP to ensure that the soil quality doesn't deplete and that the grass seed remain in the soil for later rehabilitation of the disturbed areas.

In addition to the impact discussed in the paragraph above, rainwater falling onto stockpiles may become polluted with dust originating from aggregate and other construction material, such as bitumen from pre-mix stockpiles. Therefore stockpiles of topsoil should be correctly covered to prevent this as well as loss of topsoil by wind erosion.

Table 7: Significance of Issue 1 (Stockpile areas for construction materials and topsoil) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium © Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Medium 🙂	 C - Remove vegetation only in designated areas for construction. C - Rehabilitation works must be done immediately after the involved works are completed. 	M - To be included in EMP

	C -All compacted areas should be ripped prior to them being rehabilitated/landscaped.	M - To be included in EMP	
	P/C - The top layer of all areas to be excavated must be stripped and stockpiled in areas where this material will not be damaged, removed or compacted. This stockpiled material should be used for the rehabilitation of the site and for landscaping purposes.	M - To be included in EMP	
	C - Strip topsoil at beginning of works and store in stockpiles no more than 1,5 m high in designated materials storage area.	M - To be included in EMP	
	C – Stockpiles should be covered correctly.	M - To be included in EMP	
	C - Stockpiles should not be stored in any watercourses/drainage lines or within the flood plain/ below the 1:100 year flood line	M - To be included in EMP	
Result: Although the issue can be mitigated, the significance of the impact should still be			

2) Erosion

Unnecessary clearing of vegetation could lead to exposed soils prone to erosive conditions. Insufficient soil coverage after placing of topsoil, especially during construction where large surface areas are applicable could also cause erosion. To cause the loss of soil by erosion is an offence under the Soil Conservation Act (Act No 76 of 1969). The management of surface water run-off during construction and operational phases is very important. If construction takes place during the rainy season, sufficient storm water management will be required to manage water runoff.

Table 8: Significance of Issue 2 (Erosion) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ⓒ Low ■	Already achieved $\sqrt{}$	mitigation
-	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M
Necessary To Mitigate ☆	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Medium 😉	P & C - A storm water management plan must be compiled for the construction and operational phases of the proposed development.	M - To be included in EMP
	P & C - The storm water management plan must be submitted to the local authority and DWS for approval.	M - To be included in EMP
	P & C - Large exposed areas during the construction phases should be limited. Where possible areas earmarked for construction during later phases should remain covered with vegetation coverage until the actual construction phase. This will prevent unnecessary erosion and siltation in these areas.	L - To be included in EMP
	P & C - Rehabilitate exposed areas immediately after construction in these areas is completed (not at the end of the project).	M - To be included in EMP
	P & C - Unnecessary clearing of flora resulting in exposed soil prone to erosive conditions should be avoided.	M - To be included in EMP
	 P - Specifications for topsoil storage and replacement to ensure sufficient soil coverage 	M - To be included in EMP

as soon as possible after construction must be implemented.	
P & C – All embankments must be adequately compacted and planted with grass to stop any excessive soils erosion and scouring of the landscape.	M - To be included in EMP
C – Storm water diversion measures are recommended to control peak flows during thunder storms.	M - To be included in EMP
P, C, and O - The eradication of alien vegetation should commence as soon as possible. The areas cleared adjacent of the river must be covered with suitable indigenous vegetation to ensure quick and sufficient coverage of exposed areas	M - To be included in EMP
P, C – Fence-off sensitive areas prior to construction and apply temporary storm water management measures outside the watercourse and watercourse buffer zones	M - To be included in EMP

3) Potential moderate heave of transported and residual greenstone soils

The potential heave conditions must be taken into consideration when designing the filling station, foundations and other structures that could be affected by this aspect. The geotechnical engineer mentioned that special foundation designs will most probably be required.

Table 9: Significance of Issue 3 (Heave) After Mitigation

Mitig	ation Possibilities	Mitigation	Significance	of	Issue	after

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High ● Medium ⓒ Low ■	Already achieved √	mitigation
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E
Necessary To Mitigate 🌣	Planning phase, Construction	Medium M
	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ●	P & C - Special foundation designs will most probably be required in such areas. P & C - Underground fuel tanks must also be designed to take the heave conditions and the	M - Engineer's recommendations to be included as part of the EMP M - To be included in EMP
	acidity of the soils into consideration; O – A leak detection system	
	must be put in place to identify any potential leaks in underground tanks. The fuel tanks must be installed in accordance with the relevant SANS standards.	M - To be included in EMP

4) Collapse settlement in the loose colluvium and residual granite horizons

The collapse potential of some of the soils could cause dangerous conditions during the construction and operational phases of the development (i.e. the collapse of walls of excavated areas - walls can collapse onto construction workers)

Table 10: Significance of Issue 4 (Collapse Potential) After Mitigation

Mitigation Possibilities	Mitigation	Significance	of	Issue	afte	r
High ⊕ Medium ⊕ Low ■	Already achieved $\sqrt{}$	mitigation				
	Must be implemented during	Low/ elimino	ated	L	/	E

Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M
Necessary To Mitigate 🌣	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ⊕	P & C – Mark all excavated areas clearly during the construction phase and erect signs on site to warn workers and passers-by of possible collapsible soil conditions.	M - Engineer's recommendations to be included as part of the EMP
	P & C - put temporary precautionary measures in place during the construction phase to prevent accidents associated with the collapsing of soils.	M - To be included in EMP
	O – During the operational phase the site and structures must be checked (on an annual basis in areas with collapsible soils) for movement or possible collapse conditions.	M - To be included in EMP

5) Difficult excavation (1,5m deep) in areas of shallow bedrock, hardpan ferricrete and where large core stones are present

Construction equipment will be required for excavations deeper than 1,5m, especially in areas where basements are planned. The large construction vehicles will move across the study area and could damage the sensitive areas. The rocky sub-soil excavated these areas must be carted away immediately and should be stored in already disturbed areas (away from the flood plain and the graves to be conserved).

Table 11: Significance of Issue 5 (Difficult Excavations) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
William 1 03315 illines	Already achieved √	mitigation
High ⊕ Medium ⓒ Low ■	•	Low/ eliminated L / E
Positive Impact/ Neutral - Not	Must be implemented during	
Necessary To Mitigate ☼	Planning phase, Construction	Medium M
incoosia, rommigato A	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Medium 🔾	P & C – Plan heavy vehicle and machinery circulation routes prior to the construction phase and identify temporary storage areas for excavated sub-soil.	M - Engineer's recommendations to be included as part of the EMP
	P & C - put temporary precautionary measures in place during the construction phase to prevent accidents associated with mechanical excavation exercises.	M - To be included in EMP
	O – Even though no additional graveyards were identified during the various site surveys and tests that were conducted, there is still a possibility for the identification of additional graves or old waste sites, especially during deeper excavation exercises. If such sites are discovered, construction in that specific area must be stopped instantly and the cultural and historical specialists as well as Dr. De Vos must be contacted immediately to investigate the matter and to propose suitable mitigation measures.	M - To be included in EMP

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6) The areas below the 1:100 year flood line have a site class designation of P (Flooding) – Periodic undulation and flooding. These areas are not regarded as suitable for development.

This area is not suitable for any type of development. The risk of flooding in these areas threatens people and livelihoods. All disturbed open spaces along water bodies and within watercourses, especially the areas below the 1:50 and 1:100 year flood line should be rehabilitated with vlei/suitable riparian vegetation where possible.

Table 12: Significance of Issue 6 (Areas below the 1:100 year flood line) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊕ Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M
Necessary To Mitigate 🌣	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ⊕	P&C – No dumping shall be allowed the areas below the flood line/ sensitive open space areas to be conserved	M - To be included in EMP
	P & C - No parking areas or structures should be planned in this area	M - To be included in EMP
	P & C - No service or waste yard should be planned in this area	M - To be included in EMP
	P & C – All disturbed open spaces along water bodies, especially the areas below the 1:100 year flood line should, where possible, be rehabilitated with vlei/ suitable riparian vegetation	M - Engineer's recommendations to be included as part of the EMP
	P & C - The wetland delineation conducted by Terrasoil must be taken into	M - To be included in EMP

consideration. The wetland and riparian areas together with the	
proposed buffer zones must be	
marked out on the study area	
prior to commencement with	
construction. The ECO must	
supply the GPS co-ordinates	
and must confirm that the	
areas were correctly marked	
out. The sensitive areas must	
then be demarcated by a	
conservation fence/barrier	
tape and all contractors and	
workers must be informed of this	
"no-go" zone. Only workers and	
equipment required for rehabilitation and the	
installation of services will be	
allowed to enter this zone. The	
ECO must be informed prior to	
the commencement of work in	
this zone. The work in this area	
can only commence once the	
Section 21 Water-Use License	
have been issued by DWS.	
,	

7) A suitable qualified engineer must be appointed to confirm the 1:100 year flood line zone.

In terms of Section 144 of the National Water Act, 1998, the 1:100 year flood line must be indicated on all planning drawings. Section 21 (c) and (i) Water-Use License Applications will be required for rehabilitation works and the installation of services and infrastructure in the areas below the 1:100 year flood line.

Table 13: Significance of Issue 7 (Appointed engineer confirming the 1:100 flood line) After Mitigation

Mitigation Possibilities	Mitigation	Signific	ance	of	Issue	af	fter
High ⊕ Medium ⊕ Low ■	Already achieved $\sqrt{}$	mitigation					
	,	Low/	elimin	ated	L	/	E

Positive Impact/ Neutral - Not	Must be implemented during	Medium M
Necessary To Mitigate ☆	Planning phase, Construction	High H
	and/ or Operational phase	Not possible to mitigate,
	P/C/O Mitigation	but not regarded as a fatal
		flaw NP
High ●	P& C - Qualified engineer to be appointed to confirm the 1:100 flood line (pre-construction and post-construction flood lines)	M - Engineer's recommendations to be included as part of the EMP.
	P - The necessary Section 21 Water-Use License applications must be submitted to DWS and no construction are allowed to	
	commence without the necessary licenses	

8) Seasonal shallow groundwater, perched water and seepage near the flood plain.

The need to consider shallow ground water hazards prior to development is evident from the extent of ground water flooding in some areas. Groundwater rise leading to groundwater flooding can be due to direct rainfall recharge.

Table 14: Significance of Issue 8 (Seasonal shallow groundwater, perched water and seepage near the flood plain) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ② Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☼	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate,
		but not regarded as a fatal flaw NP
Medium 😉	P & C – Areas that could potentially be affected by perched water conditions must	M - To be included in EMP

be identified on a layout plan. It will be better to limit construction in these areas to the dryer months. It is however understood this will not always be possible and that it could become necessary to drain some of the areas in order to make construction possible.

The areas to be drained must be identified and discussed with the appointed ECO and wetland specialist and draining plans/ possible cut-off trenches must be discussed with the wetland specialist and the ECO prior to commencement with such works. The wetland specialist and ECO must supply temporary mitigation measures where required in order to minimise impacts on the surface and ground water movement patterns that sustain the watercourses of the study area.

The water and soil quality of the areas to be drained must be monitored prior to construction. The monitoring tests must then be repeated (every month) during the construction phase. pollution (mainly any associated with lead, anthrax, other diseases etc. are detected during the testing exercises, the construction works must be stopped and suitably qualified specialists must be appointed to assist with the compilation of the required mitigation measures and to supply advice regarding The proposed way forward.

The ground water movement across the study area is towards the Jukskei River. Ground water monitoring points (at the point where the ground water seeps into the riverine system) must

be determined prior to the commencement with the development and ground water quality samples at this monitoring points must also be taken during the water and soil quality test intervals.	
P & C - All the mitigation measures as proposed by the wetland specialist must also be taken into consideration	M - To be included in EMP

9) Moderate erodability of surficial soils.

Unnecessary clearing of vegetation could lead to exposed soils prone to erosive conditions. The management of surface water run-off during construction is very important to prevent soils erosion on the site. If construction takes place during the rainy season, sufficient storm water management will be required to manage water runoff.

Table 15: Significance of Issue 9 (Moderate erodability of surficial soils) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ⊙ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Medium ©	P & C - in order to prevent erosion, siltation and water pollution during the construction phase of the development, it will be necessary to implement temporary storm water management measures during the construction phase. This will	M - To be included in EMP

assist with the management of run-off from the construction areas.

In areas where excavations are done (i.e. excavations for the installation of pipes/ for basements/ foundations. especially against the steeper slopes, a temporary shallow channel just below the stored excavation materials could assist with the prevention of siltation/ the washing of the excavated materials into the watercourses lower down. The usage of sand bags/ temporary stone weirs are also recommended in areas that are prone to erosion.

The temporary storm water management measures each phase must be attached the EMP prior commencement with such phase.

- P & C Plan construction in phases and minimise disturbance to the specific construction areas.
- 0 implement groundwater quality and level monitoring as in order to assess performance of the the mitigation measures.
- P & C Rehabilitate/ cover, where possible, exposed areas immediately after construction phase has been a completed. If this is not possible, temporary mitigation measures must be applied until rehabilitation or coverage of such areas are possible.

M - To be included in EMP

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M - To be included in EMP

M - To be included in EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

10) Good drainage will be required as the occurrence of season perched water tables is possible, especially in the shallow bedrock drainage areas. This may cause problems with dampness in surface structures and with installation of services.

A good drainage system will be required as the occurrence of season perched water tables is possible. Any new activity such as installation of underground services should be scrutinised for possible impacts on the water regime of the road and road reserve. Experience shows that such activities often cause slumping of stable slopes near roads.

Table 16: Significance of Issue 10 (Good drainage will be required as the occurrence of season perched water tables is possible, especially in the shallow bedrock drainage areas. This may cause problems with dampness in surface structures and with installation of services) After Mitigation

Mitigation Possibilities High ● Medium ○ Low ○ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Mitigation Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	Significance of Issue after mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal
Medium ③	P & C - Identify perched water tables early and provide adequate drainage for these trigger points. These areas must be indicated on a plan and contractors and other members of the team must be notified of possible perched water conditions and the mitigation measures for the drainage of the areas and for construction in these areas must be discussed with all relevant parties. P & C - Use environmentally friendly drainage methods (i.e.	flaw NP M - To be included in EMP M - To be included in EMP

bio-swales) in areas where foundations. services. basements etc. are to be installed. The ground water movement patterns must be handled in such a way that it will have a minimum impact on the sustainability of wetlands and riparian zones that are dependent on the ground water supply for the optimal functioning of the ecosystems associated with such areas/zones.

- P & C The wetland specialist must be involved in the ground water drainage planning and the proposed drainage concepts must also be tested with the Department of Water Affairs, because they will be responsible for the issuing of the Section 21 (C) and (i) licenses required for the construction and operational phases of the development.
- P, C & O Where required temporary storm water attenuation features must be implemented. The feature/s must preferably be located outside the wetland and watercourse buffers and such features must also be designed to act as silt traps that can be maintained/cleaned by mechanical equipment.

The proposed features must be designed to break the speed of the water and to prevent concentrated storm water flow in sensitive areas (i.e. areas with higher erosion potential, against steeper slopes).

P, C & O – The incorporation of M - To be included in EMP berms into the landscaping of the development could also assist in storm water management if such

M - To be included in EMP

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M - To be included in EMP

embankments/ berms are planned in conjunction of the storm water engineers and the wetland specialist. Such integrated planning measures could reduce the sizes of the required storm water attenuation features, which often appear unattractive and which tend to cover developable areas.	
The appointed Landscape Architects must become part of the integrated planning team from the early stages of the development in order to place the proposed landscaping berms at strategic points as identified by engineers.	

11) Wet surface conditions and seepage may also occur and special drainage measures should be implemented. Surface water runoff should be controlled to prevent erosion of the surficial soils.

A good drainage system will be required as the occurrence of wet surface conditions and seepage. When the surface runoff water is not controlled this can lead to unnecessary erosion of the surficial soils in the area.

Table 17: Significance of Issue 11 (Wet surface conditions and seepage may also occur and special drainage measures should be implemented. Surface water runoff should be controlled to prevent erosion of the surficial soils) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊙ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Must be implemented during Planning phase, Construction and/ or Operational phase P/C/O Mitigation	Low/ eliminated L / E Medium M High H Not possible to mitigate,

		but not regarded as a fatal
		flaw NP
Medium 😏	P & C – implementing of a good drainage system.	M - To be included in EMP
	P & C - Identify perched water tables early and provide adequate drainage for these trigger points	M - To be included in EMP
	P & C - Grading of land should be away from the building to allow for adequate drainage.	M - To be included in EMP
	P & C - Drainage for storm water run-off should be adequate, and blocked drains and gutters should be kept clear.	M - To be included in EMP

12) The three historic cemetery sites will most probably warrant a separate zone where no development may take place.

The three historic cemetery sites will most probably warrant a separate zone where no development may take place. Development on this site will be an offence under the National Heritage Resources Act (Act 25 of 1999). According to the specialist Leonie Marais-Botes these three historic cemeteries consist of graves older than 60 years and must be conserved.

Table 18: Significance of Issue 12 (The three historic cemetery sites will most probably warrant a separate zone where no development may take place) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium © Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M
Necessary To Mitigate 🌣	and/ or Operational phase	High H
	and, or Operational priase	9

	P/C/OMitigation	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ●	P & C – The existing graveyards must be clearly demarcated and fenced prior to the construction phase (the ECO and heritage specialist must be present when during the demarcation process). The appointed heritage specialist recommended that a 50m buffer be applied around such graves. The project team must discuss the buffer zone with the heritage specialist and if any relaxation of the proposed buffer is required, the heritage specialist must be approached to assist in this regard. The 50m buffer is a guideline as supplied by SAHRA.	M - To be included in EMP
	If the heritage specialist propose restoration/renovations to the graveyard/graves, the specialist must discuss the proposed actions with SAHRA and must incorporate such works as part of the Heritage Management Plan to be compiled for the Construction and Operational Phases of the project.	
	P & C – If any additional graves, archaeological sites/ historical structures or features are identified during the construction phase, construction in the specific area must stop with immediate effect. The heritage specialist, Dr. De Vos/ the appointed anthrax specialist and the ECO must immediately be contacted and such specialist must supply the required guidance regarding the proposed way forward. If	M - To be included in EMP

required, the proposed development layout must be amended to incorporate such features. Alternatively SAHRA must be approached for the approvals necessary relocate the graves/ structures/ to remove the structures from the study area.

C The heritage management plan for the construction and operational phases of the project must be compiled and approved by SAHRA prior to commencement with any demolitions, restoration works/ renovations in the affected areas.

This plan must be attached to the EMP and the heritage specialist must supply a plan (as part of the management plan), which identifies the areas to be fenced/protected (including the appropriate buffers around such areas) during construction and operational phases of the development.

P & C - The fence/walls around the Sizwe hospital must remain/ a new fence must be erected around the hospital prior to the construction phase in order to prevent any construction workers from entering the premises and to protect the facility from damage. The heritage specialist and the ECO must assist with demarcation of the proposed hospital construction fencing.

C - The proposed demolition of the Sizwe Hospital as a final phase of the M - To be included in EMP development must also be addressed in the heritage management plan to be compiled. The heritage

M - To be included in EMP

Gaut: 002/13-14/E0153

M - To be included in EMP

specialist must clearly identify the structures on the adjacent to the hospital site, which must be protected/ renovated as memorials. No demolition/ renovation activities proceed until the proposed demolition authorisations/permits obtained from the various authorities, including SAHRA and no demolition of the any hospital structures may commence before finalisation of the future plans with the existing social services performed by the hospital. P & C – The demolition method (i.e. burning down/ fumigation | M - To be included in EMP prior to demolition etc.) must also form part of the heritage management plan and the appointed anthrax specialist must also agree to the proposed method of demolition and mitigation measures proposed (from a disease outbreak/medical

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

point of view).

13) Ideally the clayey soils should be removed below roads and paved areas and replaces with insert materials.

Geologic clay soils are mostly composed of phyllosilicate minerals containing variable amounts of water trapped in the mineral structure. Therefore it would be ideal to remove the clayed soils below roads and paved areas and replace it with insert materials for more stability and to prevent the forming of cracks in the roads and pavement.

Table 19: Significance of Issue 13 (Ideally the clayey soils should be removed below roads and paved areas and replaces with insert materials) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium © Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/C/O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Medium	P & C – Identify areas that will require the removal of clayish soils prior to the construction phase. P & C – Identify temporary storage positions (not in the flood line areas/ within any watercourses/ against steep slopes) for such soils and confirm what will happen to the soils that are removed. Some of the clayish soils could be used for the lining of dams to be constructed on other sites/ attenuation features. This will prevent the loss of valuable soils dumped and polluted at landfill sites.	M - To be included in EMP M - To be included in EMP

14) The large volume of dumped materials will also pose a problem due to the uncontrolled manner and variability in properties of this material.

Some of the dumped materials can cause contamination in the soils which can lead to soil pollution. When dumping of materials is not controlled this can have an impact on the ecological soils as well as the ecological system.

Table 20: Significance of Issue 14 (The large volume of dumped materials will also pose a problem due to the uncontrolled manner and variability in properties of this material) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High • Medium © Low • Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/C/O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate,
Medium	P & C – Demarcated areas for	but not regarded as a fatal flaw NP M - To be included in EMP
	P & C – Dumping of materials should be controlled.	M - To be included in EMP

15) The soils on the site are not regarded as suitable for usage as construction materials.

Because the soil on the site is not suitable for construction materials, enough construction materials must be provided. The type of soils found on this site by the specialist namely clayed soils is not suitable for the development of infrastructures.

Table 21: Significance of Issue 15 (The soils on the site is not regarded as suitable for usage as construction materials) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊕ Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M
Necessary To Mitigate 🌣	and/ or Operational phase	High H
	P/C/OMitigation	Not possible to mitigate,

	but	not regarded as a fatal
	flav	v NP
Medium 💿	P & C – Store sub-soils that are suitable for construction purposes in designated areas on the study area. Separate the sub-soil to be used for construction purposes from the topsoil. The temporary storm water management measures as proposed for stockpiles on the study area are also applicable to sub-soil storage.	· To be included in EMP
	P & C – Promote the usage of construction materials obtained from the site. This will promote re-use and recycling and it will eliminate high transport and soil importation costs.	· To be included in EMP
	P & C - From a landscaping point of view it is always better to prevent the import of soils that are not in line with the soil types of the study area. The application of imported and different soils layers above the soils of the study area could lead to the formation of even more parched water conditions/ higher water tables. If soils are imported for landscaping purposes, the imported soils must preferably be mixed with the soils on the site to improve drainage and permeability and to prevent the occurrence of "finger drainage" patterns.	· To be included in EMP

Siltation problems. 16)

Siltation problems may occur when there is dumping of materials into the wetlands and lead to water pollution. There will definitely need to be mitigation measure to prevent

water pollution during the construction phase where many of the building materials will be dumped.

Table 22: Significance of Issue 16 (Siltation problems) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ⊕ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Medium 💿	P & C – Demarcated areas for dumping of construction materials must be implemented.	M - To be included in EMP
	P & C - No dumping of construction materials near the wetland areas. Note: Other suitable mitigation measures to address this problem have already been	M - To be included in EMP
	included in issues above	

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

17) Possible contaminated soils on the study area (associated with bacterial and viral diseases treated and the Sizwe Hospital and possible anthrax spores in animal carcasses apparently buried in the areas but not found).

With the tropical diseases treated by the Sizwe Hospital and possible anthrax spores in animal carcasses apparently buried on the study area but not found, there is a possibility that soil contamination may occur.

Table 23: Significance of Issue 17 (Possible contaminated soils on the study area (associated with bacterial and viral diseases treated and the Sizwe Hospital and possible anthrax spores in animal carcasses apparently buried in the areas but not found)) After Mitigation

	T	
Mitigation Possibilities	Mitigation	Significance of Issue after
High Medium Low Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M
Necessary To Mitigate ☆	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Medium	P & C - The specialist forum team that was appointed to assist with the disease issues confirmed that there are no or very limited risks associated with the possible exposure of new burial sites or waste sites during the construction phase. The suitably qualified specialists did not regard it as necessary to apply any special mitigation measures (i.e. protective clothing, the application of formaldehyde etc.) prior to and during construction. Apparently a human being must be exposed to at least 1 300 anthrax spores/ more per day before there is a risk of being infected. Furthermore, the anthrax spores are too heavy to be inhaled by humans. Dr. De Vos (leading athrax specialist) however agreed to assist (when required) during the construction phase if any anthrax/disease matters arise. He was formerly involved in a development in Cape Town, which also involved anthrax graves of animals. If any additional burial sites (of	M - To be included in EMP

humans animals) are identified during the construction phase. The construction works in the specific area will immediately All relevant experts stop. (including the cultural and historical specialists) will immediately become involved and investigate the matter and all necessary pollution tests (i.e. soil tests, ground water tests, air quality tests (if required) will immediately be performed in order to determine the risks involved. If required, affected area will be excluded from the development/ suitable mitigation measures will be supplied by the experts in order to reduce/ prevent pollution and infection risks.

P & C - The contamination currently caused by the sewer leaks of the Sizwe Hospital must be addressed prior to the construction phase. In the soil tests that were conducted, the specialists identified traces of the TB virus. This poses potential health risks to the construction workers and to people away from the study area that come in contact with the water of the Jukskei River. The ground water movement on the study area is towards the Jukskei River and the ground water daylights at the river.

M - To be included in EMP

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Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

18) Current soil and water pollution cause by the sewage spillage of the Sizwe Hospital.

The current soil and water pollution caused by the sewage spillage of the Sizwe Hospital had been taken into consideration in the planning and construction phases. The soil and water need to be rehabilitated.

Table 24: Significance of Issue 18 (Current soil and water pollution cause by the sewage spillage of the Sizwe Hospital) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ⊕ Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M
Necessary To Mitigate 🌣	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
	_	but not regarded as a fatal
		flaw NP
High ●	P & C – The contamination currently caused by the sewer leaks of the Sizwe Hospital must be addressed prior to the construction phase. In the soil tests that were conducted, the specialists identified traces of the TB virus. This poses potential health risks to the construction workers and to people away from the study area that come in contact with the water of the Jukskei River. The ground water movement on the study area is towards the Jukskei River and the ground water daylights at the river.	M - To be included in EMP

19) Acidity (pH) of the soils.

According to the specialists, the acidity of the soils on the study area is high. Anthrax spores cannot survive in soils with high acidity and bone remains of animal carcasses and humans will decompose at increased rates in such soil conditions. According to the specialists involved it is highly unlikely that one will find any remaining bones of animals or humans that were buried in the late 1920s (at the time when there was an anthrax outbreak in the Johannesburg area).

Table 25: Significance of Issue 19 (Acidity (pH) of the soils) After Mitigation

Mitigation Possibilities High Medium Low Positive Impact/ Neutral - Not Necessary To Mitigate	Mitigation Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	Significance of Issue after mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ●	P, C & O – According to the specialists, the acidity of the soils on the study area is high. Anthrax spores cannot survive in soils with high acidity and bone remains of animal carcasses and humans will decompose at increased rates in such soil conditions. P, C & O – The services to be installed for the proposed development must be able to tolerate the acidity of the soils.	

20) Blasting could be required in areas where excavation difficulties are experienced.

Some blasting may be required where deep road cuttings are required, where outcrops are present.

Table 26: Significance of Issue 20 (Blasting could be required in areas where excavation difficulties are experienced) After Mitigation

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊜ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E Medium M

A1		
Necessary To Mitigate 🌣	Planning phase, Construction	High H
	and/ or Operational phase	Not possible to mitigate,
	P/C/O Mitigation	but not regarded as a fatal
		flaw NP
Medium 😏	C – Surrounding residents must be informed of blasting exercises at least one week in advance.	M - To be included in EMP
	C – Blasting operations should be carefully controlled and the necessary safety precautions must be implemented.	M - To be included in EMP
	C – Allowance should be made in the quantities and specifications for the excavation of wad (or other soft material) selectively from the floor of cuttings and between pinnacles.	M - To be included in EMP

6.1.1.2 Hydrology

Refer to Annexure I for the Geo-Hydrological Investigation and Refer to Annexure I for Wetland Report.

6.1.1.2. a Surface Hydrology

Water Bodies and Drainage Features

The Jukskei River and non-perennial drainage lines/tributaries of the river traverses the study area. The Jukskei River, which dominates the topography of the study area, enters the site in the south-eastern section and it exists the study area at the northern boundary. The one tributary, which flows in a south-western direction, flows into the Jukskei River in the center

of the eastern part of the study area. The other tributary enters the study area in the southwest and eventually confluence with the Jukskei River at the northern boundary of the study area (also central and just west of the Rand Aid development).

The slopes across the study area are mainly towards the Jukskei River channel, with slopes from 1 600 m in the south and the north sloping down to 1540m at river level. The portions of the study area that are situated adjacent to the two tributaries also slope towards the tributaries. Refer to Figure 9 for Site Hydrology

From topographic maps dating from 1937, 1975 and 2002 (Refer to Annexure Aa) it is very clear that significant alteration of the flow channel of the Jukskei River has taken place, especially in the vicinity of the Linksfield Road off/on ramp. Urban development related impacts caused significant degradation of the flow channel as well as accelerated erosion of the downstream channel of the river. This occurrence is a common phenomenon in the Johannesburg and Midrand areas that are underlain by Johannesburg Granite Dome and the storm water management and development approach of new developments must aim to prevent concentrated storm water flow that reduce the penetration of surface water and the increase of storm water speed and quantity in concentrated areas.

The historical aerial also shows signs of intensive crop production activities that took place on the banks (floodplain) of the Jukskei River. These activities caused the removal of the natural vegetation, including riparian vegetation in large sections of the flood plains.

Although the link between crop production and degradation of the channel in terms of erosion is not easily established it is the comparison with present day conditions that provide a stark contrasting perspective of the state of the river channel. Also Refer To Aerial Photographs Annexure J That Shows Signs Of Historical Agricultural Activities That Took Place on the Study Area

From the 1937 aerial photograph it is however evident that the Jukskei River barely exhibited any significant erosion. In fact, the channel seems to be very shallow and some areas appear to have no channelling at all.

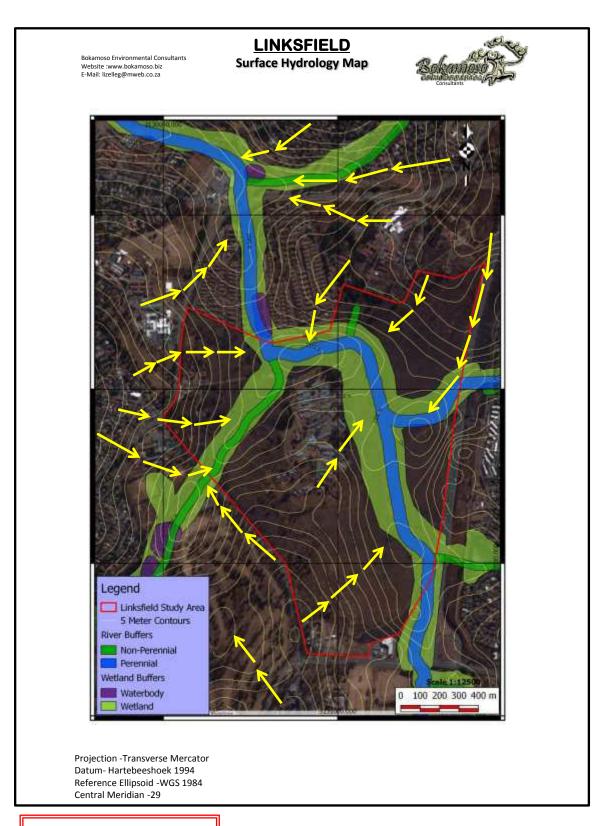


Figure 9: Site Hydrology

Wetlands:

Refer to Annexure T for Wetland Report and Refer to figure 10 for Wetland Delineation

Galago Environmental CC and the Dr. Louis van Rooy (the geotechnical engineer of the project) identified some possible wetlands/ wet conditions on the study area and predicted some perched water table conditions.

In order to confirm the presence of wetlands (by using the DWS 2005 guidelines document), the applicant decided to appoint Dr. Johan van der Waals (qualified soils scientist and wetland specialist) to assist with a phase 2 (detailed) wetland delineation of the study area.

As already mentioned topographic maps dating from 1939, 1975 and 2002 (*Photos are included in the wetland report attached hereto as Annexure 1*) indicate that major alteration of the flow channel of the Jukskei River has taken place in the vicinity of the off/on ramp on Linksfield Road. This impact has, with others, led to a significant degradation of the flow channel as well as accelerated erosion of the downstream channel of the river.

From the aerial photographs dating from 1937 and 1948 it is also clear that intensive crop production activities took place on the banks (floodplain) of the Jukskei River. Although the link between crop production and degradation of the channel in terms of erosion is not easily established, it is the comparison with present day conditions that provide a stark contrasting perspective of the state of the river channel.

Wetlands are defined, in terms of the National Water Act (Act no 36 of 1998) (NWA). The Jukskei River floodplain as well as its tributaries and associated valley bottom wetland systems flow through/occur on the site.

According to the wetland specialist the channels of both the Jukskei River and its tributary have been compromised severely through:

- increased storm water runoff from urban developments and roads;
- historical agricultural activities on the banks of the Jukskei River;
- historical infrastructure development over and in the river channel;

Failed human interventions to control the erosion of the banks; and

• Significant engineering intervention is required for the stabilisation of channels'

banks.

The wetland areas are restricted to the Jukskei River floodplain as well as the tributary's immediate banks. There were two small wetlands identified into the Jukskei River. Without

adequate storm water planning and design these wetlands could be compromised.

6.1.1.2.b Sub- Surface Hydrology

Findings of Geotechnical Survey Conducted by Dr. Louis van Rooy:

Even though no groundwater seepage was noted in any of the excavated trial pits, the

mottled appearance and occasional presence of ferruginised soils in some profiles are

evidence of seasonal saturated soil profile conditions.

According to the geotechnical engineer the site conditions are such that groundwater will

penetrate down slope towards the drainage gullies and the Jukskei River where the water

may seep into the streams and rivers or percolate downwards towards the regional

groundwater table.

Due to the fact that there are smaller drainages and some structures and roads present on

and around the study area, the local run-off directions on the site may vary. On the higher

lying portions of the study area will encourage precipitation to either run off or seep away

as shallow interflow and eventually emerge as seep water within the floodplain.

At present surface runoff and drainage is largely controlled by the road orientation and

generally there is no evidence of erosion in roads parallel to the slope in the area underlain

by greenstone bedrock. However, regions underlain by granitic bedrock do exhibit

evidence of erodible conditions of the surficial soils.

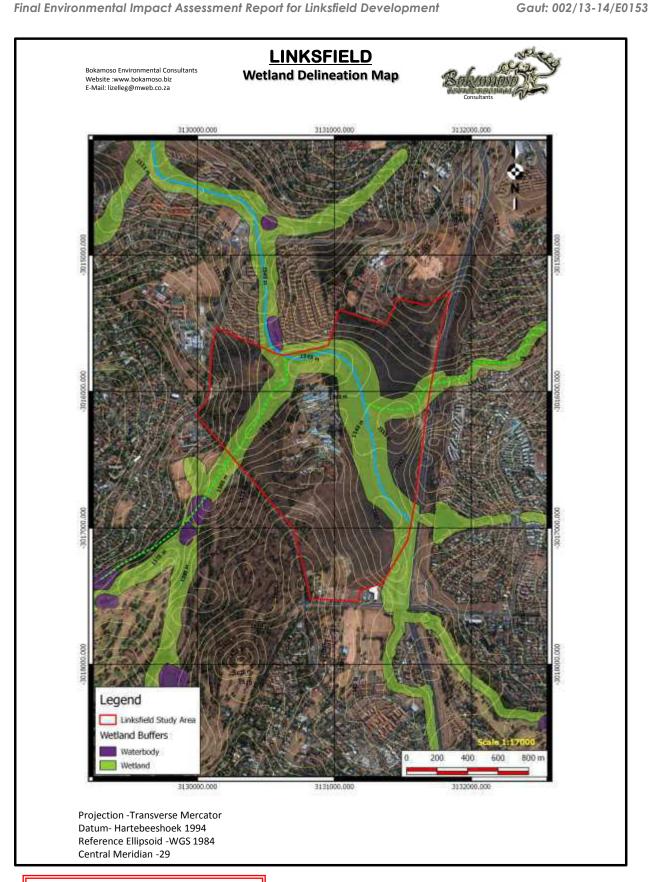


Figure 10: Wetland Delineation

Findings of Geo-Hydrological Study Conducted by Aurecon:

Note: This study was conducted by Dr. Mannie Levin. He was also selected as part of the specialist forum that was established during the assessment process to investigate the possibility of graves and ground water contamination (mainly associated with the graves and diseases) on and around the study area. Refer to Annexure I for geo-hydrological report and refer to Annexure G for Dr. Levin's response to the additional graveyards and waste sites identified on a map by one of the I&Aps

Study Brief:

Aurecon was appointed by the applicant to perform a geo-hydrological investigation at the proposed Linksfield Mixed Use Development Site, located on Portion 137 and the Remainder of Portion 1 of the farm Rietfontein 61-IR, Johannesburg. The main objective of the geo-hydrological investigation was to evaluate the potential anthrax pollution impact that the historical cemeteries and the Sizwe Tropical Disease Hospital could have on the groundwater resources on the site and the surrounding area. The investigations consisted of the following:

- Desk study & Site Visit;
- Hydro census (this included the testing of the water quality of boreholes on surrounding properties. Please note that Dr. Levin also offered and tried to test some of the boreholes at the adjacent golf course, but unfortunately the management of the golf course refused to allow any testing of boreholes);
- Aquifer Classification; and
- Report on the findings

Description of the Ground Water Potential, the Ground Water Movement and the Aquifer

The topography slopes towards the river channel and the perennial drainages and local runoff from the 3 cemeteries is therefore down towards the drainages. No linear structures, faults or shear zones are indicated on the geological map of the site however zones of weathering, brecciation and jointing may be present.

According to Barnard (2000), groundwater is usually encountered in the weathered zone and the fractured zone between the weathered and fresh granite. The geotechnical engineer Dr. Louis van Rooy reported in his geotechnical report compiled for the site that the depth of weathering was only about 1.5 m deep in the test pits that were dug.

He furthermore mentioned the occurrence of ferricrete, which is an indication that a perched aquifer could be present during the rainy season. However, it is important to take note that the geotechnical survey was done during the rainy season and no perched water was intersected in any of the test pits.

The groundwater potential of the study area is generally classed as low to moderate and according to Vegter (1995) the probability of drilling a borehole yielding more than 2 l/s in the Basement Complex is only between 20 and 30%.

The aquifer present can be classified as an inter-granular and fractured aquifer with groundwater occurrence associated mainly with the deeper weathered zones, whereas fault zones and intrusive contacts represent other less common modes of groundwater occurrence. The depth to groundwater level commonly occurs between 5 and 30 m below surface depending on the topographical locality of the borehole.

Based on the above, the geo-hydrologist mentioned that it can be assumed that the regional groundwater flow direction will follow the local topography. Groundwater flow will thus be towards the Jukskei River and the perennial drainages.

In the geo-hydrological survey Dr. Levin concluded that the aquifer system in the study area can be classified as a "Minor Aquifer System". The local population and commercial properties does not use groundwater as a source of potable water and only the Huddle Park Golf Club use borehole yields for irrigation. One can also assume that the aquifer is only important for supplying base flow to the Jukskei River and the tributaries.

The vulnerability, or the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the

uppermost aquifer, in terms of the above, is classified as medium. A relatively shallow water table (~5 mbgl) and rocks with moderately weathering underlie the site.

The aquifer susceptibility (qualitative measure of the relative ease with which a groundwater body can be potentially contaminated by anthropogenic activities and which includes both aquifer vulnerability and the relative importance of the aquifer in terms of its classification) was classified as medium.

A medium GQM index was calculated for this area and therefore a medium level of protection is needed to adhere to the Department of Water Affair's (DWS) water quality objectives. Reasonable and sound groundwater protection measures are recommended to ensure that no cumulative pollution affects the aquifer, even in the long term.

In terms of DWS's overarching water quality management objectives which is (1) protection of human health and (2) the protection of the environment, the significance of this aquifer classification is that if any potential risk exist, measures must be triggered to limit the risk to the environment, which in this case is the (1) protection of the Secondary Underlying Aquifer, (2) the Jukskei River and its tributaries which drains the subject area and (3) any potential users of groundwater in the site area.

Detail Regarding the Hydro Census

A hydrocensus was carried out on the 14th of May 2014 on the property, as well as the adjacent area to identify legitimate groundwater users. Two boreholes were found. The first borehole is located on the Huddle Park Golf and Recreation property approximately 1km upstream from the small eastern cemetery. Unfortunately the borehole could not be sampled because it was damaged.

Other boreholes are located further away but could not be recorded as the owner of the golf course (as already mentioned) refused access to the boreholes. They are however situated upstream and have little contribution to the investigation. The second borehole is located at the Sizwe Tropical Disease Hospital that was used in the past. The groundwater is

seeping out (artesian flow) of the borehole and the water was sampled and the locality recorded.

During the hydrocensus samples were also taken in the Jukskei River upstream and downstream below the hospital as well as in the two perennial drainages. The coordinates of the four surface water and one borehole sample are attached as Appendix A of the geo-hydrological report.

The water samples were submitted to Aspirata Microbiological & Chemical Laboratory (a certified laboratory) for macro chemical analysis and bacteriological analysis. The pathogen analysis includes *Bacillus anthraxis*, Clostridium and Mycobacterium.

The chemical analytical results were compared with the SABS drinking water standards (SANS 241:2006, edition 6.1) and the water in the borehole of the hospital and the surface water was found to be suitable for human consumption (Class 1).

The surface water samples taken at the eastern perennial drainage and downstream in the river however shows unacceptable ammonia levels, placing the samples in Class II quality not suitable for drinking. The results of samples show higher Potassium and Phosphate values than the borehole and this correlates with the results of the soil chemistry reported by Dr. Van Der Waals (2014).

All the samples furthermore fall on the boundary of the Calcium-Magnesium-Carbonate and Calcium-Magnesium-Sulphate-Chloride fields and showing little saline pollution from waste or sanitation.

The absence of Anthracis and Tuberculosis genus certainly indicates no site related pathogen pollution in the water. The results of the water analyses confirm the conclusion by Dr. Van Der Waals (2014) that none of the human diseases identified during the literature survey is present in the water.

6.1.1.2.c Implications for Development:

- Pollution of the groundwater will percolate down slope towards the river and drainages feeding into the river;
- No shallow or perched water table was intersected in the geotechnical test pits.
 However, during the rainy season water will percolate down to the solid rock and
 move down slope or will percolate deeper into fractures to the deeper aquifer. The
 groundwater in the aquifer will also flow down slope to the river and
 drainages/tributaries referred to;
- Any pollution from the cemeteries will therefore end in the river or drainages;
- The surface water samples should therefore indicate any impact from the cemeteries;
- The chemical and pathogen results do however not show any pollution that could be linked to the grave sites;
- There are no groundwater users in the area that can be impacted by the cemeteries;
- Two small wetlands, feeding into the Jukskei River, were identified. These are situated in positions that are not considered adequate for urban development and they should therefore be kept as open spaces on the site. However, without adequate storm water planning and design these wetlands could be compromised.
- The wetland areas are restricted to the Jukskei River floodplain as well as the tributary's immediate banks;
- The channels of both the Jukskei River and its tributary have been compromised severely through:
 - increased storm water runoff from urban developments and roads;
 - historical agricultural activities on the banks of the Jukskei River;
 - historical infrastructure development over and in the river channel; and
 - Failed human interventions to control the erosion of the banks
- Significant engineering intervention is required for the stabilisation of channels' banks;

- To conclude, it is recommended that the site be developed outside of the wetland areas and that the identified drainage features be stabilised and protected to prevent further degradation;
- Storm water mitigation will have to be implemented on the site outside of the wetland areas:
- Any boreholes drilled in the study are must be sampled for pathogen analysis to confirm the present results; and
- The planned development must ensure total runoff to reduce recharge and erosion impact on the soil layers in the study area.

6.1.1.2. d Issues and Impacts – Hydrology

Table 27: Issues and Impacts – Hydrology

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High Medium Low Positive Impact/ Neutral - Not Necessary To Mitigate
21)	Siltation, erosion and water pollution in the Jukskei River could occur if a stormwater management plan is not implemented	-	③
22)	Pollution of the groundwater will percolate down slope towards the river and drainages feeding into the river. Any pollution from the cemeteries will therefore end in the river or drainages	_	
23)	The chemical and pathogen results do however not show any pollution that could be linked to the grave sites	+	‡

24)	Removal of vegetation coverage,	-	•
	increased hard surfaces and increased erosion, surface water pollution and siltation problems		
25)	There are no groundwater users in the area that can be impacted by the cemeteries	+	‡
26)	Two small wetlands, feeding into the Jukskei River, were identified. These are situated in positions that are not considered adequate for urban development and they should therefore be kept as open spaces on the site. However, without adequate storm water planning and design these wetlands could be compromised.	_	⊙
27)	Significant engineering intervention is required for the stabilisation of channels' banks	-	©
28)	Any boreholes drilled in the study area must be sampled for pathogen analysis to confirm the present results	-	•
29)	The planned development must ensure total runoff to reduce recharge and erosion impact on the soil layers in the study area	-	•
30)	Storm water mitigation will have to be implemented on the site outside of the wetland areas	-	•
31)	The possible identification or more graves and waste sites on the study area during constructions (mainly when excavations are done)	-	
32)	Possible ground water contamination when hospital is demolished	_	©

33)	Storage of topsoil and sub-soil below the flood line and in drainage features	•	•
34)	Dumping of builder's rubble below the flood line or within watercourses or watercourse buffers	-	•

Table 28: Comments of the I&AP's regarding the Hydrology

Issue:	I&AP	Issues Addressed in Report √/X
Affected parties are	Irwin Juckes -	$\sqrt{}$
concerned about the	<u>ijuckes@isbroadband.co.za</u>	
destruction of the wetlands.		Refer to Issue 34, page 148
	Ian Friedland - <u>ian@llinc.co.za</u>	
"My interest is in the		
preservation of the Jukskei	Benita de Andrade -	
and Sandringham streams	Benita958@gmail.com	
and riparian zones as		
functional wildlife corridors		
and in providing sufficient		
space along the rivers for		
hiking trail continuous with		
adjacent sections of river."-		
Irwin Juckes		

6.1.1.2. e Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

21) Siltation, erosion and water pollution in the Jukskei River could occur if a stormwater management plan is not implemented

If erosion, siltation and water pollution is not addressed, the sustainability of the non-perennial river can be negatively impacted by the development.

Table 29: Significance of Issue 21 (Siltation, erosion and water pollution) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊙ Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M
Necessary To Mitigate 🌣	and/ or Operational phase	High H
	P/C/OMitigation	Not possible to mitigate,
	-	but not regarded as a fatal
		flaw NP
Medium 😊	P/ C / O -	M - To be included in EMP
	The storm water design for the proposed development must be designed to: - Address the construction and operational phase storm water management. - Prevent bank and riparian zone erosion especially in the upper section of the main tributary. - Reduce and/ or prevent siltation, erosion and water pollution. If erosion, siltation and water pollution is not addressed, the sustainability of the drainage and the open space systems especially in the upper section of the main tributary can be negatively impacted by the development. - Storm water runoff should not be concentrated as far as possible and sheet runoff from paved surfaces need to be curtailed. - Runoff from paved surfaces need down by the strategic placement of	

berms. The vegetation must be retained as far as possible, and rehabilitated if disturbed by construction activities to ensure that erosion and siltation do not take place. No trees should be planted within five meters of the line of the water bearing services.	
Note: Other suitable mitigation measures to address this problem have already been included in issues above	

22) Pollution on the groundwater will percolate down slope towards the river and drainage feeding into the river. Any pollution from the cemeteries will therefore end in the river drainage.

The ground water pollution potential on the study area is regarded as high and if not planned and managed correctly, the construction and operational phases of the proposed road could cause sub-surface water pollution. Therefore if there are any pollution form the cemeteries, it will flow down and end in the river drainage.

The storm water management plan must be designed to:

- Reduce and/ or prevent siltation, erosion and water pollution; and
- Improve the surface and ground water quality of the study area and the lower lying areas within the catchment area.

Table 30: Significance of Issue 22 (Ground water pollution) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance	of	Issue	after
	Already achieved $\sqrt{}$	mitigation			

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High ⊕ Medium © Low ■	Must be implemented during	Low/ eliminated L / E		
riigii e Medioiii e Low	planning phase, construction	,		
Positive Impact/ Neutral - Not		Medium M		
Necessary To Mitigate 🌣	and/ or operational phase	High H Not possible to mitigate,		
	P/C/O			
		but not regarded as a fatal		
		flaw NP		
Medium ©	P/C/O - Compilation of a storm water management plan that will address storm water management during the construction and operational phases of the project	M - To be included in EMP		
	P/C/O – On-going monitoring of groundwater levels on and in the immediate vicinity of the site is essential. The monitoring positions to be indicated by the appointed geo-hydrologist. The geo-hydrologist must also assist with the compilation of a ground water management programme and plan.	M - To be included in EMP		
	P/C/O – Establish man-made wetland-like systems at storm water outlets and in and around storm water attenuation features. This will assist with the purification of surface water prior to it entering the riverine systems and the ground water	M - To be included in EMP		
	P/C/O – The establishment of weirs (even if made out of stone that were collected on the study area) in existing and newly created drainage channels/lines will also help to break the speed of the water, it will distribute the storm water across the surface, it will purify the storm water and it will act as silt traps. It will also be possible to establish some vleitype vegetation behind the weirs, where soils are deposited.	M - To be included in EMP		

24) Removal of vegetation coverage, increased hard surfaces and increased erosion, surface water pollution and siltation problems

The development will add large amount of hard surfaces such as paving and structures with roofs to the study area. The proposed development will also lead to the compaction of soils. The soils layers will thus become less permeable, storm water will be canalised rather than evenly spread. The quantity and speed of the storm water will increase significantly and the quality of the surface water will deteriorate, because of the lack of vegetative coverage. Erosion and siltation will also become a problem.

In order to address this issue, it will be necessary to compile a storm water management plan/ system for the proposed development. The storm water management plan must be designed to:

- Reduce and/ or prevent siltation, erosion and water pollution. If
 Erosion, siltation and water pollution are not addressed, the long-term
 sustainability of the water bodies and open space systems lower down
 in the catchment area cannot be guaranteed; and
- Improve the surface and ground water quality of the study area and
 The lower lying areas within the catchment area.

Table 31: Significance of Issue 24 (Removal of vegetation coverage, increased hard surfaces and increased erosion, surface water pollution and siltation problems) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ○ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E
Necessary To Mitigate 🌣	planning phase, construction	Medium M

	and/ or operational phase	High H
	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ⊕	P/C/O - Compilation of a storm water management plan that will address storm water management during the construction and operational phases of the project and would mitigate the increased runoff due to vegetation removal.	M - To be included in EMP and conditions of approval
	P/C/O - If possible, implement the development in phases and clear the vegetation in phases and as required for the implementation of the phases.	M - To be included in EMP
	P/C/O – Where possible the proposed construction circulation routes must be restricted to disturbed areas and existing dirt roads. Avoid unnecessary circulation routes through watercourse/ flood line areas.	M - To be included in EMP
	P/C/O – the proposed rehabilitation plan for the study area must also address the phased implementation of formal landscaping along new roads and in other open space areas that will not form part of the proposed natural open space area associated with the river system.	M - To be included in EMP
	P/C/O - A ground coverage of at least 75% must be achieved in areas where natural areas and formal landscaping are to be implemented. This coverage must be achieved by the appointed landscape contractor prior to the handing-over of the completed works.	M - To be included in EMP
	Note: Other suitable mitigation	

measures	to	address	this
problem	have	already	been
included i	n issue	s above	

26) Two small wetlands, feeding into the Jukskei River, were identified. These are situated in positions that are not considered adequate for urban development and they should therefore be kept as open spaces on the site. However, without adequate storm water planning and design, wetlands could be compromised.

The two small wetlands feeding into the Jukskei River are not adequate for urban development and therefore should rather be kept as open spaces on the site. The wetlands should be taken into consideration in the storm water planning and design to protect these areas.

Table 32: Significance of Issue 26 (Two small wetlands, feeding into the Juksei River, were identified. These are situated in positions that are not considered adequate for urban development and they should therefore be kept as open spaces on the site. However, without adequate storm water planning and design, wetlands could be compromised.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊙ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal
		flaw NP
Medium ③	P - Adequate storm water planning and design is required to avoid wetlands being compromised;	M - To be included in EMP
	P/ C / O - The temporary and permanent storm water and drainage measures must take	M - To be included in EMP

the long term sustainability of the wetland systems into consideration. At present the systems receive a certain amount of ground water and surface water and the water flows into and across such wetland in a specific pattern. Adjustments to this flow pattern could have a negative impact on the coexistence of the wetland and riverine systems. The appointed storm water engineers and the wetland specialist must liaise in order to ensure that the matter is sufficiently addressed.	
Note: Other suitable mitigation measures to address this problem have already been included in issues above	

27) Significant engineering intervention is required for the stabilisation of channels' banks

Vegetative-based structural reinforcements are preferred, especially in cases with fisheries resources and/or water quality issues. Where construction will adversely affect significant fish or wildlife habitat, mitigation measures should be included in the plan. Mitigation measures may include in-stream structures such as pools, riffles, and woody structures, or streamside measures such as trees, shrubs, and other features that enhance wildlife habitat.

Table 33: Significance of Issue 27 (Significant engineering intervention is required for the stabilisation of channels' banks Significant engineering intervention is required for the stabilisation of channels' banks) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance	of	Issue	after
		mitigation			

High ■ Medium □ Low ■	Already achieved $\sqrt{}$	Low/ eliminated L / E
Positive Impact/ Neutral - Not	Must be implemented during	Medium M
Necessary To Mitigate 🌣	planning phase, construction	High H
	and/ or operational phase	Not possible to mitigate,
	P/ C / O	but not regarded as a fatal
		flaw NP
Medium	P/C/O - To ensure stabilisation of the channel banks and limiting erosion and the collapsing of the banks, an engineer should properly design the reinforcements. Vegetative-based structural reinforcements are preferred. P/ C/ O - Steep embankment along roads and in other sections of the development should also be planted with vegetative based structural reinforcements	M - To be included in EMP M - To be included in EMP
	Note: Other suitable mitigation measures to address this problem have already been included in issues above	

28) Any boreholes drilled in the study area must be sampled for pathogen analysis to confirm the present results.

Any boreholes drilled in the study area during the construction phase must be sampled for pathogen analysis to confirm the present results; should there be any pathogens present there must be mitigation measures in place. The chemical and pathogen results do however not show any pollution that could be linked to the grave sites.

Table 34: Significance of Issue 28 (Any boreholes drilled in the study area must be sampled for pathogen analysis to confirm the present results.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ⊙ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ●	P /C - Samples from the boreholes must be taken for pathogen analysis to confirm results Note: Other suitable mitigation measures to address this problem have already been included in issues above	M - To be included in EMP

29) The planned development must ensure total runoff to reduce recharge and erosion impact on the soil layers in the study area

Uncontrolled runoff water can have a significant impact on the soil layers of the study area, therefore the total runoff water must be identified and confirm toe reduce recharge and erosion impact on the soil layers.

Table 35: Significance of Issue 29 (The planned development must ensure total runoff to reduce recharge and erosion impact on the soil layers in the study area.) After Mitigation/Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊙ Low ■	Already achieved √	mitigation
	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not	planning phase, construction	Medium M
Necessary To Mitigate 🌣		High <mark>H</mark>
	and/ or operational phase	Thigh the

	P/C/O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ⊕	P /C - Uncontrolled runoff water can have a significant impact on the soil layers of the study area, therefore the total runoff water must be identified and confirm toe reduce recharge and erosion impact on the soil layers.	
	P /C - Plan reviews are conducted to ensure they provide for adequate construction and post-construction storm water runoff pollution control.	
	P /C - Pre-construction meetings help to identify potential storm water runoff problem areas on the construction site and ensure they are addressed as part of the SWMP.	
	Note: Other suitable mitigation measures to address this problem have already been included in issues above	

30) Storm water mitigation will have to be implemented on the site outside of the wetland areas

When implementing the storm water mitigation measure the sensitive wetland areas must be taken into consideration. The storm water mitigation will have to be implemented outside of the wetland/ wetland buffer areas as this could have a negative effect on integrity of the wetland system. When not managed and planned correct the wetland can be impacted by the storm water mitigations.

Table 36: Significance of Issue 30 (Storm water mitigation will have to be implemented on the site outside of the wetland areas) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊙ Low ■	Already achieved √ Must be implemented during	mitigation Low/ eliminated L / E
Positive Impact/ Neutral - Not	planning phase, construction	Medium M
Necessary To Mitigate 🌣	and/ or operational phase	High H
	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ●	P /C - Plan reviews are conducted to ensure they provide for adequate construction and post-construction storm water runoff pollution control. P /C - Pre-construction meetings help to identify potential storm water runoff problem areas on the construction site and ensure they are addressed as part of the SWMP. Note: Other suitable mitigation measures to address this problem have already been	M - To be included in EMP M - To be included in EMP

The possible identification of more graves and waste sites on the study area during 31) construction (mainly when excavations are done)

There is a possibility that more graves can be found on the site during the construction phase, due to the fact that the some of the graves are older than 60 years there can be some more graves that were not identified during the site visits. Mitigation measures must

be implemented for when there is possible identification of more graves and waste sites in the study area as this can have a major impact on the development.

Table 37: Significance of Issue 31 (The possible identification of more graves and waste sites on the study area during construction (mainly when excavations are done)) After Mitigation/ Addressing of the Issue

Mitigation Possibilities High • Medium • Low • Positive Impact/ Neutral - Not Necessary To Mitigate	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	Significance of Issue after mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate,
		but not regarded as a fatal flaw NP
Low	P /C - The appointed ECO, Contractors and site workers should be on the lookout for graves or any remains during the entire construction phase. Should any graves or remains be found, a heritage specialist should be contacted to advice on the way forward. Note: Other suitable mitigation measures to address this problem have already been included in issues above	M - To be included in EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

32) Possible ground water contamination when hospital is demolished

When demolishing the Hospital there is a possibility that the chemicals used by the Hospital can percolate into the soils causing contaminated ground water, which can have an impact on the ecological and social systems. This must be taken into consideration when

compiling the Environmental Management Plan. The involved contractors should be aware of this situation.

Table 38: Significance of Issue 32 (Possible ground water contamination when hospital is demolished) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊙ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Must be implemented during planning phase, construction and/or operational phase P/C/O	Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Medium ()	P/C - A specialist needs to provide advice and be on the site during the demolishing of the hospital. Ground water tests need to be done prior and after the hospital is demolished to ensure the ground water results does not fluctuate. Note: Other suitable mitigation measures to address this problem have already been included in issues above	M - To be included in EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

33) Storage of topsoil and sub-soil below the flood line and in drainage features

The storage of topsoil or any other material within the flood line or drainage line could lead to major sedimentation in the river and downstream drainage lines.

Table 39: Significance of Issue 33 (Storage of topsoil and sub-soil below the flood line and in drainage features) After Mitigation/ Addressing of the Issue

Mitigation Possibilities High Medium Low Positive Impact/ Neutral - Not Necessary To Mitigate	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	Significance of Issue after mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ⊕	P/C - No stockpiling of topsoil or any construction material is allowed within the drainage line or flood line. Note: Other suitable mitigation measures to address this problem have already been included in issues above	

34) Dumping of builder's rubble below the flood line or within watercourses or watercourse buffers

Dumping of builder's rubble below the flood line or within watercourses or watercourse buffers can lead to contamination of the watercourses and have a major impact on the aqua life living and feeding on the watercourses.

Table 40: Significance of Issue 34 (Dumping of builder's rubble below the flood line or within watercourses or watercourse buffers) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance	of Issue	e after
High ⊕ Medium ⊜ Low ■	Already achieved $\sqrt{}$	mitigation		
Positive Impact/ Neutral - Not	Must be implemented during	Low/ elimina	ited L	/ E

Necessary To Mitigate 🌣	planning phase, construction	Medium M	
	and/ or operational phase	High H	
	P/ C / O	Not possible to mitigate,	
		but not regarded as a fatal	
		flaw NP	
High ●	P & C – Demarcated areas for dumping of construction waste	M - To be included in EMP	
	P & C – Dumping of materials should be controlled.	M - To be included in EMP	

6.1.1.3a Issues & Impacts Identification – Wetlands

Table 41: Issues and Impacts – Wetlands

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High • Medium • Low • Positive Impact - Not Necessary To Mitigate \$\infty\$
35)	Impact on wetlands in the riparian zone	•	Medium 🙂

6.1.1.3. b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation - Wetland

Impact on wetlands in the riparian zone 35)

The construction and operational phases of the proposed Linksfield mixed use development could have a detrimental impact on the wetlands in the riparian zone if not properly planned and managed.

Table 42: Significance of Issue 35 (Impact on wetlands in the riparian zone) After Mitigation/ Addressing of the Issue

AAILI arabi an Daasilailibi aa	Mitigation	Significance of Issue after
Mitigation Possibilities		mitigation
High ⊕ Medium ⊙ Low ■	Already achieved √	
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E
Necessary To Mitigate ☼	planning phase, construction	Medium M
and the same of th	and/ or operational phase	High H
	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Medium 😏	P/C/O – The temporary drainage feature should be left intact with a narrow buffer zone of ten meters to allow natural flow of storm water down the drainage line. The wetland and associated buffer zones must be excluded from development.	M - To be included in EMP
	P/C/O – Riparian vegetation along the main stream channel needs to be rehabilitated in order to increase the amount of surface flow of the stream and in order to improve the integrity of the riparian and in stream habitat integrity of the resource. On-going maintenance of the riparian zone will be required in order to prevent the re-establishment of the alien tree community after the initial clearance has taken place.	M - To be included in EMP
	P/C/O – It is essential that the stream continuity of the main drainage line be reinstated. In this regard the following points	M - To be included in EMP

are made:

- If public open spaces within the buffer zones of the stream and wetland areas are provided it should be adequate to maintain the ecological connectivity of the riparian and in-stream ecology of the area.
- It is recommended that these areas are managed adequately by restricting the movement of people to a limited number of allocated pathways and pets (e.g. dogs) should be restrained by a lead at all times.
- It is recommended that alien and invasive vegetation (trees) are removed. This will increase the water volume flowing within the streams associated with the property and improve will the connectivity of the riparian zone.
- C No vehicles should be allowed to indiscriminately drive through the wetland areas. A fence should be erected along the various wetland buffer zones to prevent entry into the wetland areas and drainage line by construction vehicles and prevent storing or dumping of topsoil, construction material and other waste in the wetland/drainage line.
- C/O All areas affected by construction should be rehabilitated upon completion of the construction phase. Areas should be reseeded with indigenous grasses as required.

M - To be included in EMP

Gaut: 002/13-14/E0153

M - To be included in EMP

P/C - Site offices, parking areas for construction vehicles, etc. should be confined to nonsensitive areas.	M - To be included in EMP
Note: Other suitable mitigation measures to address this problem have already been included in issues above	

6.1.1.4 Topography

The topography of the site is undulating with incised and often eroded stream channels throughout. The general topography is dominated by the river and two small tributaries. The overall slope is towards the river channel and locally in the south-east and south-west the slopes are towards the smaller drainage channels. The altitude on the study area ranges from approximately 1600m above sea level (in the south) to approximately 1540m above sea level at stream level (in the north). The slope across the study area ranges from between 0-5% in the south-western corner to 5-15% in the rest of the study area.

According to the GDARD C-Plan the study area is not affected by a ridge. The study area slopes down to the watercourses that traverse the site. The Ridge issue was also addressed in the updated issues and response report attached hereto as Annexure An.

The GDARD C-Plan, which also identifies ridges were used. Galago Ventures, the appointed fauna and flora specialists communicate with GDARD (prior to the conducting of the fauna and flora/ ridges studies) regarding the specific investigations required. GDARD did not request and ridges study and no ridges were indicated on the GDARD C-Plan. The site slopes downwards towards the watercourse and the slope is rather regarded as a valley than a ridge. The photographs below of the study area clearly illustrates that the study area is not affected by a ridge. The valley associated with the watercourses is visible on the photographs.

If the study area is regarded as a ridge, the Huddle Park golf course Linksfield Road, Club Street and the residential areas to the south of Linksfield Road are also developed on the same "so-called" ridge system. If the is the case the "so-called" ridge cannot be classified as a Class 2 Ridge, because it has already been severely transformed.

PHOTO 1: VIEW FROM THE N3 TOWARDS THE STUDY AREA – IN A SOUTH-WESTERN DIRECTION. THE VALLEY IS CLEARLY VISIBLE ON THE PHOTOGRAPH AND NO PROMINENT RIDGE IS VISIBLE ON THE STUDY AREA. THE AREAS BEHIND THE STUDY AREA (IN THE VICINITY OF THE HUDDLE PARK GOLF COURSE) APPEAR EVEN HIGHER.



PHOTO 2: VIEW FROM THE N3 TOWARDS THE STUDY AREA – IN A NORTH-WESTERN DIRECTION. NO PROMINENT RIDGE IS VISIBLE ON THE STUDY AREA. THE AREAS BEHIND THE STUDY AREA. THE HIGHER LYING SECTIONS OF THE STUDY AREA ARE LEVEL WITH THE N3 FREEWAY.



PHOTO 3: THE STUDY AREA AS VIEWED FROM LINKSFIELD ROAD – TOWARDS THE NURSERY, WHICH IS SITUATED ON THE HIGHEST PART OF THE STUDY AREA. NO PROMINENT RIDGE IS VISIBLE. THE STUDY AREA IS ALMOST LEVEL WITH THE ROAD AND RESIDENTIAL AREA TO THE SOUTH OF THE ROAD.



6.1.1.4a Issues & Impacts Identification – Topography

Table 43: Issues and Impacts – Topography

	Issue/Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High • Medium • Low • Positive Impact - Not Necessary To Mitigate ‡
36)	Due to the undulating nature of the study area, some cut and fill exercises will be required for the creation of platforms	-	©
37)	The slope across the study area is sufficient to allow for the installation of services that gravitate	+	‡
38)	Due to the topography of the site, large sections of	-	<u>©</u>

the study area are visible from the surrounding	
roads and properties	

6.1.1.4. b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation - Topography

36) Due to the undulating nature of the study area, some cut and fill exercises will be required for the creation of platforms

The undulating nature of the study area will require some major cut and fill exercises which will cause disruptions to the soil profile and possibly erosion and sedimentation.

Table 44: Significance of Issue 36 (Due to the undulating nature of the study area, some cut and fill exercises will be required for the creation of platforms) After Mitigation/ Addressing of the Issue

	Mitigation	Significance of Issue after
Mitigation Possibilities	Already achieved $\sqrt{}$	mitigation
High ⊕ Medium ⊙ Low ■	Must be implemented during	Low/ eliminated L / E Medium M
Positive Impact/ Neutral - Not	planning phase, construction and/ or operational phase	High H
Necessary To Mitigate 🌣	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Medium 😊	P/C - Proper mitigation measures need to be implemented during these cut and fill exercises to ensure that erosion and sedimentation is limited.	M - To be included in EMP
	P/C - Some of the soils on the study area are associated with unstable conditions. This must be taken into consideration during cut and fill exercises and during the remainder of the	M - To be included in EMP

construction phase

Gaut: 002/13-14/E0153

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

38) Due to the topography of the site, large sections of the study area are visible form the surrounding roads and properties

Mitigation measures to restrict/ prevent the visual impacts of the development will have to be implemented. This will specifically include mitigation measures requested by Rand Aid in the north-western corner of the study area (along the northern boundary).

Table 45: Significance of Issue 38 (Due to the topography of the site, large sections of the study area are visible form the surrounding roads and properties) After Mitigation / Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after		
High ⊕ Medium © Low ■	Already achieved $\sqrt{}$	mitigation		
Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Must be implemented during planning phase, construction and/or operational phase P/C/O	Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP		
Medium 💿	P – Architectural and landscaping guidelines must be supplied in the EMP and the proposed Architectural theme must blend in with the surrounding area.	L - To be included in EMP L - To be included in EMP		
	P – The colour scheme should be taken from the palette of colours in the natural surroundings.			
	P – Existing trees should be retained as far as possible on the site in order to soften the impact of the proposed	L - To be included in EMP		

permanent structures and to bring the scale of the higher structures down to a more human scale. P - Landscaping should be L - To be included in EMP done in concurrence with the building construction in order to create an instant visual enhancement of the development. P - The landscaping of the L - To be included in EMP proposed development should blend in with the natural vegetation of the area. Trees, shrubs and groundcovers that are endemic to the area indigenous and/or should preferably be used landscaping that is in line with the natural vegetation of the area will not only help to reduce the visual impact of the development, but it will also create habitats for fauna and flora species. L - To be included in EMP P - Extend the green buffer area along the northern boundary of the study area towards the north-western corner (along the northern boundary of the site) in order to assist with the "screening-off" of the visual impacts that will be

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

experienced from the Rand Aid

site.

6.1.1.5 Climate

According to information obtained from the Johannesburg weather office, the climate of the study area is typical of the Transvaal Highveld. **Refer to Figures 11 to 14 below for weather information**.

The summer months are warm to hot with afternoon thunderstorms, which can be severe, and sometimes even hail is produced.

The winter days are cool and dry with temperatures dropping considerably during the evenings. The summers are mild to hot and the winters mild. It is a summer rainfall region with a mean annual precipitation of approximately 740mm. The Weinert N value is approximately 2.3, which indicates that chemical decomposition is the predominant form of weathering of rock.

Temperature °C

The maximum of 26.0 °C and minimum of 13.63 °C are experienced in summer. The average winter temperatures ranges between 5.37 °C and 18.32 °C.

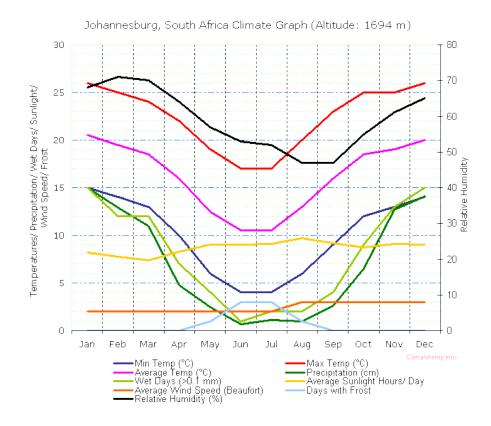


Figure 11: Johannesburg, South Africa Climate Graph

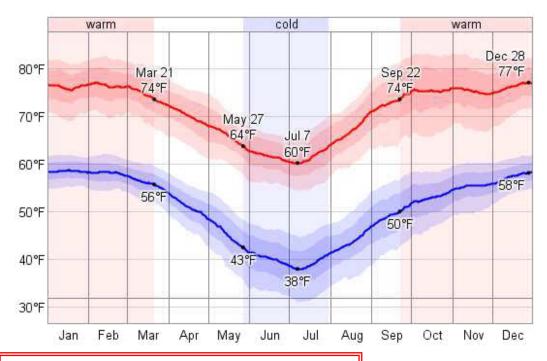


Figure 12: Daily Temperatures for Johannesburg

Rain

The average annual rainfall is 740mm.

Wind

North-westerly winds are the prevailing wind direction during spring and summer and southeastern winds are dominant during the winter months.

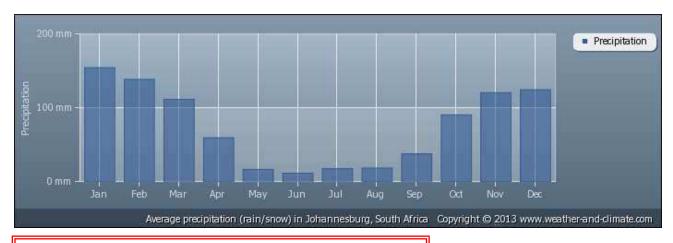


Figure 13: Average precipitation rain in Johannesburg

Figure 14: Wind Direction

6.1.1.5. a Issues & Impacts Identification – Climate

Table 46: Issues and Impacts – Climate

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High • Medium • Low • Positive Impact - Not Necessary To Mitigate ‡
39)	Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes road construction and environmental rehabilitation works extremely difficult in flood line and wetland areas;	_	•
40)	If dry and windy conditions occur during the construction phase, dust pollution could become a problem. In the winter dust will be carried over the areas to the north and northwest of the study area. During spring (especially the windy August) construction dust will be carried across the areas to the south and southeast of the study area. Refer to Figure 14	_	•

6.1.1.5.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

39) Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which make it extremely difficult to build in and to do rehabilitation works of disturbed areas.

These wet conditions often cause delays to building projects and the draining of water away from the construction works (in the case of high water tables) into the water bodies of the adjacent properties, could (if not planned and managed correctly) have an impact on the water quality of these water bodies.

Table 47: Significance of Issue 39 (Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes it extremely difficult to build in and to do rehabilitation works of disturbed areas) After Mitigation/Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ② Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Must be implemented during planning phase, construction and/ or operational phase P/C/O	Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ●	P/C - Where possible, limit construction exercises (especially construction in and around the watercourse areas and areas with perched water conditions) to the dryer periods; P/C - Construction workers and construction vehicles and machinery must stay out of the soggy areas during the wet periods. Barrier tape should be used to demarcate the areas that are drenched with water	L - To be included in EMP L - To be included in EMP

(especially the ecologically sensitive areas and the areas covered with valuable topsoil) and it should only be removed when the appointed	
Environmental Control Officer (ECO)/ site supervisor/ project manager/ main contractor regard the conditions in the	
affected areas as favourable.	

40) If dry and windy conditions occur during the construction phase, dust pollution could become a problem.

The negative impact of dust is generally associated with the construction phase and it is temporary. The impact should however be considered in context with the surrounding area that currently has a distinctive rural character with a combination of residential development, agricultural activities and open space areas provided by agricultural properties. The dust pollution during the construction phase will most probably not be regarded as that unusual.

Sweeping of the construction site, clearing of builders' rubble and debris as well as the regular watering of the construction site (storage areas, roads etc.) must take place at least once a day.

Table 48: Significance of Issue 40 (Dust Pollution) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after		
High ⊕ Medium ⊙ Low ■	Already achieved $\sqrt{}$	mitigation		
	Must be implemented during	Low/ eliminated L / E		
Positive Impact/ Neutral - Not	planning phase, construction	Medium M		
Necessary To Mitigate 🌣	and/ or operational phase	High H		
	P/C/O Not possible to mitigat			
		but not regarded as a fatal		

		flaw NP
High ⊕	P/C - Sweeping of the construction site, clearing of builders' rubble and debris as well as the regular watering of the construction site (storage areas, roads etc.) must take place at least once a day during the dry windy periods.	L - To be included in EMP

6.1.2 THE BIOLOGICAL ENVIRONMENT

Biology is a natural science concerned with the study of life and living organisms, including their structure, function, growth, evolution, distribution, and taxonomy. Modern biology is a vast and eclectic field, composed of many branches and sub-disciplines.

A Flora and Fauna Habitat Survey was conducted by Galago Environmental CC. **Refer to Annexure S.**

The habitat study had the following objectives:

- To assess the current status of the habitat component and current general conservation status of the property;
- To list the perceptible flora of the site and to recommend steps to be taken should endangered, vulnerable or rare species be found;
- To provide lists of mammals, birds, reptiles and amphibians which occur or might occur, and to identify species of conservation importance;
- To highlight potential impacts of the development on the fauna and flora of the proposed site; and
- To provide management recommendations to mitigate negative and enhance positive impacts should the proposed development be approved.

Galago Environmental CC obtained information about the Red Data species that occur in the area from GDARD and the Guidelines issued by GDARD to plant specialists were consulted to ascertain the habitat of the Red Data species concerned.

6.1.2.1 Vegetation

The Study Area

According to the vegetation and fauna specialists the study area is situated with the quarter degree square 2627BB (Roodepoort). Mucina and Rutherford classified this area as Egoli Granite Grassland, with archaean granite and gneiss of the Halfway House Granite Dome at the core of Johannesburg. This grassland type occurs within a strongly seasonal summer rainfall region and very dry winters.

More than two-thirds of this vegetation unit has already undergone transformation, mostly by urbanization.

Vegetation communities

Seven vegetation study units were identified by Galago Environmental CC:

- Mixed Alien and indigenous vegetation
- Disturbed Elionurus Eragrostis grassland
- Elionurus Eragrostis grassland
- Eragrostis Senecio Moist Grassland
- Wetland vegetation
- Pastures
- Hyparrhenia hirta terraced grassland

a. Medicinal plants

Of the 168 plant species recorded on the site, 31 species with medicinal properties were found (i.e. 18%). Their distribution in the various vegetation communities are as follows:

Table 49: Number of medicinal species in the various vegetation communities

VEGETATION COMMUNITY	TOTAL NO OF SPECIES IN VEGETATION COMMUNITY	NO OF MEDICINAL SPECIES IN VEGETATION COMMUNITY
Mixed Alien and indigenous vegetation	58	8
Disturbed Elionurus - Eragrostis grassland	65	17
Elionurus- Eragrostis grassland	81	26
Eragrostis- Senecio Moist Grassland	43	6
Wetland vegetation	26	1
Pastures	5	0
Hyparrhenia hirta terraced grassland	28	7

b. Alien Plants

Alien plants are not listed separately, but are included in the lists as they form part of each particular study. Forty alien plant species, of which three species were Category 1 Declared weeds, eight were Category 2 Declared invaders and two were Category 3 Declared invaders, were recorded on the site. The number of alien species in each vegetation community is reflected in table 49.

Table 50: Number of alien species in each vegetation community

VEGETATION COMMUNITY	NO OF ALIEN SPECIES	CAT 1	CAT 2	CAT 3	NOT DECLARED
Mixed Alien and indigenous vegetation	29	2	5	2	20
Disturbed Elionurus - Eragrostis grassland	13	1	2	0	10
Elionurus- Eragrostis grassland	3	0	1	0	2
Eragrostis- Senecio Moist Grassland	9	0	2	0	7
Wetland vegetation	14	2	5	1	6
Pastures	3	0	0	0	3
Hyparrhenia hirta terraced	4	0	0	0	4

ſ	grassland			
	grassiaria			

The alien plant names printed in **bold** in the plant tables in the Flora Report are those of Category 1 Declared Weeds and the removal of these plants is **compulsory** in terms of the regulations formulated under "The Conservation of Agricultural Resources Act" (Act No. 43 of 1983), as amended. Category 2 Declared invaders may not occur on any land other than the demarcated area and should likewise be removed.

Although the regulations under the above Act require that Category 3 Declared invader plants may not occur on any land or inland water surface other than in a biological control reserve, these provisions shall not apply in respect of Category 3 plants already in existence at the time of the commencement of said regulations. If this is the case, a land user must take all reasonable steps to curtail the spreading of propagating material of Category 3 plants.

c. Orange listed species

Three of the four Orange-listed plant species known to occur in the quarter degree grid squares were found. Two of these species were found.

d. Red listed species

Eleven Red-listed species are known to occur in the quarter degree grid square. Two of these within 5km of the site, but will not be affected during construction or by the proposed development. The habitats on this site were not suitable for these two.

Mixed alien and indigenous vegetation

<u>Red- and Orange-listed Species:</u> The habitat was not suitable for any of the Red-listed or Orange-listed species known to occur in the quarter degree grid square.

<u>Medicinal and alien species:</u> Eight of the 31 medicinal and 29 of the 40 alien species were found on the site in the mixed alien and indigenous vegetation. Two of the alien species were Category 1 Declared weeds, five were Category 2 Declared invaders and two were Category 3 Declared invaders.

<u>Sensitivity:</u> This study area was not considered sensitive from a vegetation point of view.

<u>Disturbed Elionurus – Eragrostis grassland</u>

The Disturbed *Elionurus – Eragrostis* grassland that abuts the N3 highway is connected with the natural grassland along the highway, but the smaller area in the west is enclosed by mixed alien and indigenous vegetation. 65 of the 168 plant species were recorded in Disturbed *Elionurus – Eragrostis* grassland, of the 65, 52 were indigenous vegetation.

<u>Red- and Orange-listed Species:</u> The habitat is not suitable for the Red list species known to occur in the quarter degree square, but a few specimens of the Orange list *Hypoxis* hemerocallidea were found during the study near Modderfontein Road.

<u>Medicinal and alien species:</u> Seventeen of the 31 medicinal species and 13 of the 40 alien species recorded on the site were found. One of the alien species was Category 1 Declared weed and two were Category 2 Declared invaders.

<u>Sensitivity:</u> The vegetation of this study area was not considered sensitive. *Hypoxis* hemerocallidea did not occur in sufficient numbers to make a relocation operation viable.

Elionurus - Eragrostis grassland

<u>Functional aspects:</u> 78 indigenous species were recorded in the *Elionurus – Eragostis* grassland. The natural primary grassland that had been burned before the site visit and most of the grasses had not yet formed inflorescences. This part of the study unit north of the drainage line contained small rocky outcrops and the species diversity was slightly

higher than that of the area south of the drainage line where the vegetation was somewhat trampled by grazing cattle.

Red- and Orange-listed species: The habitat of the Elionurus – Eragostis grassland study unit north of the drainage line was suitable for the red list species Habenaria bicolor but the species only flowers in March, none were able to be observed during the present survey. A few specimens of the Orange list plant species Callilepis leptophylla were found in the study unit but not in such quantities to make a relocation operation viable.

Medicinal and alien species: Twenty-six of the 31 medicinal species recorded on the site were found in this study unit. Furthermore, three of the recorded alien species were Category 2 Declared invaders in the study.

Sensitivity: The vegetation of the Elionurus – Eragostis grassland study unit north of the drainage line is considered sensitive, but because connectivity with natural grassland on neighboring sites did not exist, its continued existence as a healthy vegetation unit is doubtful. The unit south of the drainage line was of low sensitivity.

Eragrostis-Senecio Moist Grassland

Functional aspects: The unit consisted of low-lying natural grassland along the drainage lines. Of the 168 plant species recorded on the site 43 were recorded in the Eragrostis-Senecio Moist Grassland study unit, 34 were indigenous species.

Red- and Orange-listed species: The habitat is not suitable for the Red List species, but suitable for the Orange List Hypoxis hemerocallidea, but none was found.

Medicinal and alien species: Six medicinal species and 9 alien species were recorded in the study. Two of the alien species were Category 2 Declared invaders.

Sensitivity: Due to the close proximity to the drainage line, the vegetation of the study unit was considered sensitive.

Wetland vegetation

<u>Functional aspects and connectivity:</u> The vegetation of the drainage lines that was very disturbed by the presence of alien species such as *Nasturtium officinale*. A small natural wetland had formed as a result of seepage near the upper boundary of the *Elionurus-Eragrostis* grassland.

<u>Red- and Orange-listed species:</u> The habitat of the drainage lines in the study was not suitable for any of the Red list species, but 15 specimens of the Red list species *Trachyandra* erythrorrhiza was found in the small wetland formed as a result of seepage near the upper boundary of the *Elionurus-Eragrostis* grassland.

The habitat is not suitable for Gnaphalium nelsonii.

<u>Medicinal and alien species:</u> Fourteen of the 40 alien species recorded on the site were found in the wetland vegetation. Two were Category 1 Declared weeds, five were Category 2 Declared invaders and 1 was Category 3 Declared invader. Only one medicinal species was found.

<u>Sensitivity:</u> This study was considered sensitive and should be excluded from the development as the wetlands form biological filters and drainage lines form corridors for the movement of species, which include pollinators of plant species. A buffer of 200m should be allowed around the Red List species.

Pastures

<u>Functional aspects and connectivity:</u> This study unit consisted of planted pasture dominated by *Medicago sativa* (lucern). The species diversity of this study unit was very low. Of the 168 plant species recorded on the site 5 were recorded the pasture study unit. Three of these were herbaceous species and two were grasses.

Red- and Orange-listed species: The habitat was not suitable for any Red list or Orange list species known to occur in the quarter degree square.

Medicinal and alien species: No Medicinal species were recorded. Three alien species, none of which were declared invaders, were recorded in the Pasture study unit.

Sensitivity: The vegetation of the study unit was not considered sensitive.

Hyparrhenia hirta terraced grassland

Functional aspects and connectivity: The unit comprised secondary grassland that had in the past been graded terraces. The vegetation unit had been burnt during winter. The species diversity on this study unit was low. Of the 168 plant species recorded on the site 28 were recorded in the Hyparrhenia hirta terraced grassland, 24 of these were indigenous species.

Red- and Orange-listed species: The habitat was not suitable for any Red list or Orange list species known to occur in the quarter degree square.

Medicinal and alien species: Seven medicinal species were recorded in this unit. Four alien species, none of which declared invaders

Sensitivity: The unit was not considered sensitive from a vegetation point of view. However, a heritage specialist should determine the extent of possible grave sites that exist in the Hyparrhenia hirta terraced grassland, according to local law.

Conclusions made by Galago Environmental CC:

The Elionurus - Eragrostis grassland that abuts the N3 highway north of the drainage line was primary grassland and deemed sensitive. The habitat of this grassland was suitable for the orchid Habenaria bicolor that flowers in March. A small natural wetland, formed as a result of seepage, occurred near the northern boundary of the Elionurus - Eragrostis

grassland. A red list species, the *Trachyandra erythrorrhiza* was recorded in this small wetland. Development within the recommended buffer zone might destroy the population of this species.

Implications for Development:

- The dumping of builders' rubble and other waste in the area earmarked for exclusion must be prevented, **through fencing or other management** measures.
- All declared weeds and invaders must be removed from the site.
- All areas designated sensitive in a sensitive mapping exercise should be incorporated into the system.
- Development structure should be clustered as close as possible to existing development.
- The open space system should be managed in accordance with an Ecological Management Plan that complies with the Minimum Requirements for Ecological Management Plans and forms part of the EMP.
- The open space system should be fenced off prior to construction commencing.
- Information boards should be erected within the development to inform residents of the presence of Red/Orange listed species.
- Only plant species indigenous to the natural vegetation of the area, should be used for landscaping in the communal areas.
- To minimize artificially generated surface storm water runoff, the total sealing of paved areas such as parking lots should be avoided.
- It is recommended and motivated that the plant species, *Trachyandra erythrorrhiza*, should be relocated from its current position to the delineated wetland area that will not have any development taking place.

6.1.2.1.a Issues & Impacts Identification – Flora

Table 51: Issues and Impacts – Flora

Issue/ Impact	Positive/	Mitigation Possibilities
	Negative/	High • Medium ©
	Neutral ±	ingii e Medioiii e

			Low Positive Impact - Not Necessary To Mitigate
41)	Loss of natural grassland areas	-	
42)	Loss of medicinal plant species	-	
43)	The eradication of weeds and exotic invaders	+	☼
44)	The dumping of builders' rubble and other waste in the area earmarked for exclusion	-	•
45)	Loss of the red-listed plant species Trachyandra erythrorrhiza	-	•

Comments of the I&AP's

The following two comments below were received from I&AP's.

Table 52: Comments of the I&AP's regarding the flora on site

Issue:	I&AP	Issues Addressed in Report $\sqrt{/X}$
I am strongly objecting to the development of the Linksfield Mixed Use Development Project which is planned at the property between the N3 highway/Club street Extension and Modderfontein Road.	Zelda Onay zeldao@cubicice.com	√ Refer to page 156, Implications of development
I am a resident in the Linksfield area and feel that this development will have a huge negative impact on the infrastructure and traffic for the area. This site was used for the burial of patients and animals who died in the Rietfontein Hospital from smallpox at the turn of the century as well as other highly		

infectious diseases. There is no way of knowing whether pathofens are still viable in the ground. The land also borders the Sizwe Tropical Disease Hospital where there are in-patients who receive treatment for multiple and extensive diseases. A development encroaching on the hospital would seriously compromise the health of these patients. The development will also upset the natural habitat and eco-system of the flora and fauna.		
We confirm that we have received the notification from Bokamoso	Leenta De Villiers <u>leentadevilliers@vodamail.co.za</u>	\checkmark
Environmental Consultants in connection with the proposed development on the farm Rietfontein.		Refer to Issue 41, page 175
We hereby registered as an interested party and want to make sure that we are updated with all future proceedings/notification, letters, meetings, etc.) of the above development.		
We are the retail nursery (Linksfield Nursery CC) on the corner of Linksfield Road and Club Street and occupy this portion of Portion 1 of the farm Rietfontein for the past 33 years. We have build our future around this nursery over the past 33 years. We became a landmark and an asset to the general public and businesses in our surrounding area.		
We are greatly concerned about the graves next to the nursery as well as the exotic grasslands situated on this property.		

6.1.2.1.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

41) The loss of natural grassland areas.

Some disturbed natural grassland areas and natural primary grassland areas will be lost due to the proposed development. However the layout makes provision for the conservation of the natural primary grassland which is regarded as sensitive.

Table 53: Significance of Issue 41 (Loss of natural grassland areas) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium © Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Must be implemented during planning phase, construction and/or operational phase P/C/O	Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal
		flaw NP
Low ©	P/ C / O - Although some disturbed natural grassland and natural primary grassland areas will be lost due to the proposed development the sensitive natural primary grassland will be conserved and will be linked to the larger regional open space system. The Red-Listed plant species will be relocated to a suitable habitat on the site which will be identified by a specialist.	H - To be included in EMP

Result: Although the issue can be mitigated, the significance of the impact should be determined / confirmed and assessed in the Significance Rating Table

42) Loss of medicinal plant species.

Some medicinal plant species will be lost due to the proposed development.

Table 54: Significance of Issue 42 (The loss of medicinal plant species) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ⊙ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Low	P – As much as possible of the medicinal plant species should be removed prior to construction and be transplanted in a suitable area by a vegetation specialist.	H - To be included in EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

44) The dumping of builders' rubble and other waste in the area earmarked for exclusion.

During construction, building rubble and construction materials are stockpiled on the site and should any of these stockpiles be within the sensitive or exclusion areas it will pollute these natural areas and degrade the state of such habitats. Proper management measures will limit any rubble from being stored or dumped in sensitive areas.

Table 55 Significance of Issue 44 (The dumping of builders' rubble and other waste in the area earmarked for exclusion) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊜ Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not	planning phase, construction	Medium M
Necessary To Mitigate ☆	and/ or operational phase	High H

	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ●	P / C – All areas designated sensitive in a sensitive mapping exercise should be incorporated into the system.	M - To be included in EMP
	P / C – The open space system should be managed in accordance with an Ecological Management Plan that complies with the Minimum Requirements for Ecological Management Plans and forms part of the EMP.	M - To be included in EMP
	P/C – The open space system should be fenced off prior to construction commencing.	M - To be included in EMP
	C – Rubble should not be stored in or directly adjacent to any open space areas or areas marked as sensitive.	M - To be included in EMP

Result: Although the issue can be mitigated, the significance of the impact should be determined / confirmed and assessed in the Significance Rating Table

45) Loss of the red-listed plant species Trachyandra erythrorrhiza.

The Red-Listed plant species, *Trachyandra erythrorrhiza*, was found in the *Elionurus* – *Eragrostis* grassland and would be lost should development take place without any mitigation measures. It is therefore our opinion and recommendation that this plant species should be relocated to the wetland area which is earmarked as an open space where no development will take place. This area is also thought to be more suitable for this species as it is marshy soils that hold more water. Apart from the benefit that it will have with this relocation in terms of the bio-physical environment, the species chances of survival on a vacant land with the probability of illegal dumping and informal settlements is low. Relocating this plant species to the delineated wetland (future open space area) will

provide this plant with a secure environment to colonise and form a viable population.

Refer to Figures 5 and 15, Ecological Sensitivity map and Ecological Sensitivity after mitigation.

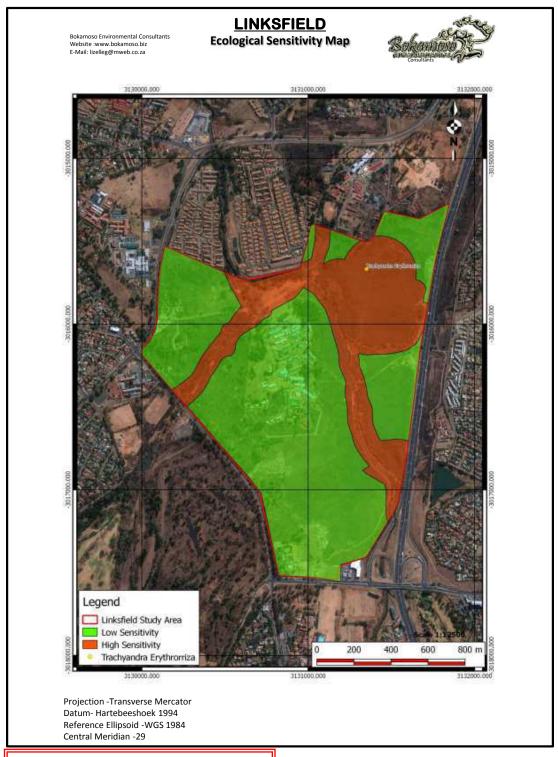


Figure 5 – Ecological Sensitivity Map

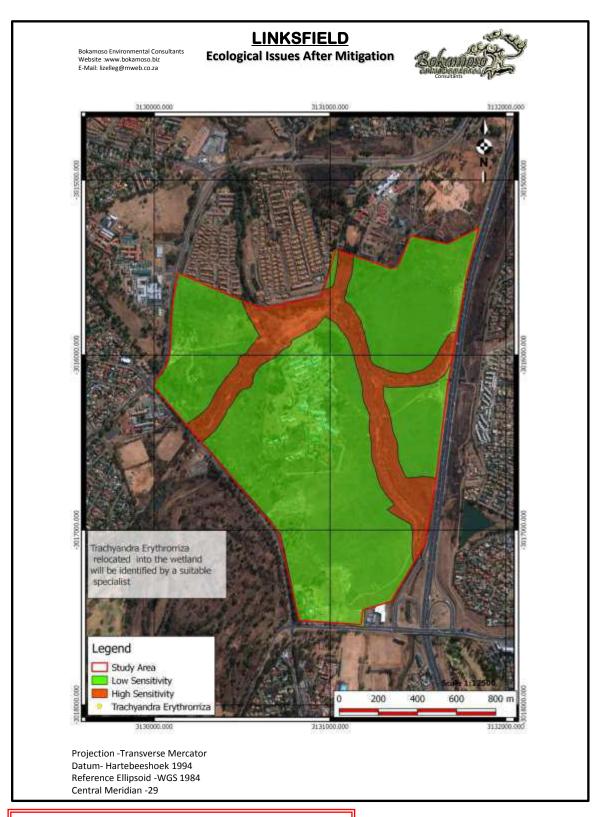


Figure 15 – Ecological Sensitivity After Mitigation

Table 56: Significance of Issue 45 (Loss of the red-listed plant species *Trachyandra* erythrorrhiza) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High Medium Low Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Must be implemented during planning phase, construction and/ or operational phase P/C/O	Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal
High ●	P - It is recommended and motivated that the plant species, Trachyandra erythrorrhiza, should be relocated from its current position to the delineated wetland area that will not have any development taking place.	L / E - To be included in EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table.

6.1.2.2 Vertebrate Faunal Survey (Annexure S)

Mammals

On the 19 October 2013 an eight hour site visit was conducted. During the visit the observed and derived presence of mammals associated with the recognized habitat type of the study, were recorded.

Observed and Expected Species Richness: Due to the presence of three habitat types, especially all forms of aquatic types, the study site should have a fair number of species, but it must be emphasized that the species richness is for the general area and **NOT** for the study area.

<u>Mammal Habitat Assessment</u>: In optimum conditions the possibility exists that the roughhaired golden mole, spotted necked otter, hedgehog and white-tailed mouse may occur on the site study. 16 species of mammals with red data status may occur.

<u>Threatened and Red Listed Mammal Species:</u> Due to the presence of especially rupicolous and wetland-associated vegetation cover the possibility of more Red listed mammal species increases dramatically. The white-tailed mouse is often found in rocky areas with good grass cover. The wetland-associated vegetation cover along the Jukskei River creates an opportunity for species such as the Rough-haired golden mole and the spotted-necked ofter to occur on the study site.

Avifauna (Annexure S)

<u>Avifaunal Habitat Assessment:</u>

Within this vegetation type three major avifauna habitat systems were identified:

- River and Riparian vegetation
- Open grassland
- Disturbed and Transformed areas

Of the 335 avifaunal species recorded for the 2628AA q.d.g.c.(quarter degree grid cell), 149(44%) are likely to occur within the study area and 71 (48%) of these avifaunal species were actually observed within the study area. The river and riparian habitat as well as a buffer zone of 50m from the edge of the river should be regarded as highly sensitive for the half-collared Kingfisher as well as other avifauna that breed, forage and roost along the river system.

The proposed development could increase populations of avifaunal species which are able to adapt to areas changed by man. Development of the grassland areas will however decrease the habitat for grassland avifaunal species within the direct vicinity of the study area and decrease the foraging habitat for avifaunal species that breed and forage along the river and within the river riparian zone.

The Half-collared Kingfisher has been observed along the Jukskei River in the past and is known to occur along this river system according to the SABAP2 data.

Reptiles and Amphibians

Galago Environmental CC compiled a list of species which may occur on this site. According to Galago four of the 44 reptile species which may occur on the study site were confirm during the site visit. And of the possible 14 amphibian species which may occur on the site, two were confirmed on the site.

The striped harlequin snake has been recorded on this quarter degree square, and a few moribund termitaria. A small possibility exists that this cryptic snake may occur on this particular study site.

Conclusions made by Galago Environmental CC:

<u>Mammals:</u> The study found that the Jukskei River and its tributaries with their buffer zones should be considered as ecologically highly sensitive. The possibility exist that 16 species of mammals and a Red Data status may occur within the study site. The possibility may occur that the Golden mole can be found on the development area.

<u>Birds:</u> With exception of the Half-collared Kingfisher the proposed development will not have a negative effect on any of the other Red Data avifaunal species recorded for the 2628AA q.d.g.c. The study areas should be regarded as highly sensitive.

<u>Reptiles and Amphibians:</u> In the herpetofaunal study, it was found that the study site contains a wetland, which is a potential breeding ground for the giant bullfrog. The striped harlequin snake has been recorded on this quarter degree square and a few moribund termitaria.

Recommendations from Galago Environmental CC

- Should hedgehogs be encountered during the development, these should be relocated to natural grassland areas in the vicinity.
- The contractors must ensure that no mammal species are disturbed, trapped, hunted of killed during the construction phase.
- Alien and invasive plants must be removed in a phased manner.
- Measurement must be taken to mitigate erosion that can be caused by the increased runoff and a decreased water quality.
- A monitoring plan should be implemented to confirm the presence of the Half-collared Kingfisher within the surrounding area.
- A 50m buffer zone from the edge of the river should be left undeveloped and undisturbed for Half-collared Kingfisher.
- The work should be restricted to one area at a time.
- No Vehicles should be allowed to move in or across the wet areas or drainage lines and possibly get stuck.
- The contractors must insure that no Fauna is disturbed.
- When there is work done close to the drainage lines, the area should be fenced off during the construction phase.
- During construction the noise must be kept at a minimum to reduce the impact on the development on the Fauna residing in the area.
- Every effort should be made to retain the linear integrity, flow dynamics and water quality for the Jukskei River Stream and its tributaries. The same applies to the wetlands, and all the water bodies associated with riparian vegetation.
- If the Giant Bullfrog or any other herpetological species are encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity.

6.1.2.3 Issues & Impacts Identification

Table 57: Issues and Impacts – Fauna

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High Medium Low Positive Impact Not Necessary To Mitigate
46)	If the entire area to be developed is cleared at once, smaller birds, mammals and reptiles will not be afforded the chance to weather the disturbance in an undisturbed zone close to their natural territories.	_	③
47)	Noise of construction machinery could have a negative impact on the fauna species during the construction phase. During the construction and operational phase (if	-	③
49)	not managed correctly) fauna species could be disturbed, trapped, hunted or killed. Loss of habitat can lead to the decrease of fauna numbers and species.	_	©

Comments and issues from the I & AP's:

The I&AP's have a concern about the wild monkeys and the giant bullfrog that may occur on the site. The interest and effected parties are concerned that the development may have an impact on the fauna in this area. The following two comments below were received from I&AP's.

Table 58: Comments of the I&AP's regarding the fauna on site

Issue:	I&AP	Issues Addressed in Report
I worked with you on a couple of projects over the years and I have had 14 years experience in the Property Development Industry. The Infrastructure in the area is already under stress and would never cope with additional traffic, water, sewerage and electricity demands. Plus the idea of touching anthrax graves is terrifying as Anthrax would still be alive underground.	Candice Shaer candicem@mweb.co.za	√/X √ Refer to page 183, Recommendations from Galago
I also work with a group of people who look after the wildlife living at the Sizwe site and I strongly object to this development that will destroy the home of hundreds of animals and birds.		
There are further serious concerns about the natural habitat and ecosystem of the flora and fauna (wild monkeys live in the area, to mention just one of the endangered animals), and this will be destroyed once the development is underway. It is inconceivable that such destruction should be allowed to go unhindered. Furthermore, the development of this	Naomi Brehm Naomi@evasolutions.co.za	√ Refer to issue 46, page 186
scheme will pose great risks with regard to safety and crime levels, security, infrastructure, environment and sanitation; and will result in unacceptable and increased traffic congestion on the roads leading to the N1, the OR Tambo Airport, Eastgate shopping centres and other development in the area. It will also result in the inevitable reduction of property values in all the surrounding areas, which have		
become suburbs of choice over the years for the multitude of citizens who live and work there. I take the strongest exception to this proposed development and call on		

the developers and the local	
municipality to prevent it from going	
ahead in the interests of the	
thousands of households, men,	
women and children, animals and	
nature, whose lives and futures will	
be at risk should it be given	
permission to continue.	

6.1.2.4 Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

46) If the entire area to be developed is cleared at once, smaller birds, mammals and reptiles will not be afforded the chance to weather the disturbance in an undisturbed zone close to their natural territories.

The site needs to be cleared in small sections to allow for fauna species to disperse to other areas and that they are not trapped within an area and unable to hunt for food.

Table 59: Significance of Issue 46 (If the entire area to be developed is cleared at once, smaller birds, mammals and reptiles will not be afforded the chance to weather the disturbance in an undisturbed zone close to their natural territories) After Mitigation/Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High • Medium • Low • Positive Impact/ Neutral - Not Necessary To Mitigate	Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Medium	P/ C - Where possible, work should be restricted to one area at a time. This will give the smaller birds, mammals and reptiles a chance to weather	L - To be included in EMP

ſ	the	disturbance	in	an
	undist	urbed zone clos	se to	their
	natura	al territories.		

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

47) Noise of construction machinery could have a negative impact on the fauna species during the construction phase

If not managed correctly, noise pollution (i.e. by machinery without noise muffing devices) could have a negative impact on the fauna and birds in the area. This will however only be a short-term impact and it is expected that many of the birds will return to the area during the operational phase.

Table 60: Significance of Issue 47 (Noise of construction machinery could have a negative impact on the fauna species during the construction phase) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium © Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Medium 🔾	P/C – During the construction phase noise should be kept to a minimum to reduce the impact of the development on the fauna residing on the site.	L - To be included in EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

48) During the construction and operational phase (if not managed correctly) fauna species, especially birds, could be disturbed, trapped, hunted or killed.

There is always a risk that construction personnel or new residents of the development may disturb, trap, hunt or kill fauna on the study area. This will have a detrimental impact on the local biodiversity and will decrease fauna numbers. The issue can be mitigated if this issue is included in conservation-orientated clauses that may be built into contracts of construction personnel and residents and if the council prosecutes offenders of these actions.

Caught animals should also be relocated to conservation areas in the vicinity.

Table 61: Significance of Issue 48 (During the construction and operational phase (if not managed correctly) fauna species could be disturbed, trapped, hunted or killed) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ⊙ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Must be implemented during planning phase, construction and/or operational phase P/C/O	Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ●	C/O - The contractor must ensure that no fauna species are disturbed, trapped, hunted or killed during the construction phase. Caught animals should be relocated to the conservation areas in the vicinity. Council shall prosecute offenders.	L - To be included in EMP
	C/O - Should hedgehogs be encountered during the development, these should be relocated to natural grassland areas in the vicinity.	L - To be included in EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

49) Loss of habitat can lead to a decrease of fauna numbers and species

All mitigation measures for impacts on the indigenous flora of the area should be implemented in order to limit habitat loss and maintain and improve available habitat, in order to maintain and possibly increase numbers and species of indigenous fauna.

Table 62: Significance of Issue 49 (Loss of habitat can lead to a decrease of fauna numbers and species) After Mitigation/ Addressing of the Issue

Mitigation Possibilities High • Medium • Low • Positive Impact/ Neutral - Not Necessary To Mitigate	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	Significance of Issue after mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal		
Low ©	P/ C / O – All mitigation measures for impacts on the indigenous flora of the area should be implemented in order to limit habitat loss as far as possible and maintain and improve available habitat, in order to maintain and possibly increase numbers and species of indigenous fauna.	flaw NP H - In terms of local fauna population L - In terms of the global conservation status of fauna		
	P/ C - No vehicles must be allowed to move in or across the wet areas or drainage lines and possibly get stuck. This leaves visible scars and destroys habitat. It is important to conserve areas where there are tall reeds or grass and areas where there are short grass and mud.	L -To be included in EMP		

- With proper cultivation of indigenous specific plant species the bird numbers and species in the area could even increase. Lists of plant species that attract birds to gardens are available. The area must however be kept as natural as possible. - Dumping of builders' rubble and other waste in the areas earmarked for exclusion must be prevented, through fencing other manaaement measures. These areas must be connected to one another and properly managed throughout the lifespan of the project in terms of fire. eradication of exotics etc. to

Result: This issue cannot be mitigated and the significance of the impact should be determined / confirmed and assessed in the Significance Rating Table

ensure continuous biodiversity.

6.2 DESCRIPTION OF THE EXISTING SOCIO-ECONOMIC ENVIRONMENT

General:

According to most of the objections and issues raised by the I&APs related to the socio-economic environment, it became clear that most of the surrounding land-owners and members of the public that are aware of the hospital's history of treating patients with tropical diseases and the graveyards, were extremely concerned about the possibility of disease outbreaks when the soils on the study area are moved/ disturbed by construction activities. Some people also raised concerns regarding the relocation of graves that have high cultural and historical value.

Furthermore there are rumours that some of the livestock that died of anthrax during the anthrax outbreak in 1923 were also buried somewhere on the larger study area, which used to be ± 600 ha in extent. Unfortunately most of the historical records of the hospital

were destroyed by a fire and therefore no/only limited concrete evidence regarding the patients that were treated at the hospital, the patients/people that were buried in the cemeteries and the illnesses of the patients that were treated etc. are available.

This uncertainty regarding the activities that took place on the hospital site and the *status* quo of the study area in terms of possible soil and ground water contamination with diseases (i.e. anthrax spores, small pox etc.) and medical waste sites have already caused preconceived misconceptions for many years and due to the fact that people associated the site with death, diseases, danger, mystery, disease outbreaks etc. the site has been treated as an isolated pocket and a health risk for many years. We got the impression that many of the I&APs want the study area to remain undeveloped and in "quarantine".

As already mentioned in this report, other developers in the past also tried to obtain approvals for certain land-uses on the property, but all the former efforts were unsuccessful.

As EAP responsible for the EIA for the mixed-use development, which is regarded by the Department of Human Settlement as one of their priority projects, we immediately realised that it will be of the utmost importance that our impacts assessment and studies conducted to inform the impact assessment, address all issues (especially the issues which relate to Anthrax, possible disease outbreaks as a result of the disturbance of the soils on the study area and the possible loss of historical graves). Many issues listed by the I&APs refer to possible life-threatening conditions that could be created if the soil layers and the ground water movement are disturbed. In cases where such very serious issues are raised no EAP or government official can afford it to make any uninformed recommendations or decisions. In cases like this one we have to base our recommendations on the scientific facts and professional opinions of the specialists involved. The applicant agreed to appoint the best specialists in their field of expertise to assist with the inputs regarding the graves and diseases.

GDARD also indicated in their approval of the Scoping Report and Plan of Study for the EIA that they regard the preliminary issues raised as serious and they therefore stated that the EIA Report will also be subjected to a peer review by suitably qualified specialists to be

nominated by GDARD. We regard the peer review request of GDARD as responsible, because this means that GDARD will also base the decision to be issued on the inputs and recommendations of independent specialists.

The possible decrease of land value if "low cost" housing is introduced into the area and traffic capacity are the other major socio-economic concerns raised by the I&APs.

All the socio-economic impacts identified are listed and discussed below. The specialist reports that were compiled to address the socio-economic issues that were identified and raised, were also taken into consideration throughout the Impact Assessment process.

During the public meetings and in the follow-up comments supplied by the I&APs it became clear that the potential influx of lower income groups into the area and the impacts on the existing roads and services are the major concerns. People do not trust the developer or government and they are convinced that security problems in the area will only increase and that the area will eventually become a "crime haven" and a slum.

6.2.1 Archaeology/Cultural History

Refer to Annexure Q for Heritage Impact Assessment Report and Also Refer to Annexure Aq for Updated Comments from this specialist

6.2.1.1 Introduction

Leonie Marais-Botes Heritage Practitioner and Association with Dr. A. C. van Vollenhoven of Archaetnos Archaeologist and Heritage Consultants, were appointed by Bokamoso Environmental to conduct a cultural and historical survey for the study area. The aim of the survey was to determine the nature and potential of cultural heritage resources found within the boundaries of the area that is to be impacted by the development.

Cultural heritage resources are broadly defined as all non-physical and physical humanmade occurrences, as well as natural occurrences that are associated with human

activity. These include all sites, structures and artefacts of importance, either individually or in groups, in the history, architecture and archaeology of human (cultural) development.

The scope of work consisted of conducting a Phase 1 archaeological survey of the site in accordance with the requirements of Section 38(3) of the National Heritage Resources Act (Act 25 of 1999).

In order to establish heritage significance the following method was followed:

- Investigation of primary resources (archival information)
- Investigation of secondary resources (Literature, maps and drawings)
- Physical evidence (site investigation)
- Determining Heritage Significance

The objectives were to: Gain an overall understanding of the heritage sensitivities of the area and indicate how may be impacted on through development activities.

6.2.1.2 Short Summary of the History of the Study Area

(Information obtained from the cultural and heritage report and other resources (i.e. newspaper articles, discussions with people, museum archive etc.))

The development history of the Rietfontein Hospital is closely linked to the life and work of Dr. John Max Mehliss (Medical Doctor), who qualified as a doctor in Germany. He returned to South-Africa in approximately 1893 and re-joined his family in the very new mining camp of Johannesburg. It is believed that Dr Mehliss was in private practice on the Witwatersrand for some years.

In 1895, he was put in charge of the smallpox lazaret established by government on the Farm Rietfontein in 1894. He became the full-time medical superintendent in 1896 and he most probably also moved to the official residence (still on the study area today) during that year.

As already mentioned in this report, the Rietfontein Hospital was originally established on its present site because it was a day's march from Johannesburg' and a safe distance for such an infectious disease as smallpox. This made the hospital a convenient facility for the treatment of other unpleasant diseases too.

In the early months of 1898, when leprosy was frequently being diagnosed in rural Blacks recruited for the mines, Dr Mehliss was commissioned to build a leper asylum in the northeastern corner of the study area. This is how the group of institutions known as the "Rietfontein Hospitals" were established.

The main building materials used for the leper asylum were wood and corrugated iron and apparently the buildings were surrounded by a 12-foot iron fence, and patrolled by armed guards. This facility had accommodation for approximately 30 patients.

In August 1900 the first leper hospital was closed and 29 patients were moved to Westfort Hospital in Pretoria. Shortly after their departure approximately 20 000 sheep captured by the British from the Boere were kept for many months in the deserted enclosure.

In 1904 the plague broke out in Johannesburg and more than 1 000 patients were treated at the Sizwe Hospital. Apparently those who died were also buried in a separate plague cemetery in the grounds, in graves demarcated only by numbers.

In 1939 another outbreak of smallpox hit Johannesburg. Patients were dying at the rate of 20-30 a day and according to available information/ articles quick lime was poured into the graves against the disease lingering.

Today only approximately 320 hectares (less than 50%) of the original farm remains and it is completely surrounded by urban development, major roads and infrastructure.

Apparently it is believed that approximately 7 000 victims of smallpox, leprosy, plague and syphilis were buried on the Sizwe Hospital Site and the cemeteries were divided into black, white and Jewish sections. There are also rumours of patients that were buried on the site

in led lined caskets (apparently patients that died of bacterial diseases were either burnt or buried in led lined caskets), hazardous medical waste sites, and the burying of the animals that died of Anthrax on the larger study area.

The cultural and historical specialist could find no evidence of the corrugated iron and wood leper asylum anywhere on the study area and the group of specialists that were appointed to search for graves, could only identify 3 graveyards on the study area. **Refer to Annexures J for historical photographs of the study area, which indicates the graveyards.**

One of the I&APs recently supplied Bokamoso with a plan, which indicates possible positions of other graveyards and hazardous medical waste sites on the study area. **Refer to Annexure F**. This plan was forwarded to the specialist forum appointed to assist with the graveyard and anthrax/ disease issues and the opinions of the relevant specialists are attached hereto as **Annexure G**. None of the specialists agreed with the plan supplied by the I&AP. Apparently the soil and geotechnical conditions on the study area are not favourable for excavations that are deep enough for graves or waste sites.

During one follow-up site visit (after the map with the possible additional graves and waste sites was provided) on a possible grave was identified adjacent to the nursery, which is situated in the south-eastern section of the study area. The geotechnical engineer, cultural and historical specialist and the soil scientist investigated the matter and confirmed that there are no graves present in the area investigated. Refer to Annexure As for the feedback from the specialists after the follow-up investigation.

6.2.1.3 Cultural and Historical Features/ Sites/ Issues Identified by the Cultural and Historical Specialists

• <u>Graves:</u> There are three grave sites on this development area. Originally the cultural and historical specialist only identified two grave sites. The soil scientist however also identified a third grave site adjacent to the river and the 1937 aerial photograph confirms the presence of the three grave yards.

The possibility of graves not visible to the human eye always exists and this should be taken into consideration in the Environmental Management plan. It is important to note that all the graves in the cemeteries are of high significance and are protected by various laws.

- The Hospital premises: At present, in the form of the Sizwe Clinic, the old hospital is still serving the needs of patients associated with HIV and it appears to be functioning in a proper manner.
 - The hospital also has a long and excellent record of dealing with the illnesses of the underprivileged. It was also a place of work of a number of outstanding medical practitioners including Dr Mehliss who managed the establishment for 32 years.
- Areas utilised for farming: Some of the areas appear to have been used for dry-field planting of crops. From a heritage point of view these ought to be clear of any inhibiting issues concerning the proposed development.
- Historic personnel housing: In the north-western corner of the property, there occur a group of buildings that appear to have been the original personnel accommodation, a modern SAPS facility and the original dwelling of Dr Mehliss dating over a hundred years old.

6.2.1.4 Legal requirements

It should be noted that in terms of the South African Resources Act (Act 25 of 1999) Section 35(4) no person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or material.

Also important is that Section 34(1) of this act states that no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit, issued by the relevant provincial heritage resources authority.

6.2.1.5 Feedback from SAHRA

Refer to Annexure Qi

"In terms of the National Heritage Resources Act, no 25 of 1999, heritage resources, including archaeological or paleontological sites over 100 years old, graves older than 60 years, structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority.

This means that prior to development it is incumbent on the developer to ensure that a Heritage Impact Assessment is done. This must include the archaeological component (Phase 1) and any other applicable heritage components. Appropriate (Phase 2) mitigation, which involves recording, sampling and dating sites that are to be destroyed, must be done as required.

The quickest process to follow for the archaeological component is to contract an accredited specialist (see the web site of the Association of Southern African Professional Archaeologists www.asapa.org.za) to provide a Phase 1 Archaeological Impact Assessment Report. This must be done before any large development takes place.

The Phase 1 Impact Assessment Report will identify the archaeological sites and assess their significance. It should also make recommendations (as indicated in section 38) about the process to be followed. For example, there may need to be a mitigation phase (Phase 2) where the specialist will collect or excavate material and date the site. At the end of the process the heritage authority may give permission for destruction of the sites.

Where bedrock is to be affected, or where there are coastal sediments, or marine or river terraces and in potentially fossiliferous superficial deposits, a Paleontological resources – or at least a letter of exemption from a Palaeontologist is needed to indicate that this is unnecessary. If the area is deemed sensitive, a full Phase 1 Paleontological Impact Assessment will be required and if necessary a Phase 2 rescue operation might be necessary.

If the property is very small or disturbed and there is no significant site the heritage specialist may choose to send a letter to the heritage authority to indicate that there is no necessity for any further assessment.

Any other heritage resources that may be impacted such as built structures over 60 years old, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscape or view scapes must also be assessed."

Implications for Development:

- In terms of the National Heritage Resources Act, no 25 of 1999, heritage resources, including archaeological or paleontological sites over 100 years old, graves older than 60 years and structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority;
- A suitably qualified specialist to conduct phase 1 Impact Assessment Report;
- Appropriate (Phase 2) mitigation, which involves recording, sampling and allocating an age to the sites that are to be destroyed, must be done as required;
- The possibility of graves not visible to the human eye always exists and this should be taken into consideration in the Environmental Management plan. It is important to note that all the graves in the cemeteries are of high significance and are protected by various laws;
- The cemetery in the south west corner of the development is a concern as the extent cannot be determined due to the dense vegetation because of the good summer rain;
- The Rietfontein (Sizwe) Hospital site is of historical and to a certain degree of scientific significance;
- The above site is also important to the community because of its work under the underprivileged;
- It is recommended that the historical significance, scientific and community contributions of the Rietfontein (Sizwe) Hospital be commemorated at a central point in the new development, as some of the hospital buildings may need to be demolished and the layout of the hospital site should form part of this display;

reburial nearer to the other graves or conservation in situ.

- It is further recommended that to assist in the site development process the known graves on the south west corner be plotted, a centre be determined and a 50 metre buffer zone be determined. In the drier season the extent should be determined and a decision made regarding the outlaying graves. The options being exhumation and
- It is accepted that new access roads may mean that some of the hospital buildings
 may need to be demolished. The Mehliss residence and first wards are the
 significant layer and should be regarded as important and conservation worthy. As
 soon as the final site development plan is available the structures earmarked for
 demolition are listed and submitted to the Heritage Impact Assessment Committee
 of the Provincial Heritage Authority of Gauteng (PHRAG) for approval;
- Management Plans be written and implemented for all remaining structures older than 60 years as well as grave sites and such management plans must be incorporated as part of the Environmental Management Plan, which will address all environments; and
- The cultural and historical report must be submitted to the Provincial Heritage Resources Authority of Gauteng (PHRAG) for comment. Refer to Annexure Qi for SAHRA comments already received

6.2.1.b Issues & Impacts Identification – Cultural and Historical

Table 63: Issues and Impacts – Cultural and Historical

	Issue/Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High Medium Low Positive Impact - Not Necessary To Mitigate
50)	Structures of cultural and historical significance may be destroyed.	-	•

51)	The cemetery in the south west corner of the	-	9
	development is a concern as the extent cannot be		
	determined due to the dense vegetation because		
	of the good summer rain.		
52)	Loss of job important social services provided by	-	•
	the hospital to the underprivileged.		
53)	Demolishing part of the Hospital Building for the	-	•
	new access roads and to make way for the		
	proposed new development.		
54)	In terms of the National Heritage Resources Act, no	_	•
	25 of 1999, heritage resources, including		
	archaeological or paleontological sites over 100		
	years old, graves older than 60 years and structures		
	older than 60 years are protected. They may not		
	be disturbed without a permit from the relevant		
	heritage resources authority		
55)	The possibility of graves not visible to the human	-	•
	eye always exists and this should be taken into		
	consideration in the Environmental Management		
	plan. It is important to note that all the graves in the		
	cemeteries are of high significance and are		
	protected by various laws		

<u>Heritage</u>

The registered I &AP's feel that the site with the graves has a lot of history and should not be destroyed. They find it offensive that some graves would be desecrated and are concerned about the environment in the area (fauna and flora would be destroyed). Not to mention the graves that will be desecrated should development happen. In the table below are some of the I&AP's comments.

Gaut: 002/13-14/E0153

February 2015

Table 44: Comment of the 18 AP's regarding heritage

Issue:	I&AP	Issues Addressed in Report √/X
I object to the proposed development of the above green lung. In that area there are Jewish graves as well as patients who died of terrible diseases and are laid to rest there. To desecrate these graves is despicable for the profit of some developer. The exhuming of these bodies could also pose a health to the workers and the future house owners who may be gardening or digging on these properties.	Howard Canin thermopressing@mweb.co.za	√ Refer to issue 50, Page 202
I strongly object to the gravesite to be used for low income housing in sandringham, I do not have the petition to sign I hereby write this email on behalf of my mother Mrs D Levy and Myself Mrs MH Chalmers we live in Lyndhurst and definitely do not think this is a good idea.	Michelle Chalmers xgiggles@hotmail.com	√
Thanks for your email. May I ask what the plans are regarding these graves? How many are there and who will be handling them? I am sure you know of all the legislation re. graves and grave sites.	Maryna Steyn Maryna.Steyn@up.ac.za	√ Refer to issue 50 & 51, page 202, 203. Refer to Section 6.2.1.3, Page 195

6.2.1.c Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

50) Structures of cultural and historical significance may be destroyed.

If any archaeological sites or graves are exposed during construction work, it should immediately be reported to a museum, preferably one at which an archaeologist is available, so that an investigation and evaluation of the finds can be made.

Table 65: Significance of Issue 50 (Structures of cultural and historical significance may be destroyed) After Mitigation/ Addressing of the Issue

Additional on Descriptibles	Mitigation	Significance of Issue after				
Mitigation Possibilities	1	mitigation				
High ⊕ Medium ⊙ Low ■	Already achieved $\sqrt{}$	Positive 🌣				
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E Medium M				
Necessary To Mitigate ☼	planning phase, construction					
	and/ or operational phase					
	P/C/O	High H				
		Not possible to mitigate,				
		but not regarded as a fatal				
		flaw NP				
High ●	P/C/O - It should be noted that in terms of the South African Resources Act (Act 25 of 1999) Section 35(4) no person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or material	L - To be included in the EMP				
	P/C/O - Also important is that Section 34(1) of this act states that no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit, issued by the relevant provincial heritage resources authority.	L - To be included in the EMP				
	P/C – If any new evidence of archeological sites or artifacts, paleontological fossils, graves or other heritage resources are found during the planning or construction phases, SAHRA or an archaeologist must be alerted immediately.	L - To be included in the EMP				
	Note: Other suitable mitigation measures to address this problem have already been					

included in issues above

Result: The issue can be mitigated and turned into a positive impact. The significance of this positive impact still needs to be determined/confirmed and assessed in the Significance Rating Table

51) The cemetery in the south west corner of the development is a concern as the extent cannot be determined due to the dense vegetation because of the good summer rain.

The good summer rain caused the grasses and shrubs to grow extensively and cause dense vegetation all around areas that might have potential graves. These areas need to be cleared prior to the commencement of construction in order to identify all grave localities.

Table 66: Significance of Issue 51 (The cemetery in the south west corner of the development is a concern as the extent cannot be determined due to the dense vegetation because of the good summer rain) After Mitigation/ Addressing of the Issue

Mitigation Possibilities High ● Medium ○ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate **The impact is a second of the impact is a	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	Significance of Issue after mitigation Positive Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ⊕	P/C/O - Potential areas of graves should be cleared of dense vegetation prior to construction. Note: Other suitable mitigation measures to address this problem have already been included in issues above	M - To be included in the EMP

Result: The issue can be mitigated and turned into a positive impact. The significance of this positive impact still need to be determined/confirmed and assessed in the Significance Rating Table

52) The above site is also important to the community because of its work under the underprivileged.

The current hospital and associated facilities provides assistance to the underprivileged in the surrounding social environment. The intention is to demolish the existing hospital and to replace the existing community function elsewhere. The proposed demolition of the hospital is only planned as the final phase of the development and viable alternatives for the replacement of the services delivered by the hospital must first be investigated. The preferred alternative as well as the required support (i.e. from the Department of Health) for the alternative must be supplied to the delegated authority prior to commencing with this final phase, which includes the demolition of the hospital and the renovation and conservation of historical structures as identified by the cultural and historical specialists.

Table 67: Significance of Issue 52 (The above site is also important to the community because of its work under the underprivileged.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium © Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	mitigation Positive Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ⊕	P/ C / O - The proposed demolition of the hospital is only planned as the final phase of the development and viable alternatives for the	M - To be included in the EMP

replacement of the services delivered by the hospital must first be investigated. M - To be included in the EMP P/C - The preferred alternative as well as the required support (i.e. from the Department of Health) for the alternative must be supplied to the delegated authority prior to commencing with this final phase, which includes the demolition of the hospital and the renovation and conservation of historical structures as identified by the cultural and historical specialists

Result: The issue can be mitigated and turned into a positive impact. The significance of this positive impact still need to be determined/ confirmed and assessed in the Significance Rating Table

53) As some of the hospital buildings may need to be demolished, the layout of the hospital site should form part of this display.

It is planned to demolish the Sizwe Hospital. Only historical structures as identified by the cultural and historical specialists will remain on the study area as memorials in remembrance of the hospital, the patients that were treated at the hospital and the staff that served the members of the community that were treated there.

Table 68: Significance of Issue 53 (As some of the hospital buildings may need to be demolished the layout of the hospital site should form part of this display.) After Mitigation/Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ○ Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Positive 🌣
Positive Impact/ Neutral - Not	planning phase, construction	Low/ eliminated L / E
Necessary To Mitigate ☆	and/ or operational phase	Medium M
		High H

	P/C/O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ●	P/ C / O - The historical significance, scientific and community contributions of the Rietfontein (Sizwe) Hospital should be commemorated at a central point in the new development Note: Other suitable mitigation measures to address this problem have already been included in issues above	M - To be included in the EMP

Result: The issue can be mitigated and turned into a positive impact. The significance of this positive impact still need to be determined/ confirmed and assessed in the Significance Rating Table

54) In terms of the National Heritage Resources Act, no 25 of 1999, heritage resources, including archaeological or paleontological sites over 100 years old, graves older than 60 years and structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority.

It is important that all legislation and legal requirements with regards to the historical sites and graves are in order prior to the commencement of construction.

Table 69: Significance of Issue 54 (In terms of the National Heritage Resources Act, no 25 of 1999, heritage resources, including archaeological or paleontological sites over 100 years old, graves older than 60 years and structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ② Low ■	Already achieved √	mitigation
	Must be implemented during	Positive 🌣
Positive Impact/ Neutral - Not	planning phase, construction	Low/ eliminated L / E

Necessary To Mitigate 🌣	and/ or operational phase	Medium M
	P/ C / O	High H
		Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ●	P – All permits should be applied for and approved by the relevant authority prior to the commencement of construction.	M - To be included in the EMP
	Note: Other suitable mitigation measures to address this problem have already been included in issues above	

Result: The issue can be mitigated and turned into a positive impact, the significance of this positive impact still need to be determined/confirmed and assessed in the Significance Rating Table

55) The possibility of graves not visible to the human eye always exists and this should be taken into consideration in the Environmental Management plan. It is important to note that all the graves in the cemeteries are of high significance and are protected by various laws.

During construction as well as pre-construction planning, the site should be cleared at the possible grave sites. Should any graves or remains be found a specialist should be contacted for investigation.

Table 70: Significance of Issue 55 (The possibility of graves not visible to the human eye always exists and this should be taken into consideration in the Environmental Management plan. It is important to note that all the graves in the cemeteries are of high significance and are protected by various laws.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance	of	Issue	after
High ⊕ Medium ⊜ Low ■	Already achieved √	mitigation			
	Must be implemented during	Positive 🌣			

Positive Impact/ Neutral - Not	planning phase, construction	Low/ eliminated L / E
Necessary To Mitigate 🌣	and/ or operational phase	Medium M
	P/ C / O	High H
		Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Medium 😏	P/C/O - Should any graves or remains be found during preconstruction or construction, a specialist should be contacted for investigation.	M - To be included in the EMP
	Note: Other suitable mitigation measures to address this problem have already been included in issues above	

Result: The issue can be mitigated and turned into a positive impact, the significance of this positive impact still need to be determined/confirmed and assessed in the Significance Rating Table

6.2.2. The Issues Associated With the Diseases That Were Treated At the Hospital and the Possible Infected Graves and Waste Sites on the Study Area

6.2.2.1 General:

One of the key issues identified by both the project team and the Interested and Affected Parties is the existence of graves and the potential risk posed by exposure to exhumation of those graves. The various cemeteries/ graves are associated with the Sizwe Hospital, which was established to treat infectious/ tropical diseases.

Those who succumbed to these infections were apparently buried on this site and it is believed that some of the patients that died from bacterial diseases were buried in lead lined caskets. There are also unverified reports of the buying of animal carcasses infected by anthrax on the site. Some of the I&APs also mentioned that there are hazardous medical waste sites on the study area. One I&AP even supplied the project team with a

map, which indicates potential graves and medical waste sites on the study area. **Refer to Annexure F for Plan supplied by one of the I&APs**

In most cases, especially in the urban context, it is possible to mitigate ecological, services and other non-life threatening social impacts, but in this specific case we regarded it as crucial to obtain the opinions of suitably qualified specialists (many that were used are known as the best in their fields of expertise) for the purpose of assessing the potential impacts associated with anthrax, tropical diseases, the graveyards and waste sites in a responsible, holistic and integrated way. For this purpose, we regarded it as prudent to establish a specialist working group consisting of the following list of specialists:

- A pathologist Dr. E.D. Fourie M.B.Ch.B (UP), M Med Pathology (UP), MBL (UNISA) and member of: The South-African Medical Association; Infectious Diseases Society of South-Africa; Gauteng Conservancy and Stewardship Association; Archaeological Society, Transvaal; Paleontological Society, Pretoria (formerly a partner at Du Buisson and Partners Pathologists now retired);
- A soil scientist and wetland specialist for the identification of graveyards and forensic soil investigations into potential pathological risks associated with the development of the Linksfield site- Dr. Johan van der Waals, Senior lecturer at the University of Pretoria and owner of Terrasoil;
- A geotechnical Engineer J Louis van Rooy (Engineering Geologist PhD (Pret)-assistance with the identification of graveyards, landfill/waste sites and any other form of disturbance underneath the ground surface;
- **A geo-Hydrologist Dr. Mannie Levin** Pr Sci Nat PhD (Geohydrology) Senior geohydrologist at Aurecon Engineering);
- Dr. Henriette van Heerden (BSc Biological with Chemistry, Microbiology and Biochemistry, Bsc Hons Microbiology, MSc Microbiology, PhD Plant Pathology (UP) Senior Lecturer at the University of Pretoria, Department Tropical Diseases and Anthrax Specialist (currently the best in this field in in South-Africa, since retirement of Dr. De Vos (also member of this team);
- **Dr. Valerius De Vos** A qualified veterinarian with a BSc (Honours) Degree in wildlife management. **Awarded honorary Professorship at the Department of Tropical**

Diseases, University of Pretoria (1992-2007), more specifically also an anthrax specialist;

- Cultural and Historical Specialists - Leonie Marais-Botes (BA (Cultural History and Archaeology) (UP), BA (Hons) Cultural History (UP), Post Grad Dip Museology (UP), Cert Conservation of Traditional Buildings (Univ of Canberra)Post Grad Dip: Heritage (Wits) in association with Dr. A.C. van Vollenhoven (BA, BA (Hons), DTO, NDM, MA (Archaeology) [UP], MA (Culture History) [US], DPhil (Archaeology) [UP], Man Dip [TUT], DPhil (History)[US], L Akad [SA] – Identification of graveyards, cultural and historical features and historical buildings of significance

We provided the challenges of the site to all the specialists in the above listed team and we requested that each specialist investigate the risks associated with the construction and operational phases of the proposed development for the study area. Two formal workshops were arranged during which the specialists discussed and tested their findings with the other members of the team. The minutes of the two workshops are attached as **Annexure D**.

During the workshops we explained that we (as EAPs) can only recommend that the project can go ahead (from a social point of view) if we are convinced that there are no serious health risks associated with the construction and operational phases of the proposed development. We indicated that we require the integrated inputs of all the specialists (the best in their fields) and that the specialist must immediately inform us if they regard the proposed project as a risk and if they are of the opinion that the project should not receive the go-ahead. Red flags raised by any of the above-mentioned specialists would have meant that there were possible "fatal flaws" from a health risk point of view and if this was the case, we would have recommended that the delegated authority issue a negative decision/ we would have advised that the applicant cease with the application process.

6.2.2.2. Summary of Inputs Supplied By Specialists:

Dr. E.D. Fourie (Pathologist):

"The proposed development on the Linksfield site encompasses the, Rietfontein Infectious Diseases Hospital and the cemeteries associated with it, as well as open land where burial pits for animals that had died of anthrax may be located.

In the pre-antibiotic era, bacterial diseases like bubonic plague, scarlet fever, diphtheria, whooping cough, typhoid fever and mycobacterial infections were often deadly. Because they are contagious, patients were isolated in fever hospitals, like the Rietfontein Infectious Diseases Hospital. Viral diseases like smallpox and various haemorrhagic fevers were also isolated.

Reasonably, the bodies of the deceased would have been repatriated, by their families, to their places of residence in sealed caskets. Some bodies, of local residents and indigent persons, would probably have been buried close by in the three demarcated cemeteries on the Linksfield development site. Of the human diseases, only smallpox viruses pose a risk of long-term survival.

I recommend that all cemeteries remain undisturbed in perpetuity, and be secured with a covering layer after full archaeological documentation.

During the meetings of experts, the soil chemistry, geology and mole interaction were discussed in the context of anthrax pits and unidentified graves. The acid pH of the soil precludes long term bone preservation and their associated bacteria. The shallow soil profile, above the bedrock, precludes deep burials, making them prone to mole disturbance.

No pits or graves could be identified outside the demarcated cemeteries. No trace of anthrax bacteria or anthrax DNA could be identified. The effluent of the Rietfontein Infectious Diseases Hospital yielded tuberculosis DNA. The sewage drainage plume of the hospital must be fully sanitised before redevelopment commences.

Anthrax last caused an epidemic under bovines in 1925. The anecdotal reference to burial pits is probably related to that incident. The possibility remains that some of these bacteria could have survived. The whole area had been examined by the experts for possible

ground disturbance. Because no signs were found on exposed surfaces, it is reasonable to postulate that the pit(s), if any, were on the adjacent, already developed, properties. In spite of the negative finding, graves or animal burial pits may be concealed under rubble or ground fill. Therefore, I recommend that a knowledgeable, archeologically trained investigator be in attendance where and whenever new ground is broken, to observe if the soil has previously been disturbed, and if any animal remains are exposed. In the unlikely event that this should happen, all activity must stop. Bacteriological and DNA specimens must be taken and analysed for anthrax. If positive, the site must be disinfected with acetic acid or paraformaldehyde under expert supervision. Exposed workers can be protected prophylactically with ciprofloxacin, until a definite finding is available.

To cause disease anthrax must first penetrate the body's integument. Skin scratches, intestinal ulceration or inhalation into the alveolar air sacks of the lungs are the usual entry routes. In the case of exposed contaminated burial sites vegetative bacteria would have transformed into a stripped down dormant form, the so called "anthrax spore". The outermost layer of the spores consists of napped glycoproteins that form a scaffold like exosporium in which the spores are held together. This arrangement restricts airborne dispersal but facilitates ingestion by grazing animals. The pathogenicity of anthrax is caused by liberated toxins after the bacteria had gained access to the body, germinated and transformed to the vegetative state. The incubation period varies from one to ten days, depending on the infective dose and virulence of the organism. Inhaled anthrax is the most lethal form of the disease. Anthrax is used in biological warfare. However, to "weaponise" the bacteria the must be very finely dispersed on a mineral salt to be able to enter the lung alveoli. Scaffold mounted bacteria particles are too large to be inhaled into the alveoli.

In the event of anthrax bacilli being liberated at Linksfield, dispersal in an infective dose to the lungs is very unlikely. Workers breaking new ground can be protected by wearing respirators equipped with filters, as additional protection. A pushcart mounted ground penetrating radar can identify disturbed soil, alerting machine operators to be extra careful. The grave identification project can be a good subject for a master's thesis. The

involvement of a university will add gravitas to the seriousness with which the developers wish to ensure safety.

If care is diligently applied, I am of the opinion that the Linksfield site can be developed without danger to the construction crew or to residents of the development."

• Dr. Johan van der Waals and Dr. Henriette van Heerden

Refer to Annexure Ab For Baseline Forensic Soil Investigation into Potential Pathological Risks Associated With Development of the Linksfield Site.

"The Linksfield site was assessed regarding grave site distribution, pathogen presence in soils and selected chemical parameters of the soils.

The distribution of the graves was established through the interpretation of historical aerial photographs and satellite images. These were found to be concentrated in three distinct areas. The two sites located along Club Road are associated with the Rietfontein Hospital. The site located on the banks of the Jukskei River appears to pre-date the hospitals main burial activities. No sites could be identified that gave the impression of haphazard burying or animal carcass burying.

During the literature survey regarding persistence of pathogens in soil all the pathogens, except for anthrax, were ruled out as risks due to poor or non-survival for prolonged periods in soil. The emphasis on anthrax was due to the reported persistence of the pathogen in soils with neutral to alkaline pH as well as elevated Ca levels and the anecdotal evidence that indicted the burial of animal carcasses of animals that died due to an anthrax outbreak. These indications informed the approach followed during the analysis phase of the investigation.

None of the human diseases identified during the literature survey could be identified in the soils. This includes anthrax. The only human pathogen in the same genus as anthrax (Bacillus cereus) was cultured from the soils along the Club Road graveyard soils. The pathogenicity of this organism is limited to two kinds of foodborne infections, an emetic

(vomiting) intoxication due to the ingestion of a toxin (cereulide) pre-formed in the food and a diarrhoeal infection due to the ingestion of bacterial cells/spores which produce enterotoxins in the small intestine (Arnesen et al., 2008).

Bacillus cereus is ubiquitous and its spores will not be eliminated from food materials by heat treatment, apart from canning. Spores are present in almost all categories of foods before storage, generally in numbers too low to cause foodborne poisoning (Opinion of the Scientific Panel on Biological Hazards, 2005). It therefore poses a negligible risk.

The chemical analysis data of the soils was inconclusive regarding differences between control plots outside the graveyards and the graveyard soils. This was especially so for pH, calcium (Ca) and magnesium (Mg) levels. Potassium and phosphorus levels showed a significant difference between the two soil sample zones with higher levels in the graveyard soils. From the data it therefore appears that only K and P levels were influenced by the presence of the graveyard. The reason for these increased values falls outside of the scope of this study.

The absolute values of the pH and Ca levels indicate that none of the soils can be considered conducive for the survival of anthrax, rather, the levels are low enough to confidently indicate a very low risk of anthrax survival. However, as there is a potential risk that localised infected remains may still be encountered during earthwork activity, workers will have to be given a standard operating procedure upon uncovering graves. Workers will have to be properly informed about the disease and the risks and they will have to adhere to a "biosecurity" protocol that has to be set up with linked safety measures. Workers and general public will have to be informed of anthrax and the symptoms. If grave sites are uncovered the bones / grave site must be covered with soil, excavation must be stopped and experts must be called in to identify the origin of the bones. Samples should be taken to confirm the absence/presence of Bacillus anthracis. Should any sample be positive for anthrax all workers will have to receive medical care and a treatment protocol using penicillin or a cephalosporin (for penicillin susceptible individuals)."

Input Supplied by Dr. Henriette van Heerden as part of the Specialist Forum:

Refer to Annexure E

"Background information of Anthrax

Anthrax is a zoonotic bacterial infectious disease caused by the spore forming bacterium,

Bacillus anthracis. Primarily it is a disease of domestic and wild animals and can be

transmitted to humans but on very rare occasions since humans are resistant towards

anthrax.

Infection of the pathogen can occur through the entry of spores into the host through

insect bites or abrasions (cutaneous) or consumption of contaminated animal products or

vegetation (gastrointestinal) or the inhalation of the spores (pulmonary).

Bacillus anthracis is able to form spores that are highly resistant to harsh conditions like

chemical disinfection, heat, cold etc. and has the ability to survive in the soil for a long

period. The spores are present in abundance in soil at sites where infected animals had

died or been buried.

The reason that anthrax could pose a risk is because it is a soil-borne bacterium that can

remain in the soil for extended periods. All though anthrax affects humans on rare

occasions, the negative connectivity linked to anthrax is based on its use as a biological

weapon.

Use of B. anthracis as a biological weapon usually requires the manipulation of the

bacteria making it resistant against penicillin antibiotic which is usually used to treat this

disease very effectively in humans and animals. The recombinant (manipulated) bacteria is

mixed with magnesium sulphate powder that allows easy inhalation by humans that could

results in death if not treated with appropriated antibiotics.

In the natural environment B. anthracis occurs in the soil, with endemic B. anthracis

occurring in elevated calcium and neutral to alkaline soils and infection through inhalation

requires large numbers of spores or continuous exposure over an extended period.

Risk of anthrax spores present at Linksfield area.

None to low. Low in the event of exposing burial sites where animals died of anthrax (no

animal grave sites were identified on the study area).

The public tend to panic or get emotional, due to lack of information, whenever anthrax is

mentioned as its most highly publicised use has been as a biological weapon. With the

Linksfield development the only risk that anthrax will pose is at a burial site where the

animals died of anthrax.

Facts that were considered with this assessment include:

i. Records of burial of animals that died of anthrax

We could find no records at the hospital, Adler Museum, NICD etc. that might have records

about animals that died of anthrax and that were buried at the site.

ii. Disturbance in soil where animals were buried in large graves

No burial sites could be identified with aerial photographs and no soil disturbance was

observed by the soil specialist that also indicated that the soil structure does not lend itself

to burial of animals deeper than 1.0-1.5 m.

Another possibility is that animal carcasses that died of anthrax were burned, as it has been

an acceptable practise, which would have destroyed the anthrax spores.

iii. Likelihood of humans contracting anthrax from anthrax spores at Linksfield site

As the low pH of the soils in the Linksfield area does not support survival of anthrax in soil,

anthrax most likely only occurs at burial sites where animals or humans that died of anthrax

were buried.

Bacillus anthracis only poses a low risk in burial sites where anthrax related carcasses were buried. Workers will be trained to identify burial sites and a specific operating procedure will be followed which will involve the identification of anthrax at a burial site.

In the event that anthrax is identified various options can be considered like; no further development at that specific site or alternatively decontamination of that site. In the event that anthrax is identified at the site, it should be kept in mind that the most lethal form of anthrax infection is through inhalation of spores, but a lethal dose of anthrax will consist of 10 000 spores. Since it is implausible for *B. anthracis* to survive in the non-ideal soil conditions it would require exposure over an extended period for anthrax to become a risk.

The most likely form of anthrax infection is cutaneously and humans are fairly resistant towards cutaneous infections. In the improbable event that such an incident could occur; cutaneous lesions can be very effectively treated with antibiotics where abraded skin is exposed to anthrax infected cutaneous lesions can be very effectively treated with antibiotics where abraded skin is exposed to anthrax infected soil.

CONCLUSION: There is no record of anthrax related carcasses being buried at the site; no burial sites could be identified with aerial photographs. In the event of anthrax, anthrax can only be a risk when a human is exposed to spores over a long period which will not be possible during this development or exposure to large amount of spores which has been indicated to be a very unlike

Input Supplied by Dr. Johan van der Waals as part of the Specialist Forum: Refer to Annexure E

"The only pathogen that could survive in soils for extended periods was found (from literature and experience) to be anthrax (*Bacillus anthracis*). None of the organism could be isolated or identified in the soil samples. The chemical characteristics of the soil on the site indicated that the organism could not survive in the soils outside of a host as the soils were acidic (as opposed to alkaline that favours the organism's persistence). The only

human pathogen that was identified was (Bacillus cereus) that is ubiquitous in the environment and poses a negligible and manageable risk to human health.

Dedicated gravesites for humans were found on the site but no indications of large scale animal burial sites were found. No potential hosts in terms of the presence of animal bones could therefore be identified.

Provided that adequate and standard measures are implemented for the handling of exposed animal remains during development no risk is foreseen regarding the development of the site. In fact, the current status quo with uncontrolled dumping, squatting and human movement across the site poses a larger risk than development as none of the current activities are structured or controlled.

With the development of the site activities can be structured and any risk mitigated adequately.

I therefore support the development of the site in a controlled and structured manner."

Input supplied by Dr. Mannie Levin – Geo-Hydrologist:

Aurecon was appointed to perform a geohydrological investigation at the proposed Linksfield Mixed Use Development Site, located on Portion 137 and the Remainder of Portion 1 of the farm Rietfontein 61-IR, Johannesburg.

The objective of the geohydrological investigation is to evaluate the potential anthrax pollution impact that the historical cemeteries and the Sizwe Hospital could have on the groundwater resources on the site. The investigations consisted of the following:

- 1. Desk study & Site Visit
- 2. Hydrocensus
- 3. Aquifer Classification
- 4. Report on the findings

Based on the existing data and newly acquired data, the following can be concluded:

- The groundwater potential in the study area is classed as low to moderate;
- During the geotechnical survey no perched groundwater was recorded in the test pits;
- During the hydrocensus it was found that there are no groundwater users in the selected study area;
- Only one borehole not in use was recorded at the hospital;
- No groundwater level could be recorded in the study area as the water at the borehole was artesian confirming the flow pattern of groundwater down to the river level;
- The chemical results showed that the surface water sampled in the Jukskei River and perennial drainage in the east is not suitable for drinking as result of ammonia levels above Class II;
- Surface water sampled in the western perennial drainage fall in Class I drinking water standard and is suitable for drinking;
- All samples showed no measurable trace metals (including led);
- The pathogen samples showed no Anthracis which correspond to the soil sample analyses;
- Clostridium was recorded in surface water sampled outside and in the eastern part
 of the site which indicate that the source could be outside the development area;
- The Mycobacterium results showed only genus other than Tuberculosis which confirm no pollution from the grave sites as it is also present outside the site area'
- The aquifer is classed as a minor aquifer that requires medium level protection against pollution;
- It is concluded that the preliminary results of the geohydrological investigation confirmed the soil pollution studies that no anthracis or tuberculosis pollution is still present on the site.

Input supplied by J Louis van Rooy – Geotechnical Engineer Refer to Annexure E and Y

The aims of the geotechnical investigation were to:

 Determine the geology and the relevant mechanical properties of the soil and rock horizons present on the site.

- Zone the site according to the NHBRC site classes.
- Comment on the excavation characteristics and possible uses of the materials underlying the site.
- Comment on possible shallow groundwater or seepage.

The results from the trail pits, soil profiles and soil laboratory tests indicate the following expected geotechnical constraints for this site are:

- Collapsible soil,
- Seasonal shallow groundwater; perched groundwater and surface seepage near the floodplain,
- Moderate erodability of surficial soils, and
- Localised difficulty of excavation to 1.5 m depth.

Based on the findings and conclusions no specific constraint is of such negative impact as to render this site unsuitable for development from a geotechnical perspective.

Input supplied by Dr. Valerius De Vos:

Refer to Annexure E

No concrete evidence could be found that anthrax occurred on Portion 1 of Rietfontein 61-IR (above mentioned site). Word of mouth and earlier land-use practices provide circumstantial evidence that both livestock and human cases of anthrax occurred and fatalities were buried there. Though old burial registers had been lost.

Assuming the above mentioned facts, preliminary recommendations are made for future development in the area. The present situation outside the Sizwe Hospital complex is unsafe with the uninhibited entrance of people. Erosion can cause possible exposure of contaminated material. Decontamination of the area is impossible.

The safest option is to adopt the *containment principle* to develop the area in such a way that what is down below the surface, stays below. The Linksfield Mixed Development Project meets this objective, though certain mitigation measures should be followed:

- Isolate or contain the area in such a manner that there can be no harm caused. Surface development should be used. Relatively shallow or floating reinforced concrete foundations should be used preferably. Trenches, foundations and basements deeper than one meter, could increase the possibility of unearthing burial ground with further implications. The rest of the area should be managed in a way to prevent erosion, e.g. tarmac or brick roads, areas & grass lawn coverage on the rest of the premises;
- At this stage it is not imperative to do a comprehensive microbiological survey for anthrax. It would be futile to do such a survey without knowing the locality of anthrax burial places. The area is too big. At great cost it would take hundreds/thousands of samples to locate anthrax spores. Even a limited survey to the building area only will take a vast amount of tests. Future action will not be affected by positive or negative results. A positive test will only prove what is suspected. A negative result still will not prove that anthrax is absent. Even cm³ cannot be covered;
- Where anthrax burial sites are identified, or bone fragments discovered,
 microbiological testing for Bacillus anthracis should be performed;
- Where tests prove to be positive for anthrax, the site should be decontaminated.
 (Drench it with 5% formaldehyde solution.);
- When doing excavations, make use of protective clothing, anti-dust masks & protective eye wear. A TLB with a closed cabin, filled with dust and chemical filters, will be the best option;
- Water in a mist spray should be used to curb the dust problem continuously;
- Identify all burial sites and demarcate, isolate and avoid these;
- Workers should be aware and have knowledge of the early symptoms of anthrax.
 The latter is easily treated by antibiotics.

Conclusions:

The laissez faire land use option for this site is unsafe in respect of anthrax, as well as other infectious diseases. (Status quo). It is concluded that the safest option is to adopt the containment/isolation principle.

Surface development should be done as far as possible. The Linksfield Mixed Development meets with this objective but with the proper mitigation measures put in place during construction.

Input supplied by Leonie Marais-Botes and Dr. A van Vollenhoven

"The proposed Linksfield Mixed-Use Development aims at creating an integrated living environment and distinct urban character defined by a mixed use approach to land use and building typology. The concept seeks to achieve high quality urban environment providing spaces to live, work and play. The approach is in line with the urban densification strategy and will provide a mixed-use node connecting with other polycentric nodes within the city.

The site earmarked for development comprise of 158 hectares of prime estate surrounded by Sandringham, Glenhazel, Sunningdale, Lyndhurst, Corlett Gardens, Rembrandt Park, Edenvale Ext 1, Marais Steyn Park, Dowerglen, Senderwood and the golfing ground, Huddle Park. Approximately 15 hectares of the site is occupied by the Sizwe Hospital. The N3 Highway and the main arterial connector routes around the development create an edge condition that defines the boundaries of the proposed Linksfield Mixed-Use Development.

The following heritage resources are situated on the above site:

- 3 cemeteries
- 3 graves within the boundaries of the Sizwe/Rietfontein hospital
- Structures older than 60 years

The boundaries of the 3 cemeteries are well defined (soil studies)

Structures older than 60 years can be divided in 4 layers

- Circa 1895-1910 (structures associated with Mehliss period)
- Circa late 1920's early 1930's (hospital structures and staff housing)
- Circa 1940's Department of Public Works structures opposite Sandringham SAPS
- Modern

Conclusion:

- The Rietfontein (Sizwe) Hospital site is of historical and to a certain degree of scientific significance.
- The above site is also important to the community because of its work under the underprivileged."

6.2.2.3 Results of Specialist Investigations and Inputs

All the specialists confirmed, in writing (and by signing/ certifying their inputs) that there are **no/limited** health risks associated with the construction and operational phases of the proposed project. In fact, Dr. De Vos, Dr. van Heerden and Dr. Johan van der Waals agreed that the long term health risks (if any) will be reduced if the site is covered with concrete. **Refer to Annexure E for inputs received from above listed specialist team**

No sign of anthrax spores or any other diseases were found in any of the soil or water tests that were conducted by the specialists. The results of the studies are set out in the various specialist reports attached hereto as Annexures Z and Ab.

The geo-hydrologist also tested the water for signs of lead (these tests were done to determine whether there are any lead lined caskets in the graveyards or on the study area), but the test results for lead were also negative.

The information supplied by the specialist forum and Dr. Basson and other experts during separate discussion meetings/ interviews however brought the following facts to our attention:

- According to Dr. Wouter Basson no humans died of anthrax in South-Africa. There
 are no records of any reported cases. There are however records of such cases in
 Zimbabwe;
- Apparently human bones are not carriers of anthrax spores;
- According to Dr. Basson corpses that were infected with bacterial diseases were always burnt. The Government would not have buried a person that died of a bacterial disease;
- According to Dr. Basson the anthrax outbreak affected all the farms on the
 Johannesburg area and animals infected with anthrax were most probably buried/
 burnt on all the surrounding farms. He regards the risks of getting infected with
 anthrax on the study area no higher than on any of the surrounding developed/
 undeveloped properties;
- The specialist forum could not find any signs of graves of animals that died of anthrax on the study area. According to the Dr. De Vos (Veterinary and anthrax specialist), Dr. Henten (Veterinary and anthrax specialist) and Dr. Basson (anthrax specialist), the carcasses of animals that died of anthrax would have been burnt and the remains would have been buried in a mass grave;
- Apparently anthrax and small pox are the only diseases of concern. The facts
 regarding anthrax are already set out above. According to Dr. Henriette van
 Heerden (anthrax and tropical disease expert) the small pox virus cannot live longer
 than 8 years and therefore small pox is not regarded as a potential threat;
- Apparently high acidity soils cover the study area and anthrax spores cannot survive in acidic conditions;
- The geotechnical engineer indicated that the excavatability of the site is very difficult and that it would have been almost impossible in the late 1800s and early 1900s to dig deep graves on the site, which is mainly covered with shallow soils with scattered rocks. Both the geotechnical engineer and the soil scientist agreed that there are only three major graveyards on the study area and they recommended that the graveyards be conserved and excluded from the development. The

- cultural and historical specialist also attended these discussions and she also agreed with their findings;
- Acidic soils will also speed-up the decomposing process of carcasses and corpses.
 According to the specialists the chances of finding any bones in the acidic soils are low.

6.2.2.4 Implications for Development:

Dr. E.D. Fourie (Pathologist):

- It is recommend that all cemeteries remain undisturbed in perpetuity, and be secured with a covering layer after full archaeological documentation;
- During the meetings of experts, the soil chemistry, geology and mole interaction
 were discussed in the context of anthrax pits and unidentified graves. The acid pH of
 the soil precludes long term bone preservation and their associated bacteria. The
 shallow soil profile, above the bedrock, precludes deep burials, making them prone
 to mole disturbance;
- No pits or graves could be identified outside the demarcated cemeteries. No trace
 of anthrax bacteria or anthrax DNA could be identified;
- The effluent of the Rietfontein Infectious Diseases Hospital yielded tuberculosis DNA.
 The sewage drainage plume of the hospital must be fully sanitized before redevelopment commences;
- Anthrax last caused an epidemic under bovines in 1925. The anecdotal reference to burial pits is probably related to that incident. The possibility remains that some of these bacteria could have survived. The whole area had been examined by the experts for possible ground disturbance. Because no signs were found on exposed surfaces, it is reasonable to postulate that the pit(s), if any, were on the adjacent, already developed, properties;
- In spite of the negative finding, graves or animal burial pits may be concealed under rubble or ground fill. Therefore, I recommend that a knowledgeable, archeologically trained investigator be in attendance where and whenever new ground is broken, to observe if the soil has previously been disturbed, and if any animal remains are

- exposed. In the unlikely event that this should happen, all activity must stop. Bacteriological and DNA specimens must be taken and analysed for anthrax.
- If positive, the site must be disinfected with acetic acid or paraformaldehyde under Exposed workers can be protected prophylactically with expert supervision. ciprofloxacin, until a definite finding is available.
- To cause disease anthrax must first penetrate the body's integument. Skin scratches, intestinal ulceration or inhalation into the alveolar air sacks of the lungs are the usual entry routes. In the case of exposed contaminated burial sites vegetative bacteria would have transformed into a stripped down dormant form, the so called "anthrax spore". The outermost layer of the spores consists of napped alycoproteins that form a scaffold like exosporium in which the spores are held together. This arrangement restricts airborne dispersal but facilitates ingestion by grazing animals;
- Anthrax is used in biological warfare. However, to "weaponise" the bacteria the spores must be very finely dispersed in mineral salt to be able to enter the lung alveoli;
- Scaffold mounted bacteria particles (the bacteria particles referred to in this study) are too large to be inhaled into the alveoli;
- In the event of anthrax bacilli being liberated at Linksfield, dispersal in an infective dose to the lungs is very unlikely. Apparently a human must be exposed to at least 1 300 anthrax spores per day;
- Workers breaking new ground can be protected by wearing respirators equipped with filters, as additional protection;
- If care is diligently applied, I am of the opinion that the Linksfield site can be developed without danger to the construction crew or to residents of the development."

Dr. van der Waals and Dr. Van Heerden:

The distribution of the graves was established through the interpretation of historical aerial photographs and satellite images. These were found to be concentrated in three distinct areas. The two sites located along Club Road are associated with the Rietfontein Hospital. The site located on the banks of the Jukskei River appears to predate the hospitals main burial activities;

- No sites could be identified that gave the impression of haphazard burying or animal carcass burying;
- The chemical analysis data of the soils was inconclusive regarding defences between control plots outside the graveyards and the graveyards soils. This was especially so for pH, Ca and Mg levels. Potassium and P levels showed a significant difference between the two soil sample zones with higher levels in the graveyard soils. From the data it therefore appears that only K and P levels were influenced by the presence of the graveyard. The absolute values of the pH and Ca levels indicate that none of the soils can be considered conducive for the survival of anthrax, rather, the levels are low enough to confidently indicate a very low risk of anthrax survival;
- During the literature survey regarding persistence of pathogens in the soil all the pathogens, except for anthrax, were ruled out as risks due to poor or non-survival for prolonged periods in soil;
- The emphasis on anthrax was due to the reported persistence of the pathogen in soils with neutral to alkaline pH as well as elevated Ca levels and the anecdotal evidence that indicted the burial of animal carcasses of animals that died due to an anthrax outbreak. These indications informed the approach followed during the analysis phase of the investigation.
- None of the human diseases identified during the literature survey could be identified in the soils. This includes anthrax;
- The absolute values of the pH and Ca levels indicate that none of the soils can be considered conducive for the survival of anthrax, rather, the levels are low enough to confidently indicate a very low risk of anthrax survival;
- However, as there is a potential risk that localized infected remains may still be
 encountered during earthwork activity, workers will have to be given a standard
 operating procedure upon uncovering graves. Workers will have to be properly
 informed about the disease and the risks and they will have to adhere to a
 "biosecurity" protocol that has to be set up with linked safety measures;
- If grave sites are uncovered the bones / grave site must be covered with soil, excavation must be stopped and experts must be called in to identify the origin of the bones. Samples should be taken to confirm the absence/presence of *Bacillus anthracis*. Should any sample be positive for anthrax all workers will have to receive

- medical care and a treatment protocol using penicillin or a cephalosporin (for penicillin susceptible individuals)."
- The risk of anthrax spores present at the Linksfield area is none to low. Low in the event of exposing burial sites where animals died of anthrax (no animal grave sites were identified on the study area);
- We could find no records at the hospital, Adler Museum, NICD etc that might have records about animals that died of anthrax and that were buried at the site;
- No burial sites could be identified with aerial photographs and no soil disturbance was observed by the soil specialist that also indicated that the soil structure does not lend itself to burial of animals deeper than 1.0-1.5 m;
- As the low pH of the soils in the Linksfield area does not support survival of anthrax in the soil, anthrax most likely only occurs at burial sites where animals or humans that died of anthrax were buried;
- Bacillus anthracis only poses a low risk in burial sites where anthrax related carcasses
 were buried. Workers will be trained to identify burial sites and a specific operating
 procedure will be followed which will involve the identification of anthrax at a burial
 site;
- In the event that anthrax is identified various options can be considered like; no further development at that specific site or alternatively decontamination of that site;
- The most likely form of anthrax infection is cutaneous and humans are fairly resistant towards cutaneous infections. In the improbable event that such an incident could occur; cutaneous lesions can be very effectively treated with antibiotics where abraded skin is exposed to the anthrax infection;
- There is no record of anthrax related carcasses being buried at the site; no burial sites could be identified with aerial photographs;
- In the event of anthrax, anthrax can only be a risk when a human is exposed to spores
 over a long period which will not be possible during this development or exposure to a
 large amount of spores which have been indicated to be very unlikely;
- Provided that adequate and standard measures are implemented for the handling of exposed animal remains during development no risk is foreseen regarding the development of the site;

- In fact, the current status quo with uncontrolled dumping, squatting and human movement across the site poses a larger risk than development as none of the current activities are structured or controlled; and
- With the development of the site activities can be structured and any risk mitigated adequately.

Dr. Mannie Levin:

- The pathogen analyses showed no pathogens that are related to grave sites or the hospital and this report therefore confirms the Terra Soil science report;
- Any boreholes drilled in the study area must be sampled for pathogen analysis to confirm the present results;
- Although this investigation shows no pollution it is recommended that the planned development must ensure total runoff to reduce recharge and erosion impact on the soil layer in the study area.

J Louis van Rooy:

Localized difficulty of excavation to 1.5 m depth.

Dr. De Vos

- No concrete evidence could be found that anthrax occurred on Portion 1 of Rietfontein 61-IR (above mentioned site). Word of mouth and earlier land-use practices provide circumstantial evidence that both livestock and human cases of anthrax occurred and fatalities were buried there. Although old burial registers had been lost;
- Even the present situation (No-go option) outside the Sizwe Hospital complex is unsafe with the uninhibited entrance of people. Erosion can cause possible exposure of contaminated material. Decontamination of the area is impossible;
- The safest option is to adopt the containment principle to develop the area in such a way that what is down below the surface, stays below. The Linksfield Mixed Development Project meets this objective, though certain mitigation measures should be followed;

- Isolate or contain the area in such a manner that there can be no harm caused.
 Surface development should be used. Relatively shallow or floating reinforced concrete foundations should be used preferably;
- Trenches, foundations and basements deeper than one meter, could increase the
 possibility of unearthing burial ground with further implications. The rest of the area
 should be managed in a way to prevent erosion, e.g. tarmac or brick roads, areas &
 grass lawn coverage on the rest of the premises;
- At this stage it is not imperative to do a comprehensive microbiological survey for anthrax. It would be futile to do such a survey without knowing the locality of anthrax burial places. The area is too big. At a great cost it would take hundreds/thousands of samples to locate anthrax spores. Even a limited survey to the building area only will take a vast amount of tests. Future action will not be affected by positive or negative results. A positive test will only prove what is suspected. A negative result still will not prove that anthrax is absent. Even cm³ cannot be covered;
- Where anthrax burial sites are identified, or bone fragments discovered, microbiological testing for Bacillus anthracis should be performed;
- Where tests prove to be positive for anthrax, the site should be decontaminated.
 (Drench it with 5% formaldehyde solution);
- When doing excavations, make use of protective clothing, anti-dust masks & protective eye wear. A TLB with a closed cabin, filled with dust and chemical filters, will be the best option;
- Water in a mist spray should be used to curb the dust problem continuously;
- Identify all burial sites and demarcate, isolate and avoid these areas;
- Workers should be aware and have knowledge of the early symptoms of anthrax.
 The latter is easily treated by antibiotics.

Leonie Marais-Botes & Dr. A van Vollenhoven

- It is recommended that the historical significance, scientific and community contributions of the Rietfontein (Sizwe) Hospital be commemorated at a central point in the new development. As some of the hospital buildings may need to be demolished the layout of the hospital site should form part of this display.
- It is further recommended that to assist in the site development process the known graves on the south west corner be plotted, a centre be determined and a 50 metre buffer zone determined. In the case of outlaying graves being discovered the options being exhumation and reburial nearer to the other graves or conservation in situ.
- It is also recommended that the three graves situated in the hospital grounds be exhumed and the remains reburied at the Mehliss residence. This will aid in future conservation of the said graves.
- It is accepted that new access roads may mean that some of the hospital buildings may need to be demolished. The Mehliss residence and first wards are the significant layer and should be regarded as important and conservation worthy. As soon as the final site development plan is available the structures earmarked for demolition are listed and submitted to the Heritage Impact Assessment Committee of the Provincial Heritage Authority of Gauteng (PHRAG) for approval/comment. In addition alterations to buildings older than 60 years must also be submitted to the Provincial Heritage Resources Authority of Gauteng (PHRAG) for approval.
- Management Plans be written and implemented for all remaining structures older than 60 years as well as grave sites to ensure regular maintenance on these structures and grave sites in future.

Table 71: Issues and Impacts – Diseases, Waste Sites, Graves

Issue/ Impact	Positive/	Mitigation Possibilities
	Negative/ Neutral ±	High • Medium •
		Positive Impact - Not
		Necessary To
		Mitigate 🌣

56)	Possibility of finding more graves on the study area,	_	•
	especially during site clearance and excavations		
	(this could include graves of animals that died of		
	anthrax)		
57)	Possible ground water contamination – anthrax	_	0
	spores and other diseases/ viruses currently and		
	formerly treated at the hospital		
58)	Possible water and soil contamination due to lead	-	0
	lined caskets		
59)	The disturbance of the soil layers of the study area	-	©
	will re-activate anthrax spores, which can survive in		
	soil for more than 200 years. The spores will		
	distribute through ground water movement and		
	through dust pollution. The ground water		
	movement is towards the Jukskei River and the dust		
	will be carried across the surrounding residential		
	areas.		
60)	The disturbance of the soil can also cause small	-	©
60)		-	3
60)	The disturbance of the soil can also cause small	- ±	©
,	The disturbance of the soil can also cause small pox outbreaks	- ±	
,	The disturbance of the soil can also cause small pox outbreaks The acid pH of the soil precludes long term bone	- ±	
,	The disturbance of the soil can also cause small pox outbreaks The acid pH of the soil precludes long term bone	- ±	
,	The disturbance of the soil can also cause small pox outbreaks The acid pH of the soil precludes long term bone preservation and their associated bacteria.	- ±	
,	The disturbance of the soil can also cause small pox outbreaks The acid pH of the soil precludes long term bone preservation and their associated bacteria. The absolute values of the pH and Ca levels	- ±	
,	The disturbance of the soil can also cause small pox outbreaks The acid pH of the soil precludes long term bone preservation and their associated bacteria. The absolute values of the pH and Ca levels indicate that none of the soils can be considered	- ±	
,	The disturbance of the soil can also cause small pox outbreaks The acid pH of the soil precludes long term bone preservation and their associated bacteria. The absolute values of the pH and Ca levels indicate that none of the soils can be considered conducive for the survival of anthrax, rather, the	- ±	
,	The disturbance of the soil can also cause small pox outbreaks The acid pH of the soil precludes long term bone preservation and their associated bacteria. The absolute values of the pH and Ca levels indicate that none of the soils can be considered conducive for the survival of anthrax, rather, the levels are low enough to confidently indicate a	- ±	
61)	The disturbance of the soil can also cause small pox outbreaks The acid pH of the soil precludes long term bone preservation and their associated bacteria. The absolute values of the pH and Ca levels indicate that none of the soils can be considered conducive for the survival of anthrax, rather, the levels are low enough to confidently indicate a very low risk of anthrax survival		☆
61)	The disturbance of the soil can also cause small pox outbreaks The acid pH of the soil precludes long term bone preservation and their associated bacteria. The absolute values of the pH and Ca levels indicate that none of the soils can be considered conducive for the survival of anthrax, rather, the levels are low enough to confidently indicate a very low risk of anthrax survival The shallow soil profile, above the bedrock,		☆
61)	The disturbance of the soil can also cause small pox outbreaks The acid pH of the soil precludes long term bone preservation and their associated bacteria. The absolute values of the pH and Ca levels indicate that none of the soils can be considered conducive for the survival of anthrax, rather, the levels are low enough to confidently indicate a very low risk of anthrax survival The shallow soil profile, above the bedrock, precludes deep burials, making them prone to		☆

64)	In spite of the negative finding, graves or animal	_	③
	burial pits may be concealed under rubble or		
	ground fill.		
65)	Scaffold mounted bacteria particles (the bacteria	±	‡
	particles referred to in this study) are too large to be	_	
	inhaled into the alveoli.		
	In the event of anthrax bacilli being liberated at		
	Linksfield, dispersal in an infective dose to the lungs		
	is very unlikely. Apparently a human must be		
	exposed to at least 1 300 anthrax spores per day.		
66)	During the literature survey regarding the	±	\$
	persistence of pathogens in the soil all the	_	
	pathogens, except for anthrax, were ruled out as		
	risks due to poor or non-survival for prolonged		
	periods in soil;		
67)	There is a potential risk that localized infected	-	©
	remains may still be encountered during earthwork		
	activity		
68)	The current status quo ("No-go" option) with	±	₩
	uncontrolled dumping, squatting and human		
	movement across the site poses a larger risk than		
	development as none of the current activities are		
	structured or controlled.		
	Even the present situation ("No-go" option) outside		
	the Sizwe Hospital complex is unsafe with the		
	uninhibited entrance of people. Erosion can cause		
	possible exposure of contaminated material.		
	Decontamination of the area is impossible.		
69)	With the development of the site, activities can be	-	©
	structured and any risk mitigated adequately		

70)	The pathogen analyses conducted by the geo-	+	₩
	hydrologist showed no pathogens that are related		
	to grave sites or the hospital and this correlates with		
	the Terra Soil study		
71)	Localized difficulty of excavation to 1.5 m depth.	-	•
72)	The cultural and heritage specialists identified graves and historical structures to conserve	±	❖
73)	Some of the I&APs are of the opinion that small pox	<u>+</u>	\$
	is still treated at the hospital		

Comments of the I&AP's

Medical

There a number of enormous risks posed on the area i.e. regarding security, infrastructure, sanitation, and traffic.

Most importantly, this development exposes the community to serious health risks, as the land they wish to develop contains the graves of people and animals who have died from diseases, which at present have been eradicated, such as smallpox and anthrax. Once exposed, these dormant bacteria may once again proliferate and place the community at risk of infection, especially those that have not been immunized.

The land they wish to develop borders the Sizwe Tropical Disease Hospital where patients are treated for multiple and extensive drug resistant Tuberculosis. Patients are treated at the hospital away from their communities and families as their disease is contagious and highly infectious. A development that would encroach on the hospital would put both the patients and the surrounding communities in a compromised state.

The digging up of the graves will have a health risk on the neighbourhood, putting all of us and our children's lives in danger. The affected and interest parties of this development

have a strong objection to this development due to the history of the Sizwe (Rietfontein) Hospital and the disease that can occur during the development.

The following table consists of some interested and affected parties that have a concern regarding the smallpox that is current being treated at the Sizwe Hospital and the effect it may have on their health when the development occurs.

Table 72: Comments of the I&AP's regarding the medical impact.

Issue:	I&AP	Issues Addressed in Report √/X
I strongly object to the development on this piece of land. Down the years, many people with contagious disease were buried on this land, and there needs to be a study done, as I feel that you will be opening Gauteng to multiple disease, as we are not sure what has been buried here.	Ron Clark ronclark@nextnet.co.za	Refer to page 226, Dr. Johan van der Waals and Dr. Henriette van Heerden
Disease such as anthrax, small pox among other diseases that could cause an epidemic, were buried here. There is concern over this issue, so make sure before you act.		
This development exposes the community to severe health risks. The land designated for development in the Rietfontein hospital area (now Sizwe) contains 7000 graves of people and animals who have died from serious contagious diseases like Ebola, Anthrax, smallpox, foot-and-mouth disease and others. Some of these diseases are known to stay dormant in the soil for hundreds of years, only to be released when they are airborne. Disturbing this soil could lead to an untold	Norman Preston NPreston@denovobus.co.za	√ Refer to issue 59, Page 242

epidemic affecting thousands of people.		
I received an email asking to explain my concerns and objection to projects to build over the Graveyard in Linksfield.	Christine Toner Christine@coral-i.com	√ Refer to issue 56, Page 238
I have highly appalled by this suggestion as firstly I live in the area and secondly the blatant facts of the health risks at hand if those graves are opened. The diseases that people had that have died and been buried there cannot be resurrected and it will create a disease ridden epidemic, that will infect and more than likely kill many people. Its inhuman to dig up graves unnecessarily, from ANY perspective! UNLESS there is a very valid reason, (i.e floods that have defaced the graves and are starting to collapse) you should NEVER dig up graves. There is MORE than enough space in Johannesburg to build developments in other areas. Putting humans is danger is just plain stupidity and you will not only infect people but more than likely bring down the value of the surrounding areas, that families have spent their time and money on over the years to keep them wellmaintained and give them a good resale value. Edenvale/Linksfield is one of the most popular and sort after areas in Johannesburg as it is central to all areas, including the airport. This idea, I feel should truly be scrapped.	Ilana Stain	
My main objections lie in the clear human health violations – from the graves that will be disturbed to the overloading of the area and municipal systems. It is vital that a proper	Ilana Stein ilanas@wilderness.co.za	V

EIA takes place and that, should this development go ahead, the results of the EIA are submitted to the public for		
perusal. lease consider this my formal petition against the development of the land near Linksfield currently allocated to the burial ground for the national institute of	Ingrid Dyer Ib coldcut@hotmail.com	√
communicable disease. I have signed the online petition but it was requested that I include a direct email.		
I have strong concerns around the health implications around developing this land. It is currently isolated for a reason. Digging up the graves on that premises is just asking for trouble. Just because a soil sample around the grave is fine doesn't mean that moving bodies doesn't have risks. And then to develop a high population density community right on top of that? Goodness, it is almost like you are seeking a way to kill people off.		
Over and above the fact that you are disturbing the final resting place of people of many different religions! This seems like a no-brainer discussion to me and I am actually horrified that it is even being considered.		
I am a property owner in Sandringham. I am the registered ratepayer, and address you in that capacity.	Mike Shapiro andis@telkomsa.net	√ Refer to issue 56,
This is regarding the proposed development of the land around the Sizwe Hospital for infectious diseases in Edenvale and the land adjacent to the 'Sandringham Dip' on club		Page 238 Refer to issue 121, Page 330 Refer to section 6.2.8 Services,

street opposite Huddle Park, right on our door step.	page 315
The piece of land in question has hundreds of bodies buried on it of patients that died from infectious diseases which may be exhumed for construction. To exhume these bodies constitutes a huge risk to the city as a whole. I also don't see how the current infrastructure (road, water, sewerage and electricity) would handle such a huge development. There is the environmental impact and destruction of one of our city's precious green belts.	
I strongly object this development.	

6.2.1.c Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

Possibility of finding more graves on the study area, especially during site clearance and excavations (this could include graves of animals that died of anthrax)

There is a possibility that more graves can be found on the study area during the construction phase. The finding of graves while cleaning and excavating the site can have a major impact on the development and mitigation measures must be implemented if this situation may occur.

Table 73: Significance of Issue 56 (Possibility of finding more graves on the study area, especially during site clearance and excavations (this could include graves of animals that died of anthrax).) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance	of	Issue	after
	Already achieved $\sqrt{}$	mitigation			

High Medium Low Low ■	Must be implemented during	Positive 🌣
Positive Impact/ Neutral - Not	planning phase, construction	Low/ eliminated L / E
Necessary To Mitigate ☆	and/ or operational phase	Medium M
	P/ C / O	High H
		Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ●	P/C - Workers will have to be given a standard operating procedure upon uncovering graves.	L - To be included in the EMP
	Note: Other suitable mitigation measures to address this problem have already been included in issues above	

Result: The issue can be mitigated and turned into a positive impact, the significance of this positive impact still need to be determined/confirmed and assessed in the Significance Rating Table

57) Possible ground water contamination - anthrax spores and other disease/ viruses currently and formerly treated at the hospital

While demolishing some parts of the hospital for the access roads there is a possibility that the current and former disease/viruses treated at the hospital may percolate into the soils and causing ground water contamination, which will have an impact on the development and the ecological life.

Table 74: Significance of Issue 57 (Possible ground water contamination - anthrax spores and other disease/ viruses currently and formerly treated at the hospital.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance	of	Issue	after
High Medium Low Low Medium High High High High High High High High High High High High High High High High High High High High High High High High	Already achieved $\sqrt{}$	mitigation			
	Must be implemented during	Positive 🌣			
Positive Impact/ Neutral - Not	mest se implemented doming	Low/ elimin	ated	L	/ E

Necessary To Mitigate 🌣	planning phase, construction	Medium M
	and/ or operational phase	High H
	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Low 6	P/C/O-Groundwater tests need to be done in between phases to ensure that the ground water does not get contaminated during the different phases.	M - To be included in the EMP
	C - Medical assistance should be available at all times for construction staff	M - To be included in the EMP
	Note: Other suitable mitigation measures to address this problem have already been included in issues above.	

Result: The issue can be mitigated and turned into a positive impact, the significance of this positive impact still need to be determined/confirmed and assessed in the Significance Rating Table

58) Possible water and soil contamination due to lead lined caskets

According to I&APs some of the graves may have lead lined caskets and exposure of these caskets can have an impact on the water and soil if damaged. The lead lined caskets being exposed to the soils and water can lead to soil and water contamination. Take note that the appointed geo-hydrologist could not find any signs of lead contamination in the water tests. The soil tests also tested negative for lead contamination. Furthermore, some of the specialists confirmed that the bodies of anthrax victims would have been burnt, because it was a policy to burn bodies and carcasses of victims of bacterial diseases such as anthrax.

No other gravesites were identified on the study area and due to the shallow soils and the hard greenstone that underlies most of the study area, it is highly unlikely that any

additional graveyards will be discovered on the study area. The original study area was approximately 600ha in extent and the specialists involved are of the opinion that the remainder of the gravesites were located in other sections of the original study area with deeper soils. Developments already took place across almost two thirds of the original hospital premises and therefore it is also unlikely that any other graves will be identified on the original and larger Sizwe Hospital site.

Table 75: Significance of Issue 58 (Possible water and soil contamination due to lead lined caskets.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊙ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🜣	Must be implemented during planning phase, construction	Positive 🌣 Low/ eliminated L / E
The cool of the same of the sa	and/ or operational phase	Medium M
	P/ C / O	High H
		Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Low ©	C – If any other gravesites are discovered during the construction phase, all construction activities in the area involved must immediately stop. The relevant specialists must be contacted and they must propose the way forward.	M -To be included in the EMP
	C - Soil and water samples must immediately be taken in order to determine whether there is any ground water and soil contamination. The possible presence of led in the water and the soil must also be confirmed during the testing exercises. Note: Other suitable mitigation	M- To be included in the EMP
	measures to address this problem have already been	

included in issues above	

Result: The issue can be mitigated and turned into a positive impact, the significance of this positive impact still needs to be determined/confirmed and assessed in the Significance Rating Table

59) The disturbance of the soil layers of the study area.

The disturbance of the soils layers of the study area will re-activate anthrax spores, which can survive in soil for more than 200 years. The spores will distribute through ground water movement and through dust pollution. The ground water movement is towards the Jukskei River and the dust will be carried across the surrounding residential areas.

Even though the anthrax spores can survive for 200 years or more, the risks of being affected by anthrax is regarded as low to none. Apparently one must be exposed to 1 300 or more such spores per day and the spores are regarded as too heavy and too big for humans to inhale. Furthermore, anthrax spores cannot survive in soils with high acidity. The soils of the study area are acidic.

No signs of any anthrax spores were found in any of the soil or water tests that were conducted and the team of specialists could not identify any other graveyards.

A possible new graveyard/ grave was identified to the north of the nursery during a follow-up site investigation (after one of the I&APs identified other possible graveyards and waste sites). The soil scientist and the cultural and historical specialist conducted follow-up soil tests and did some excavations in the area with the possible grave, but no graves could be identified. Apparently the specialist only found a rand water pipeline and servitude in this area and there were also some evidence of former construction works in this area that are associated with the pipeline.

Table 76: Significance of Issue 59 (The disturbance of the soil layers of the study area.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
	Already achieved √	mitigation
High ■ Medium □ Low ■	,	Positive 🌣
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E
Necessary To Mitigate 🌣	planning phase, construction	Medium M
	and/ or operational phase P/ C / O	High <mark>H</mark>
	F/C/O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Medium	P/C - Even though there are almost no risks of getting infected by anthrax if the soil layers are disturbed, dust control during construction must be treated as a priority. Dust control will eliminate possible health risks associated with the inhalation of dust, especially if one takes the fact that old aged people resides in close proximity of the hospital into consideration. This will also eliminate any possibility of the spreading of anthrax spores by means of dust. C - Sweeping of the construction site, clearing of builders' rubble and debris as well as the regular watering of the construction site (storage areas, roads etc.) must take place at least once a day during the dry and windy season. In severe circumstances the watering down of the construction site (the exposed areas) must take place twice a day (early in the morning and late in the afternoon).	L - To be included in the EMP L - To be included in the EMP

Result: The issue can be mitigated and turned into a positive impact, the significance of this positive impact still need to be determined/confirmed and assessed in the Significance Rating Table

60) The disturbance of the soil can also cause small pox outbreaks.

If the soils are disturbed there is a possibility that the workers can get infected by small pox and cause a small pox outbreak. This must be taken into consideration and be implemented into the EMP, should there be any worker with the symptoms of small pox.

Table 77: Significance of Issue 60 (The disturbance of the soil can also cause small pox outbreaks.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ○ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	mitigation Positive ☆ Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Medium 🔾	P/ C - There are no risks associated with small pox. Small pox cannot survive in the soil for longer than 8 years. The last small pox outbreak was more than 50 years ago.	Not necessary to mitigate

Result: It will not be necessary to mitigate this issue, because small pox cannot survive in the soil for longer than 8 years. The last small pox outbreak was more than 50 years ago. People raised this issue, because they are uninformed. According to Dr. Wouter Basson he was not even aware that small pox can survive longer than 8 years. In his opinion, the lifespan is even shorter.

63) The effluent of the Rietfontein Infectious Diseases Hospital yielded tuberculosis DNA.

The current soil and water pollution cause by the sewage spillage of the Sizwe Hospital but taken into consideration in the planning and construction phases. The soil and water need to be rehabilitated.

Table 78: Significance of Issue 63 (The effluent of the Rietfontein Infectious Diseases Hospital yielded tuberculosis DNA) After Mitigation/ Addressing of the Issue

Mitigation Possibilities High ● Medium © Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆ Medium ©	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	Significance of Issue after mitigation Positive Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP M - To be included in the EMP
	plume of the hospital must be fully sanitized before redevelopment commences. P/C - The soils need to be rehabilitated to ensure that contaminated soil is removed from the site. Note: Other suitable mitigation measures to address this problem have already been included in issues above	M - To be included in the EMP

Result: The issue can be mitigated and turned into a positive impact, the significance of this positive impact still need to be determined/confirmed and assessed in the Significance Rating Table

64) In spite of the negative finding, grave or animal burial pits may be concealed under rubble or ground fill.

In spite of the negative finding, grave or animal burial pits may be concealed under rubble or ground fill. Therefore we recommend that a knowledgeable, archeologically trained investigator be in attendance where and whenever new ground is broken, to observe if the soils has previously been disturbed, and if any animal remains are exposed.

Table 79: Significance of Issue 64 (In spite of the negative finding, grave or animal burial pits may be concealed under rubble or ground fill) After Mitigation/ Addressing of the Issue

	T	T
Mitigation Possibilities	Mitigation	Significance of Issue after
High • Medium © Low • Positive Impact/ Neutral - Not	Already achieved √ Must be implemented during	mitigation Positive Low/ eliminated L / E
Necessary To Mitigate ☆	planning phase, construction and/ or operational phase	Medium M High H
	P/C/O	Not possible to mitigate, but not regarded as a fatal flaw NP
Medium 💿	P/C - In the event that graves or animal remains are found all activity must stop.	
	P/ C - a knowledgeable, archeologically trained investigator should be in attendance where and whenever new ground is broken, to observe if the soils has previously been disturbed, and if any animal remains are exposed. Note: Other suitable mitigation measures to address this problem have already been included in issues above	→ To be included in the EMP

Result: The issue can be mitigated and turned into a positive impact, the significance of this positive impact still need to be determined/confirmed and assessed in the Significance Rating Table

67) There is a potential risk that localized infected remains may still be encountered during earthwork activity

This is a possibility during the construction of any development and should always be highlighted to the site workers. Should any graves or remains be found a specialist/s in the particular field need to be contacted.

Table 80: Significance of Issue 67 (There is a potential risk that localized infected remains may still be encountered during earthwork activity) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium © Low ■ Positive Impact/ Neutral - Not	Already achieved √ Must be implemented during	mitigation Positive 🌣
Necessary To Mitigate 🌣	planning phase, construction	Low/ eliminated L / E
I a a a a a a a a a a a a a a a a a a a	and/ or operational phase	Medium M
	P/C/O	High H
		Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Medium	P/ C - According to the appointed specialists there are no - limited risks involved. In fact the risks of getting infected due to construction on the study area is no higher than construction activities on other portions of land in the area. No specific mitigation measures are required. P/ C - If any graves are discovered during the construction phase, the soils of the area involved will be tested for anthrax and led. Ground water tests will also be conducted in order to determine whether the construction activities activated any spores. If any risks are detected during such	M - To be included in the EMP

site specific tests, appropriate mitigation measures will be applied, even if this means that construction will be stopped on a temporary or permanent basis. P/ C - It is very important to M - To be included in the EMP request that all construction workers confirm their health status prior to commencing with construction works on the study area. If any of the construction workers have any health problems (mainly associated with viral and bacterial diseases), such problems must be declared prior to the construction phase. This aspect will be discussed in more detail with the appointed contractors and subcontractors. Note: Other suitable mitigation measures to address this problem have already been included in issues above

Result: The issue can be mitigated and turned into a positive impact, the significance of this positive impact still need to be determined/confirmed and assessed in the Significance Rating Table

69) With the development of the site activities can be structured and any risk mitigated adequately

To ensure a well-managed site all activities need to be properly structured and planned ahead. All risks should be properly mitigated.

Table 81: Significance of Issue 69 (With the development of the site activities can be structured and any risk mitigated adequately) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance	of	Issue	after
		mitigation			

High ● Medium © Low ■	Already achieved $\sqrt{}$	Positive 🌣
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E
Necessary To Mitigate ☼	planning phase, construction	Medium M
	and/ or operational phase	High H
	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ●	P/C/O-To ensure a well-managed site all activities need to be properly structured and planned ahead. All risks should be properly mitigated.	L - To be included in the EMP
	Note: Other suitable mitigation measures to address this problem have already been included in issues above	

Result: The issue can be mitigated and turned into a positive impact, the significance of this positive impact still need to be determined/confirmed and assessed in the Significance Rating Table

71) Localized difficulty of excavation to 1.5 m depth.

Care should be taken during the foundations and all other excavations due to the localized difficulty.

Table 82: Significance of Issue 71 (Localized difficulty of excavation to 1.5m depth.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High • Medium • Low • Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	mitigation Positive ☆ Low/ eliminated L / E Medium M High H Not possible to mitigate,

		but not regarded as a fatal
		flaw NP
High ⊕	P/ C - According to the specialist team, the soils of the study area are shallow. It is unlikely that any additional waste sites or graves will be discovered during the construction phase. We however already addressed the possible discovery of additional graveyards/ waste sites.	
	Note: Other suitable mitigation measures to address this problem have already been included in issues above	

Result:

The issue can be mitigated and turned into a positive impact, the significance of this positive impact still need to be determined/confirmed and assessed in the Significance Rating Table

6.2.2 Agricultural Potential

A soil and agricultural potential survey was done for the proposed Linksfield Mixed use development (refer to Annexure Ac for Agricultural Potential Report compiled by Dr. Johan van der Waals and Refer to Figure 16 for Agricultural Potential Soils Map).

Terra Soil Science was appointed by Bokamoso to conduct an agricultural potential survey of the proposed Linksfield development site, which is situated in the Gauteng Province.

The assessment of agricultural potential rests primarily on the identification of soils that are suitable for crop production.

Method of soil survey

The survey was conducted in five phases:

- Phase 1: Land type data
- Phase 2: Topographic parameters
- Phase 3: Satellite image interpretation
- Phase 4: Site visit and soil survey
- Phase 5: Use of geotechnical survey data

In addition, the geotechnical report as produced by J Louis van Rooy (2013) was used to ascertain subsoil conditions as well as the presence of potential seepage areas.

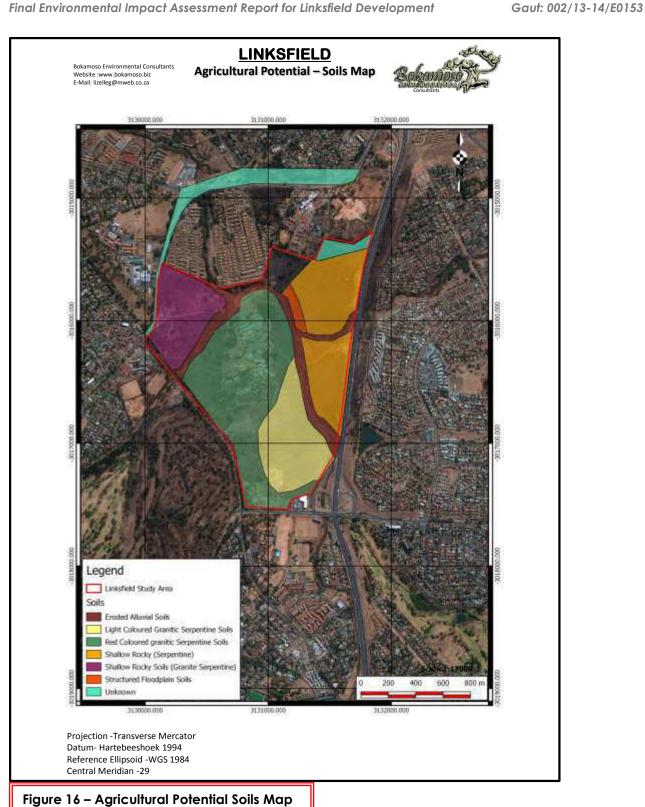
The soils can be divided into the following sections described below:

Red Coloured Granite/Serpentine Derived Soils

This area is dominated by red soils of varying depth and stone content. The dominated soils are of the Hutton from. The red colour and slightly higher clay content that the median granite derived soil on the Halfway House Granite Dome is presumed to be inherited form a serpentine geology influence. These soils show no morphological sings of wetness.

Light Coloured Granite/Serpentine Derived Soils

This area is dominated by soils with coarse sandy A horizons with bleached colours overlying serpentine material with varying degrees of weathering. The valley areas are severely eroded and the soils in the drainage channel areas are therefore severely altered and impacted. Wetland soils are found in the valley bottom position.



Shallow and Rocky Granite/Serpentine Derived Soils

This area is dominated by shallow sandy soil material overlying weathering serpentine material. The soils exhibit copious amounts of quartz pebbles on the surface and artefact of the presence of a stone line indicating the boundary between Granite and serpentine material with subsequent surface disturbance by humans as well as intense mole activity. The dominant soil form is Glenrosa.

Shallow and Rocky Serpentine Derived Soils

The eastern section of the site is dominated by shallow and structured rocky soils with rock outcrops occurring throughout. The dominated soil forms are Mispah and Glenrosa. Small areas of wetland or poorly drained soils occur on the edge of the Jukskei River. The soils are variable, but dominantly of high clay content with some degree of swelling properties.

Structured Floodplain Soils

The Structured soils have formed on the floodplain in a small section of the site on the eastern bank of the Jukskei River. These soils are dark in colour and structured with a degree of swelling. The dominated soils are Willobrook and Rensburg forms.

Eroded and Alluvial Soils

The soil along the banks of the Jukskei River and its tributary has been cultivated since the 1930's. In comparison the field survey revealed that most of the soils associated with the banks of the rivers have been eroded significantly. Most of the erosion and impacts are associated with increased storm water runoff on sites in the catchment of the Jukskei River.

Agricultural potential

Soil potential linked to current land use and status

It has appeared that the current land use of the site is derelict open veld as there are no structured farming activities taking place on this site. Although the site is suitable for grazing, there are major limitations to this land. Due to the lack of fencing and traffic within the area there is limitation in this area.

Cost-benefit analysis

Under the specific circumstances the costs of production will invariably outweigh the potential benefits as the soils are predominantly shallow and there are significant constraints in terms of grazing activities. The cost-benefit analysis will invariably be negative.

Surrounding developments and activities

The entire areas surrounding the site suffer the same limitations as the site itself, however most of the area has been developed as residential area with associated infrastructure.

Conclusions on agricultural potential of the area made by the agricultural specialist

The survey site is covered mainly by shallow and rocky soils, but it is not enough to increase the agricultural potential of the site. The site is suited for grazing but this land use is unlikely due to several human activities in the area. There is no way to improve the agricultural potential through soil preparation. The land has been degraded significantly through the dumping of rubble as well as erosion of drainage features.

Agricultural Hub

The study area is **not** located in an agricultural hub or an area identified for agricultural use by GDARD according to the Draft Policy on the Protection of Agricultural Land (2006).

Conclusion:

At present the agricultural potential of the study area is low. The soils are very shallow and scattered rock in the upper soil layers is a common phenomenon. This makes the study area totally unsuitable for the planting of crops or for the usage of any farming equipment.

The study area is furthermore surrounded by urban structures and this will make it extremely difficult to apply pesticides and fertilisers to the land. Surrounding land-owners will raise concerns regarding the odours and potential health impacts associated with the application of pesticides, especially during the windy periods. This issue is a common phenomenon at small towns with agricultural land immediately adjacent to the town.

From a grazing point of view, the study can be regarded as suitable. The grazing potential is however compromised by various other factors such as theft, the lack of fences and the potential of flies and odours associated with the animals that will roam the site.

As environmental consultants it is also important to compare the socio-economic values of the various potential land-uses for the study area with one another. In the case of the study area, the socio-economic value of the proposed mixed-use development on the study area is regarded as much higher than the socio-economic value of agricultural activities. It is also important to note that the study area is not situated within any of the 7 agricultural hubs identified by GDARD.

6.2.2.a Issues & Impacts Identification – Agricultural Potential

Table 83: Issues and Impacts – Agricultural Potential

Issue/ Impact	Positive/	Mitigation Possibilities
	Negative/ Neutral ±	High • Medium •
		Low Positive Impact - Not
		Necessary To
		Mitigate 🌣

74)	Some	agricultural	land	will	be	lost,	mainly	for	-	0
	grazinç	g purposes.								

Agricultural Potential Related issues raised by the I&APs

The following paragraph, which is applicable to agricultural potential, was extracted from the comments from the City of Johannesburg.

Table 84: Comments of the I&AP's regarding the agricultural potential

Issue:	I&AP	Issues Addressed in Report
Agricultural Potential The agricultural potential of the site ranges from high to very low. The proposed development is likely to take away soils with high potential for agricultural productivity. In this regard the applicant may consider conducting a thorough agricultural potential of the land in order to incorporate agricultural activities into the proposal such that food security and food safety in the region can be attained at the same time.	Tshilidzi Tshimange TshilidziT@joburg.org.za	Refer to issue 74, Page 257 Refer to section 5.2.2 Agricultural, page 46

6.2.2.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

74) Loss of agricultural land

The relative size of this area as well as risks posed by trespassing, security and theft has a negative influence on the economic viability of a farming enterprise.

Table 85: Significance of Issue 74 (Loss of Agricultural Land) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊕ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E
Necessary To Mitigate ☼	Planning phase, Construction	Medium M
	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Low ®	P/C - The agricultural potential for the cultivation of crops is regarded as low. The study area however has some grazing potential.	NP
	The social and economical potential of urban development on this property is regarded as higher than the agricultural potential and therefore the loss of agricultural land associated with the study area is not regarded as a major issue.	

Result: Although the impact is low, the significance of this impact still needs to be determined/confirmed and assessed in the Significance Rating Tables.

6.2.3 Existing Land Use

6.2.3.1 The Study Area

The site is mostly vacant and undeveloped, with the exception of approximately 15 hectares occupied by the hospital, 10 hectares by cemeteries, three hectares by a nursery and three hectares by personnel accommodation. The Jukskei River and its associated riparian and wetland systems, which currently forms part of the larger continuous Gauteng open space network system, cut through the study area. Some of the riparian vegetation

adjacent to the river was destroyed by historical agricultural activities along the floodplains of the river and the natural vegetation of the study area cannot be regarded as pristine.

6.2.3.2 Surrounding Developments and Land Uses

The study area, which is wedged between the N3 (to the east), Modderfontein Road (to the north), Club Street (to the west) and Linksfield Road (to the south), is almost surrounded by established residential areas well within the urban development boundary.

A golf course (The Linksfield Golf Course) is situated to the south-west of the study area and the sports grounds of a school are located to the south of the study area. The Jukskei River and two non-perennial tributaries of the river traverse the study area. A retirement village named Rand Aid is situated immediately to the north of the study area. Only the Jukskei Rivers separates the Rand Aid Development from the existing Sizwe Hospital and the study area earmarked for the mixed-use development.

The following established residential areas surround the study area:

- Marais Steyn Park and Dowerglen to the east (also to the east of the N3);
- Bedford, Senderwood and St Andrews to the south (also to the south of Linksfield Road);
- Sandringham, Glenkay, Fairvale, Silvamonte, Viewcrest and Sunningdale to the west (also to the west of Club and Modderfontein Roads)
- Dunsevern, Dorelan and Rembrandt Park to the north of the Rand Aid Retirement Development (and to the north of Modderfontein Road).

The Edenvale Hospital is situated to the north east of the study area and the National Institute of Communicable Diseases (NICD) is located to the west of the study area, adjacent to Modderfontein Road.

Sandringham High School is situated to the west of the study area (on the south-western corner of the intersection between Modderfontein Road and George Street). Businesses,

social facilities and commercial developments that mainly cater for the needs of the local communities are distributed throughout the various neighbourhoods.

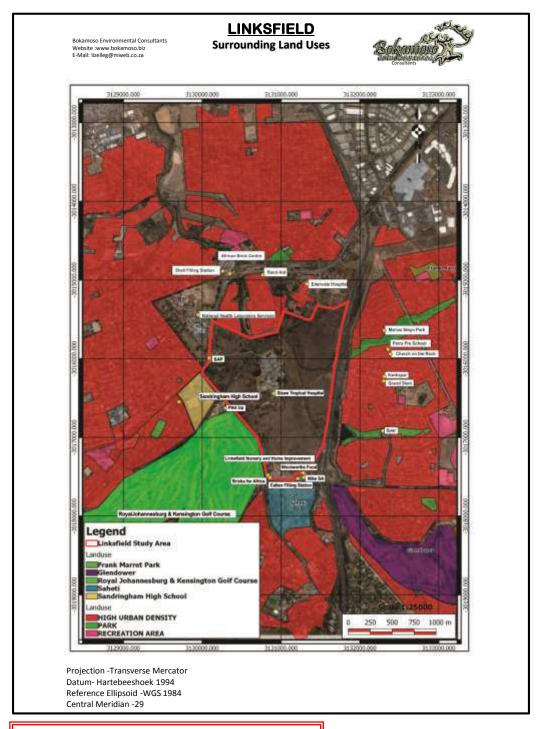


Figure 17: Surrounding Land Uses Map

6.2.4 The Proposed Land Use

Refer to Annexure X for the Proposed Final Layout

The proposed mixed-use development will include, amongst others:

- 8 400 residential units:
- 150 000m² retail;
- 300 000m² offices:
- 300 000m² light industrial; and
- 50 000m² hotel and conference facilities.

The development of the Linksfield site forms part of the densification strategy in the Greater Johannesburg Metropolitan Municipality. The development is envisioned as a high quality and multi-faceted living environment including the following land uses:

- Residential Apartments;
- Offices & Business Parks;
- Convenience Retail Entertainment & Restaurants;
- Commercial and Light Industrial uses;
- Hotels & Conference Facilities:
- Show Rooms;
- Retirement Villages & Gymnasium;
- Educational Uses including Schools and Tertiary Education, and
- Active and Passive Recreational Space.

6.2.4.1 The Housing Precinct

The housing development will comprise of approximately 8 400 residential units with associated facilities and supportive land uses. The housing development will be integrated and include units ranging from upper-end penthouse apartments integrated with bonded and financed (Gap housing) apartments. Approximately 50% of the housing products will cater for families earning between R3 500 and R15 000 per month; providing housing that is under-serviced in an area that was previously out of reach to these families.

6.2.4.2 Community Facilities

Community facilities will cater for the development as well as surrounding neighbourhoods. It is a precondition that all social facilities be planned and developed at the same time as the residential development in consultation with the various departments and municipality. At a minimum, the community facilities should include public schools, a community centre, tertiary education (university), business centre, social halls, police station, youth centre and various community parks.

6.2.4.3 Commercial Precinct

The commercial development will be limited to 35% of the development site. This component will be located adjacent to the N3 highway to maximise on the benefits that the freeway exposure offers. The commercial precinct, which will consist of mixed business, commercial and light industrial uses can potentially yield up to 800, 000m² of bulk and create over 25 000 jobs.

6.2.4.4 Green Spaces

The natural landscapes will be a fundamental theme in the development as the vast majority of open space in the site will be utilised for recreational activities. The integration of natural and landscaped green elements such as parks along the river edge in the urban form will create a natural hierarchy and contribute to precinct definition.

The study area is furthermore linked to the larger continuous Gauteng Open Space System by means of the Jukskei River and two of its tributaries. At present the embankments of the river are eroded and the river's edge and riparian vegetation are in desperate need of maintenance and rehabilitation actions. These conditions only increase the pollution problems of the Jukskei River. The current ecological value of the riverine system is very low, but the ecological and conservation potential is regarded as very high. The proposed development will create the opportunity to rehabilitate the ecological systems associated with the river and its tributaries and it will also create the opportunity for the implementation of on-going open space maintenance and monitoring plans.

6.2.5 Need and Desirability/ Sustainability of the Development

Refer to Annexure Ad for Market Study 1 and Refer to Annexure Ar for Market Study 2

Need

Recent market studies have shown that mixed use development are in increasing demand, especially in close proximity to mobility spines. This development will create job and educational opportunities and it will promote the upgrading of existing sub-standard services and the provision of additional higher standard services to the existing and new residents of the area. The study area is situated in a prime location in terms of accessibility, visibility and the provision of services and the incorporation of a variety of land-uses will contribute to the long term sustainability of the development. The proposed new development will provide ample social facilities, which will fulfil the needs of the new residents and such facilities will also be available to the surrounding residents.

At present the study area is neglected and unutilised and the graveyards and historical buildings are subject to vandalism. Most of the metal markings on the graves have already been removed and there are already vagrants/ squatters on the property, which currently have a negative impact on the security of the study area and its surroundings. The homeless and jobless regard vacant and neglected land in the middle of an urban area as ideal for the erection of informal structures. They are not aware of the graveyards on the study area and the possibility of disease outbreaks when the soils of the study area are exposed which also becomes insignificant when homeless people seek shelter.

The Jukskei River, which flows through the study area, makes the site even more sought after by the homeless, because the river provides drinking water as well as bathing and washing facilities. The locality of the study area makes it easy for the unemployed to seek jobs, because they are not confronted with travelling costs and if they manage to find jobs, such jobs are within their daily reach.

As mentioned in this report, the soil tests in the vicinity of the Jukskei River showed traces of TB DNA and the sewer spillages of the existing Sizwe Hospital is most probably responsible for this. Without any intervention/ development on the study area, the Jukskei River will be subject to even more pollution and the TB DNA, which was found adjacent to the river poses serious health risks to potential squatters that will eventually settle on the property and to other residents of Johannesburg that are in contact with the water of the river.

The proposed development will be a well and pro-actively planned development that will promote job creation, the stimulation of the local economy, social well-being, the upgrading of services, the optimum utilisation of services, the prevention of pollution, increased security, the conservation and rehabilitation of open spaces and the upliftment of previously disadvantages individuals. The main purpose of the PPP, which was formed prior to the application process was to achieve the goals as set out above.

Most of the surrounding residents tend to avoid the study area and they regard the disturbance of the soil layers on the property, which accommodates some graves of former patients, as lethal. Many of the I&APs believe that construction activities on the site will lead to small pox and anthrax outbreaks. This matter was thoroughly investigated and addressed in this report and as environmental consultants we now feel comfortable (after completion of our investigations and after obtaining the opinions of specialists) to confirm that there is no or only a low risk of getting infected by anthrax (not small pox – the small pox virus can only survive up to 8 years and the last small pox case dates back to 1960). This anthrax risk is only associated with the construction phase and will be completely eliminated during the operational phase, because most of the study area will be covered with concrete. In fact, according to some of the experts that were consulted, the chances of getting anthrax on the study area during the construction phase is no higher than on other development sites in the Johannesburg area, because the entire Johannesburg area was affected by the anthrax outbreak in the 1920s.

6.2.5.a Issues & Impacts Identification – Proposed Land-Use

Table 86: Issues and Impacts – Proposed Land-Use

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High Medium Low Low Positive Impact/ Neutral - Not Necessary To Mitigate
75)	Impacts on surrounding property values	+/-	☼●
76)	Rates and taxes payable to the local authority.	+	*
77)	Upgrading of existing services, increase in services capacity and the installation of new and higher standard services in the area	+	*
78)	Upgrading of existing roads and the construction of new roads	+	*
79)	Impacts on security	+/-	☆ ⊕
80)	The provision of more social facilities in the area (i.e. shopping centre, schools, clinic etc.)	+	*
81)	Optimum utilization of existing services	+	*
82)	Establishment of a new clinic facility with upgraded services. The existing leaking sewer pipes will be removed.	+	‡
83)	The optimum utilization of valuable development land adjacent to the N3 freeway	+	‡
84)	Promotion of infill development	+	*
85)	Increase in traffic on already congested roads	-	•
86)	The protection and maintenance of the existing	+/-	☼ ⑤

	graveyards and the incorporation of the		
	graveyards and selected historic buildings (as		
	memorials) as part of the development		
87)	Poor people will move into area surrounded by	-	•
	well-established residential areas. The people		
	have no money and this will lead to petty crime.		
	Petty crime eventually becomes major crime.		
001	Daniel de la constant		_
88)	Dangerous excavations.	_	•
88)	Dangerous excavations.	_	•
88)	Damage to the existing services and infrastructure	<u> </u>	•
,		-	
,	Damage to the existing services and infrastructure	-	
,	Damage to the existing services and infrastructure during the construction phase and disruptions in	-	
,	Damage to the existing services and infrastructure during the construction phase and disruptions in services (i.e. electricity, water, damage to Telkom	+	

Need and Desirability Related issues raised by the I&APs

The following three comments below was received from the I&AP's amongst others.

Table 87: Comments of the I&AP's regarding the need and desirability

Issue:	I&AP	Issues Addressed in Report
I have just studied the environmental	Anthony Saffer	
plan for the Linksfield Mixed Use. I would like to set out both pro and	<u>asaffer@charter.co.za</u>	V
against the development.		Refer to issue 125,
		Page 346
The pro's:		
We need more housing;		Refer to section 6.2.4 Proposed land use,
Nothing can remain the same, things		page 260
change and the voters see this as a		p 5.90 200
waste of space. This will stop the		Refer to demolition and
voters from protesting.		relocation of the Sizwe
Amainal		Hospital, page 12
Against:		Refer to issue 75,
The existing roads cannot handle the traffic we have at		Page 267

the consequents		
 the moment; We have no public transport in the areas; New schools to be built as there is no capacity at the existing schools. That there are not enough teachers at the moment does not really make this a fair objection; The will have to be another hospital built as Edenvale is at capacity; The area you are using is adjacent areas where there are high property values. These values are guaranteed to drop if the project goes ahead. 		
At the end of the day housing will be provided, but at what cost? The surrounding are depreciate, traffic will become impossible and the income from rates and taxes will decrease (if the council has the integrity to accurately value the properties). Sandringham SAPS is also not able to deal with a larger area.		
Taking the above into account, I am against this development.		
I live in John Avenue in Bedford Park are and I strongly object to the proposed Township Development at Linksfield Senderwood for all the obvious reasons: Crime, overcrowding in the area, decrease in property value, extensive traffic, health risks, etc.	Micaela Soliani micsol@netactive.co.za	√ Refer to issue 87, Page 270
I wish to place on record my sincere objections to this scheme. The area already has a full complement of people and I am sure that all our facilities will be inadequate and the traffic increased tremendously.	Bella Morris bella@uos.co.za	√ Refer to issue 85, Page 269 Refer to issue 80,
Besides which all the graves which will have to be exhumed will create an epidemic of all those dreaded diseases which will impact on all the people of the area and beyond.		Page 264

6.2.5.b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

75) Impacts on surrounding property values

The proposed development might create a fluctuation in property values within the surrounding area. The impact on surrounding property values is not anticipated to be highly negative as the development provides/upgrades services and infrastructure in the surrounding community.

Table 88: Significance of Issue 75 (Impacts on surrounding property values) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ○ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ●	P – The project need to be planned and coordinated in such a way that it rather increases the property values of the surrounding properties rather than decreasing it. As mentioned, this project is regarded as unique, because it will not only provide much needed housing, but it will also strive to fulfill in the social and economical needs of the residents. The PPP which has been formed, will contribute to the success of the project. All houses and facilities to be provided will be fully serviced and the aesthetical appearance of the development will also receive	NP

priority.	
If well planned and managed the proposed development could uplift the area and the surrounding property values will most probably increase.	

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

79) Impacts on security

To ensure a safe and secure environment it is necessary that security personnel be appointed to monitor security on the site during construction and the operational phases. During the Operational phase it is thought that security will increase with the open veld areas being removed for the development and there is no longer open space available for illegal settlements or squatting. It will however still be necessary to monitor and patrol the open space areas adjacent to the river.

Table 89: Significance of Issue 79 (Impacts on security) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊙ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/C/O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ⊕	P / C - Adequate security personnel need to be appointed as soon as the study area is being prepared for construction as well as during the entire construction period.	M - To be included in the EMP
	P – Surrounding landowners	M – To be included in the EMP

need to be notified when construction commences.	
C - Only security personnel should be allowed to remain on the site overnight. The security personnel should preferably be sourced via a local security company reducing the risks significantly.	M - To be included in the EMP
C&O – Compile a construction and operational phase security management and monitoring plan	M – To be included in the EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

85) Increase in traffic on already congested roads

An increase in the traffic during the construction and operational phases of the development will have an impact on traffic flow of the area. The impact of additional traffic during the construction phase, especially heavy construction vehicles that can slow traffic down, can be mitigated to a certain extent by not allowing construction vehicles to use public roads during peak traffic times, as well as to avoid construction activities on public roads during peak traffic times. Existing roads are planned to be upgraded and a new road will also be constructed.

Table 90: Significance of Issue 85 (Increase in traffic on already congested roads) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ○ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E
Necessary To Mitigate 🌣	Planning phase, Construction	Medium M
Necessary to Miligate 💢	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP

High ⊕	P/C - Construction vehicles to avoid peak hour traffic.	M – To be included in the EMP
	P/ C – Inform surrounding residents, businesses, schools etc. if the construction activities will have impacts on traffic flow (i.e. if a lane will be closed/ if access to properties will be temporarily closed/ affected). Notices must be distributed to the affected parties at least 4 weeks prior to the planned disruptions. In cases where temporary service roads are to be provided, a representative of the developer must discuss the matter with the affected parties at least 4 weeks in advance.	M - To be included in the EMP
	P/C/O The road upgrading recommended by the traffic engineers to be implemented.	M - To be included in the EMP
Danilla Althornala tha income	C&O - Compile a construction phase Traffic Management Plan	M - To be included in the EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

86) The protection and maintenance of the existing graveyards and the incorporation of the graveyards and selected historic buildings (as memorials) as part of the development.

The proposed development site has a number graveyards and historic buildings that need to be incorporated into the development and need to be maintained. Continuous maintenance of these structures should take place throughout the operational phase of the development.

Table 91: Significance of Issue 86 (The protection and maintenance of the existing graveyards and the incorporation of the graveyards and selected historic buildings (as memorials) as part of the development) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium © Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Neutral - Not Necessary To Mitigate ☆ / Low ■	P/C - The historic areas/ structures need to be properly demarcated so that the structures/buildings are not subject to any damage or negative impact.	L - To be included in the EMP
	O – A continuous maintenance programme should be established for these historic structures	L – To be included in the EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

87) Poor people will move into area surrounded by well-established residential areas. The people have no money and this will lead to petty crime. Petty crime eventually becomes major crime.

Should the NO-GO option be approved the entire study area will be open for illegal dumping, squatting and informal settlements. Due to the shortage of daily necessities, petty crimes will start and escalate into major crimes.

Table 92: Significance of Issue 87 (Poor people will move into area surrounded by well-established residential areas. The people have no money and this will lead to petty crime. Petty crime eventually becomes major crime) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue afte
High ⊕ Medium ⊙ Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Low/ eliminated L / I

Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M
Necessary To Mitigate 🌣	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ⊕	P - Introducing a development (such as the preferred alternative) on this open land that complements the surrounding environment will limit the chance/occurrence of petty crimes establishing in the area.	M - To be included in the EMP

Result: Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

88) Dangerous excavations

These excavation areas are dangerous to the public. The issue can be mitigated to a certain extent by putting up proper signs indicating the danger of excavations and putting temporary fencing/barricading around the excavations where possible. It is recommended that the developer does everything possible to ensure the safety of workers and the public.

Table 93: Significance of Issue 88 (Dangerous excavations) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊙ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ⊜	P/C - Although regarded as a normal practice, it is important	M - To be included in the EMP

to erect proper signs indicating the danger of the excavation in	
and around the development site. Putting temporary fencing	
around excavations where possible.	

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

89) Damage to the existing services and infrastructure during the construction phase and disruptions in services (i.e. electricity, water, damage to Telkom cables) during the construction phase.

Although short-term interruptions may occur during the construction phase, the interruptions will only be of a temporary nature. This also allows for the upgrading of services which could in the long-term, provide for a more sustainable supply.

Table 94: Significance of Issue 89 (Damage to the existing services and infrastructure during the construction phase and disruptions in services (i.e. electricity, water, damage to Telkom cables) during the construction phase) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ⊙ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/C/O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ●	P/ C – Determine areas where services will be upgraded and relocated well in advance. P/ C – Discuss possible disruptions with affected parties in the surrounding area to determine most convenient times for service disruptions and warn affected parties well in advance of dates that service	L - To be included in the EMP L - To be included in the EMP

disruptions will take place.	
C - The line of reporting should be clear and should be made available to all I&APs to avoid any unnecessary conflict between construction workers and the public.	L – To be included in the EMP
C - If a road will be temporarily closed due to construction the local community should be notified well in advance.	L - To be included in the EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

6.2.6 Institutional Environment

A development will only be sustainable if the economical, ecological, social and institutional environments are equally addressed. The Government is responsible for the compilation of legislation, policies, guidelines etc. on national, provincial and local level and the purpose of such legislation is to provide the planning tools that are required to achieve sustainable development.

South-Africa is equipped with some of the best environmental and planning related legislation and if all the relevant legislation and planning tools are taken into consideration from the outset, sustainable development will be achieved.

6.2.6.1 On an International Level

International Level- Conventions

 Convention relative to the Preservation of Fauna and Flora in their natural state, 8 November 1993 (London);

 Convention on Biological Diversity, 1995 (provided and added stimulus for a reexamining and harmonization of its activities relating to biodiversity conservation.

This convention also allows for the in-situ and ex-situ propagation of gene material);

 Agenda 21 adopted at the United Nations Conference on Environment and Development (UNCED) in 1992 (An action plan and blueprint for sustainable

development).

Although the above do not have a direct influence on the site, their provisions inform many

of the laws and spatial instruments discussed below.

6.2.6.2 On a National Level

National Legislation

The National Environmental Management Act; 1998 (Act No. 107 of 1998)

This Act addresses issues relating to environmental administration and it promotes

sustainable development. If the involved authorities do not take the principles of NEMA into

consideration when evaluating an environmental report/ document, the involved authority

can be held responsible for any damage to the environmental (social, ecological and

economical).

Implications for Development:

Not significant. The purpose of the EIA report will be to determine whether the proposed

development/development alternatives will be viable and sustainable; and to supply

suitable mitigation measures that will protect the environment during the construction and

operational phases of the development.

If "fatal flaws" are identified during the EIA process, the EAP will not recommend that the

project receive the go-ahead.

The 2010 Amended NEMA EIA Regulations

The Environmental Impact Assessment process followed is in terms of Government Notices No. R544, 545 and R546 published in the Government Gazette no. 33306 of 18 June 2010, promulgated in terms of the NEMA. Some minor amendments to the listed activities as listed in listing Notices 1, 2 and 3 came into effect on 29 November 2013 and such amendments are also taken into consideration.

The Regulations list activities that could have a detrimental impact on the environment (social, economical, institutional and ecological) and if a proposed development triggers any of the activities as listed in the Regulations, it will be necessary to follow an EIA Process. If only activities as listed in listing notices 1 and 3 are triggered, it will only be necessary to follow a Basic Assessment Process and if activities as listed in listing Notice 2 are triggered, it will be necessary to follow a full EIA process.

In the case of the proposed mixed-use development, activities as listed in listing notices 1, 2 and 3 are triggered and it will therefore be necessary to follow a full EIA process. Refer to Item 1.3 on Page 18 of this report for the listed activities that are being applied for.

A full EIA Process consists of a Scoping Process and an EIA Process. The Scoping Process for this development has already been completed and this report represents the Final EIA Report that is available for public comment for a period of 21 days. Comments regarding the Final EIA Report must be forwarded to the assessing official at GDARD. It is however recommended that the I&AP/ commenting authority also forward the comments to Bokamoso. This will enable the EAP to respond the comments and supply such comments to GDARD for purpose of the evaluation of the Final EIA.

It is however also important to take note of the fact that the 2010 NEMA EIA Regulations were replaced by the Amended 2014 NEMA EIA Regulations on 4 December 2014, but due to the fact that the application was submitted in terms of the 2010 NEMA EIA Regulations, this application will be dealt with in terms of such Regulations. Once the Decision has been issued in terms of the 2010 NEMA EIA Regulations, such Decision will be regarded as a

Decision issued in terms of the New 2014 EIA Regulations and all following procedures (i.e. Amendment Applications, Appeals etc.) must be made/submitted in terms of the 2014 NEMA EIA Regulations. Refer to Chapter 8 – Transitional Arrangements and Commencement of the 2014 NEMA EIA Regulations.

Regulation 53 (3) of the 2014 NEMA EIA Regulations furthermore states "Where an application submitted in terms of the previous NEMA EIA Regulations, is pending in relation to the activity of which a component of the same activity was not identified under the previous NEMA Notices, but is now identified in terms of Section 24 (2) of the Act, the competent authority must dispense of such application in terms of the previous NEMA regulations and <u>may</u> authorise the activity identified in terms of Section 24 (2) as if it was applied for, on condition that all impact of the newly identified activity and requirements of these Regulations have also been considered and adequately assessed."

Implications for Development:

The proposed development trigger various activities as listed in listing notices 1, 2 and 3 of the 2010 Amended NEMA EIA Regulations and therefore it will be necessary to follow a Full EIA Process. This report represents the Final EIA Report compiled for the proposed mixed-use development.

Even though the 2010 NEMA EIA Regulations were replaced by the 2014 Amended NEMA EIA Regulations, the application, which has been submitted whilst the 2010 NEMA EIA Regulations were still in effect, will be dealt with in terms of the 2010 NEMA EIA Regulations.

Once the Decision has been issued in terms of the 2010 NEMA EIA Regulations, such Decision will be regarded as a Decision issued in terms of the New 2014 EIA Regulations and all following procedures (i.e. Amendment Applications, Appeals etc.) must be made/submitted in terms of the 2014 NEMA EIA Regulations. Refer to Chapter 8 – Transitional Arrangements and Commencement of the 2014 NEMA EIA Regulations.

The National Water Act, 1998 (Act No: 36 of 1998)

In terms of Section 144 of the National Water Act it is required that the 1:50 and 1:100 year

flood line be indicated on all relevant drawings submitted as part of township approval.

The study area is affected by the Jukskei River and its tributaries and therefore a Section 21

Water Use License will be required for any development which may take place within and

/or impact any water resource.

In addition a Section 21 Water Use Licenses will be required for any construction activities or

discharge of stormwater within the 1:100 year flood lines and wetlands/ watercourses as

defined in the NWA.

Implications for Development:

A Section 21 Water-Use License application has already been compiled and submitted to

DWS for consideration. In order to promote integrated and holistic planning, DWS required

that the Draft/Final EIA be attached as part of the S21 Water-Use License application.

National Environmental Management: Air Quality (Act No. 39 of 2004) – NEM:AQA

The purpose of the Act is "To reform the law regulating air quality in order to protect the

environment by providing reasonable measures for the prevention of pollution and

ecological degradation and for securing ecologically sustainable development while

promoting justifiable economic and social development; to provide for national norms and

standards regulating air quality monitoring, management and control by all spheres of

government; for specific air quality measures; and for matters incident thereto".

Should the township include activities that are listed in the Act, a licence application will

have to be submitted to City of Johannesburg Metropolitan Municipality.

Implications for Development:

Not Significant. At this stage it is not envisaged that the proposed development will trigger any activities as listed in the Schedules attached to the NEMA:QA. It is however also important to take cognisance of the fact that this Act also Regulates Dust and Noise Pollution and sets certain standards that must be adhered to.

National Environmental Management: Waste Act (Act 59, 2008) – NEM:WA

The Waste Management Act aims to reform the law regulating waste management in order to protect the health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licensing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.

Objectives:

- To ensure sound environmental management of waste;
- To provide for the utilisation of environmentally-sound methods that maximise the utilisation of valuable resources and encourage resource conservation and recovery;
- To reduce the risk to human health and prevent the degradation of the environment; through usage of mechanisms that promote the following:
 - Pollution prevention and cleaner production;
 - Volume reduction at source;
 - Recycling, recovery and re-use;
 - Effective management of contaminated land and decommissioning of facilities;
- Set guidelines and targets for waste avoidance and volume reduction through source reduction and waste minimisation measures, including composting,

- recycling, re-use, recovery, green charcoal process, and others, before collection, treatment and disposal in appropriate and environmentally sound waste management facilities in accordance with this act;
- To ensure the proper segregation, collection, transportation, storage, treatment and disposal of waste through the formulation and adoption of the best environmental practice in ecological waste management;
- To promote national research and development programs for improved waste management and resource conservation techniques, a more effective institutional arrangement and indigenous and improved methods of cleaner production, waste reduction, re-use, collection, treatment, separation and recovery;
- To encourage greater private sector participation in waste management;
- To encourage cooperation and self-regulation among waste generators through the application of market-based instruments;
- To institutionalise public participation in the development and the implementation of national, provincial and local integrated, comprehensive, and ecological waste management programs;
- To strengthen the integration of ecological waste management and resource conservation and recovery topics into the academic curriculum of formal and non-formal education in order to promote environmental awareness and action among the citizenry; and
- To control the export, import, transit, reuse, recovery, treatment and disposal of
 waste to ensure that all operations relating to export, import, transit, reuse,
 recovery, treatment and disposal will be undertaken in an environmentally sound
 manner.

The waste act was also amended on 29 November 2013 and it now incorporates Category A, B and C wastes. The amendments were also considered during the EIA process for the proposed mixed-use development.

Implications for Development:

At this stage it is not envisaged that any activities as listed in NEM:WA will be triggered. The Contaminated Land Section of the Waste Act (Part 8 of Chapter 4) and the Contaminated Land Regulations, which came into effect in 2014, must be taken into consideration of any medical or other waste sites are discovered during the construction phase of the development.

When the National Environmental Management: Waste Act, 59 of 2008 ("NEMWA") came into operation, in July 2009, the operation Part 8 of Chapter 4 (the "Contaminated Land Provisions") was postponed to a later date. In terms of a recent government gazette, 1 the Contaminated Land Provisions came into operation on 2 May 2014.

NEMWA provides that "contaminated" in relation to land means:

"the presence in or under any land, site, buildings or structures of a substance or microorganism above the concentration that is normally present in or under that land, which substance or micro-organism directly or indirectly affects or may affect the quality of soil or the environment adversely".

The Contaminated Land Provisions apply even if the contamination occurred before the commencement of NEMWA; originated on land that has not been assessed for contamination; arises or is likely to arise at a different time from the actual activity that caused the contamination; or, arises through an act or activity of a person that results in a change to pre-existing contamination.

Among the important consequences of the operation of these provisions are the requirements for notification of contamination; consequences of identification and notification of contaminated land; and, transfer of contaminated land.

National Heritage Resources, 1999 (Act No 25 of 1999)

The National Heritage Resources Act legislates the necessity for a cultural and heritage impact assessment in areas earmarked for development, which exceed 0.5 ha. The Act makes provision for the potential destruction of existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA).

It is important to note that in terms of the National Heritage Resources Act, (Act No 25 of 1999); all historical sites and materials older than 60 years are protected. It is an offence to destroy, damage, alter or remove such objects from the original site, or excavate any such site(s) or material without a permit from the National Monuments Council. Gravesites are subject to the requirements of the National Monuments Act, No. 28 of 1969.

Implications for Development:

Due to the existence of the Sizwe Hospital buildings and old graves, a Heritage Impact Assessment needs to be undertaken. If buildings older than 60 years are to be modified or demolished, it will be necessary to obtain the necessary permits/ authorisations from SAHRA/ the delegated authorities. Even though it is not the intention to relocate any of the graves on the study area, there is a possibility of discovering separate and isolated graves that will be better preserved if relocated to the graveyard areas earmarked for conservation.

National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004)

The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment was developed.

National Spatial Biodiversity Assessment

The National Spatial biodiversity Assessment (NSBA) classifies areas worthy of protection based on its biophysical characteristics, which are ranked according to priority levels.

Specialist ecological assessments have been conducted for the study area.

Implications for Development:

Refer to Annexure A for GDARD C-Plan Maps

The Development Facilitation Act, 1995 (Act 67 of 1995)

This Act formulates a set of general principles to serve as guidelines for land development inter alia revolving around:

- The promotion of integration of the social, economic, institutional and physical aspects of land development;
- The promotion of integrated land development in rural and urban areas in support of each other;
- The promotions of the availability of residential land and employment opportunities in close proximity to or integrated with each other;
- The promotion of a combination of diverse land-uses, with each proposed land development area to be judged on its own merit and no specific use, whether residential, commercial, conservation etc., to be regarded as less important;
- Discouraging urban sprawl to promote more compact towns/ cities;
- Encouraging environmentally sound land development practices; and
- Promoting sustained protection of the environment.

Implications for Development:

The proposed development will therefore need to comply in broad terms, with the

principles of the Development Facilitation Act, 1995 in that it will balance the economic

and social needs with the need to protect the environment.

Principles contained in NEMA and the DFA

Implications for Development:

The development will need to optimise the utilisation of existing resources, including bulk

infrastructure, roads, transportation, and social facilities. The natural environment will play

an integral part in the design of the township and is a very important component of the

township establishment process. Cognisance was taken of environmental sensitivity of the

site.

Municipal Systems Act – No. 32 of 2000

This Act clearly establishes the Integrated Development Plan and Integrated Spatial

Development Framework as guidelines to inform development and processes in this

regard.

Implications for Development:

The provisions of the IDP and Spatial Development Frameworks are relevant to the

proposed development. The proposed development will be in line with the IDP and the

relevant development frameworks and plans for the area. **Refer to Annexure P** for the Town

Planning Memorandum, which motivates the proposed development in terms of the

applicable provincial and local authority frameworks, policies and plans.

6.2.6.3 On a Provincial Level

Gauteng 2050

Two of the themes of the Strategy are Equitable Growth and Sustainable Development and Infrastructure. The Strategy notes that overcoming the structural challenges that have deepened poverty and unemployment within South Africa is essential if we are to move towards a state of more equitable and inclusive growth. In targeting this objective, key priorities include focusing on ensuring more equitable ownership patterns across the economy – enabling more people within South Africa to share in the benefits and duties of economic leadership, while also promoting economic activities that support the creation of decent work for all. It is also essential that responsible business practices are encouraged, in support of environmental sustainability – while also addressing the significant development tasks ahead – and ensuring a holistic focus on the needs of all within the city-region.

Implications for Development:

Regarding Sustainable Development and Infrastructure, the Strategy provides that ongoing development must be considered in the context of environmental conservation and resource scarcity: the pressures placed on water supply and quality, air quality, the stability of our ecosystems, and the carbon-intensive nature of our technology and practices.

The proposed development attempts to balance equitable growth with environmental sustainability.

The Gauteng Spatial Development Framework (GSDF), 2011

The GSDF is premised on building Gauteng as a sustainable city region that allows agriculture to provide the link between rural and urban economic development, is shaped by infrastructure led investment, and is based on public transport specifically the railway line as the backbone of accessibility in the future. As an integrated approach to spatial development for 2055, the GSDF contributes to reducing the cost of doing business in the

GCR by indicating where resources should be spent and the nature and type of infrastructure investment that can create a more equitable society. This will allow the GCR to become more efficient in doing business by providing an enabling environment that supports economic growth through co-ordinated and structured investment spending. In this light the GSDF represents a dynamic spatial management system that is capable of setting broad-scale spatial strategic direction and, simultaneously, permitting detailed enquiry as to what this means spatially at any successive scale or level of planning.

Implications for Development:

The principles of the strategy are supported by this development.

Gauteng Transport Infrastructure Act, 2001 (Act No 8, 2001)

The purpose of this Act is to consolidate the laws relating to roads and other types of transport infrastructure in Gauteng. It provides for the planning, design, development, construction, financing, management, control, maintenance, protection and rehabilitation of provincial roads, railway lines and other transport infrastructure in Gauteng.

Implications for Development:

According to this provincial act, the proposed alignments for the Gautrans roads on the Gautrans Grid Road Network Map must be honoured by planners.

This Act is relevant to the proposed development.

Gauteng Noise Control Regulations, 1999

The Regulations control noise pollution. As a result a specialist study will be conducted to inform the EIR. This will ensure that if development proceeds, it is done in line with these Regulations.

Implications for Development:

A noise impact assessment was conducted and the layout was amended to locate the residential areas in areas with lower noise levels (levels below 55 dBA). The activities as proposed for the land-uses to form part of the development, must also take the Gauteng Noise Control Regulations into consideration, especially the prescribed noise limits for an urban environment.

The Gauteng Draft Red Data Policy

The main purpose of the draft Red Data Policy is to protect red data fauna and flora species in the Gauteng Province. This policy requires that red data species are conserved.

The specialist ecological studies will be conducted to establish the existence of and habitats for these species.

Implications for Development:

A red data species fauna and flora survey has been conducted for the study area by Galago Environmental CC. **Refer to Annexure S for Red Data Survey**

The specialists identified a few *Trachyandra erythrorrhiza* sp. in the north-eastern section of the study area and suggested that a 200m buffer be applied. The habitat in which the species were found is not an ideal habitat for the species, because the species prefer wetland/ marshy conditions and the wetland specialist confirmed that the area in which the *Trachyandra erythrorrhiza* were found cannot be classified as a wetland.

It was furthermore established that the status of the species must still be assessed (IUCN) and apparently more species were found in Gauteng than reflected on the available data basis. More than 1 000 species were apparently found on the Farm Grootfontein to the east of the Rietvlei Dam Nature Reserve and according to a botanist that grows red data species for the University of Pretoria and GDARD, he successfully managed to cultivate Trachyandra erythrorrhiza specimens through relocation and by means of seed. The

species that were planted in suitable habitats are growing and they are multiplying and producing seed on a continuous basis. Refer to Annexure Si for input supplied by specialist

Based on the above, it is suggested that the few Trachyandra erythrorrhiza spidentified on the study area be relocated to the marshy and more suitable habitats on the study area (adjacent to the drainage line). The areas adjacent to the drainage line are incorporated as open space in the development layout and the species will be protected when relocated to this conservation zone. The botanist agreed to assist the project team with the relocation of the species. The proposed project is a government project and the relocation of the species can be regarded as a pilot project.

GDARD Draft Ridges Policy

The Gauteng Draft Ridges Policy of 2001 requires classification of the various ridges in the Gauteng Province. Areas with slopes steeper than 5°/ 8,8% are regarded as ridges and the policy also applies a 200 meter buffer around the delineated ridges. No development is supported on untransformed Class 1 and 2 ridges, whilst some development proposals will be considered on Class 3 and 4 ridges.

Implications for Development:

According to the GDARD C-Plan, the study area is not affected by any ridges and therefore the Draft Ridges Policy is not applicable

Draft Policy on the Protection of Agricultural Land (2006)

The study area does not lie within any of the 7 Agricultural Hubs as determined by GDARD in 2006.

Implications for Development:

The Draft policy on the protection of Agricultural Land (2006) is not applicable to the proposed development.

The GDARD Conservation Plan (C-Plan 3) and the Bio-Diversity Requirements

Refer to Annexure A for C-Plan Maps and Refer to Annexure Ae for the GDARD Bio-Diversity

Requirements

The C-Plan is a spatial tool that, on the basis of conservation targets for the province, identifies and maps areas that are of importance to biodiversity in the province. It provides the base layer that informs the specific ecological investigations to be carried out in order to inform decision making on EIA applications.

Implications for Development:

The ecological investigations that were conducted for the study area took the C-Plan data into consideration. The sensitivity mapping that was done after the completion of the surveys was based on the buffer requirements and guidelines as supplied in the Gauteng Bio-Diversity Requirements (Version 3).

6.2.6.4 On a Local Level

The Local Government Ordinance, 1939 (Ordinance 17 of 1939)

Section 152(1) of the Ordinance states that the objectives of the Local Government and as per those of the City of Johannesburg Metropolitan Municipality are interalia, to ensure the provision of services to communities in a sustainable manner. The proposed development will comply with this.

Implications for Development:

The capital costs for the proposed development will essentially be the responsibility of the developer. Relative to this, however, lies an obligation on the local authority to support proposals in its interest (expansion of its tax base) as well as those in the interest of the community (investment and ensuring sustainability of development over time).

City of Johannesburg Metropolitan Municipality's Growth Management Strategy GMS)

The GMS prescribes where, and under what conditions, growth can be accommodated. The future growth of the City must ensure that population and economic growth is supported by complimentary services and infrastructure whilst also meeting spatial and socio-economic objectives. The two key objectives of the strategy are to:

- Determine priority areas for short-medium term investment and allocation of a) future development rights.
- b) Re-direct the respective capital investment programmes of the City's service providers to address the short-term hotspots and strategic priority areas.

The GMS sets high, medium and low priority areas across the City and describes specific interventions. The list below provides a summary of the other seven Development Strategies of the sub-region:

- Supporting an efficient movement system;
- Ensuring strong viable nodes;
- Supporting sustainable environmental management;
- Initiating and implementing corridor development;
- Managing urban growth and delineating an urban development boundary;
- Increased densification of strategic locations; and
- Facilitating sustainable housing environments in appropriate locations.

Implications for Development:

The proposed development supports the objectives of the GSM.

City of Johannesburg Integrated Development Plan (IDP) 2012/16

The Johannesburg IDP is a short-long-term planning tool which provides space for the development of the municipality in an integrated and coordinated manner. The policy envisions a city that is resilient, sustainable and liveable. This is to be achieved through

various developmental strategies including the Spatial Development Frameworks. The spatial development strategies and how the development will encourage these are discussed below:

- Supporting an efficient movement system: a road network that encourages efficient
 movement within the development and connects with the larger region is proposed.
 The development will also cater for multi-modal transportation that supports public
 transport, pedestrian and cycling infrastructure.
- **Ensuring strong viable nodes**: The development will incorporate various activities within close proximity to each other. The various activities within the development will make it efficient and sustainable, thus making it a strong viable node in the city.
- Supporting sustainable environmental management: The natural landscapes will be a fundamental theme in the development as the vast majority of open space in the site will be utilised for recreational activities. Emphasis will be placed on public space, pedestrian environment, public parks and protection of biodiversity areas.
- Initiating and implementing corridor development: The proposed development is located along the Modderfontein road and Linksfield drive which have been classified as Mobility Roads. The proposed development will encourage economic activity along these corridors.
- **Increased densification of strategic locations**: The Linksfield mixed land use development will have higher densities and clustered activities which will coordinate investment infrastructure and encourage densification in the area.
- **Facilitating sustainable housing environments in appropriate locations**: The development will offer a variety of housing topologies catering for different income groups and conserve the natural landscape of the site.

Implications for Development:

From the above, the proposed development is in line with the development principles of the spatial development for the city. The development will be sustainable and will contribute towards achieving the vision of the city.

Johannesburg Regional Spatial Development Framework

Although the Draft RSDF emphasises open spaces and medical facilities for the site, it also identifies certain interventions including the following:

- Support affordable residential development within the Sub Area;
- Contain the neighbourhood nodes in the Sub Area;
- Modderfontein Road has been identified as a Mobility Spine;
- Protect the quality and integrity of the environment.

Implications for Development:

The proposed development responds to some of the intervention requirements identified in the RSDF.

6.2.6.5 Issues & Impacts Identification – Institutional

Table 95: Issues and Impacts – Institutional

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High Medium Low Positive Impact - Not Necessary To Mitigate
91)	The proposed development will be in line with the international, national, provincial and local legislation, planning frameworks, guidelines, policies etc.	+	‡
92)	The proposed development will trigger activities as listed in Section 21 of the National Water Act. A Section 21 Water-Use License application must be	+/-	‡

	submitted to DWS for activities in terms of Section		
	(c) and (i).		
93)	In terms of Section 144 of the National Water Act	+/-	\$
	the 1:100 year flood line must be indicated on all		
	planning drawings. A Section 21 Water-Use		
	License will also be required if structures are		
	erected/ if filling or cutting exercises are planned		
	for the areas below the flood line.		
94)	The proposed development will be within the	+	‡
	urban development boundary		
95)	The proposed development will be regarded as	+	\$
	infill development and it will prevent urban sprawl		
96)	The proposed development will supply much	+	\$
	needed housing to be delivered by the		
	government in order to achieve housing targets		
97)	The proposed development will be in line with the	+	‡
	Gauteng Densification Strategy		

When looking at the institutional environment, it is important that legislation relevant to all environments (economical, ecological and social) be taken into consideration.

- From an ecological point of view the primary grasslands and wetland areas must be taken into consideration and legislation and policies that protects the involved resources must also be taken into consideration;
- From a social and economic point of view the study area is ideally situated for a mixed use development in line with the land-uses of the surrounding environment.

 Numerous legislation documents, development frameworks, the IDP and policies promote development on and around the study area.

6.2.7 Qualitative Environment

6.2.7.1 Visual Analysis

Refer To Figure 18 for Visual Analysis and Refer To Figure 19 to 22 For 3d Illustrations Of The Topography Of The Study Area. Please refer to Annexure Ri for the Visual Impact Assessment. Also Refer to Annexure Av for the Architect's Artist Impressions of the proposed residential structures in the North-Eastern corner of the study area. Annexure Au also includes perspectives and bird's eye view architectural concepts for the proposed development.

The study area is regarded as strategically located from a visibility and accessibility point of view and the site was specifically selected for its high visibility from the surrounding environment. The study area comprises of an undulating landscape with the site's highest point of \pm 1615m above sea level in the south-western corner. The site mainly slopes towards the Jukskei River, which enters the study area at the eastern boundary and exits the study area in the north-west.

In the vicinity of the Linksfield Road/ N3 interchange, the study area is very visible from the N3 Freeway, but the visibility becomes less when one moves along the N3 towards the north, because the vertical alignment of the N3 suddenly cuts off with embankments on both sides of the freeway. Apart from the fact that the embankments act as a visual screen it also assists with the reduction of noise levels across the study area. Signage boards and buildings adjacent to the freeway that requires maximum exposure must take the height of the embankment into consideration.

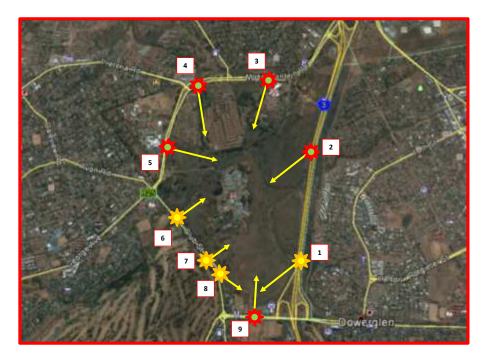


Figure 18: Visibility of the Linksfield Study Area

Direction of Photograph

High Visibility

Low Visibility

Figure 18 – Visual Analysis Map

From Modderfontein Road, which runs in a west-east direction to the north of the study area, the visibility of the study area is very low. The topography which slopes towards and then away from Modderfontein Road, the Edenvale Hospital, the Rand Aid Development and the riparian vegetation along the Jukskei river act as effective visual screens. The visual impacts of the proposed development on the properties to the north of Modderfontein Road will be low.

The study area is very visible from certain view sheds on the Rand Aid study area. The open space area along the Jukskei River will however act as a visual buffer between the Rand Aid Development and the proposed mixed-use development. The architectural theme, finishings and layout of the proposed new mixed-use development must take the view from the Rand Aid residential development into consideration and the tranquil atmosphere and "Sense of Place" experienced along the river must be enhanced.

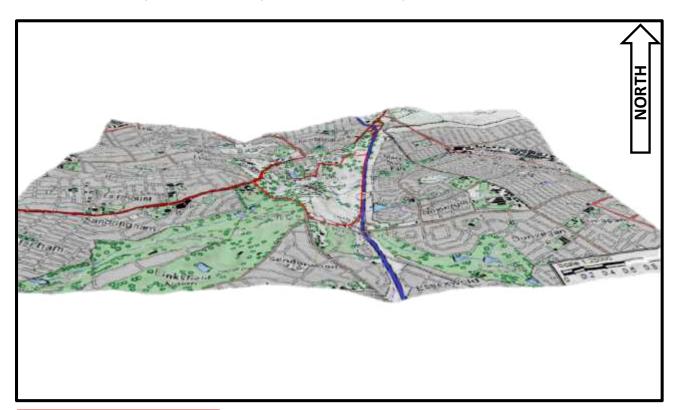


Figure 19 – 3D Illustration 1

The open space along the northern boundary, which will act as a visual screen is currently only associated with the watercourses on the study area and it does not extend far enough along the northern boundary of the study area to screen the north-western corner of the development (some of the higher density residential units will be constructed in this area). During the focus group meeting at Rand Aid it was requested that the applicant extend the "green buffer" along the northern boundary, even though there is no watercourse present in this area. The applicant undertook to consider the extension of the "green buffer".

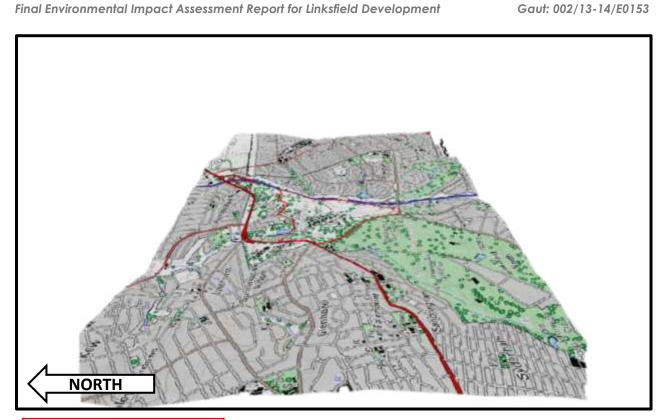


Figure 20 – 3D Illustration 2

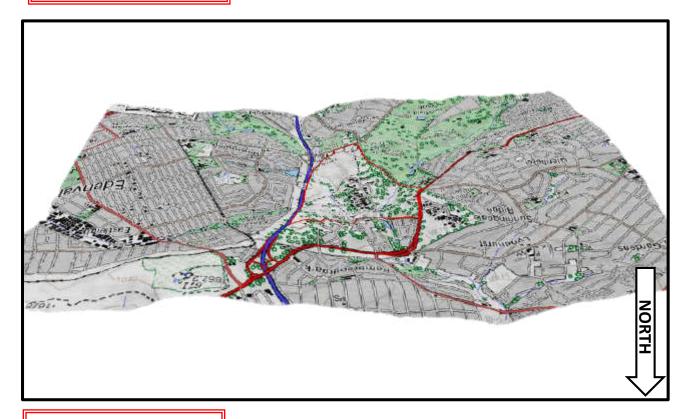
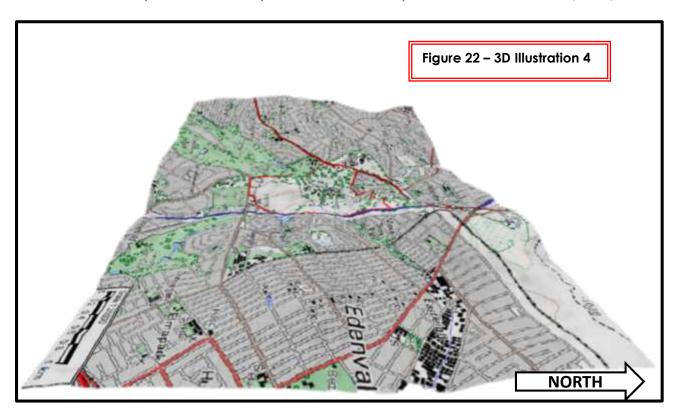


Figure 21 – 3D Illustration 3



The study area is very visible from the west (Modderfontein Road and Club Road) and land-uses that require maximum exposure, will benefit from such exposure if located along the western boundary of the study area.

The study area is not very visible from the south and therefore the visual impacts on the properties located to the south of the study area will be low. The conclusion of the Visual Impact Assessment by Zone Land Solutions is that the proposed development will have a low negative impact from Key Observations Points identified in the foreground (<1km), without mitigation, and a low positive impact if the mitigation measures are implemented.

Implications for Development:

- The visibility of the study area from the N3, Club Avenue and sections of Modderfontein Road is regarded as an opportunity. The land-uses that require maximum exposure must be situated in the areas that are most visible;
- The screening effect of the embankment along the N3, which screens portions of the study area must be taken into consideration when planning developments

- along the N3. Higher buildings and elevated advertisement boards might be required adjacent to the embankment in order to make such structures visible;
- The study area will be visible from the Rand Aid Development and therefore the architectural theme, finishings and layout of the proposed new mixed-use development must take the view from the Rand Aid residential development into consideration and the tranquil atmosphere and "Sense of Place" experienced along the river must be enhanced;
- The proposed development will blend in tastefully with the surrounding urban fibre and the proposed land-uses for the study area will be in line with the surrounding land-uses:
- Extend the "green buffer" along the northern boundary of the study area to the west in order to act as visual screen and to improve security. Layout must be amended; and
- Buildings and structures must be in line with regional policy documents, especially the principles of critical regionalism, which guide planning and design, namely Sense of Place, Sense of History, Sense of Craft, Sense of Nature and Sense of Limits.

6.2.7.2 Sense of Place

A sense of place is the subjective feeling a person gets about a place by experiencing the place visually, physically, socially and emotionally. The "Sense of Place" of an area is one of the major contributors to the "Image of the area". The main "Sense of Place" creators include the area adjacent to the river and the cultural & historical features on and around the study area. The sense of place attributes an intrinsic value of the project site and has to a large degree, further been negatively impacted upon by the introduction of large-scale infrastructure in the region and the other competing land uses on the project site.

The study area is situated in an attractive setting and has a unique "Sense of Place". The historical features, the tranquil atmosphere adjacent to the river and the attractive views from the north-western corner of the study area are regarded as the main contributors to the "Sense of Place" of the study area. The existing stigma associated with possible disease

outbreaks (mainly due to limited knowledge about the diseases that were treated at the Sizwe Hospital), the graves on the study and the security risks associated with the vacant portion of land has a negative impact on the "Sense of Place" and atmosphere experienced on the study area. At this stage people prefer to avoid the study area and to place it in "quarantine".

Implications for Development:

- If well planned, developed and managed, the proposed development could enhance the "Sense of Place" of the study area;
- Scientific facts about the diseases that were treated at the hospital will eliminate the uncertainty that hangs over the study area;
- The specialists that were appointed to determine the health risks associated with the development of the study area confirmed that the risks of getting infected are none to low. In fact the specialists are of the opinion that it will be better to develop the study area

6.2.7.2a Issues & Impacts Identification – Sense of Place and Visual

Table 96: Issues and Impacts – Sense of Place and Visual

	Issue/ Impact	Positive/	Mitigation
		Negative/	Possibilities
		Neutral ±	High Medium Low Positive Impact/Neutral - Not Necessary To
			Mitigate 🌣
98)	The visibility of the study area creates an opportunity for maximum exposure	+	☼
99)	The embankment adjacent to the N3 freeway will screen some of the developments to be situated	+	‡

	adjacent to the freeway. The designs of the		
	structures to be placed adjacent to the		
	embankment must take the height and impact of		
	the embankment into consideration.		
100)	The views from the north-western corner of the	+	₩
	study area are attractive and should be utilised in		
	the development		
101)	Two of the graveyards are situated adjacent to	-	•
	Club Street are visible.		
102)	The proposed development will be visible from	-	•
	the Rand Aid Development. Lower income group		
	housing could have a negative impact on the		
	property values.		
103)	The proposed development could have a	-	©
	negative impact on the "Sense of Place" created		
	adjacent to the river.		

6.2.7.2b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

101) Two of the graveyards are situated adjacent to Club Street are visible.

To reduce any negative visibility of graveyards on the site, specifically the two visible from Club Street, mitigation measures need to be implemented. The graveyards must be renovated and a memorial in remembrance of the patients that were buried on the study area must be erected in the graveyard. The elements and/or some of the finishings used for the memorial can be repeated at focal areas throughout the development.

Table 97: Significance of Issue 101 (Two of the graveyards are situated adjacent to Club Street are visible) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Iss		Issue	after
	Already achieved $\sqrt{}$	mitigation			

High ■ Medium □ Low ■	Must be implemented during	Low/ eliminated L / E		
Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M		
Necessary To Mitigate 🌣	and/ or Operational phase	High <mark>H</mark>		
	P/C/O Mitigation	Not possible to mitigate,		
		but not regarded as a fatal		
		flaw NP		
High ●	P/C - The graveyards must be renovated and a memorial in remembrance of the patients that were buried on the study area must be erected in the graveyard. The elements and/or some of the finishings used for the memorial can be repeated at focal areas throughout the development.	L - To be included in the EMP		

102) The proposed development will be visible from the Rand Aid Development. Lower income housing could have a negative impact on the property values.

As the site is visible to surrounding residential areas it would have a negative impact should low-cost housing be developed on such a visible area. However, the preferred alternative is not low-cost housing.

Table 98: Significance of Issue 102 (The proposed development will be visible from the Rand Aid Development. Low cost housing could have a negative impact on the property values.)

After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ⊙ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E
Necessary To Mitigate ☼	Planning phase, Construction	Medium M
	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,

		but not regarded as a fatal
		flaw NP
High ●	P – Introducing a development (such as the preferred alternative) on this open land that complements the surrounding environment will not have a negative impact on property values. The proposed development is not low-cost housing.	M – To be included in the EMP

103) The proposed development could have a negative impact on the "Sense of Place" created adjacent to the river.

The proposed development is designed with integrity and style and is planned to fit in with the surrounding environment and preserve the river system by managing it as open spaces.

Table 99: Significance of Issue 103 (The proposed development could have a negative impact on the "Sense of Place" created adjacent to the river) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊙ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/C/O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Medium 💿	P – The proposed development should be designed and planned in such a way that it fits in with the surrounding environment.	

P - Plan vegetated and landscaped areas along the N2 to minimise visual impacts onto the site.	M - To be included in the EMP
P/C - Design buildings to reflect the local architecture and sense of place of the region.	M – To be included in the EMP
C - Appropriate barriers should, where possible, be erected around the construction site to prevent unnecessary visual and noise pollution/	M - To be included in the EMP

6.2.7.3 Acoustical Environment

Bokamoso appointed Enviro-Acoustic Research (EARES) to determine the potential noise impact on the proposed Linksfield mixed-use development, mainly due to the busy roads (i.e. the N3 freeway) that surround the study area. As per SANS 10328:2008 'Methods for environmental noise impact assessments', a future scenario should be under investigation (e.g. 15 years from initial development implementation), because traffic noise levels escalate when traffic counts increase.

The following rating levels are proposed for receptors in the study area:

- The International Finance Corporation (IFC) (Equator principal) with a 55 and 45 dBA day/night time rating level for receptors; and
- Urban with a main road for the Zone Sound Levels (SANS Rating Levels) of 60 dBA for days and 50 dBA for nights.

The project team provided the acoustic engineer with a preliminary layout for the proposed development and requested that the acoustical engineer confirm whether the proposed land-uses, especially the proposed residential areas, will be situated in areas with acceptable noise levels (within the 55dBA noise limit).

The first acoustical report indicated that the proposed residential area in the south-eastern corner of the study area will be subject to noise levels that are higher than the accepted standards. The acoustical engineer recommended that the residential area rather be relocated to another area, further away from the freeway and that another land-use that is more compatible with higher noise levels (i.e. offices, commercial, light industrial) be placed in the area adjacent to the busy freeway.

The project team agreed with the recommendations of the acoustical engineer and amended the layout plan accordingly. The amended layout was provided to the acoustic engineer and he confirmed that the IFC Guidelines levels as well as SANS Rating Level for residential areas will not be exceeded. The risk is very low and the significance of the noise impact would be low. This is due to the residential areas located further away from the N3 and the buildings located between the road and the residential area will act as a barrier to the noise.

The noise generated by the development activities during the construction and operational phases were also considered.

The following represent a summary of the mitigation measures to be implemented during the construction and operational phase to reduce the anticipated impact of noise pollution. **Refer to Annexure Af, EMP.**

Implications for Development:

Mitigation measures for the anticipated noise impact during the construction phase:

- The construction site yard, workshop, concrete batching plant and other noisy fixed facilities should be located well away from noise sensitive areas;
- All construction vehicles, plant and equipment are to be kept in good repair;
- o Truck traffic should be routed away from noise sensitive areas where possible;
- Construction activities are to be contained to reasonable hours during the day and early evenings. Night-time activities near noise sensitive areas should

not be allowed. No construction should be allowed on weekends from 14h00 on Saturday afternoons to 06h00 the following Monday morning;

Gaut: 002/13-14/E0153

- With regards to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents on how best to minimise impact, and the local population should be kept informed of the nature and duration of intended activities;
- As construction workers operated in a very noisy environment, it must be ensured that their working conditions comply with the requirements of the Occupational Health and Safety Act (Act No 85 of 1993). Where necessary ear protection gear should be worn.

Mitigation measures for the anticipated noise impact during the operational phase of the proposed development

The following noise specific mitigation measures will need to be considered:

- o The residential area should preferably be developed away from all main routes;
- The industrial and business areas should be used as a noise buffer for the proposed residential areas; and
- If high quality air-conditioning equipment should be installed. Equipment with the best noise rating should be used.

6.2.7.3a Issues & Impacts Identification – Acoustical Environment

Table 100: Issues and Impacts – Acoustical Environment

Issue/ Impact	Positive/	Mitigation
	Negative/	Possibilities
	Neutral ±	High Medium
		Low
		Positive Impact/
		Neutral - Not
		Necessary To

			Mitigate 🌣
104)	Noise associated with the construction yard	-	©
	during the construction phase		
105)	Construction noise after hours and during	-	•
	weekends		
106)	The views from the north-western corner of the	+	₩
	study area are attractive and should be utilised in		
	the development		
107)	Health implications of construction workers that	-	0
	work in noisy environments		
108)	Noise levels in residential areas exceed the	-	•
	acceptable noise levels		
109)	Noise created by kitchen and air conditioning	-	©
	equipment		

6.2.7.3b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

104) Noise associated with the construction yard during the construction phase

Noise related to the construction yard specifically will not be tremendously loud and it is important to remember that this will be of short term. This could however be mitigated by only allowing construction during working hours and no construction on Sundays.

Table 101: Significance of Issue 104 (Noise associated with the construction yard during the construction phase) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ○ Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M
Necessary To Mitigate 🌣	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
		but not regarded as a fatal

		flaw NP
Low 6	C – Site workers must comply with the Provincial noise requirements as outlined.	M - To be included in the EMP
	C – Noise activities shall only take place during working hours.	M - To be included in the EMP

Result:

Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

105) Construction noise after hours and during weekends

Construction activities will always increase the local noise levels but it is important to note that it is only for the construction phase and is thus of short term.

Table 102: Significance of Issue 105 (Construction noise after hours and during weekends)

After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after	
High ● Medium © Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/C/O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP	
High ●	 C - Site workers must comply with the Provincial noise requirements as outlined. C - Noise activities shall only take place during working hours. 	M - To be included in the EMP M - To be included in the EMP	

Result:

Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

107) Health implications of construction workers that work in noisy environments

The health implications posed on site workers due to high noise levels are serious and therefore the noise levels of the development should be properly managed and maintained at the legal threshold.

Table 103: Significance of Issue 107 (Health implications of construction workers that work in noisy environments) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ○ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Low ®	C – Site workers must comply with the Provincial noise requirements as outlined in order to keep the noise levels to the required level.	M - To be included in the EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

108) Noise levels in residential areas exceed the acceptable noise levels

Construction activities will always increase the local noise levels but it is important to note that it is only for the construction phase and is thus of short term. The surrounding residential areas will have a local noise increase for this short phase.

Table 104: Significance of Issue 108 (Noise levels in residential areas exceed the acceptable noise levels) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance	of	Issue	after
		mitigation			

High ● Medium ○ Low ■	Already achieved $\sqrt{}$	Low/ eliminated L / E		
Positive Impact/ Neutral - Not	Must be implemented during	Medium M		
Necessary To Mitigate ☆	Planning phase, Construction	High H		
	and/ or Operational phase	Not possible to mitigate,		
	P/C/O Mitigation	but not regarded as a fatal		
		flaw NP		
High ⊕	C - Site workers must comply with the Provincial noise requirements as outlined.	M - To be included in the EMP		
	C - Noise activities shall only take place during working hours.	M - To be included in the EMP		
	C - Appropriate barriers should, where possible, be erected around the construction site to prevent unnecessary visual and noise pollution.	M - To be included in the EMP		

109) Noise created by kitchen and air conditioning equipment

The noise created by kitchen appliances and air conditioning equipment is considered to be very low.

Table105: Significance of Issue 109 (Noise created by kitchen and air conditioning equipment) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after	
High ● Medium ○ Low ■	Already achieved $\sqrt{}$	mitigation	
	Must be implemented during	Low/ eliminated L / E	
Positive Impact/ Neutral - Not Necessary To Mitigate 🌣	Planning phase, Construction	Medium M	
Necessary to miligate 🖈	and/ or Operational phase	High H	
	P/C/O Mitigation	Not possible to mitigate,	
		but not regarded as a fatal	

		flaw NP
Medium 😏	O – It is encouraged that the equipment installed or bought for the new houses and other buildings should have the technology that allows for low noise levels.	L – To be included in the EMP

6.2.7.4 Light Pollution

Due to the fact that the proposed development will be a mixed-use development, with different land-uses, the lighting requirements of the different land-use zones will also differ.

The lighting adjacent to the freeway and Club Street will be designed to attract the attention of people passing by and the lighting to be provided in the residential areas and in the open space areas will be more subtle with low glaring qualities.

Street and security lighting must be designed in order not to spread light into the eyes of oncoming traffic on the proposed main routes. Internal streets and security lighting should also be designed not to disturb residents at night. Light beams must face downwards and not higher than a 45 degree angle from the ground. **Refer to Annexure Af, EMP.**

Table 106: Issues and Impacts – Lighting Pollution

	Issue/Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High Medium Low Positive Impact - Not Necessary To Mitigate
110)	If not planned and managed correctly the lights	•	•

(interior and exterior) and the signage of the	
development could cause visual pollution	

6.2.7.4a Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

110) If not planned and managed correctly the lights (interior and exterior) and the signage of the development could cause visual pollution

Noise related to the construction yard specifically will not be tremendously loud and it is important to remember that this will be of short term. This could however be mitigated by only allowing construction during working hours and no construction on Sundays.

Table 107: Significance of Issue 110 (Noise associated with the construction yard during the construction phase) After Mitigation/ Addressing of the Issue

Mitigation Possibilities High Medium Low Positive Impact/ Neutral - Not Necessary To Mitigate	Mitigation Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	Significance of Issue after mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate,	
		but not regarded as a fatal flaw NP	
High ⊕	P/ C/ O – The lighting of the proposed development should be designed and planned in such a way that it fits in with the surrounding environment and does not inconvenience surrounding residents.		

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

6.2.7.5 Air Quality / Dust

Some dust pollution may occur during the construction phase if dry and windy conditions occur, but will only be temporary and will not occur during the operational phase.

6.2.7.5a Issues & Impacts Identification – Air Quality / Dust

Table 108: Issues and Impacts – Air Quality / Dust

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High Medium Low Positive Impact - Not Necessary To Mitigate
111)	Dust pollution is regarded as a major issue. I&APs are of the opinion that anthrax spores in the dust can be inhaled and cause disease outbreaks.	-	❸
112)	If dry and windy conditions occur during the construction phase, dust pollution could become a problem	_	•

Air Quality / Lighting Pollution Related issues raised by the I&APs

The following three comments below was received from the I&APs amongst others.

Table 109: Comments of the I&AP's regarding Lighting Pollution and Air Quality

Issue:	I&AP	Issues Addressed in Report √/X
This is an extract applicable to light pollution from Ray Swanepoel's comment:	Ray Swanepoel rsconsult@vodamail.co.za	√
Effect and design of artificial lighting.		Refer to issue 110, Page 311
There is a considerable body of research regarding the effect of		

artificial light on human health. Given the government's (local and provincial) tendency as well as the wastage of energy involved in lighting systems to light "affordable housing" areas by using floodlights on high poles and the subsequent spillage of light into neighbouring areas, please report on the expected health impact of all lighting to be used in the development and how this will be mitigated. Light pollution is a serious consideration and must be avoided.		
I am raising an objection to the Sizwe	Hilton Kramer	
development.	<u>Hilton@buymango.co.za</u>	$\sqrt{}$
I have a family member who lives in close proximity who is critically ill and will not be able to survive the effect of the building process, in terms of dust and potential diseases.		Refer to issue 112, Page 313
I am willing to take legal class action against the developers if this development goes ahead. I also believe that this development places many people's lives at risk.		
I am sending this email as a petition to the digging up of the grave site so the	Vic Alley vicalley@gmail.com	V
township development take place. Graves like these may contain various bacteria that once disturbed may be carried by winds etcetera and be reintroduced into the population giving rise to illness and disease. Opening these graves sites could be disastrous to our health.		Refer to issue 111, Page 314

6.2.7.5b Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

111) Dust pollution is regarded as a major issue. I&APs are of the opinion that anthrax spores in the dust can be inhaled and cause disease outbreaks

Dust pollution is always an issue during construction but can be mitigated by the spraying of water over soil surfaces where heavy vehicles drive. The issue regarding the inhalation of

anthrax spores in dust and the presence of anthrax spores on the site have been discussed in Section 6.2.2. and cannot be mitigated.

Table 110: Significance of Issue 111 (Dust pollution is regarded as a major issue. I&APs are of the opinion that anthrax spores in the dust can be inhaled and cause disease outbreaks)

After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium © Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate	Already achieved √ Must be implemented during Planning phase, Construction and/ or Operational phase P/ C / O Mitigation	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ●	P/ C – All soil surfaces where dust is easily generated need to be sprayed with water daily to suppress dust.	M - To be included in the EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined/ confirmed assessed in the Significance Rating Table

112) If dry and windy conditions occur during the construction phase, dust pollution could become a problem

Dust pollution is always an issue during construction but can be mitigated by the spraying of water over soil surfaces where heavy vehicles drive.

Table 111: Significance of Issue 112 (If dry and windy conditions occur during the construction phase, dust pollution could become a problem) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance	of	Issue	afte	∋r
High ⊕ Medium ⊕ Low ■	Already achieved $\sqrt{}$	mitigation				
	Must be implemented during	Low/ elimin	ated	L	/	E

Positive Impact/ Neutral - Not	Planning phase, Construction	Medium M
Necessary To Mitigate 🌣	and/ or Operational phase	High H
	P/C/O Mitigation	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ⊕	P/C – All soil surfaces where dust is easily generated need to be sprayed with water daily to supress dust.	M - To be included in the EMP

6.2.8 Services

WSP SA Civil and Structural Engineers were appointed by the applicant to investigate water and sanitation infrastructure options and to compile an engineering services design report for the proposed Linksfield Mixed Use development.

Please refer to Annexure Ag for Bulk Services Report.

6.2.8.a Water

The Linksfield development water utilization will have an impact on the existing bulk infrastructure system. In order to quantify this impact GLS Consulting was approached for technical advice.

A certain amount of pressure is exerted on the regional bulk water supply scheme with every new development. Thus it is expected that each developer contributes to the upgrading of the external bulk water supply infrastructure in relation to the volume of water consumed. The bulk contribution is calculated by the Local Authority.

Water Demand:

The average daily water demand for the full development is projected at 9900m³/d. The instantaneous demand however is recommended to be four times higher (peak factor of

4) than the daily average would advocate. The instantaneous demand, therefore translates to **458 l/s**. The instantaneous demand is a key parameter in the hydraulic assessment of the development's impact on the existing water transfer infrastructure.

Proposed New And Upgraded Water Infrastructure:

The GLS Report confirmed that it will be necessary to upgrade and expand the current bulk water transfer system. It will be necessary to install a new 600mm pipe and PRV and this pipe will then be connected to the existing 750mm pipeline, which runs from the Linksfield Reservoir. The proposed pipeline will be parallel to the northern side of Club Street between Grant Road and a point approximately 225m measured along Club Street from the intersection with Linksfield Road. The length of the new pipeline section is approximately 2030m.

Even though the 750mm Ø pipeline from the Linksfield reservoir has capacity to accommodate both the Linksfield and Huddle Park developments, it is recommended that it be replaced with a 1000mm Ø pipeline. Future velocities will ultimately exceed 3m/s and the pipeline has a limited remaining useful lifespan. The required length of the pipeline upgrade is approximately 970m.

The proposed upgrades to the bulk water reticulation system will be done on behalf of the local authority. The local authority will be the owner of the pipeline and it will also be possible for other developments to connect to this system.

The internal water reticulation pipe network will be installed inside and on the high side of road reserve as a rule. There is no requirement for water pipeline servitudes.

Implications for Development:

The proposed upgradings to the existing bulk water reticulation system and the proposed new water pipe to be installed along Club Street, will trigger activities as listed in Listing Notice 1 of the 2010 Amended NEMA EIA Regulations. A separate Basic Assessment

application for the upgrading of the water infrastructure has been submitted to GDARD, on behalf of the local authority for the required water infrastructure upgrades. The local authority will take ownership of the water services upgrades and will also be responsible for the maintenance additions to the existing network. The entire area will benefit from the proposed and much needed upgradings and expansions to the existing bulk water reticulation system.

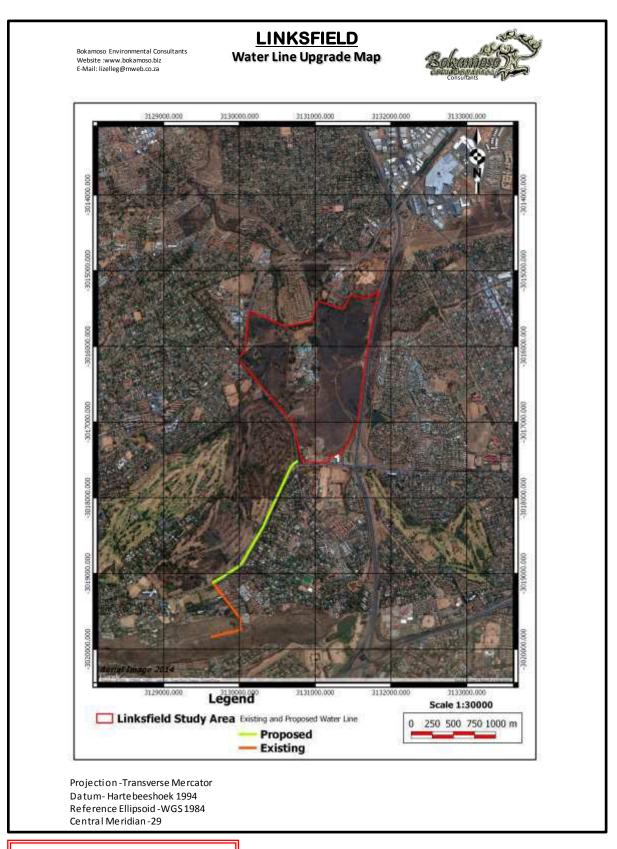


Figure 23 – Water Line Upgrade

6.2.8.b Sewer Drainage Scheme

The Bruma Outfall sewer has limited space capacity available to accommodate the sewage generated by the proposed Linksfield development. Capacity will however be sufficient once the diversion of the Illiondale pump station to the Modderfontein outfall has been completed. The construction is currently in process. Bulk contributions will be payable and are calculated by the Local Authority.

Sewer Generation

An assessment of the average peak daily dry weather sewer flow for the proposed development was done by GLS consulting. The estimate is based on sewer production rates as prescribed by JW, and is estimated at 6930m³/d.

The positioning of the sewer drainage pipelines will be dictated to a large extent by the topography of the site. Sewer servitudes will be required wherever mid-block sewer drainage pipes and sewer drainage pipes inside road reserves are not sufficient to drain the site.

Implications for Development:

- Sewer servitudes will be required wherever mid-block sewer drainage pipes and sewer drainage pipes inside road reserves are not sufficient to drain the site;
- According to the available information the proposed sewer line upgrades will not trigger any activities as listed in the 2010 Amended NEMA EIA Regulations.

6.2.8.c Storm water management

A Storm Water Master Plan for the proposed Linksfield Mixed use development was compiled by WSP Group Africa (Pty) Ltd (refer to Annexure Ah for the Storm Water Management Report).

Development runoff

The surface runoff for a 1:5 year recurrence period storm was used as a basis for the storm water master plan. The peak flow increase from a pre-development rate of 8.3 m³/s within

43 minutes to a post development rate of 25.2 m³/s within 26 minutes. A detainment of **29 989 m³** is required to offset the increased storm water to be generated by the proposed development.

The runoff of two catchments joins the Jukskei River on the proposed development site. The site layout and topography allows for the provision of retention facilities that would offset the effect of the increased runoff coefficient of the proposed development.

The hydrological implications of the development on the stormwater runoff in the Jukskei River are as follows: 1:25 year recurrence period peak flow increases from a predevelopment 16.7 m³/s in 42 minute to 48.3 m³/s in 21 minutes. A detainment of **48 820** m³ is required to offset the increase in storm water generation form the proposed development.

Several storm water servitudes will be required for the construction of the storm water systems. The servitudes will be registered in favour of the entities responsible for maintenance of the infrastructure.

Implications for Development:

- The layout and topography allows for the provision of retention facilities that would offset the effect of the increased runoff coefficient of the development;
- There are hydrological implications such as 1:5 year recurrence period peak flow increase from a pre-development of 8.3 m³/s within 43 minutes to 25.2 m³/s within 26 minutes.

6.2.8.d Electricity

Refer to Annexure Ai for the electrical study

The bulk electricity supply to the proposed Linksfield development will be from an existing bulk electricity network in the proposed development area which is both underground and overhead. The estimated electrical power requirement is 40MVA. The development falls under City Power's jurisdiction.

The followings were indicated by the City Power:

 There should be sufficient capacity to supply the proposed development from their underground 11kV network;

 There might be a need to supply the development from several 11kV circuits in order to meet the total load. (If this becomes necessary then the development would have to construct the required switching station to City Power's specification and standards)

 City Power will consider a metering system for the entire development at the single bulk supply point.

On the basis of taking away the large heating loads the following alternative sources of energy was presented:

Solar Water Heating

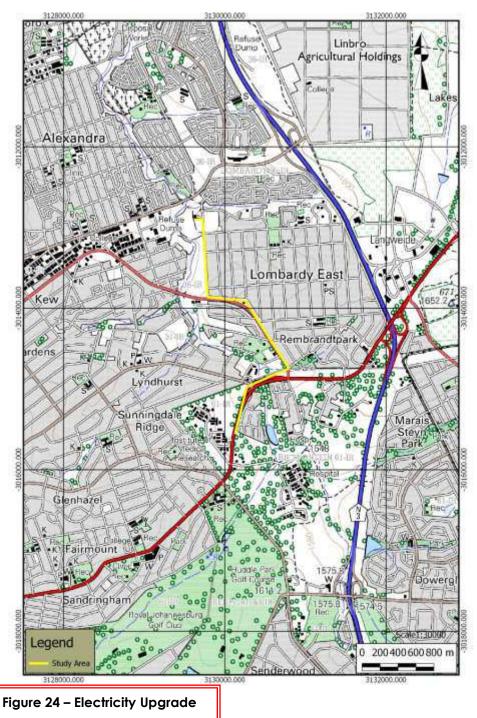
The low pressure water heating systems will be installed in the residential units without any electrical back-up, and also utilized as much as possible in the commercial and mixed-use portions of the development.

Solar lighting

Solar PV panels will be installed to generate as much green electricity for the development as possible. Street lights using pole mounted PV modules as well as energy efficient LED lamps will be used for the development.

Natural Gas

It is proposed that the commercial, institutional, and mixed-use portions of the development will include a natural gas network to allow the distribution of natural gas to every unit. The natural gas will be used primarily for heating and cooking, resulting in a substantial reduction of peak electrical demand.



Implications for the Development:

The proposed upgradings to the existing electrical supply for the mixed-use development, will trigger activities as listed in Listing Notice 1 of the 2010 Amended NEMA EIA Regulations. A separate Basic Assessment application for

the proposed upgradings has been submitted to the delegated authority, on behalf of City Power. City Power will be responsible for the upgrades and will also be responsible for the maintenance of the upgradings. The entire area will benefit from the proposed electricity upgradings.

6.2.8. e Traffic

Refer to Annexure Aj for the Traffic Study Report

WSP Group Africa (Pty) Ltd was appointed to undertake a traffic study for the proposed Linksfield Mixed use development. The development will consist of a combination of the following land uses: Shopping centre, Retail/ Shopping centre, Offices, Warehouse, Hotel, Institutional, and Residential.

The surrounding road network system includes the following roads:

- N3 Eastern bypass freeway
- Modderfontein road
- Linksfield Road
- London Road
- Club Street(M30)
- Pretoria Road;
- George Avenue;
- Swemmer Road; and
- Worldsworth Road

The proposed mixed-use development will generate approximately 9 000 - 10 000 vehicle trips (during a typical AM and PM peak hour) respectively and will therefore require major road upgradings that will not only be planned to accommodate the proposed development, but to also address the existing traffic congestion problems that are experienced by road users. In order to accommodate the estimated traffic demand with minimal disruptions to the existing road network, a roads master plan was developed and this new road master plan (Refer to Annexure B of the Supporting Road Network: Design

Rationale Memorandum, Annexure Aj at the back of the EIAR, for the proposed new road master plan) caters for the regional mobility as well as the accessibility requirements of the proposed mixed-use development.

Regional access will be gained from the Linksfield interchange, the Modderfontein interchange and a new interchange, which will be constructed between the two said interchanges. Refer to Annexure B of the Supporting Road Network: Design Rationale Memorandum (Annexure Aj)

The proposed new road network concept is a product of various sessions with the project team and the following roads authorities:

Refer to Annexure Aj for Supporting Road Network: Design Rationale Memorandum

- Ekurhuleni Metropolitan Municipality The Roads and Storm Water Department (EMM);
- Gauteng Department of Roads and Transport (GDRT);
- South African National Roads Agency SOC Limited (SANRAL); and
- Johannesburg Roads Agency (JRA).

The proposed road upgradings are based on the 2023 traffic volumes and the approach was to implement a sustainable solution that will mitigate the traffic impacts of the new development. Due to limited road reserves, some of the proposed upgrades are not feasible.

Over and above the proposed road upgrades, an integrated public transport system is proposed to be implemented by the proposed Linksfield development. The proposed system will include infrastructure provisions for public transport. The implementation of the integrated public transport system will most probably alleviate the predicted road network congestion problems.

Proposed Road Upgrades and New Roads:

New Roads

The Internal Road Layout

The proposed internal road system is based on a radial and block road network pattern and the spacing and layout of arterial and collector streets were strategically designed to create an interconnected network capable of providing a balance between accessibility and mobility. Public transport also formed an integral part of the planning process and the aim is to improve connections for public transport users.

At present there is no direct south-north link between Modderfontein Road and Linksfield Road and apart from the existing route via Club Street, the N3 is the only other alternative (at this stage most probably the faster alternative) for road users that travel from the south to the north. In order to address this problem, a new Class 3 road (speed limit 80km/h), with a south-north alignment is proposed from Linksfield Road to Modderfontein Road. The intention of this road is to provide an alternative south-north road, almost parallel to the N3 and this road will also be designed to serve commercial and office uses planned along this route.

An additional south-north road (also a Class 3 road with variable speed limits 60km/h to 80km/h) from Club Street to Modderfontein Road is also proposed to fulfill the same supporting function to the N3 and the existing local indirect link via Club Street.

Access Points to the Study Area

Marginal access ramps (LEFT-IN, LEFT-OUT) will be constructed on the Linksfield Interchange and on the N3 (an on-ramp). The main purpose of the proposed ramp is to provide direct access onto and out of the Linksfield development. Such direct access will minimize traffic volumes to be generated by the proposed development on the Linksfield Interchange during peak hours.

Two new access roads will be constructed along Club Street, between Linksfield Road and George Avenue and two access roads along Modderfontein Road (between Pretoria Road and the Modderfontein Interchange) will be upgraded. The Huddle Park access point will be re-positioned.

Proposed Upgrades to Existing Roads:

The proposed **upgrades on the existing road** include the following:

- Upgrading of Linksfield Road from 3 lanes per direction to 4 lanes per direction between Club Street and the Linksfield Interchange.
- Upgrading of Club Street from 1 lane per direction to 2 lanes per direction between Linksfield Road and Byron Avenue.
- Upgrading of Club Street from 2 lanes per direction to 3 lanes per direction between Linksfield Road and Modderfontein Road.
- Upgrading of Modderfontein Road from 2 lanes per direction to 3 lanes per direction between Swemmer Road / Gerorge Avenue and Pretoria Road.

The detailed design of the affected external intersections, to reflect the proposed upgrades (number of lanes, signal settings and the like), will form part of an additional addendum to this study. The following upgrades are envisaged:

- Signalised access on Linksfield Road between Club Street and the Linksfield Interchange.
- Signalised intersection at Club Street / Civin Drive and Linksfield Road.
- Signalised access opposite Huddle Park Residential Development.
- Signalised intersection at Club Street / Swemmer Road and Modderfontein Road / George Avenue.
- Signalised intersection at Pretoria Road and Modderfontein Road.
- Signalised intersection at Wordsworth Road and Modderfontein Road.

• Priority intersection at Kerry Street and Modderfontein Road.

Access spacing should be invested on the following roads to improve safety and mobility:

- Wordsworth Road / Main Road / Canning Road.
- Pretoria Road / Johannesburg Road / Northview Road.
- Avon Road / Northfield Avenue / Athol Street.
- George Avenue / Durham Street / Hathorn Laan; and
- Club Street

The access points along these roads should comply with the requirements detailed in the "TRH26, South Road Classification and Access Management Manual".

Implications for Development:

- The proposed development is expected to generate 9252 and 9987 peak hour vehicular trips during the morning and afternoon peak hours. In order to accommodate the additional traffic demand at acceptable levels of service, new road links, new intersections, intersection upgrades, access closures and substantial road upgrades to the existing road network will be required;
- In order to reduce private car use, it will also be necessary to implement an integrated public transport system;
- Some of the proposed road upgradings will also trigger activities as listed in the 2010
 Amended NEMA EIA Regulations and a separate application for such road upgradings have already been submitted to GDARD; and
- The separate road upgrade applications will be done on behalf of the relevant road authority.

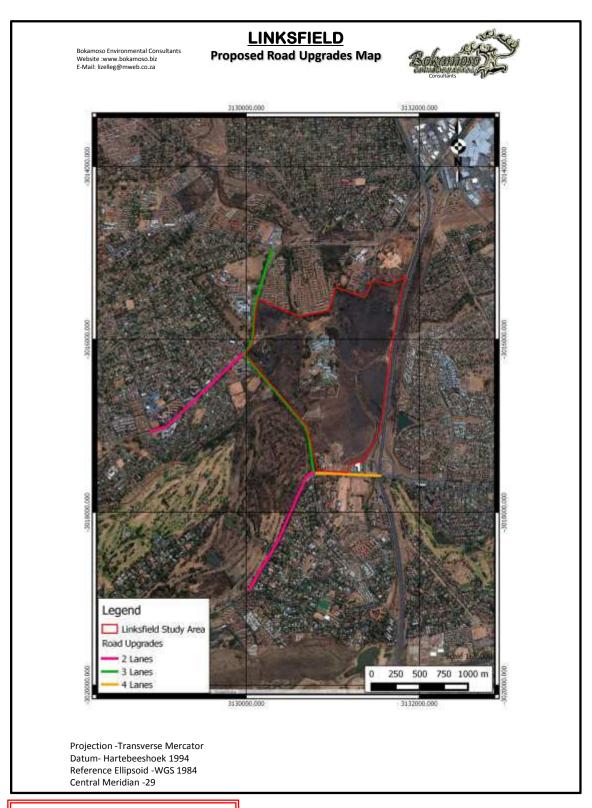


Figure 25 – Electricity Upgrade

6.2.8.f Issues & Impacts Identification – Services

Table 112: Issues and Impacts – Services

	Issue/Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High Medium Low Positive Impact - Not Necessary To Mitigate
113)	General The upgrading of services could lead to the temporary disruption of services in the surrounding area. Accesses to surrounding properties could also be affected, especially when road upgrades and new roads are implemented.	-	
114)	Storm water The proposed development will lead to increased hard surfaces and the quantity and the speed of the storm water across the study area and into the water bodies and adjacent properties will increase.	-	③
115)	Construction works (especially near drainage lines) could cause water pollution, siltation, soil compaction and impacts on sensitive wetlands and eco-systems lower down in the catchment area	-	•
116)	Surface water flows will be altered during the construction phase Erosion and siltation during construction as a	-	•

	result of bad management		
118)	The use of insufficient drainage systems during	_	•
	the construction phase (i.e. sub-surface		
	drainage systems & no mechanisms to break the		
	speed of the surface water)		
119)	Water supply	-	9
	The existing municipal water network system		
	does not have the capacity to accommodate		
	the water requirements of the proposed new		
	development.		
120)	The proposed upgrades to the bulk water	+ -	‡
	reticulation system will trigger activities as listed		
	in the 2010 Amended NEMA EIA Regulations.		
121)	Sewer	+	‡
	The Bruma Outfall sewer has limited capacity		
	available to accommodate the sewage		
	generated by the proposed Linksfield		
	development. Capacity will however be		
	sufficient once the diversion of the Illiondale		
	pump station to the Modderfontein outfall has		
	been completed. The construction is currently in		
	process. Bulk contributions will be payable and		
	are calculated by the Local Authority.		
122)	Electricity	+ -	*
	The proposed development will require at least		
	40MVA electricity. According to City Power		
	there might be a need to supply the		
	development from several 11kV circuits in order		
	to meet the total load.		
	The proposed upgrades will trigger activities as		
	listed in Listing Notice 1 of the 2010 Amended		

	NEMA EIA Regulations.		
	A separate Basic Assessment application for the		
	proposed upgrades has been submitted to the		
	delegated authority, on behalf of City Power.		
	City Power will be responsible for the upgrades		
	and will also be responsible for the maintenance		
	thereof. The entire area will benefit from the		
	proposed electricity upgrade.		
123)	Waste Management	-	0
	The construction and operational phases of the		
	proposed development will create large		
	quantities of builder's and domestic waste to be		
	accommodated by local registered landfill sites.		
124)	The involved local authority will be responsible	+	‡
	for the removal of domestic waste – increased		
	rates and taxes – Please refer to Section 6.2.5.a		
125)	Traffic	-	©
	The proposed development will generate		
	between 9 000 and 10 000 peak hour trips in an		
	area which already experiences traffic		
	congestion problems		
126)	Many construction vehicles will use the	-	0
	surrounding road network during the		
	construction phase. This could cause damage		
	to the existing roads and it could also lead to		
	dangerous conditions on the surrounding roads.		
127)	Heavy construction vehicles that will cross the	-	
	watercourses on the study area could cause		
	damage to the watercourses, especially during		
	the rainy season.		

128)	Due to limited road reserve it will not be feasible	_	©
	to implement all the proposed road upgrades.		

Table 113: Comments of the I&AP's regarding the Qualitative Environment

Issue:	I&AP	Issues Addressed in Report
		√/X
Water: A number of the listed activities involve water – has Bokamoso applied for any Water Use Permits from the Department of Water Affairs. The area's wetlands are a concern, and the Spruit may well be impacts on negatively. How far is Bokamoso with the process of official assessments and approvals from the Department of Water Affairs? The area is already overcrowded as many houses have been demolished and numerous dwellings have replaced it. This has led to a low water pressure. The parties affected by the proposed development feels that the development may have a negative impact on the current water system.	Jeanine De Andrade Carole Tymvios Beverley Tarpey Natalie Koneight - Rand Water	
Storm water: "I would like to register my concerns regarding the proposed township development in the Sandringham Modderfontein area. The drainage system currently cannot cope with the amount of water during a storm what will happen if there is a development, more flooding???	Monty Isserow	Refer to issue 114, Page 337

These are only a few points that I would like to make. I am sure if I had enough time to think about it I would be able to find more issues." - Monty Isserow monty@issies.com		
"Refer to today's discussion with my representative Guthrie Head wherein he requested a detailed programme, which encompasses all landmarks from the start of the final scoping report through to the final approval by the Minister. This programme should include for example such aspects as the Geotechnical Investigation, Public Participation meetings, the removal of all the graves including the desanctification of the entire burial area. And, finally, what provision will be made for the HUGE increase in sewerage. You will appreciate that the aspects enumerated above are only a small number of the items which should be reflected in the programme. Your early attention will be appreciated.	Marilyn Joubert Theresa Askham Theresa Askham Cheryl Katzen Steven Magid William Surmon Michael Rudnicki Jonathan Aarons Rael Super Valerie Hawker Isabel Frits de Arevalo Elicia Demont Jackie Chalom Areil Pheiffer	Refer to issue 121, Page 330
Traffic: "We strongly object to the mixed-use township that is planned to be opened by Sandringham High. It will undoubtedly cause an increase in traffic in an	Jeremy and Chana Katz lostinafrica@axxess.co.za Murray Zipp Grant Rae Joe & Megan Da Silva Debbie Nofal Robert Moore Jeremy Katz Craig Stollard	√ Refer to issues 125 & 126, Page 346-348

already congested area, as Cecelia Verainakis well as tax the sewage, Ian Friedland water and electrical systems Ray Wolder already put in place. " Anthony Saffe Ann Price Dr. Brian Sher The affected parties object Isaac Dave Miller to the development and Monty Isserow has a concern with the Jonathan Aarons infrastructure of the roads. Lillian Picker Everyone knows it is already Gary Swil a nightmare to get up and Claudine de Andrade down that road can you Seth Meyerowitz imagine if you build. The Elaine Glogauer roads are already under Kathi Niemann severe strain and will not be Stanley Noik able to accommodate Steven Magid additional people living in Andy Feldman the area. Candice Shaer llana Stein Skapoutsis Kay Stoler Beverley Tarpey R.B. Kent Stanley Friedman Reg Shlagman Sharron Dickson Jonathan Aarons Isis Balderstone Mrs Kent Demetrio SIlveira Robert Guy Demont David & Wendy Carroll Lyn Hood Howard Hahn Rory Gaddin John De Meyer Lisa Blass Cheryl Katzen Electricity: Julia Meltzer Carole Tymvios The affected parties object Beverley Tarpey to the development due to Zita Dos Possos Refer to issue 122, page 330 electricity problems. Agnieszka Malonik the They also feel that the Ian Friedland Elaine Glogauer electricity and load shedding is already Kelly Nesbitt problem and including Theresa Askham more families into this area Leslie Harris with only exasperate this Nicole Bartkunsky problem. Tina Maram Keith Campbell For the affected parties of the Jens Heinemann

development the traffic is Susan Kacev already a problem, and feels Julia Meltzer that the development will Micaela Soliani increase the traffic and will Myrna Samuels have a negative effect on Nicole Bartkunsky the traffic. The points of Jenny Saltz contention is the huge Natalie Elson increase in the volume of Michael Balderston traffic that George Kairinos these developments will generate Nicole Bartkunsky only Michaela Horvitch not George/Swemmer/Club Natalie Minkovich Jeremy and Chana Katz streets but also on Johannesburg/Pretoria Eddie Blatt – Roads which are already Brenda Stern overloaded at peak times. Reg Shlagman Debbie Nofal Traffic banks up from the Modderfontein intersection Christine Osler all the way up on Pretoria Keith Campbell road as it is an arterial road Pam Blumenthal leading to Greenstone, Edenvale and Kempton Park and surrounds.

6.2.8.g Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

113) The upgrading of services could lead to the temporary disruption of services in the surrounding areas.

Access to surrounding properties could also be affected, especially when road upgrades and new roads are implemented.

Table 114: Significance of Issue 113 (The upgrading of services could lead to the temporary disruption of services in the surrounding areas) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium ○ Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E
Necessary To Mitigate 🌣	planning phase, construction	Medium M
Necessary to Mingale 💢	and/ or operational phase	High H
	P/ C / O	Not possible to mitigate,

		but not regarded as a fatal
		flaw NP
Medium ©	P/C – Surrounding landowners should be notified of any disruptions that may occur during the construction phase.	M - To be included in the EMP

114) The proposed development will lead to increased hard surfaces and the quantity and the speed of the storm water across the study area and into the water bodies and adjacent properties will increase.

Should contaminated storm water run-off from the roads not be managed, it could lead to surface water and ground water pollution. Bio-swale and bio-filters could be installed to minimize the risk of pollutants entering the natural drainage system of the area.

This will also raise the flood levels of water bodies in the area, if storm water is not managed correctly.

Table 115: Significance of Issue 114 (The proposed development will lead to increased hard surfaces and the quantity and the speed of the storm water across the study area and into the water bodies and adjacent properties will increase.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊕ Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not Necessary To Mitigate 🜣	planning phase, construction	Medium M
Necessary to miligate 🔀	and/ or operational phase	High H
	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP

Medium 💿 P - A comprehensive storm L - To be included in the EMP management water plan indicating the management of all surface runoff generated as a result of the development (during both the construction and operational phases) prior entering any natural drainage system or wetland, be submitted must approved by the local authority and DWS and submitted to GDARD prior to construction activities commencing. L - To be included in the EMP P/C - Attenuation ponds and energy dissipaters must be installed on the study area to break the speed of the water and to act as siltation ponds. L - To be included in the EMP P/ C - Surface storm water generated as a result of the development must not be channeled directly into any natural drainage system or wetland. L - To be included in the EMP The storm water management plan must indicate how surface runoff will be retained outside of the demarcated buffer/flood zone and how the natural release of retained surface runoff will be simulated. L - To be included in the EMP P - The storm water management plan should be designed in a way that aims to ensure that post development runoff does not exceed predevelopment values in: •Peak discharge for any given storm; •Total volume of runoff for any given storm; •Frequency of runoff; and debris Pollutant and

concentrations reaching water

courses.

115) Construction works (especially near drainage lines) could cause water pollution, siltation, soil and impacts on sensitive wetland and eco-systems lower down in the catchment area.

Construction related activities, especially in close proximity to the wetland, may cause pollution, siltation, erosion and various other impacts on the wetland system.

Table 116: Significance of Issue 115 (Construction works (especially near drainage lines) could cause water pollution, siltation, soil and impacts on sensitive wetlands and ecosystems lower down in the catchment area) After Mitigation/ Addressing of the Issue

Mitigation Possibilities High • Medium © Low • Positive Impact/ Neutral - Not Necessary To Mitigate	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	Significance of Issue after mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal
High ●	P - A comprehensive storm water management plan indicating the management of all surface runoff generated as a result of the development (during both the construction and operational phases) prior to entering any natural	flaw NP L - To be included in the EMP

drainage system must be submitted and approved by the local authority and DWS and submitted to GDARD prior to construction activities commencing.	
P - Construction guidelines shall be provided for the prevention and restriction of erosion and siltation during both the construction and operational phases.	L - To be included in the EMP
P/C - Attenuation ponds and energy dissipaters must be installed on the study area to break the speed of the water and to act as siltation ponds.	L – To be included in the EMP
P/ C - Surface storm water generated as a result of the development must not be channelled directly into any natural drainage system or wetland.	L – To be included in the EMP
C – During the construction phase sandbags can be placed in areas where runoff is anticipated into the wetland/river areas.	L – To be included in the EMP
P - The storm water management plan must indicate how surface runoff will be retained outside of the demarcated buffer/flood zone and how the natural release of retained surface runoff will be simulated.	L – To be included in the EMP
P/ C - Bio-swale and bio-filters could be installed to minimize the risk of pollutants entering the natural drainage system of the area.	L - To be included in the EMP

116) Surface water flows will be altered during the construction phase

Due to the excavations that will take place (there will be trenches and topsoil as well as subsoil mounds in and around the study area) and the topography of the study area will temporarily be altered. This will however only be a short-term impact if the levels are restored to normal (the surface drainage patterns from the new levels should not differ too much from the surface water drainage of the original levels) once the construction phase is completed.

Table 117: Significance of Issue 116 (Surface water flows will be altered during the construction phase) After Mitigation/ Addressing of the Issue

Mitigation Possibilities High ● Medium ○ Low ■ Positive Impact/ Neutral - Not Necessary To Mitigate ☆	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	Significance of Issue after mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate,
		but not regarded as a fatal flaw NP
High ●	P/C - Construction activities should preferably take place during the winter months P/C - If it is not possible for construction activities to take place during the winter months, construction activities should take place in phases in order to prevent large exposed areas that will cause an increase in the speed of surface water.	M - To be included in the EMP M - To be included in the EMP
	P - When storm water planning is done, every attempt possible should be made to keep the post construction and preconstruction flows similar.	M - To be included in the EMP

Result: Although the issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

117) Erosion and siltation during construction is a result of bad management

Unnecessary loss of soil, erosion as well as the compaction of soils due to traffic and equipment must be prevented.

Table 118: Significance of Issue 117 (Erosion and siltation) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High • Medium • Low • Positive Impact/ Neutral - Not Necessary To Mitigate	Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/C/O	mitigation Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
High ⊕	P/ C - Excavate only where necessary and mark out the areas to be excavated. P/ C - The top layer of all areas to be excavated for the purpose of construction must be stripped and stockpiled in areas where this material will not be damaged, removed or compacted. This stockpiled material shall be used for the rehabilitation of the site and for landscaping purposes.	L - To be included in the EMP L - To be included in the EMP
	C - When the stripping of topsoil takes place, the grass component shall be included in the stripped topsoil. The soil will contain a natural grass seed mixture that may assist in the regrowth of grass once the soil is used for back filling and landscaping. P/ C /O - Mechanisms are required for dissipating storm water	L - To be included in the EMP L - To be included in the EMP

118) The use of insufficient drainage systems during construction phase (i.e. sub-surface drainage systems & no mechanisms to break the speed of the surface water)

Clearance of the site and the compaction of soils will lead to an increase in the speed of surface water. If precautionary/ mitigation measures are not implemented this could lead to siltation and erosion.

Table 119: Significance of Issue 118 (The use of insufficient drainage systems during the construction phase (i.e. sub-surface drainage systems & no mechanisms to break the speed of the surface water) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ● Medium © Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E
Necessary To Mitigate 🌣	planning phase, construction	Medium M
Necessary to Minigate X	and/ or operational phase	High H
	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
High ●	P/C/O - Attenuation ponds and energy dissipaters must be installed on the study area to break the speed of the water and to act as siltation ponds C - Implement temporary storm	M - To be included in the EMP M - To be included in the EMP
	water management measures that will help to reduce the speed of surface water. These measures will also assist with the prevention of water pollution, erosion and siltation.	
	P/C - In order to prevent large exposed areas, it is	M - To be included in the EMP

recommended that the construction of the development be done in phases. Each phase should be rehabilitated immediately after the construction for that phase has been completed. The rehabilitated areas should be maintained by the appointed rehabilitation contractor until a vegetative coverage of at least 75% has been achieved.	
C - No excavated materials should be dumped in or near the drainage channels.	M – To be included in the EMP

119) The existing municipal water network system does not have the capacity to accommodate the water requirements of the proposed new development

The municipal water network system as it is currently, does not have sufficient capacity for the entire development. The GLS Report confirmed that it will be necessary to upgrade and expand the current bulk water transfer system. The proposed upgrades to the bulk water reticulation system will be done on behalf of the local authority.

Table 120: Significance of Issue 119 (The existing municipal water network system does not have the capacity to accommodate the water requirements of the proposed new development) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium ⊙ Low ■	Already achieved $\sqrt{}$	mitigation
	Must be implemented during	Low/ eliminated L / E
Positive Impact/ Neutral - Not	planning phase, construction	Medium M
Necessary To Mitigate 🌣	and/ or operational phase	High H
	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal

		flaw NP
High ●	P - The bulk water network system will be upgraded and expanded on behalf of the local authority.	L - To be included in the EMP

123) The construction and operational phases of the proposed development will create large quantities of builder's and domestic waste to be accommodated by local registered landfill sites.

The waste may consist of the following waste streams, namely:

- Liquid waste from vehicles;
- o Solid domestic waste; and
- Solid construction waste.

The disposal of some of the above waste streams may lead to soil, water and aesthetic pollution of the site. The soil and water pollution should be localised with little impact on the surrounding environment. Waste disposal on the site may stimulate the surrounding population to also dispose domestic waste on the site. This may lead to an uncontrolled situation that would be aesthetically unacceptable to future occupants and costly to rehabilitate.

The disposal of large quantities of waste during both the construction and operational phases, would place a burden on landfill sites in the area to accommodate the additional volumes. Although this waste is inert in most cases, it may be of significant proportions and will contribute to the saturation of the formal landfill sites in the area.

Table 121: Significance of Issue 123 (The construction and operational phases of the proposed development will create large quantities of builder's and domestic waste to be accommodated by local registered landfill sites) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
Miligation Fossibilities	_	mitigation
High ● Medium © Low ■	Already achieved $\sqrt{}$	Low/ eliminated L / E
Positive Impact/ Neutral - Not	Must be implemented during	Medium M
Necessary To Mitigate 🌣	planning phase, construction	
	and/ or operational phase	High H
	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Medium ©	C – Prevent unhygienic usage on site and pollution of the natural assets. Develop a central waste temporary holding site to be used during construction. (Near the access entrance). This site should comply with the following:	L - To be included in the EMP
	 Skips for the containment and disposal of waste that could cause soil and water pollution, i.e. paint, lubricants, etc.; Small lightweight waste items should be contained in skips with lids to prevent wind littering; Bunded areas for the containment and holding of dry building waste. THESE AREAS SHALL BE PREDETERMINED AND LOCATED IN AREAS THAT ARE ALREADY DISTURBED. THESE AREAS SHALL NOT BE IN CLOSE PROXIMITY TO THE DRAINAGE CHANNELS. 	
	C - Workers will only be allowed to use temporary chemical toilets on the site. CHEMICAL TOILETS SHALL NOT BE IN CLOSE PROXIMITY TO THE DRAINAGE CHANNELS.	L - To be included in the EMP

C - No French drain systems may be installed.	L - To be included in the EMP
C - No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site. All waste must be removed to a recognized waste disposal site on a weekly basis. No waste materials may be disposed of on or adjacent to the site. The storage of solid waste on site, until such time that it may be disposed of, must be in the manner acceptable to the Local Authority.	L - To be included in the EMP
C - Keep records of waste reuse, recycling and disposal	L - To be included in the EMP
for future reference. Provide information to the ECO	
(Environmental Control Officer)	

125) The proposed development will generate between 9000 and 10 000 peak hour trips in an area which already experience traffic congestion problems.

Traffic increase during the construction and operational phases of the development will have an impact on traffic flow of the area. The impact of additional traffic during the construction phase, especially heavy construction vehicles that can slow traffic down, can be mitigated to a certain extent by not allowing construction vehicles to use public roads during peak traffic times, as well as to avoid construction activities on public roads during peak traffic times.

Table 122: Significance of Issue 125 (The proposed development will generate between 9000 and 10 000 peak hour trips in an area which already experience traffic congestion problems) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium © Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🜣	Must be implemented during planning phase, construction and/ or operational phase P/C/O	Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP
Medium 💿	P/C Construction vehicles and activities to avoid peak hour traffic times. P/C/O Public Transport facilities will be provided.	L - To be included in the EMP L - To be included in the EMP
	P/C/O The road upgradings recommended by the traffic engineers are to be implemented.	L - To be included in the EMP

126) Many construction vehicles will use the surrounding road network during the construction phase. This could cause damage to the existing roads and it could also lead to dangerous conditions on the surrounding roads.

As a result of the new development there will be more heavy vehicles on the sub-standard local roads during the construction and operational phases and they will cause damage to these roads. The heavy vehicles will also add to the danger of driving on these local roads and will increase dangerous driving conditions on dirt roads by creating dust pollution.

Table 123: Significance of Issue 126 (Many construction vehicles will use the surrounding road network during the construction phase. This could cause damage to the existing roads and it could also lead to dangerous conditions on the surrounding roads) After Mitigation/Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High Medium Low Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not Necessary To Mitigate 🜣	Must be implemented during planning phase, construction and/or operational phase	Low/ eliminated L / E Medium M High H
	P/C/O	Not possible to mitigate, but not regarded as a fatal flaw NP
Medium	P/ C/ O Construction vehicles and activities as well as other heavy vehicles to avoid peak hour traffic times.	L - To be included in the EMP

127) Heavy construction vehicles that will cross the watercourses on the study area could cause damage to the watercourses, especially during the rainy seasons.

Heavy construction vehicles should not cross the watercourses without a water use license being issued for work in the wetland.

Table 124: Significance of Issue 127 (Heavy construction vehicles that will cross the watercourses on the study area could cause damage to the watercourses, especially during the rainy seasons) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance of Issue after
High ⊕ Medium © Low ■	Already achieved $\sqrt{}$	mitigation
Positive Impact/ Neutral - Not	Must be implemented during	Low/ eliminated L / E Medium M
Necessary To Mitigate 🌣	planning phase, construction	Medium M

	and/ or operational phase	High H
	P/ C / O	Not possible to mitigate,
		but not regarded as a fatal
		flaw NP
Low	P/C – The time spent in the wetland/ riparian zone should be limited at a time.	M - To be included in the EMP
	P/C – Access into the wetland areas should be avoided as far as possible.	M - To be included in the EMP
	P/C – No riparian vegetation may be removed from the riparian zone.	M - To be included in the EMP
	P/C – The area should be prepared with sandbags or other applicable measures to avoid siltation into the wetland/river area.	M - To be included in the EMP
	P/C – All disturbed and damaged areas need to be rehabilitated after the construction activities.	M - To be included in the EMP

128) Due to limited road reserve it will not be feasible to implement all the proposed road upgrades.

Road upgrades are hindered by the width of the road reserves, although the City of Johannesburg plans to upgrade some of the roads in the study are to higher order roads.

Table 125: Significance of Issue 128 (Due to limited road reserve it will not be feasible to implement all the proposed road upgrades.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation	Significance	of	Issue	after
	Already achieved $\sqrt{}$	mitigation			

High ⊕ Medium ⊙ Low ■	Must be implemented during	Low/ eliminated L / E	
Positive Impact/ Neutral - Not	planning phase, construction	Medium M	
Necessary To Mitigate ☼	and/ or operational phase	High H	
	P/ C / O	Not possible to mitigate,	
		but not regarded as a fatal	
		flaw NP	
Medium 😊	P/O – All feasible / possible road upgrades should be implemented. Public transport system should be coordinated in the area to lighten the traffic load.	L - To be included in the EMP	

6.2.9 Public Participation

Refer to Annexure Ak for details regarding the Public Participation process that was followed and Refer to Annexure Al for Social Impact Assessment. Also refer to Annexure Aw for the response to comments of City of Johannesburg

General:

Public participation forms an integral part of an EIA Process. The principles of the National Environmental Management Act govern many aspects of environmental impact assessments, including public participation. These include provision of sufficient and transparent information on an ongoing basis to stakeholders to allow them to comment and ensure the participation of previously disadvantaged people, women and youth.

Effective public involvement is an essential component of many decision-making structures, and effective community involvement is the only way in which the power given to communities can be used efficiently. The public participation process is designed to provide sufficient and accessible information to interested and affected parties (I&AP's) in an objective manner to assist them to:

Raise issues of concern and suggestions for enhanced benefits.

- Verify that their issues have been captured.
- Verify that their issues have been considered by the technical investigations.
- Comment on the findings of the EIA.

Description of the Public Participation Process That Was Followed:

The public participation process for this development was conducted in line with the Public Participation requirements as set out in Chapter 6 in Regulation 54, published in the Government Gazette No. 33306 of 18 June 2010, of the National Environmental Management Act, 1998 (Act No 107 of 1998) as amended.

The proposed Linksfield development's scoping phase was first advertised on the 10th of October 2013 in the Star Newspaper. Site notices and public notices were distributed on the 10th of October 2013 as part of the public participation process of the scoping phase. The background information document was sent to all registered Interested and Affected Parties (I&AP's) on the same day.

The Draft Scoping Report was then completed and the review notice was sent out on the 5th of December 2013 to the I&AP's of the proposed project. The review period for this Draft Scoping Report was 40 days.

The comments regarding the Draft Scoping Report were included and addressed in the Final Scoping Report, which was submitted to GDARD on the 14th of February 2013. The registered I&AP's were notified of this report and 21 days was allowed for their comments. GDARD accepted the Scoping Report and Plan of Study for EIA on 24 April 2014 and provided comments to address during the EIA phase of the proposed Linksfield development.

The sensitivity of the site and the issues raised by I&AP's during the scoping phase encouraged Bokamoso and Nali Sustainability Solutions to establish a forum consisting of highly qualified specialists and scientists in the field of tropical and communicable diseases, geo-hydrology, soils, geology, cultural and historical, and pathology. This forum assisted

with the investigation and addressing of the disease and graveyards related issues that were raised and they also made recommendations regarding the way forward. The first specialist forum meeting was held on the 20th of March 2014. The second specialist forum meeting was held on the 8th of May 2014. During these meetings the results of the various specialist inputs and the comments and inputs of the I&APs and other parties were discussed, tested and debated. All the opinion supplied by the specialists were supported by research and/or site specific investigations, testing and analysis.

After the Scoping Report was approved by GDARD on 24 April 2014, Bokamoso and Nali Sustainability Solutions commenced with the public participation process for the EIA phase. A newspaper advertisement, which notified the I&APs of the Environmental Impact Assessment (EIA) phase was published in The Star Newspaper on the 10th of June 2014. Site notices were erected and public notices were distributed on the same day.

Many I&APs again submitted objections and raised concerns regarding the proposed development. Most of the concerns related to the disease issue, the graves on the site and the impacts of the development on the services and road infrastructure in the area.

The alleged animal and human graves, which apparently also includes a Jewish cemetery were mentioned again. Unfortunately the information supplied by the I&APs were very limited and it was decided to publish a separate advertisement to invite any member of the public to come forward with any concrete information or evidence regarding any graves or graveyards on the site. This additional "grave enquiry" notice was advertised in the Star Newspaper on the 18 of June 2014, in the Tribune Newspaper on 27 June 2014 and in the Beeld Newspaper on 8 July 2014. No new information or evidence aroused from these advertisements.

It was furthermore decided to also schedule the public meeting for a later stage in the process (until after the Draft EIA report was made available to the I&APs for comment) because we believed that we received most of the issues during the scoping phase and we also believed that we addressed all/most of the issues, comments and questions in the Draft EIA Report. We also attached all the specialist reports to the Draft EIA and the

intention was to communicate with well-informed I&APs at the public meeting/s. The Draft EIA was available for comment from 22 October 2014 until 10 December 2014 (49 days).

A large number of I&APs registered and indicated that they wanted to attend the public meeting. Bokamoso planned to arrange the public meeting in November 2014. The Bokamoso team tried to reserve a venue, which is large enough and which is situated in close proximity of the study area, but unfortunately the educational facilities, church facilities and the local authority facilities in the area had no venues available. The other available venues in the area were either too small or not regarded as suitable for such a meeting (i.e. difficult to operate audio & visual equipment, not suitable for a presentation). Bokamoso eventually managed to secure a suitable venue in the Kempton Park area for 19 November 2014. This venue was large enough to accommodate more than 1 500 I&APs and the venue had high-quality audio-visual equipment available to assist with a professional presentation. This venue was however approximately 30km away from the site and the I&APs invited to the meeting indicated that they were not willing to attend a meeting at a venue that is far away from the study area.

Bokamoso was eventually forced to cancel the public meeting and had to re-schedule it for 2 December 2014. The management of the Jeppe Quandom Hall in close proximity of the study area agreed to make the hall available for the public meeting. The hall can only accommodate 500-700 people and therefore it was decided to arrange two meeting sessions. The first meeting was scheduled for the afternoon and the second meeting was scheduled for the evening. This dual meeting effort made it possible for the senior citizens to attend the meeting during the day and it accommodated that working citizens after hours. *Minutes of the public meetings are attached as Ap*

Bokamoso also arranged a focus group meeting at the Rand Aid Community Hall on 11 November 2014 (just before the public meetings). The meeting was specifically scheduled to discuss the Rand Aid issues of concern, because the Rand Aid development is situated immediately adjacent to the study area and this development currently accommodates approximately 800 residents. The Minutes of the Rand Aid focus group meeting is attached as Annexure Ao

Bokamoso and Nali Sustainability Solutions furthermore opened a database with the details of all the registered I&AP's (from the outset of the project throughout the remainder of the process). A comments and issues report was also created whereby all the issues of the I&AP's are listed and the EAP (Environmental Assessment Practitioner) then provides possible mitigation measures for the concerns/ issues raised. **Refer to Annexure An for updated comments and issues report.**

This report represents the Final Report and it will be available to the public for comment for a period of 30 days. The comments of the I&APs must be forwarded to the GDARD assessing official Mr. Mark Leroy at marc.leroy@gauteng.gov.za/ fax number 086 620 736 4 and a copy thereof must also be forwarded to the Bokamoso office for record keeping and response purposes.

The Final EIA will not only be delivered to GDARD for evaluation and a final decision. The report will also be subject to a peer review to be conducted by a suitably qualified specialist/ panel. The peer review panel will assist with the evaluation of the report and the formulation of the Decision to be issued.

Once the delegated authority issued the relevant Decision, I&APs and the applicant will have an opportunity to appeal against sections of the decision or the entire decision. The appeal must be compiled and submitted in terms of the Amended 2014 NEMA EIA Regulations, which came into effect on 4 December 2014.

Summary of the Main Issues Raised by the I&APs:

Approximately 1100 I&APs registered in the EIA Process for the Linksfield Mixed-Use Development and most of the I&APs strongly objected to the development. The Main issues raised by the I&APs are the following:

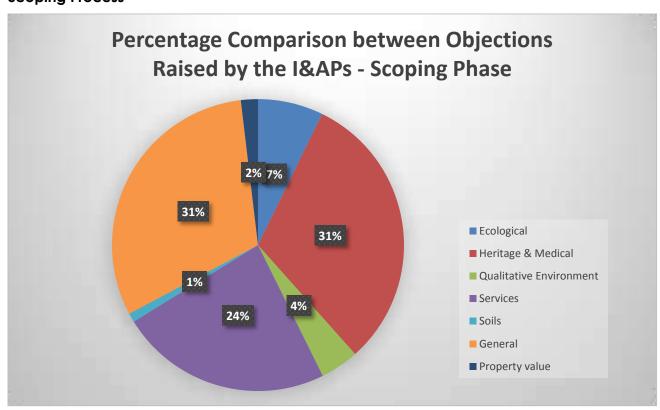
Most of the members of the surrounding community are totally against the proposed target market and the high residential density this is proposed. The community is of the opinion that the "low cost housing" will have a negative impact on their property values and that the development will eventually turn into a slum, where tenants sub-let and where crime originates;

- The development of the site is regarded as a major health risk. The impacts associated with the excavations and construction in the soil polluted with anthrax spores (possible disease outbreaks);
- The possible spread of diseases through dust pollution;
- The possibility of other disease outbreaks (associated with the diseases treated at the Sizwe Hospital);
- The possible relocation of graves with cultural and historical value;
- Development across old graveyards;
- Damage to graves with cultural and historical value;
- Ground and surface water pollution;
- The future of the Sizwe Hospital and associated buildings with cultural and historical value (most of the structures are older than 60 years);
- Visual impacts;
- Noise impacts;
- The impacts on the already stretched services and infrastructure (i.e. water, electricity and sewage provision);
- The traffic impacts on the surrounding roads, which are already experiencing severe traffic congestion;
- The impacts of additional storm water on the Jukskei River and possible flooding;
- Impacts on property values if low cost housing is developed on the study area;
- Increase in crime due to the fact that poor people will also reside on the study area;
- Impacts on the riverine system and wetlands on the study area;
- The loss of Bankenveld;
- Impacts on ecological systems; and
- Increase in security risks (construction and operational phases).

The comments raised by the I&APs were divided into 7 main categories (general; ecological, heritage and medical; qualitative environment; services; geology and soils, and property value) and as reflected in Figure 26 below, most objections raised during the scoping process were heritage related, medical and services.

After the Draft EIA, which successfully addressed and mitigated the heritage and disease issues, was made available to the I&APs for comment, the percentage comparison of the objections changed significantly. The issues that relate to the qualitative environment (i.e. strong social mobilisation against the proposed low cost housing development in an upmarket area, very high residential densities, increased noise, the possibility of the area turning into a slum, increased crime, sub-leasing etc.), the possible decrease in property values and the impact on the over stressed services and roads were the main issues raised during the EIA phase, especially in the public meetings of 2 December 2014. More than 50% of the objectors appeared to be totally against the influx of lower income groups into the area (for various social and economical reasons) and they also felt that the services and roads in the area will not be able to accommodate/service any additional residents/ tenants/ businesses. According to the objectors the existing services and roads cannot even cater in the needs of the existing residents that are dependent on such services and roads.

Figure 26: Percentage Comparison between Objections Raised by the I&APs during the Scoping Process



Addressing of the Impacts and Issues Raised by the I&APs:

All the issues/impacts raised by the I&APs are addressed in the EIA Report (under the various headings/environmental aspects) and the mitigation measures that were provided to reduce/ prevent the impacts identified are incorporated as part of the EMP (Refer to Annexure Af for EMP). Issues and response reports (Refer to Annexure Ak7 for initial Issues and Response Report and Refer to Annexure An for Updated Issues and Response Report) were also compiled, but it was almost impossible to address each issue raised on an individual basis. The issues and response reports also acted as the one of the main tools for the identification and classification of the various issues and for the compilation of the EIA report and the EMP, which address all the impacts and issues in an integrated manner.

As environmental consultants we considered the issues associated with the heritage, medical and services as the most significant and as possible "fatal flaws". We therefore recommended (already at the beginning of the project) that the applicant appoint suitably qualified specialists (the best in their fields of expertise in South-Africa) to address such issues and to confirm whether they regard the study area as suitable for the proposed mixed-use development.

In cases where the health and well-being of people are at stake, one cannot afford to take any chances and therefore the project team decided to take the cautious approach and to supply enough information that will enable the peer review panel as well as the relevant authorities to make an informed decision. Bokamoso and Nali's approach with the EIA application is described in **Item 1.2.2** of this report.

7. SIGNIFICANCE ASSESSMENT

7.1 Description of Significance Assessment Methodology

The significance of Environmental Impacts was assessed in accordance with the following method:

_		is the product of pr	•	severity. Probability describes the likelihood as follows:
	<u> </u>	Improbable	-	Low possibility of impact to occur either because of design or historic experience. Rating = 2
		Probable	-	Distinct possibility that impact will occur. Rating = 3
		Highly probable	-	Most likely that impact will occur. Rating = 4
		Definite	-	Impact will occur, in the case of adverse impacts regardless of any prevention measures. Rating = 5
		-		ne factors given to "intensity" and "duration". ded to each impact, as described below.
	The In	tensity factor is awa	rded to each	impact according to the following method:
		Low intensity	-	natural and manmade functions not affected – Factor 1
		Medium intensity	-	environment affected but natural and manmade functions and processes continue - Factor 2
		High intensity	-	environment affected to the extent that natural or manmade functions are altered to the extent that it will temporarily or permanently cease or become dysfunctional - Factor 4
Du	ıration	is assessed and a fa	ictor awarded	d in accordance with the following:
		Short term	-	<1 to 5 years - Factor 2
Dalcama	oso Lano	Jacob Arabitanta & Envir	ranmantal Cansu	Hants CC Fobruary 2015 250

Medium term	-	5 to 15 years - Factor 3
Long term	-	impact will only cease after the operational life of the activity, either because of natural process or by human intervention - factor 4.
Permanent	-	mitigation, either by natural process or by human intervention, will not occur in such a way or in such a time span that the impact can be considered transient - Factor 4.

The **severity rating** is obtained from calculating a severity factor, and comparing the severity factor to the rating in the table below. For example:

The Severity factor = Intensity factor X Duration factor

 $= 2 \times 3$ = 6

A **Severity factor** of six (6) equals a Severity Rating of Medium severity (Rating 3) as per table below:

Table 126: Severity Ratings

RATING	FACTOR					
Low Severity (Rating 2)	Calculated values 2 to 4					
Medium Severity (Rating 3)	Calculated values 5 to 8					
High Severity (Rating 4)	Calculated values 9 to 12					
Very High severity (Rating 5)	Calculated values 13 to 16					
Severity factors below 3 indicate no impact						

A Significance Rating is calculated by multiplying the Severity Rating with the Probability Rating.

The **significance rating** should influence the development project as described below:

- □ Low significance (calculated Significance Rating 4 to 6)
 - Positive impact and negative impacts of low significance should have no influence on the proposed development project.
- ☐ Medium significance (calculated Significance Rating >6 to 15)
 - Positive impact:
 - Should weigh towards a decision to continue
 - Negative impact:
 - Should be mitigated to a level where the impact

would be of medium significance before project can be approved.

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☐ High significance (calculated Significance Rating 16 and more)

Positive impact:
 Should weigh towards a decision to continue,
 should be enhanced in final design.

Negative impact:
 Should weigh towards a decision to terminate proposal, or mitigation should be performed to reduce significance to at least medium significance rating.

In correspondence received from GDARD some officials were of the opinion that the significance methodology used by Bokamoso applies a simple mathematical formula to environmental aspects with significantly different sensitivity values, which might or might not give an accurate final significance value.

The significance methodology used by Bokamoso was prescribed to environmental consultants in courses on impact assessments. No methodology can be accurate to a numerical value where the environment is concerned, because it can not be measured. Numerical values are only an indication of the significance or severity of impacts. If we do not agree with the outcome of the assessment, we will adjust the numerical value to reflect a more realistic significance. The methodology only acts as an aid to the environmental consultant and the consultant needs to use his/her experience in the field together with the methods in order to reach a realistic significance assessment of the impacts. Bokamoso, in particular Ms. Lizelle Gregory, has extensive experience in the field of impact assessments. Bokamoso attended a presentation by Dr. Pieter Aucamp on "Tools that Environmental Practitioners (EAPs) can use in an Environmental Impact Assessment (EIA)" at an IAIA meeting. Dr. Aucamp is the author of a book, titled "Environmental Impact Assessment — A practical Guide for the Discerning Practitioner". Dr. Aucamp agrees that impact assessment methods are not 100% accurate; however it is accurate in identifying significant impacts.

7.2 Significance Assessment of Anticipated Impacts

Impacts indicated under each section of the environment were each assessed according to the above methodology. *Table 127* below contains the results of the significance assessment.

Table 127: Results of significance assessment of impacts identified to be associated with the proposed development (after mitigation)

Impact	Drob ability	Coverity [) atina	Coverity	Coverity	Significance				
Impact	Probability Rating	Severity F		Severity Factor	Severity Rating	Significance Rating				
	Kaling	Intensity	Duration	racioi	Kulling	Kulling				
CONSTRUCTION PHASE										
Beneficial Impacts	T _		I _	l	Ι.,					
37. The slope across the study	5	4	3	12	4	20 High				
area is sufficient to allow for										
the installation of services that										
gravitate.	_	4				3.5.4.				
90. Job creation and skills	5	4	2	8	3	15 Medium				
training										
Adverse Impacts				T .	T					
1. Stockpile areas for	4	4	2	8	3	12 Medium				
construction materials and										
topsoil										
2. Erosion	4	4	2	8	3	12 Medium				
3. Potential moderate heave	4	2	4	8	3	12 Medium				
of transported and residual										
greenstone soils;										
4. Collapse settlement in the	3	4	4	16	5	15 Medium				
loose colluvium and residual										
granite horizons										
5. Difficult excavation (1,5m	5	4	2	8	3	15 Medium				
deep) in areas of shallow										
bedrock, hardpan ferricrete										
and where large core stones										
are present										
6. The areas below the 1:100	4	4	4	16	5	20				
year flood line have a site						High				
class designation of P										
(Flooding) – Periodic										
undulation and flooding.										
These areas are not regarded										
as suitable for development										
7. A suitably qualified engineer	4	4	4	16	5	20 High				

	т	1	T	T		
must be appointed to confirm						
the 1:100 year flood line zone						
8. Seasonal shallow	4	4	2	8	3	12 Medium
groundwater, perched water						
and seepage near the flood						
plain						
9. Moderate erodability of	4	2	4	8	3	12 Low
surficial soils						
10. Good drainage will be	4	4	4	16	5	20 High
required as the occurrence of		'		. 0	Ü	g
season perched water tables						
is possible, especially in the						
shallow bedrock drainage						
areas. This may cause						
problems with dampness in						
surface structures and with						
installation of services						
	4	4	2	8	3	12 Medium
11. Wet surface conditions	4	4	2	0	3	12 Medium
and seepage may also occur						
and special drainage						
measures should be						
implemented. Surface water						
runoff should be controlled to						
prevent erosion of the surficial						
soils	4			10	4	1 () () (
13. Ideally the clayey soils	4	4	3	12	4	16 Medium
should be removed below						
roads and paved areas and						
replaced with inert materials						
14. The large volume of	3	4	2	8	3	9 Medium
dumped material will also						
pose a problem due to the						
uncontrolled manner and						
variability in properties of this						
material						
15. The soils on the site is not	3	4	3	12	4	12 Medium
regarded as suitable for usage						
as construction materials;						
16. Siltation problems	5	4	3	12	4	20 High
20. Blasting could be required	4	2	2	4	2	8 Medium
in areas where excavation						
difficulties are experienced						
21. Siltation, erosion and water	4	2	4	8	3	12 Medium
pollution in the Jukskei River						
could occur if a stormwater						
management plan is not						
implemented						
24. Removal of vegetation	4	4	4	16	5	20 High

	ı	1	1	1	1	
coverage, increased hard						
surfaces and increased						
erosion, surface water						
pollution and siltation						
problems	_	4				25.4
27. Significant engineering	5	4	2	8	3	15 Medium
intervention is required for the						
stabilisation of channels' banks	_					
28. Any boreholes drilled in the	5	4	2	8	3	15 Medium
study area must be sampled						
for pathogen analysis to						
confirm the present results		4				10 + 4 - 1:
29. The planned development	4	4	2	8	3	12 Medium
must ensure total runoff to						
reduce recharge and erosion						
impact on the soil layers in the						
study area		4	0	10	4	00 111 1
30. Storm water mitigation will	5	4	3	12	4	20 High
have to be implemented on						
the site outside of the wetland						
areas		4	0	0	0	
31. The possible identification	2	4	2	8	3	6 Low
or more graves and waste sites						
on the study area during						
constructions (mainly when						
excavations are done)	0	4	2	10	4	0.1415
32. Possible ground water	2	4	3	12	4	8 Medium
contamination when hospital						
is demolished	2	2	2	4	2	41000
33. Storage of topsoil and sub-	2	2	_ Z	4	2	4 Low
soil below the flood line and in						
drainage features	2	2	2	4	2	41000
34. Dumping of builder's rubble below the flood line or	2	2	_ Z	4	2	4 Low
within watercourses or watercourse buffers						
	3	2	2	1	2	6 Low
35. Impact on wetlands in the riparian zone	3	Z	Z	4	_ Z	6 LOW
36. Due to the undulating	5	2	4	8	3	15 Medium
nature of the study area, some	3	Z	4	0	3	13 Medioi11
cut and fill exercises will be						
required for the creation of						
platforms						
39. Should the construction	3	3	2	6	3	9 Medium
phase be scheduled for the		٦		0	3	/ INGUIUITI
summer months, frequent rain						
could cause very wet						
conditions, which makes road						
CONTAINOUS, WITHCH THUKES TOUG	1					

	T	,		1	1	
construction and						
environmental rehabilitation						
works extremely difficult in						
flood line and wetland areas						
40. If dry and windy conditions	3	3	2	6	3	9 Medium
occur during the construction						
phase, dust pollution could						
become a problem. In the						
winter dust will be carried over						
the areas to the north and						
north-west of the study area.						
During spring (especially the						
windy August) construction						
dust will be carried across the						
areas to the south and south-						
east of the study area.						
41. Loss of natural grassland	5	3	4	12	4	20 High
areas						
42. Loss of medicinal plant	3	3	3	9	4	12 Medium
species						
44. The dumping of builders'	3	2	3	6	3	9 Medium
rubble and other waste in the						
area earmarked for exclusion						
45. Loss of the red-listed plant	4	3	4	12	4	16 Medium
species Trachyandra						
erythrorrhiza						
46. If the entire area to be	3	4	3	12	4	12 Medium
developed is cleared at once,						
smaller birds, mammals and						
reptiles will not be afforded						
the chance to weather the						
disturbance in an undisturbed						
zone close to their natural						
territories						
47. Noise of construction	3	2	2	4	2	6 Low
machinery could have a	_	_	_			,
negative impact on the fauna						
species during the						
construction phase						
48. During the construction	3	4	3	12	4	12 Medium
and operational phase (if not						. 2 / / / 0 0 0 1 1
managed correctly) fauna						
species could be disturbed,						
trapped, hunted or killed						
50. Structures of cultural and	4	2	4	8	3	12 Medium
historical significance may be	'	_	'			.2710000111
destroyed						
53. Demolishing part of the	5	2	4	8	3	15 Medium
oo. Domonstring pair of the			<u>'</u>			10 1410010111

	1	1	Т	T	1	
Hospital Building for the new						
access roads and to make						
way for the proposed new						
development.						
54. In terms of the National	3	2	4	12	4	12 Medium
Heritage Resources Act, no 25						
of 1999, heritage resources,						
including archaeological or						
paleontological sites over 100						
years old, graves older than 60						
years, structures older than 60						
years are protected. They may						
not be disturbed without a						
permit from the relevant						
heritage resources authority						
55. The possibility of graves not	2	4	2	8	3	6 Low
visible to the human eye						
always exists and this should						
be taken into consideration in						
the Environmental						
Management plan. It is						
important to note that all the						
graves in the cemeteries are						
of high significance and are						
protected by various laws						
56. Possibility of finding more	2	4	2	8	3	6 Low
graves on the study area,		'	_			0 2011
especially during site						
clearance and excavations						
(this could include graves of						
animals that died of anthrax)						
59. The disturbance of the soil	2	4	2	8	3	6 Low
layers of the study area will re-		T	_			O LOVV
activate anthrax spores, which						
can survive in soil for more						
than 200 years. The spores will						
distribute through ground						
water movement and through						
dust pollution. The ground						
water movement is towards						
the Jukskei River and the dust						
will be carried across the						
surrounding residential areas	2	1	2	2	2	41004
60. The disturbance of the soil	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	1	<u> </u>	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	4 Low
can also cause small pox						
outbreaks		0	0	4		41.000
67. There is a potential risk that	2	2	2	4	2	4 Low
localized infected remains						

	T	1	1	ī	ı	
may still be encountered						
during earthwork activity						
69. With the development of	5	4	2	8	3	15 Medium
the site, activities can be						
structured and any risk						
mitigated adequately						
71. Localized difficulty of	4	4	2	8	3	12 Medium
excavation to 1.5 m depth.						
88. Dangerous excavations.	4	4	2	8	3	12 Medium
89. Damage to the existing	4	4	2	8	3	12 Medium
services and infrastructure						
during the construction phase						
and disruptions in services (i.e.						
electricity, water, damage to						
Telkom cables) during the						
construction phase.						
104. Noise associated with the	3	2	2	4	2	6 Low
construction yard during the						
construction phase						
105. Construction noise after	4	4	2	8	3	12 Medium
hours and during weekends						
107. Health implications of	4	2	3	6	3	12 Medium
construction workers that work		_				
in noisy environments						
111. Dust pollution is regarded	2	2	2	4	2	4
as a major issue. I&AP's are of		_	_		_	Low
the opinion that anthrax						2011
spores in the dust can be						
inhaled and cause disease						
outbreaks.						
112. If dry and windy	4	2	2	4	2	8
conditions occur during the		_	_		_	Medium
construction phase, dust						Mediom
pollution could become a						
problem.						
113. The upgrading of services	4	4	2	8	3	12 Medium
could lead to the temporary		-				12 / (CGIOTT
disruption of services in the						
surrounding area. Accesses to						
surrounding properties could						
also be affected, especially						
when road upgrades and new						
roads are implemented.						
114. The proposed	4	4	4	16	5	20 High
development will lead to the	¬	-	-	10]	20 mgm
increased hard surfaces and						
the quantity and the speed of						
the storm water across the						
THE STOTTE WATER ACTORS THE		l .	1	I	<u>l</u>	

	T					
study area and into the water						
bodies and adjacent						
properties will increase.	4	4	0	0	0	10
115. Construction works	4	4	2	8	3	12
(especially near drainage						Medium
lines) could cause water						
pollution, siltation, soil						
compaction and impacts on						
sensitive wetlands and eco-						
systems lower down in the						
catchment area.						
116. Surface water flows will be	5	4	3	12	4	20 High
altered during the						
construction phase.						
117. Erosion and siltation	3	4	2	8	3	9 Medium
during construction as a result						
of bad management.						
118. The use of insufficient	4	4	2	8	3	12 Medium
drainage systems during the						
construction phase (i.e. sub-						
surface drainage systems & no						
mechanisms to break the						
speed of the surface water).						
119. The existing municipal	5	4	2	8	3	15
water network system does						Medium
not have the capacity to						
accommodate the water						
requirements of the proposed						
new development.						
123. The construction and	4	4	2	8	3	12
operational phases of the						Medium
proposed development will						
create large quantities of						
builder's and domestic waste						
to be accommodated by						
local registered landfill sites.						
126. Many construction	4	4	2	8	3	12
vehicles will use the						Medium
surrounding road network						
during the construction phase.						
This could cause damage to						
the existing roads and it could						
also lead to dangerous						
conditions on the surrounding						
roads.						
127. Heavy construction	3	4	2	8	3	9
vehicles that will cross the						Medium
watercourses on the study						
	1	i			1	

		ı			I	
area could cause damage to						
the watercourses, especially						
during the rainy season.						
OPERATION PHASE						
Beneficial Impacts						
12. The three historic cemetery	4	4	4	16	5	20 High
sites will most probably warrant						
a separate zone where no						
development may take place						
23. The chemical and	5	4	4	16	5	25 High
pathogen results do however						
not show any pollution that						
could be linked to the grave						
sites						
25. There are no groundwater	4	4	4	16	5	20 High
users in the area that can be						
impacted by the cemeteries						
37. The slope across the study	5	4	4	16	5	25 High
area is sufficient to allow for						
the installation of services that						
gravitate						
61. The acid pH of the soil	4	4	4	16	5	20 High
precludes long term bone						
preservation and their						
associated bacteria. The						
absolute values of the pH and						
Ca levels indicate that none						
of the soils can be considered						
conducive for the survival of						
anthrax, rather, the levels are						
low enough to confidently						
indicate a very low risk of						
anthrax survival						
62. The shallow soil profile,	5	4	4	16	5	25 High
above the bedrock, precludes		-	-			
deep burials						
65. Scaffold mounted bacteria	5	4	4	16	5	25 High
particles (the bacteria			·	. •		
particles referred to in this						
study) are too large to be						
inhaled into the alveoli.						
In the event of anthrax bacilli						
being liberated at Linksfield,						
dispersal in an infective dose						
to the lungs is very unlikely.						
Apparently a human must be						
exposed to at least 1 300						
anthrax spores per day						
anthrax spores per day						

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66. During the literature survey	5	4	4	16	5	25 High
regarding persistence of						
pathogens in soil all the						
pathogens, except for anthrax, were ruled out as risks						
due to poor or non-survival for						
prolonged periods in soil						
68. The current status quo	4	4	4	16	5	20 High
("No-go" option) with	7	-	-	10		20 mgm
uncontrolled dumping,						
squatting and human						
movement across the site						
poses a larger risk than						
development as none of the						
current activities are structured						
or controlled.						
Even the present situation						
("No-go" option) outside the						
Sizwe Hospital complex is unsafe with the uninhibited						
entrance of people. Erosion						
can cause possible exposure						
of contaminated material.						
Decontamination of the area						
is impossible.						
70. The pathogen analyses	5	4	4	16	5	25 High
conducted by the geo-						
hydrologist showed no						
pathogens that are related to						
grave sites or hospital and this						
correlates with the Terrasoil						
study	E	4	4	1/	E	OF High
72. The cultural and heritage specialists identified graves	5	4	4	16	5	25 High
specialists identified graves and historical structures to						
conserve						
76. Rates and taxes payable	5	4	4	16	5	25 High
to the local authority.		'	'			_0g.,
77. Upgrading of existing	4	4	4	16	5	20 High
services, increase in services						
capacity and the installation						
of new and higher standard						
services in the area						
78. Upgrading of existing roads	5	4	4	16	5	25 High
and the construction of new						
roads	4	4	4	1./	-	
79. Impacts on security	4	4	4	16	5	20 High
80. The provision of more social	5	4	4	16	5	25 High

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facilities in the area (i.e.						
shopping centre, schools,						
clinic etc.)						
81 Optimum utilization of	4	4	4	16	5	20 High
existing services						
82. Establishment of a new	5	4	4	16	5	25 High
clinic facility with upgraded						
services. The existing leaking						
sewer pipes will be removed.						
83. The optimum utilization of	5	4	4	16	5	25 High
valuable development land						
adjacent to the N3 freeway						
84. Promotion of infill	4	4	4	16	5	20 High
development						
86. The protection and	4	4	4	16	5	20 High
maintenance of the existing	-	-				
graveyards and the						
incorporation of the						
graveyards and selected						
historic buildings (as						
memorials) as part of the						
development						
90. Creation of temporary and	5	4	4	16	5	25 High
permanent jobs		'	'	10		20 mgm
91. The proposed	5	4	4	16	5	25 High
development will be in line	J	-	¬	10		25 mgm
with the international,						
national, provincial and local						
legislation, planning						
frameworks, guidelines,						
policies etc.						
92. The proposed	5	4	4	16	5	25 High
development will trigger	J	¬	¬	10		25 mgn
activities as listed in Section 21						
of the National Water Act. A						
Section 21 Water-Use License						
application must be submitted						
to DWS for activities (c) and (i).						
93. In terms of Section 144 of	3	4	4	16	5	15 Medium
the National Water Act the		¬	¬	10		10 MCGIOTT
1:100 year flood line must be						
indicated on all planning						
drawings. A Section 21 Water-						
Use License will also be						
required if structures are						
erected/ if filling or cutting						
exercises are planned for the						
areas below the flood line.						
arous bolow trie hood line.						

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94. The proposed	5	4	4	16	5	25 High
development will be within the						
urban development boundary						
95. The proposed	4	4	4	16	5	20 High
development will be regarded						
as infill development and it will						
prevent urban sprawl						
96. The proposed	4	4	4	16	5	20 High
development will supply much			'	. •		
needed housing to be						
delivered by the government						
in order to achieve housing						
targets	5	1	1	1.5	5	25 Ulark
97. The proposed	5	4	4	15	5	25 High
development will be in line						
with the Gauteng						
Densification Strategy	<u> </u>	<u> </u>				
98. The visibility of the study	3	4	4	16	5	15 Medium
area creates an opportunity						
for maximum exposure						
99. The embankment	3	4	4	16	5	15 Medium
adjacent to the N3 freeway						
will screen some of the						
developments to be situated						
adjacent to the freeway. The						
designs of the structures to be						
placed adjacent to the						
embankment must take the						
height and impact of the						
embankment into						
consideration.						
100. The views from the north-	5	1	4	16	5	25 Medium
	'	4	'1	10		25 MEGIUM
western corner of the study						
area are attractive and should						
be utilised in the development	 			1.		00.11
106. The views from the south-	4	4	4	16	5	20 High
western corner of the study						
area are attractive and should						
be utilised in the development	1					
120. The proposed upgrades	5	4	4	16	5	25
to the bulk water reticulation						High
system will trigger activities as						
listed in the 2010 Amended						
NEMA EIA Regulations.						
121. The Bruma Outfall sewer	5	4	4	16	5	25
has limited space capacity		'		. •		High
available to accommodate						9.1
the sewage generated by the	<u>İ</u>		<u>i </u>			

line was a second	1		1	T		
proposed Linksfield development. Capacity will however be sufficient once the diversion of the Illiondale pump station to the Modderfontein outfall has been completed. The construction is currently in progress. Bulk contributions will be payable and are calculated by the Local Authority.						
122. The proposed development will require at least 40MVA electricity. According to City Power there might be a need to supply the development from several 11kV circuits in order to meet the total load. The proposed upgrades will trigger activities as listed in Listing Notice1 of the 2010 Amended NEMA EIA Regulations.	5	4	4	16	5	25 High
Adverse Impacts	1			T		
8. Seasonal shallow groundwater, perched water and seepage near the flood	2	4	3	12	4	8 Medium
plain						
plain 10. Good drainage will be required as the occurrence of season perched water tables is possible, especially in the shallow bedrock drainage areas. This may cause problems with dampness in surface structures and with installation of services	4	4	4	16	5	20 High
10. Good drainage will be required as the occurrence of season perched water tables is possible, especially in the shallow bedrock drainage areas. This may cause problems with dampness in surface structures and with	2	2	4	8	3	20 High 6 Low

	Г	T	Т	T	T	
sewage spillages of the Sizwe Hospital						
19. Acidity (pH) of the soils	4	2	4	8	3	12 Medium
22. Pollution of the groundwater will percolate down slope towards the river and drainages feeding into the river Lowering of groundwater. Any pollution from the cemeteries will therefore end in the river or drainages.	4	2	3	6	2	8 Medium
26. Two small wetlands, feeding into the Jukskei River, were identified. These are situated in positions that are not considered adequate for urban development and they should therefore be kept as open spaces on the site. However, without adequate storm water planning and design these wetlands could be compromised.	5	4	4	16	5	25 High
35. Impact on wetlands in the riparian zone	3	2	3	6	3	9 Medium
38. Due to the topography of the site, large sections of the study area are visible from the surrounding roads and properties	4	2	4	8	3	12 Medium
41. Loss of natural grassland areas	5	2	4	8	3	15 Medium
42. Loss of medicinal plant species	3	4	4	16	5	15 Medium
45. Loss of the red-listed plant species Trachyandra erythrorrhiza	4	2	4	8	3	12 Medium
48. During the construction and operational phase (if not managed correctly) fauna species could be disturbed, trapped, hunted or killed.		2	3	6	3	9 Medium
49. Loss of habitat can lead to the decrease of fauna numbers and species.	3	2		4	2	6 Low
51. The cemetery in the south-	4	2	4	8	3	12 Medium

western corner of the						
development is a concern as						
the extent cannot be						
determined due to the dense						
vegetation because of the						
good summer rain.						
52. Loss of jobs and important	2	2	4	8	6	12 Medium
social service provided by the	_	_	•		o o	127/10/01/01
hospital to the underprivileged						
57. Possible ground water	3	2	3	6	2	6 Low
contamination – anthrax	3	2	3	O	2	O LOW
spores and other diseases/						
viruses currently and formerly						
treated at the hospital		0	4	0	0	
58. Possible water and soil	2	2	4	8	3	6 Low
contamination due to led						
lined caskets	_		_			
63. The effluent of the	3	4	3	12	4	12 Medium
Rietfontein Infectious Diseases						
Hospital yielded tuberculosis						
DNA.						
64. Despite the negative	2	4	3	12	4	8 Medium
findings, graves or animal						
burial pits may be concealed						
under rubble or ground fill						
73. Some of the I&APs are of	2	2	4	8	3	6 Low
the opinion that small pox is still						
treated at the hospital						
74. Some agricultural land will	2	2	4	8	3	6 Low
be lost						
75. Impacts on surrounding	3	4	4	16	5	15 Medium
property values						
85. Increase in traffic on	4	4	2	8	3	12 Medium
already congested roads						
87. Poor people will move into	2	4	3	12	4	8 Medium
area surrounded by well-						
established residential areas.						
The people have no money						
and this will lead to petty						
crime. Petty crime eventually						
becomes major crime						
101.Two of the graveyards are	5	2	4	8	3	15 Medium
situated adjacent to Club		_	'			.07110010111
Street are visible.						
102. The proposed	3	4	4	16	5	15 Medium
development will be visible]	7	+	10	J	13 MEGIOTTI
1						
Development. Low cost						

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housing could have a negative impact on the property values						
103. The proposed development could have a negative impact on the "Sense of Place" created adjacent to the river. =	3	2	2	4	2	6 Low
108.Noise levels in residential areas exceed the acceptable noise levels	2	4	3	12	4	8 Medium
109.Noise created by kitchen and air conditioning equipment	4	2	3	6	3	12 Medium
110. If not planned and managed correctly the lights (interior and exterior) and the signage of the development could cause visual pollution.	3	2	4	8	3	9 Medium
114. The proposed development will lead to increased hard surfaces and the quantity and speed of the storm water across the study area and into the water bodies and adjacent properties will increase.	3	2	4	8	3	9 Medium
123. The construction and operational phases of the proposed development will create large quantities of builder's and domestic waste to be accommodated by local registered landfill sites.	4	2	4	8	3	12 Medium
125. The proposed development will generate between 9 000 and 10 000 peak hour trips in an area which already experience traffic congestion problems.	4	4	4	16	5	20 High
128. Due to limited road reserve it will not be feasible to implement all the proposed road upgrades.	3	2	4	8	3	9 Medium

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7.3 Discussion of Significance Assessment

Thirty-nine (39) beneficial impacts associated with the proposed development were identified. Two of the beneficial impacts are associated with the construction phase and 37 beneficial impacts are associated with the operational phase of the development. Four (4) of the beneficial impacts relate to the bio-physical environment and 34 of the beneficial impacts relate to the socio-economical environment. From the above it is clear that most of the beneficial impacts relate to the operational phase of the development and such impacts are usually long term impacts. The socio-economical benefits

One-Hundred-and-Six (106) adverse impacts associated with the proposed development were identified. Seventy-Two (72) of the impacts are related to the construction phase and thirty-four (34) impacts are associated with the operational phase. The impacts associated with the construction phase are usually short term impacts that are easier to mitigate. Fifty-Six (56) of the adverse impacts relate to the bio-physical environment and fifty (50) adverse impacts relate to the socio-economical environment. Many of the socio-economical impacts received high significance ratings, but due to the fact that the impacts are positive, no mitigation is required. This indicates that the proposed development (if well planned and managed) will contribute to an improvement in the quality of life of the people residing on the study area and in the surrounding area and the quality of the bio-physical environment.

Only a few adverse impacts received high significance ratings and the high impacts identified are mainly associated with possible erosion, siltation and perched water conditions. Other impacts that were regarded as high are the increase in traffic on the already congested roads and the unavailability of municipal services. The issues identified were listed and addressed by the specialists and it was possible to mitigate these high impacts to levels that are acceptable. In some cases the potential impacts were even eliminated completely. The possible impacts associated with the diseases mainly received low significance ratings, because the spreading-risks of the diseases involved are regarded as highly improbable.

Measures that are recommended in this report and the Environmental Management Plan (EMP) could mitigate the medium and high-anticipated adverse impacts to an acceptable level.

8. CONCLUSION

The purpose of the EIA (Environmental Impact Assessment) process was to investigate, analyse and assess the bio-physical, social, economical and institutional environments associated with the proposed development and to identify issues/impacts that require mitigation, or potential "fatal flaws" that could prevent the project from happening.

In order to conduct a thorough impact assessment and to make informed conclusions and recommendations that promote sustainable development, it is extremely important that the EAP and the specialists appointed to conduct specialist surveys, remain independent at all times. The responsibilities of the EAP and the specialists are however carried-over to the delegated authority once the Final EIA is submitted and therefore it is extremely important that the EIA and the accompanying EMP contain information that will enable the delegated authority to make an informed decision, which will promote sustainable development.

This complicated project incorporated many challenges and due to the serious nature of many of the impacts raised by the Interested and Affected Parties, it was very important to involve a team of suitably qualified specialists from the outset. The specialist reports and inputs did not only assist with the addressing and elimination of issues/impacts, but such reports and inputs also contributed significantly to the production of a final development concept and layout for the proposed mixed-use development, which takes all of the environmental issues that were identified into consideration. After the project team indicated (at the Draft EIA Stage of the project) that the disease, grave and services issues could be addressed, and where required, mitigated to acceptable levels, many of the objectors/surrounding residents were still not satisfied with the efforts made by the EAP, the developer, the project team and the specialists.

The focus of the objections were suddenly redirected and the potential impact of the "nature of the development" (a development that will also accommodate lower income groups) became the main issue of concern. At the public meetings objectors indicated that they were very concerned about the influx of lower income groups into the area. Crime, sub-letting, urban slums, the erection of illegal shacks, noise impacts, visual impacts, littering and the lowering of the surrounding property values are potential cumulative impacts associated with such a high density development, which will include housing units for the lower income market. The financial and ownership model of the developer also raised some serious concerns.

One of the surrounding residents indicated that she and her family were the victims in an armed robbery at their home. They are already very concerned about the security of the area and such a development will only increase the security risks of the area. We promised to meet with this I&AP in order to discuss her issues and concerns in more detail and on a personal level. After the meeting we will propose (if possible) mitigation measures to address the issues raised by this I&AP. A separate letter will be supplied to GDARD within the next 30 days in order to supply feedback regarding the discussions and agreements made with the I&AP. If required, the EMP will also be amended to incorporate additional mitigation measures.

The Rand Aid residents indicated that the development caters for the elderly and that the residents of the development currently enjoy a "crime free" environment with a tranquil atmosphere and attractive views. Elderly people are vulnerable and also very susceptible to dust pollution, noise pollution and other potential impact that could be triggered by the construction phase of the development. Rand Aid requested that the developer implement measures to reduce the visual impacts on their development, especially in the north-western corner of the study area and suitable mitigation measures must also be proposed for the reduction of crime and noise levels. The potential lack of services and the increased traffic on the already congested roads were also serious concerns that were raised from the outset. People have little trust in government's capability to upgrade and maintain services. The current electricity capacity problems experienced at Eskom

emphasizes the serious services and maintenance problems experienced and only contribute to the country's services problems.

Obviously the concerns of the surrounding residents cannot be ignored. The tax paying residents also invest substantial amounts of private money into the upgrading of the security of their neighbourhoods and houses and cannot afford developments that increase the crime risks of the area. An aspect that is very concerning is the fact that the development will be implemented in phases over a period of 8 years. Construction activities are often associated with crime, temporary services and access disruptions, dust pollution, noise pollution, visual pollution, illegal dumping, illegal squatters etc. and it will be a challenge to manage the construction related impacts associated with the various phases throughout the 8 years.

The PPP formed to plan, implement and manage the project however differentiates this project from other public sector housing projects. A private partner will invest large sums of money into the development and will also be responsible for the planning, implementation, management, monitoring and maintenance of the project. The private development will furthermore remain the owner of the residential units and strict security and monitoring measures will be implemented to protect their valuable assets. The developer will also provide the funding for the much needed upgrading of the services and the roads and therefore the upgrading of the services, to acceptable standards, are guaranteed. This action will promote urban renewal and the optimum utilisation of services.

Reality is that government <u>must</u> provide a large number of housing units and "lower income residential units" are being erected across Gauteng (with or without private partners). The strategic locality and the size of the Linksfield study area, however creates a unique opportunity for a mixed-use development that will create many jobs and promote sustainable development. The project will however only be successful if it is well planned and managed and government specifically selected a developer with ample development experience to assist with the achievement of the goals and objectives set for the project.

As environmental consultants we feel satisfied that no "fatal flaws" associated with the project were identified and that all site sensitivities and issues/impacts were taken into consideration with the finalisation of the development concept and layout.

To follow now is a short summary of the most important findings:

Bio-Physical Environment:

The study area is underlain by both mafic and granitic rocks and excavations become difficult at a depth of approximately 1,5m. The main impacts associated with the low excavation and geological and soil characteristics of the study area are the possibility of perched water table conditions in some areas, the possible need for blasting operations in areas where extensive excavation exercises are required and the fact that it would have been extremely difficult to bury animal carcasses or humans under such challenging geotechnical and soil conditions, especially many years ago when modern day mechanical equipment was not yet available.

After extensive research and surveys, the team of specialists could only identify three graveyards on the study area and it is regarded as highly unlikely that any other graveyards will be identified on the study area. The original hospital site was ±600ha in extent and two thirds of the study area is already covered with urban development.

The possibility of graveyards underneath the existing urban development that already took place on the study area, cannot be excluded, especially if one considers the fact that some of these areas are underlain with deeper soils, which are more suitable (from an excavation point of view) for the establishment of graveyards. The possible occurrence of anthrax spores, was regarded as the only major disease related risk, but the acidic nature of the soils of the study area is not regarded as favourable for the co-existence of any anthrax spores or animal bones that are common carriers of such spores. Anthrax spores tend to thrive in higher-alkali soils. In order to confirm the possible occurrence of anthrax spores in the soils of the study area, soil samples (sourced from pre-determined points on the study area (i.e. in the graveyards and downstream from ground water movement

directions)) were tested and no signs of any of the historical diseases that were treated at the hospital, including anthrax were found.

The team of specialists however identified some TB DNA, which is most probably associated with sewer spillages of the existing hospital facility. The TB DNA in the soils, the groundwater (which daylights at the Jukskei River), and the water in the Jukskei River poses health risks to construction workers during the construction phase and it also poses risks to people that are in contact with the water of the Jukskei River, even if the development does not take place. This matter must therefore be addressed by the relevant parties as soon as possible.

The vegetation of the study area is regarded as disturbed, but two small wetland areas and the riparian vegetation adjacent to the Jukskei River were regarded as natural features with some ecological value and potential that are in urgent need of rehabilitation. The wetland and vegetation specialists recommended that a continuous natural strip, which incorporates the riparian vegetation, the wetland areas and the watercourse buffers be conserved and that this open space strip be linked to the larger Gauteng open space system. When rehabilitated and protected, the seasonal wetland areas can be utilised by Giant Bullfrogs as breeding areas and the riparian zones can be used as movement corridors and linkages to nearby foraging areas associated with grasslands. The vegetation specialists also identified a few Trachyandra erythrorrhiza sp. (according to GDARD records, red data plant species) in the north-eastern section of the study area, but it was recommended that the species be relocated to the riparian/ wetland zone, because the existing habitat is not regarded as ideal (not regarded as a wetland) and it was established that a vegetation specialist managed to successfully cultivate Trachyandra erythrorrhiza in his nursery. He confirmed that he also managed to grow many of these species in his garden and that it is possible to relocate the species to more suitable habitats on the study area. Furthermore there are questions regarding the conservation status of this species (at the IUCN and GDARD). According to some specialists, this species must be removed from the GDARD list of red listed plant species and it is not listed on the IUCN list of red data species.

In the case of the study area, the social and economical value of the study area (mainly in terms of locality, accessibility, the availability of services, the demand for housing within the urban environment etc.) is regarded as equally important or even more important than the conservation of a few Trachyandra erythrorrhiza sp., especially if one considers the fact that this species will eventually be subject to edge effects, the habitat is not regarded as ideal and the species can be relocated with success.

From a faunal point of view, the Half-collared Kingfisher has been observed along the Jukskei River in the past and is known to occur along this river system according to the SABAP2 data. The intention is however to rehabilitate and conserve the riparian zone along the Jukskei River and to link this zone as part of the larger regional open space system. The conservation and rehabilitation of this zone, if well planned and managed, will assist with habitat creation and it will promote the increase in bio-diversity. The Half-collared Kingfisher will most probably move to the study area after the construction phase if the proposed rehabilitation plan takes the specific needs of this bird species into consideration.

Some mole activity (most probably the African Mole Rat, which is not a red data species) was spotted in the graveyards. The possible occurrence of the Rough Head Golden Mole was also considered, but it was regarded as highly unlikely. It is however not the intention to remove any of the graveyards from the study area. The plan is to renovate and protect the graveyards and to incorporate the graveyards as part of the development (i.e. a memorial garden). The gardens of the graveyard can be planned to act as a habitat for the moles on the study area. We already successfully managed to create a habitat for the Juliana Golden Mole in an office park along Lynnwood Road (to the north of the Bronberg) in Pretoria. Increased mole activity was detected during the last site visit and we can see no reason why this cannot be achieved in the gardens of the graveyard that will be maintained and protected as part of the development.

Social and Economical Environment:

The most significant negative impacts associated with the proposed development are 1) the impacts on the services that are already stressed, 2) the impacts on the surrounding

traffic, which is already congested, 3) the impact of the development on the surrounding property values, 4) the possible damage to or relocation of existing graves with cultural and historical value, 5) the possible demolition of historical buildings and structures and 5) the possible health impacts associated with the diseases that could become active once the soils of the study area are exposed.

It was however confirmed in the EIA Report that it will be possible to address/mitigate all of the above-mentioned issues/impacts to acceptable and non-life-threatening levels. In fact, in some cases the application of the proposed mitigation measures will lead to long term environmental conditions that will be more advantageous than the current/"no-go" alternative. Diagrams 1 and 2 of this report motivate this statement.

The most significant positive social and economic impacts are 1) the provision of much needed housing within the urban environment, 2) job creation in close proximity to the housing to be provided, 3) the strategic locality of the study area in terms of accessibility and driving distance, 4) the upgrading of existing services and road infrastructure, 4) construction of new roads and the implementation of new services, 5) the optimum utilisation of services, 5) the generation of rates and taxes payable to the local authority, 6) the restoration and conservation of some of the heritage features on the study area; 7) the conservation of the existing graveyards, 8) the addressing of all possible soil and water contamination, 9) the "opening-up" of land which has been placed in "quarantine" for many years due to uncertainties associated with the graves and diseases treated at the Sizwe Hospital, 10) social upliftment, 11) the provision of social facilities in close proximity of the residential component and 12) an increase in the security.

From the above, it is clear that the positive socio-economic impacts associated with the proposed mixed-use development by far outweighs the negative impacts listed and which could be mitigated to acceptable levels.

Institutional Environment:

From an institutional point of view, it can be confirmed that the proposed mixed-use development will be in line with the relevant planning frameworks and policies as compiled on a local and provincial level. The proposed development is furthermore in line with Gauteng's densification strategy, it prevents urban sprawl and it promotes conservation.

The project team appointed by the applicant also identified all the relevant authorisations, permits, licenses etc., which are required in terms of the applicable legislation, by-laws, polices etc. prior to commencement with the project and all the relevant specialists have already been appointed to compile and submit the required applications/ documents.

Summary:

As environmental consultants we can confirm that there are no "fatal flaws" associated with the study area and its surroundings that could prevent the project from happening. We furthermore confirm that we feel confident and satisfied that all the potential negative environmental issues/impacts as listed by the I&APs, the specialists, authorities and Bokamoso can be addressed and mitigated to levels that are acceptable. We also attended the bi-weekly project meetings during which the various layout and land-use alternatives were discussed and it can also be confirmed that all the site sensitivities were taken into consideration with the finalisation of the layout.

If the proposed development is well planned, managed and implemented in accordance with the guidelines and mitigation measures as supplied by the various parties, the positive impacts associated with the proposed development will (in the long term) outweigh the anticipated negative impacts, which are mostly short term in nature and associated with the construction phase of the development.

9. **RECOMMENDATIONS**

As environmental consultants we can confirm that we considered all the environments (social, ecological, economical and institutional), which form the crucial building blocks of a sustainable development and we have no doubt that the planned mixed-use development will be sustainable if all the guidelines as supplied by the specialists, the project team, the relevant authorities and Bokamoso are implemented. We therefore recommend that the project receive the "go-ahead" and that the following specific conditions be included as part of the positive Decision to be issued.

- The implementation of the mitigation measures contained in the Environmental Management Plan (Annexure At) to achieve maximum advantages from beneficial impacts, and sufficient mitigation of adverse impacts;
- All the guidelines as supplied in the relevant specialist report must be taken into consideration;
- A traffic upgrading management and monitoring plan for all the road upgrading and construction phases. This purpose of this plan must be to address traffic flow throughout the development phases, to promote road safety (for cyclists, pedestrians and vehicles, to mitigate dust pollution and noise pollution associated with the proposed road upgradings, to ensure that road upgrading signage and methods are in line with the local authority and other applicable standards, to address construction vehicle and equipment impacts and to address temporary access and accessibility problems;
- A construction and operational phase security management plan must be compiled and submitted to the delegated authority for approval. The security management plan must address the on-going security of all 8 the development phases;
- The layout plan must be amended to incorporate a visual buffer in the north-western section of the study area;
- The final vertical and horizontal alignment of the link road between the Edenvale
 Hospital and the Rand Aid development must be designed to prevent crime and to
 reduce noise levels associated with the road (i.e. noise barriers/ security wall along
 the eastern boundary of the Rand Aid development);

- The compilation of a construction phase and operational phase storm water management plan that will prevent erosion, pollution and siltation. The storm water management plan and concept must be in line with the standards and requirements of DWS and the local authority. The storm water management concept has already been discussed with DWS and the final storm water drawings as supported by DWS and the local authority must be forwarded to GDARD for record keeping purposes prior to construction;
- A suitably qualified specialist must be appointed to identify and assist with the relocation of all medicinal plants found on the study area. GDARD must be contacted prior to the removal/ relocation of the medicinal plants and GDARD must also be afforded the opportunity to supply inputs regarding the proposed relocation;
- Mr. Ate Berga must be appointed to assist with the relocation of the Trachyandra erythrorrhiza sp. Mr. Berga must contact the relevant official at GDARD prior to the relocation of such species and must afford the official an opportunity to also be involved in the relocation/ transplantation process. This could be regarded as a pilot project to obtain more data regarding the species. According to the GDARD data base, the species must still be assessed;
 - All declared weeds and invaders must be removed from the site on an on-going basis and in phases. In areas below the flood line, where more than 5m³ of soil will be moved, filled, removed etc. the relevant authorities (GDARD and DWS) must be notified of areas that require weed and exotic control programmes. In some cases the removal of weeds will most probably only be allowed once the decision has been issued and once the rehabilitation plan has been approved;
 - The applicant will not be allowed to commence with any construction related activities that that require a Section 21 Water-Use Licenses prior to the issuing of such licenses;
 - Section 19 of the National Water Act must also be taken into consideration and if required, measures must be added to the management and monitoring plans to ensure compliance;
 - The Waste Act (especially Part 8, which deals with contaminated land) must also be taken into consideration if any additional graves or waste sites are exposed during the construction phase of the development;

- If the Giant Bullfrog or any other herpetological species are encountered or exposed during the construction phase, they should be removed and relocated to natural areas in the vicinity. A permit will be required from GDARD for the relocation of bullfrogs;
- Every effort should be made to retain the linear integrity, flow dynamics and water quality for the Jukskei River and its tributaries. The same applies to the wetlands, and all the water bodies associated with riparian vegetation. The ECO and appointed main contractor must delineate the wetland areas, the riparian areas and the proposed buffer zones prior to the construction phase;
- The areas to be protected must be fenced/ protected in an acceptable manner (as approved by the ECO) prior to the construction phase. The areas to be protected by a conservation line/fence during the construction phase of the development includes the graveyards, the Sizwe Hospital historical buildings and structures and the natural areas associated with the river and the wetlands (as identified by the specialists);
- The proposed demolition of the Sizwe Hospital must be regarded as the final phase of the development. Viable alternatives for the replacement of the existing social services delivered by the hospital must be considered and the preferred alternative, including the details of the historical structures to be conserved, must be approved by the relevant authorities (including SAHRA) prior to commencement with this final phase. The details of the proposed demolition, conservation of the historical structures, replacement of the existing social services delivered by the hospital as well as the relevant approvals, must be supplied to GDARD for record keeping purposes prior to commencement of the final phase;
- A Heritage Management Plan (for the planning, construction and operational phases
 of the development) must be compiled for the management, renovation and
 conservation of the historical structures and features, including the graveyards;
- The management plan must also address the possible discovery of additional graveyards or waste sites;
- A ground water and soil quality monitoring programme for the construction phase must be compiled. This plan must identify sampling points for ground water, surface water and soils. The monitoring intervals must also be prescribed. The monitoring results must be forwarded to Dr. van Heerden, Dr. De Vos, DWS and GDARD;

- In cases where contamination is detected, the relevant specialists (Dr. De Vos, Dr. Van Heerden, Dr. van der Waals and Dr. Mannie Levin) must be notified immediately;
- All ECO reports must be forwarded to Dr. De Vos and Dr. De Vos must be appointed
 to assist if any new graves/ waste sites are discovered during the construction phase.
 He must also supply mitigation measures if any disease associated contamination is
 detected during the ground water and soil quality tests;
- Some major road and services upgradings are required on and around the study area. This could cause major temporary disruptions to the existing services and it could have an impact on the accessibility of properties and the traffic flow. The affected parties must be notified (at least two weeks in advance) of any possible inconvenience that could be experienced; and
- Prove of the relevant GDARD and DWS approvals of the EIA applications and \$21 WUL
 Application for the upgrading of external roads and services must be supplied to
 GDARD prior to commencement with construction works. The upgrading of such
 external services does not fall within the scope of the authorization issued for the
 mixed-use development.

Figures

Annexure A

Copy of Company Profile and copy of Lizelle Gregory CV from Bokamoso Landscape Architects and Environmental consultants

Company of Company Profile and copy of CV from Nali Sustainability

Annexure C

Minutes – Workshops with Specialist Forum

Annexure D

Two-pager Inputs from Specialist Forum

Annexure E

Recent graveyards and hazardous medical waste (site plan received from I&AP's)

Follow-up opinion of the Specialist Forum on Annexure F

Correspondence: The Adler Museum

Annexure H

Correspondence Letters from GDARD

Annexure 1

Historical Aerial Photo of the Larger Farm

Annexure J

Newspaper Advertisement to public to come forward with information

Annexure K

Inputs from NICD

Annexure L

Minutes of the meeting with Dr W. Basson

Annexure M

More detail regarding discussions with different parties

Annexure N

Copy of the application submitted to GDARD

Annexure 0

Town Planning Memorandum

Cultural and Historical Report

Annexure Q



SAHRA comments

Annexure Qi

Visual impacts/artistic images of proposed development

Annexure R

Visual Impact Assessment

Annexure Ri

Fauna and Flora reports

Annexure S

Correspondence with Ate Berga

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Wetland Report

Annexure T

Floodline drawings

Annexure U

Noise Impact Assessment

Annexure V

Layout Alternatives

Proposed Final Layout

Annexure X

Geotechnical Report

Annexure Y

Geo-hydrological Report

Historical Topographic Maps

Annexure Aa

Baseline Forensic Soil Investigation

Annexure Ab

Agricultural Potential Report

Annexure Ac

Market Study

GDARD Biodiversity Requirements

Annexure Ae

EMP

Refer to Annexure At

Annexure Af

Services Report

Stormwater Management Conceptual Design

Annexure Ah

Electrical Report

Traffic Impact Assessment

Public Participation

Annexure Ak

Social Impact Assessment

Annexure Al

Publication of Dr de Vos

Annexure Am

Updated Issues and Response Report. *This Annexure replaces Annexure Ak6*

Annexure An

Minutes of the Rand Aid Focus Group Meeting. This Annexure replaces Annexure Ak9

Annexure Ao

Minutes of the Public Meetings that were held on 2 December 2014. This Annexure replaces Annexure Ak9

Specialists Response to the Comments of the Authorities and the I&APs

Annexure Aq

Market Study 2

Annexure Ar

Results of the trail pit excavated behind the nursery

Annexure As

Environmental Management Plan (EMP). *This Annexure replaces Annexure Af*

Annexure At

Wetland Rehabilitation Plan

Architect's Artist Impressions – Type of development visible from Rand Aid

City of Johannesburg Comments

Annexure Aw

Copy of Company Profile and copy of Lizelle Gregory CV from Bokamoso Landscape Architects and Environmental consultants

Qualifications And Experience In The Field Of Environmental Planning And Management (Lizelle Gregory (Member Bokamoso)):

Qualifications:

- -Qualified as Landscape Architect at UP 1991;
- -Qualified as Professional Landscape Architect in 1997;
- -A Registered Member at The **South African Council for the Landscape Architect Profession (SACLAP)** with Practise Number: **PrLArch97078**;
- A Registered Member at the International Association for Impact Assessment Practitioners (IAIA);
- Qualified as an **Environmental Auditor in July 2008** and also became a Member of the International Environmental Management Association (IEMAS) in 2008.

Working Experience:

- -Worked part time at Eco-Consult 1988-1990;
- -Worked part time at Plan Associates as Landscape Architect in training 1990-1991;
- -Worked as Landscape Architect at Environmental Design Partnership (EDP) from 1992 1994
- -Practised under Lizelle Gregory Landscape Architects from 1994 until 1999;
- -Lectured at Part-Time at **UP** (1999) Landscape Architecture and **TUT** (1998- 1999)- Environmental Planning and Plant Material Studies;
- -Worked as **part time Landscape Architect and Environmental Consultant at Plan Associates** and **managed their environmental division for more that 10 years** 1993 2008 (assisted the **PWV Consortium** with various road planning matters which amongst others included environmental Scans, EIA's, Scoping reports etc.)
- -Renamed business as **Bokamoso in 2000** and is the only member of Bokamoso Landscape Architects and Environmental Consultants CC:
- -More than 20 years experience in the compilation of Environmental Reports, which amongst others included the compilation of various DFA Regulation 31 Scoping Reports, EIA's for EIA applications in terms of the applicable environmental legislation, Environmental Management Plans, Inputs for Spatial Development Frameworks, DP's, EMF's etc. Also included EIA Application on and adjacent to mining land and slimes dams (i.e. Brahm Fisherville, Doornkop)

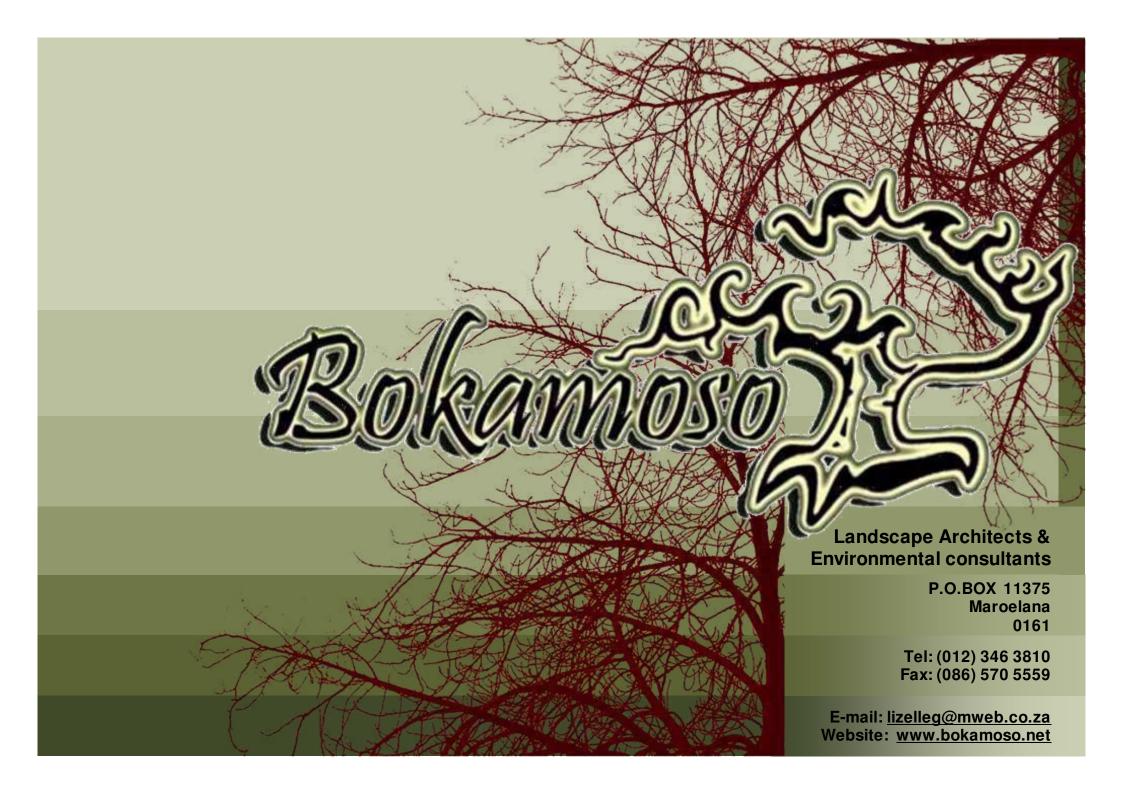
Qualifications And Experience In The Field Of Landscape Architecture (Lizelle Gregory (Member Bokamoso)):

Landscape Architecture:

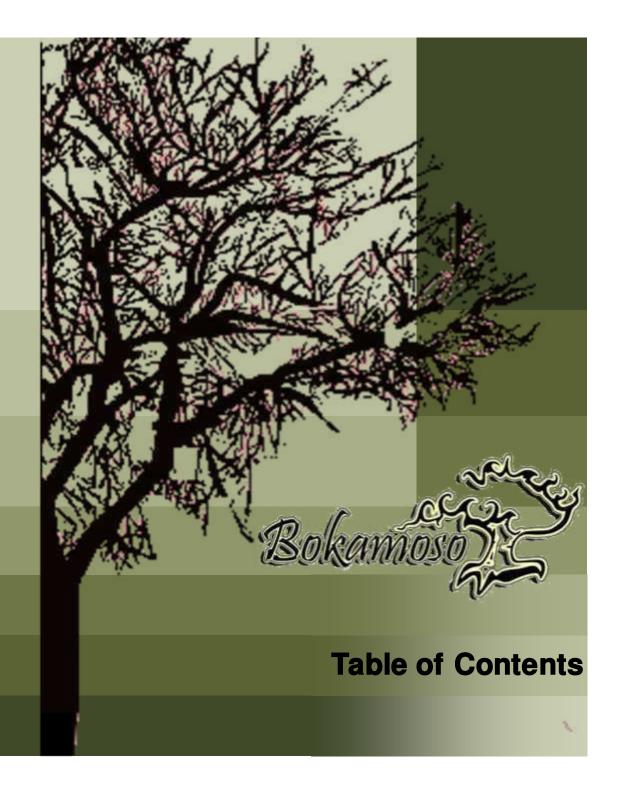
-Compiled landscape and rehabilitation plans for more than 22 years.

The most significant landscaping projects are as follows:

- -Designed the Gardens of the Witbank Technicon (a branch of TUT). Also supervised the implementation of the campus gardens (2004);
- -Lizelle Gregory was the Landscape Architect responsible for the paving and landscape design at the UNISA Sunnyside Campus and received a Corobrick Golden Award for the paving design at the campus (1998-2004);
- -Bokamoso assisted with the design and implementation of a park for the City of Johannesburg in Tembisa (2010);
- -The design and implementation of the landscape gardens (indigenous garden) at the new Coca-Cola Valpre Plant (2012-2013);
- -Responsible for the rehabilitation and landscaping of Juksei River area at the Norwood Shopping Mall (johannesburg) (2012-2013);
- -Designed and implemented a garden of more than 3,5ha in Randburg (Mc Arthurpark). Bokamoso also seeded the lawn for the project (more than 2,5 ha of lawn successfully seeded) (1999);
- -Bokamoso designed and implemented more than 800 townhouse complex gardens and submitted more than 500 Landscape Development Plans to CTMM for approval (1995 2013);
- -Assisted with Landscape Designs and the Masterplan at Eco-Park (M&T Developments) (2005-2011);
- -Bokamoso designed and implemented an indigenous garden at an office park adjacent to the Bronberg. In this garden it was also necessary to establish a special garden for the Juliana Golden Mole. During a recent site visit it was established that the moles are thriving in this garden. Special sandy soils had to be imported and special indigenous plants had to be established in the natural section of the garden.
- -Lizelle Gregory also owns her own landscape contracting business. For the past 20 years she trained more than 40 PDI jobless people (sourced from a church in Mamelodi) to become landscape contracting workers. All the workers are (on a continuous basis) placed out to work at nurserys and other associated industries;
- -Over the past 20 years the Bokamoso team compiled more than 800 landscape development plans and also implemented most of the gardens. Bokamoso also designed and implemented the irrigation for the gardens (in cases where irrigation was required). Lizelle regarded it as important to also obtain practical experience in the field of landscape implementation.

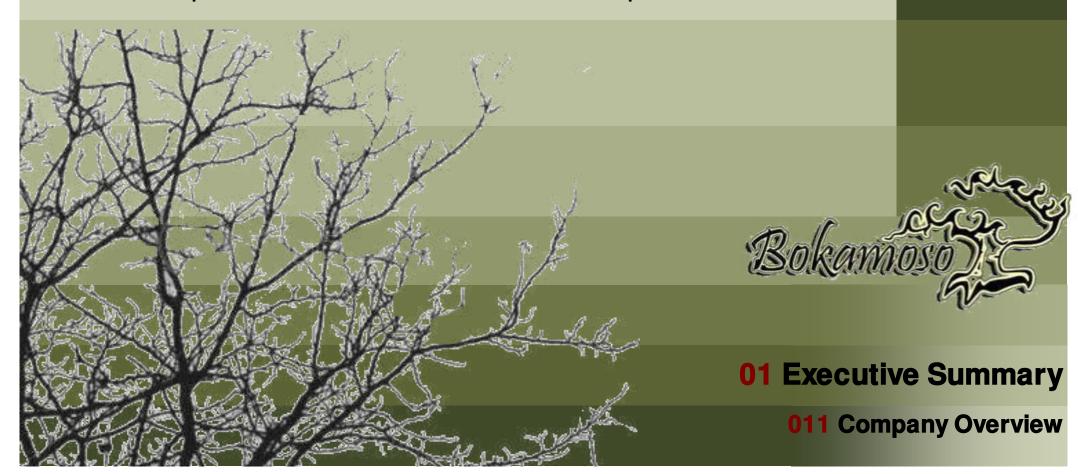


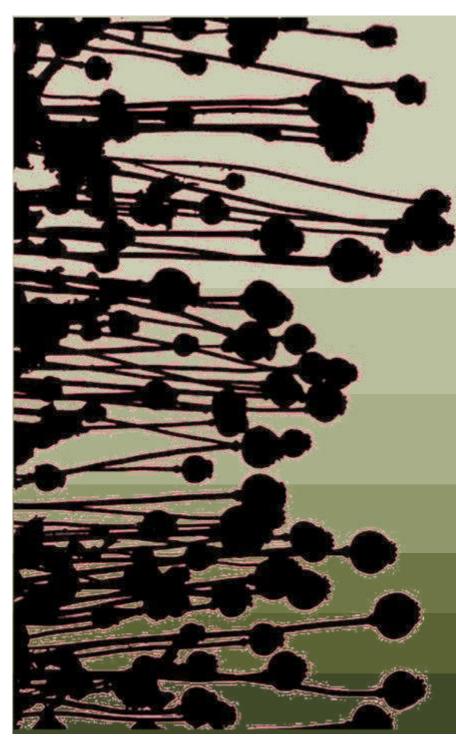
- Executive Summary
- Vision, Mission & Values
- 03 Human Resources
- 04 Services
- Landscape Projects
- Corporate Highlights
- Environmental Projects
- Indicative Clients
- 09 Tools



Bokamoso specialises in the fields of Landscape Architecture and all aspects of Environmental Management and Planning. Bokamoso was founded in 1992 and has shown growth by continually meeting the needs of our clients. Our area of expertise stretches throughout the whole of South Africa. Our projects reflect the competence of our well compiled team. The diversity of our members enables us to tend to a variety of needs. Our integrated approach establishes a basis for outstanding quality. We are well known to clients in the private, commercial as well as governmental sector.

At Bokamoso we stand on a firm basis of environmental investigation in order to find unique solutions to the requirements of our clients and add value to their operations.





Vision:

At Bokamoso we strive to find the best planning solutions by taking into account the functions of a healthy ecosystem. Man and nature should be in balance with each other.

Mission:

We design according to our ethical responsibility, take responsibility for successful completion of projects and constitute a landscape that contributes to a sustainable environment. We add value to the operations of our clients and build long term relationships that are mutually beneficial.

Values:

Integrity

Respect

02 Vision, Mission & Values

Bokamoso stands on the basis of fairness. This include respect within our multicultural team and equal opportunities in terms of gender, nationality and race.

We have a wide variety of projects to tend to, from complicated reports to landscape installation. This wide range of projects enables us to combine a variety of professionals and skilled employees in our team.

Bokamoso further aids in the development of proficiency within the working environment. Each project, whether in need of skilled or unskilled tasks has its own variety of facets to bring to the table.

We are currently in the process of receiving our BEE scorecard. We support transformation in all areas of our company dynamics.



Lizelle Gregory (100% interest)

Lizelle Gregory obtained a degree in Landscape Architecture from the University of Pretoria in 1992 and passed her board exam in 1995.

Her professional practice number is PrLArch 97078.

Ms. Gregory has been a member of both the Institute for Landscape Architecture in South Africa (ILASA) and South African Council for the Landscape Architecture Profession (SACLAP), since 1995.

Although the existing Environmental Legislation doesn't yet stipulate the academic requirements of an Environmental Assessment Practitioner (EAP), it is recommended that the Environmental Consultant be registered at the International Association of Impact Assessments (IAIA). Ms. Gregory has been registered as a member of IAIA in 2007.

Ms. Gregory attended and passed an International Environmental Auditing course in 2008. She is a registered member of the International Environmental Management and Assessment Council (IEMA).

She has lectured at the Tshwane University of Technology (TUT) and the University of Pretoria (UP). The lecturing included fields of Landscape Architecture and Environmental Management.

Ms. Gregory has more than 20 years experience in the compilation of Environmental Evaluation Reports:

Environmental Management Plans (EMP);

Strategic Environmental Assessments;

All stages of Environmental input;

EIA under ECA and the new and amended NEMA regulations and various other Environmental reports and documents.

Ms. Gregory has compiled and submitted more than 600 Impact Assessments within the last 5-6 years. Furthermore, Ms. L. Gregory is also familiar with all the GDARD/Provincial Environmental policies and guidelines. She assisted and supplied GAUTRANS/former PWV Consortium with Environmental input and reports regarding road network plans, road determinations, preliminary and detailed designs for the past 12 years.

03 Human Resources
032 Members



Collaborative Arrangements

Bokamoso has entered into Collaborative Arrangements with Nali Sustainability Solutions (NSS); an emerging 100% black wholly owned consultancy service with the aim of leveraging resources, expertise and improved competitiveness in delivering value to clients.

NSS, established in 2012 has efficiently managed and delivered on EIA projects for both the private sector and government clients, provided advisory services on environmental and land use matters and undertaken or supported strategic environmental planning and policy development.

The EIA projects managed or involved in include residential/housing, mixed use, industrial, commercial, business/retail townships and infrastructure projects including roads and engineering services.

Pirate Ncube, (owner/director) has vast experience in land us, spatial planning and environmental management. Over a period of 20 years, he has served in various capacities in the sector including as a consulting town planner, reviewer and manager of EIAs, head of environment and conservation in Gauteng and a member of the Gauteng DFA Tribunal.



Consulting

Anè Agenbacht Introduction to Sustainable Environmental Management—An overview of Principles,

Tools, & Issues (Potch 2006)

Leadership Training School (Lewende Woord 2010)

BA Environmental Management (UNISA 2011) PGCE Education (Unisa 2013) - CUM LAUDE

Project Manager

More than 10 years experience in the compilation of various environmental reports

Mary-Lee Van Zyl Msc. Plant Science (UP)

BSc (Hons) Plant Science (UP)

BSc Ecology (UP)

1year 5months working experience in the Environmental field

Specialises in ECO works, Basic Assessments, EIA's, and Flora Reports

Dashentha Naidoo BA Honours Degree in Environmental Management (UNISA)

Bachelor Social Science in Geography & Environmental Management (UKZN)

More than 4 years experience in WUL Application & Integrated Environmental Management

within water resource management.

Senior Environmental Practitioner & Water Use Licences Consultant

Ben Bhukwana BSc Landscape Architecture (UP)

More than 5 years experience in the field of Landscape Architecture (Design,

Construction, and Implementation).

Specialises in Landscape Design, ECO,& Environmentalist in training (Assisting

with DBAR).

03 Human Resources

033 Personnel

Anton Nel

B-Tech Landscape Technology (TUT) N Dip Landscape Technology (TUT)

1 year experience in ECO.

Specialises in Basic Assessment Reports.

Juanita de Beer

Events Management and Marketing (Damelin)

Specializes in Public relations and public participation processes

Alfred Thomas

CIW Foundation& Internet Marketing (IT Academy)

12 years experience in GIS and IT in general. GIS Operator and Multimedia Specialist.

Bianca Reyneke

Applying SHE Principles and Procedures (NOSA)

Intro to SAMTRAC Course (NOSA)

SHEQ Coordinator and compilation of environmental reports



03 Human Resources

034 Personnel

Elsa Viviers Interior Decorating (Centurion College)

(Accounting/ Receptionist) and Secretary to Lizelle Gregory

Loura du Toit N. Dip. Professional Teacher (Heidelberg Teachers Training College)

Librarian and PA to Project Manager

Merriam Mogalaki Administration Assistant with in-house training in bookkeeping

Landscape Contracting

Elias Maloka Site manager overseeing landscape installations.

Irrigation design and implementation.

Landscape maintenance

18 years experience in landscape contracting works.

The contracting section compromises of six permanently employed black male workers. In many cases the team consists

of up to 12 workers, depending on the quantity of work.



03 Human Resources

035 Personnel



1 Environmental Management Services

- Basic Assessment Reports
- EIA & Scoping Reports
- Environmental Management Plans
- Environmental Scans
- Strategic Environmental Assessments
- EMP for Mines
- Environmental Input and Evaluation of Spatial Development Frameworks
- State of Environmental Reports
- Compilation of Environmental Legislation and Policy Documents
- Environmental Auditing and Monitoring
- Environmental Control Officer (ECO)
- Visual Impact assessments
- Specialist Assistance with Environmental Legislation Issues and Appeals
- Development Process Management
- Water Use License applications to DWA
- Waste License Application



04 Services

041 Consulting Services

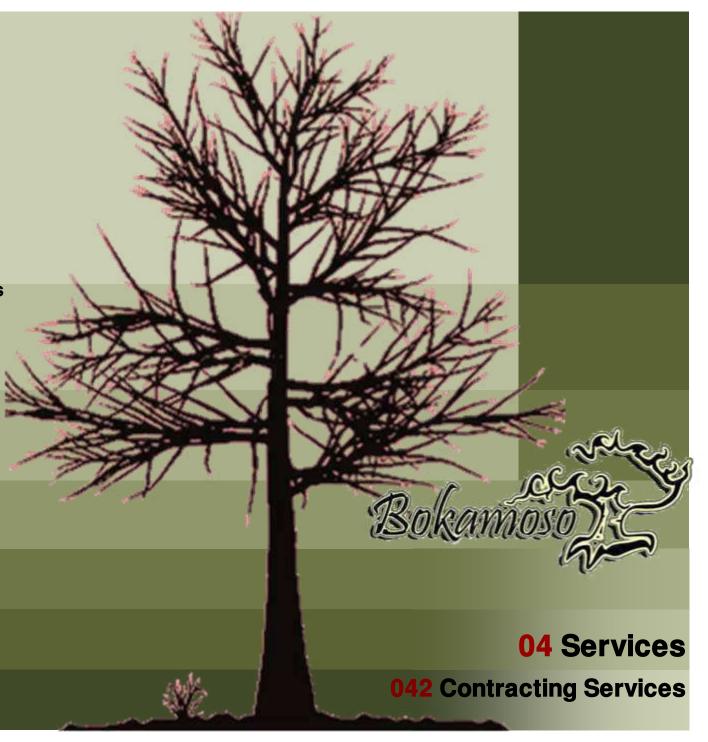
02 Landscape Architecture

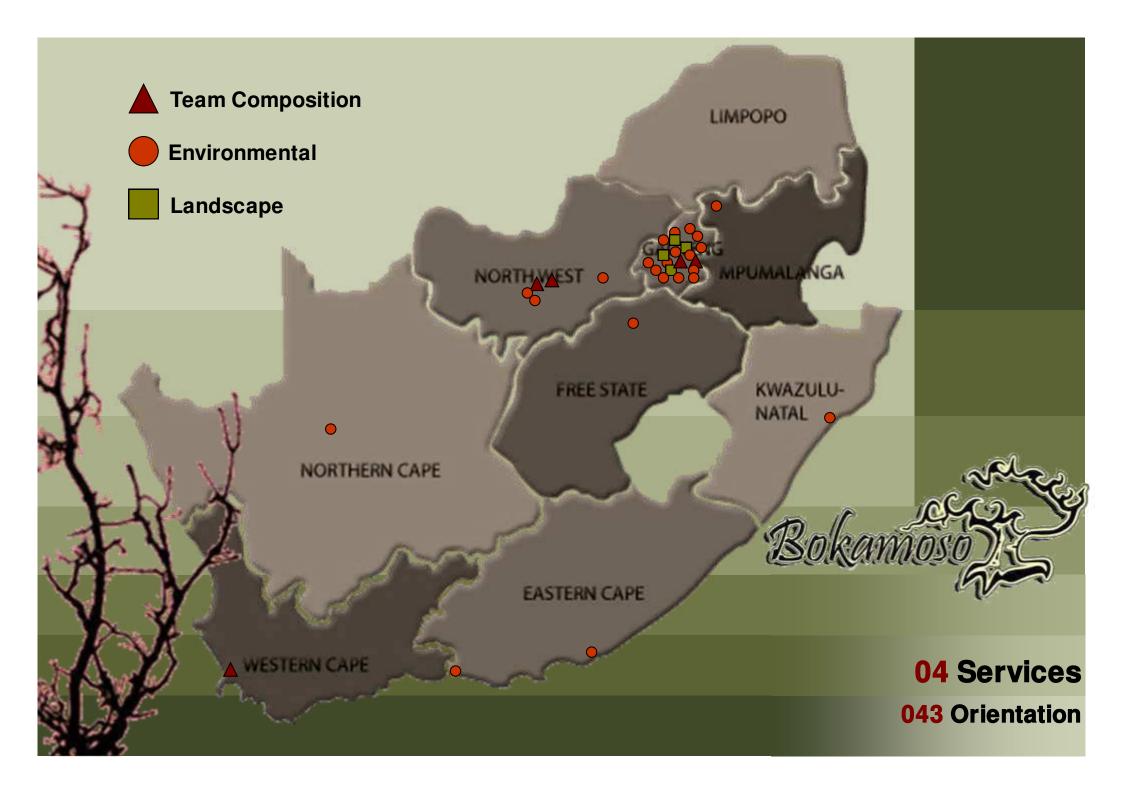
- Master Planning
- Sketch Plans
- Planting Plans
- Working Drawings
- Furniture Design
- Detail Design
- Landscape Development Frameworks
- Landscape Development Plans (LDP)
- Contract and Tender Documentation
- Landscape Rehabilitation Works

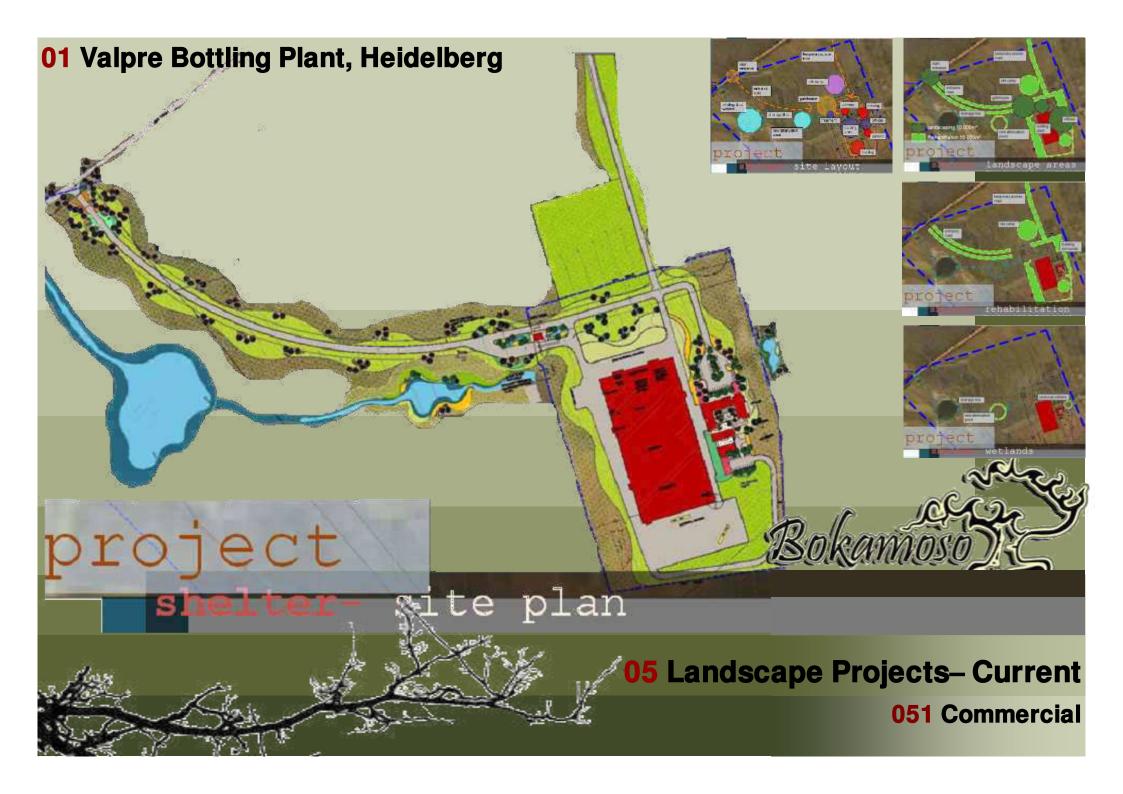
03 Landscape Contracting

Implementation of Plans for:

- Office Parks
- Commercial/ Retail / Recreational Development
- Residential Complexes
- Private Residential Gardens
- Implementation of irrigation systems







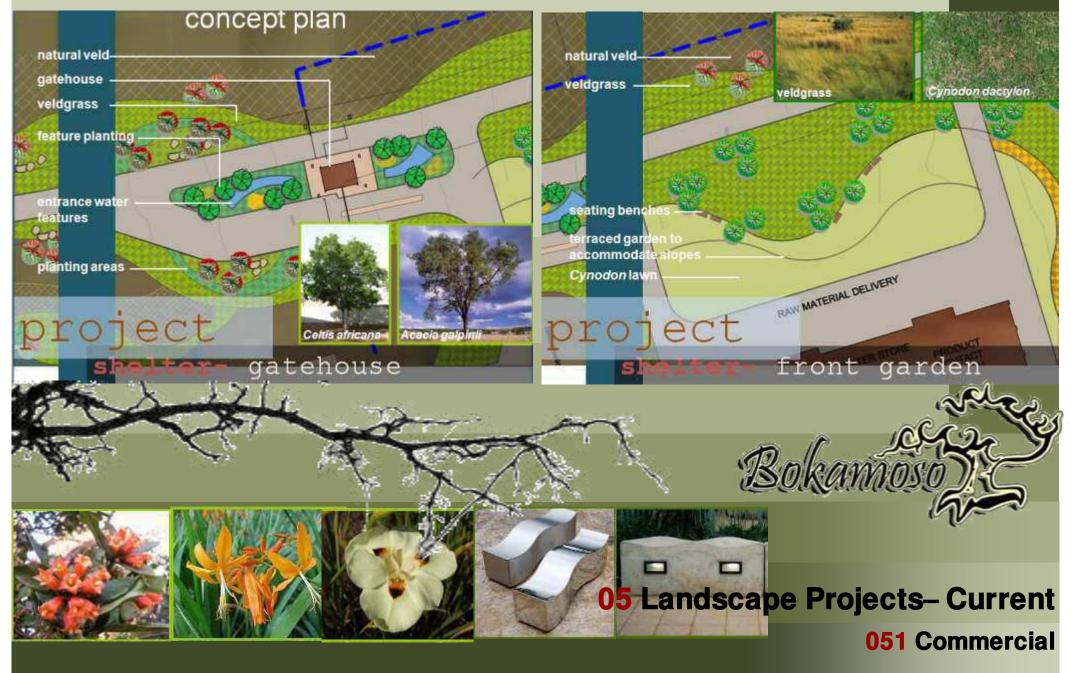
Valpre Bottling Plant, Heidelberg





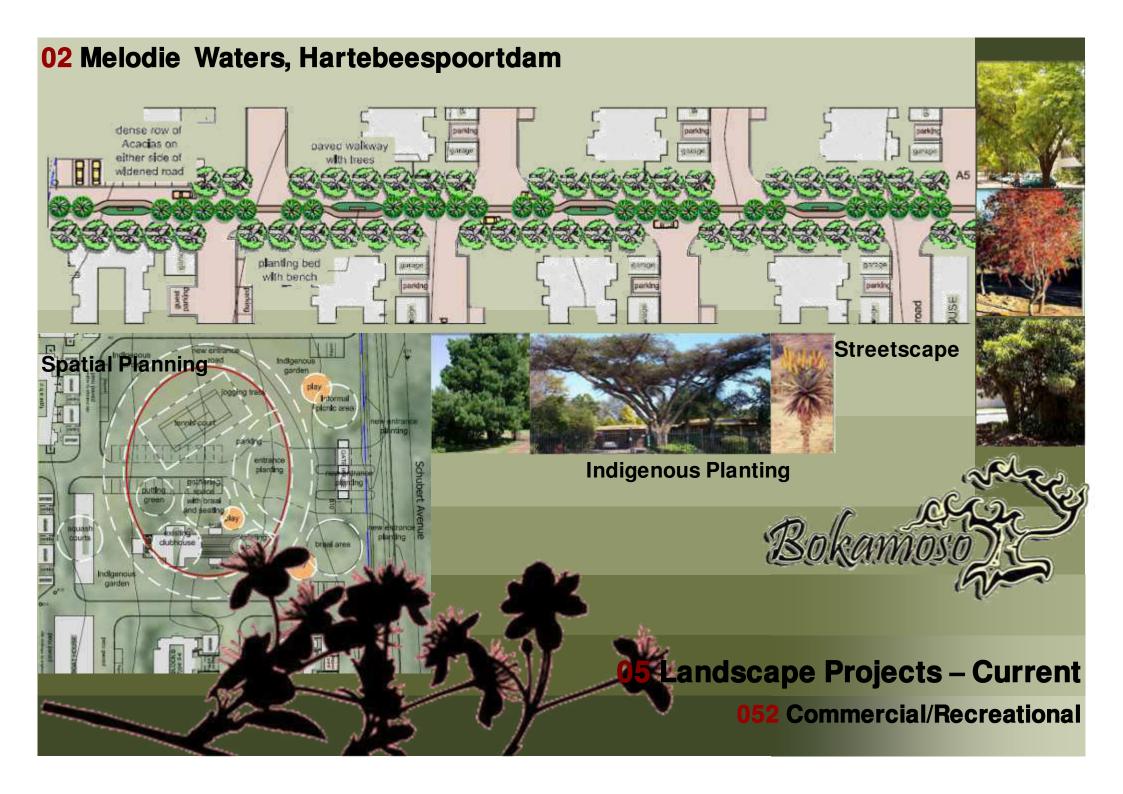


Valpre Bottling Plant, Heidelberg

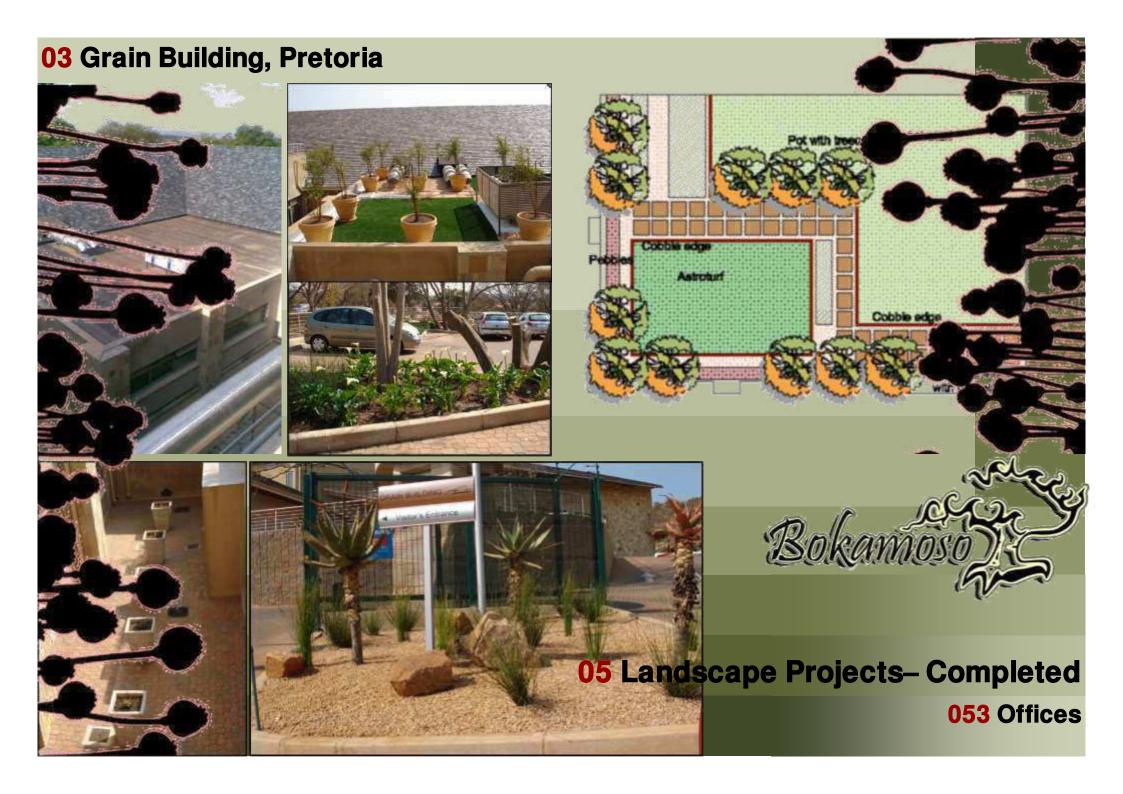


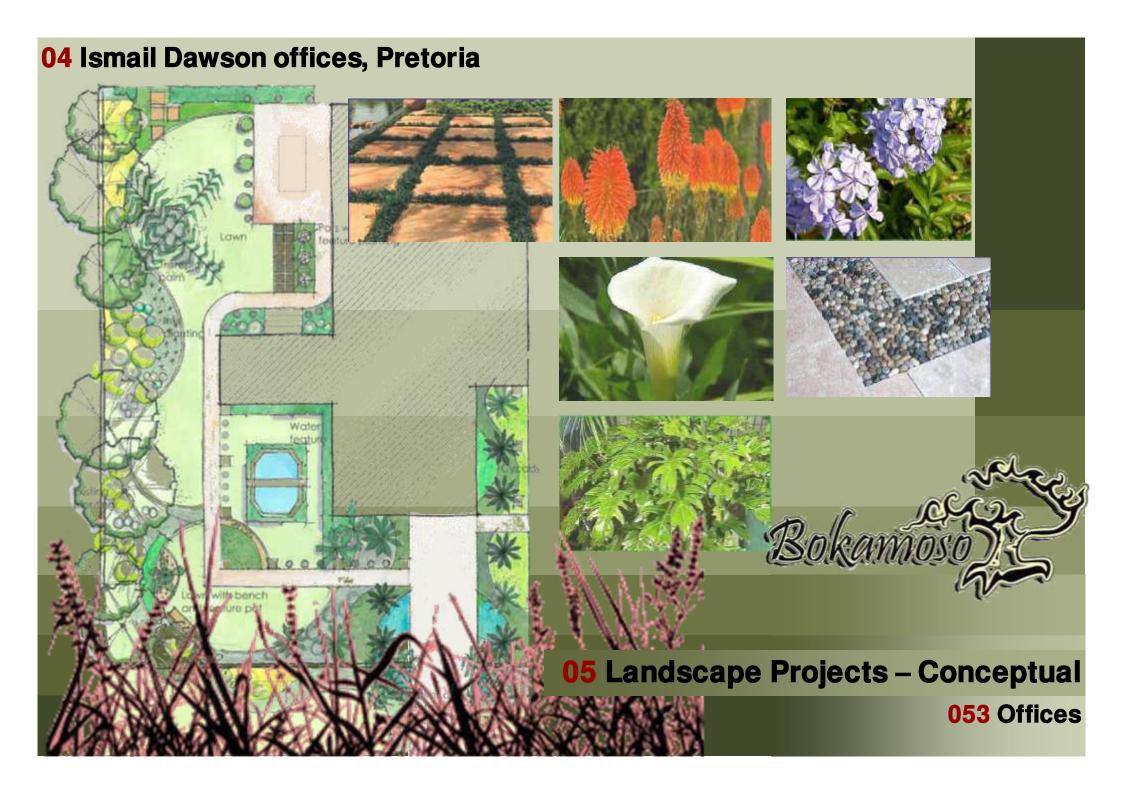
Valpre Bottling Plant, Heidelberg

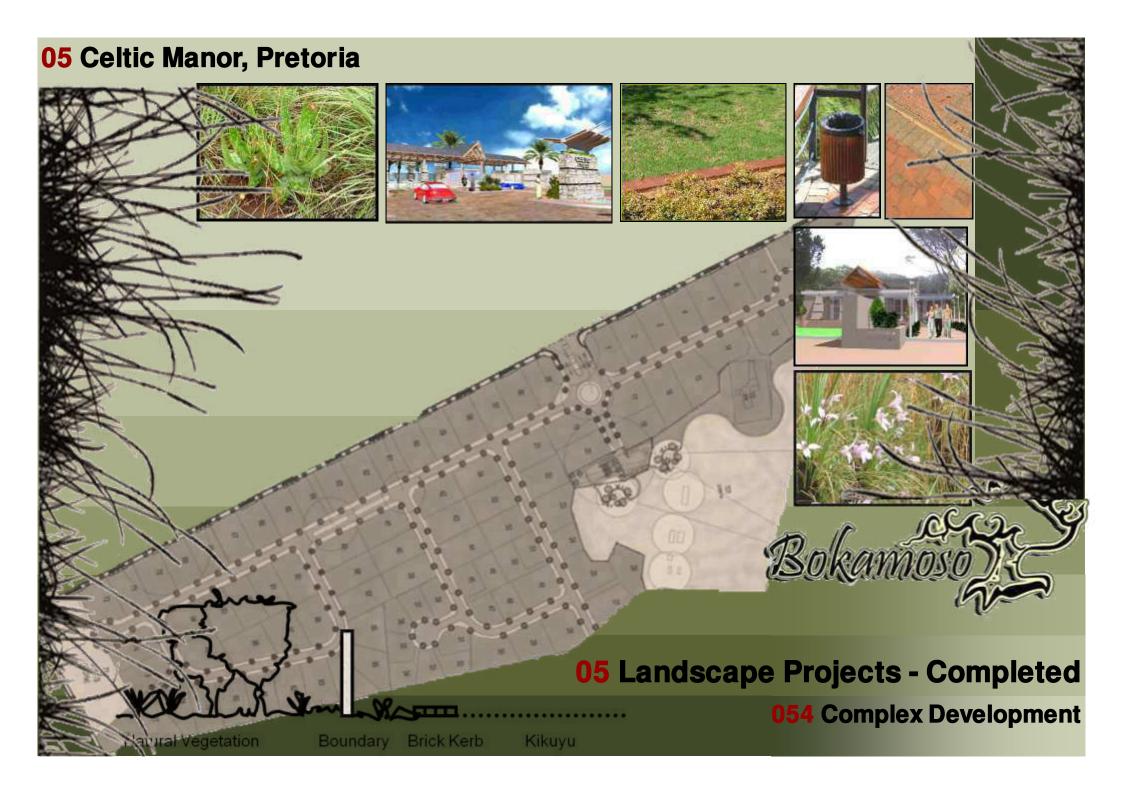


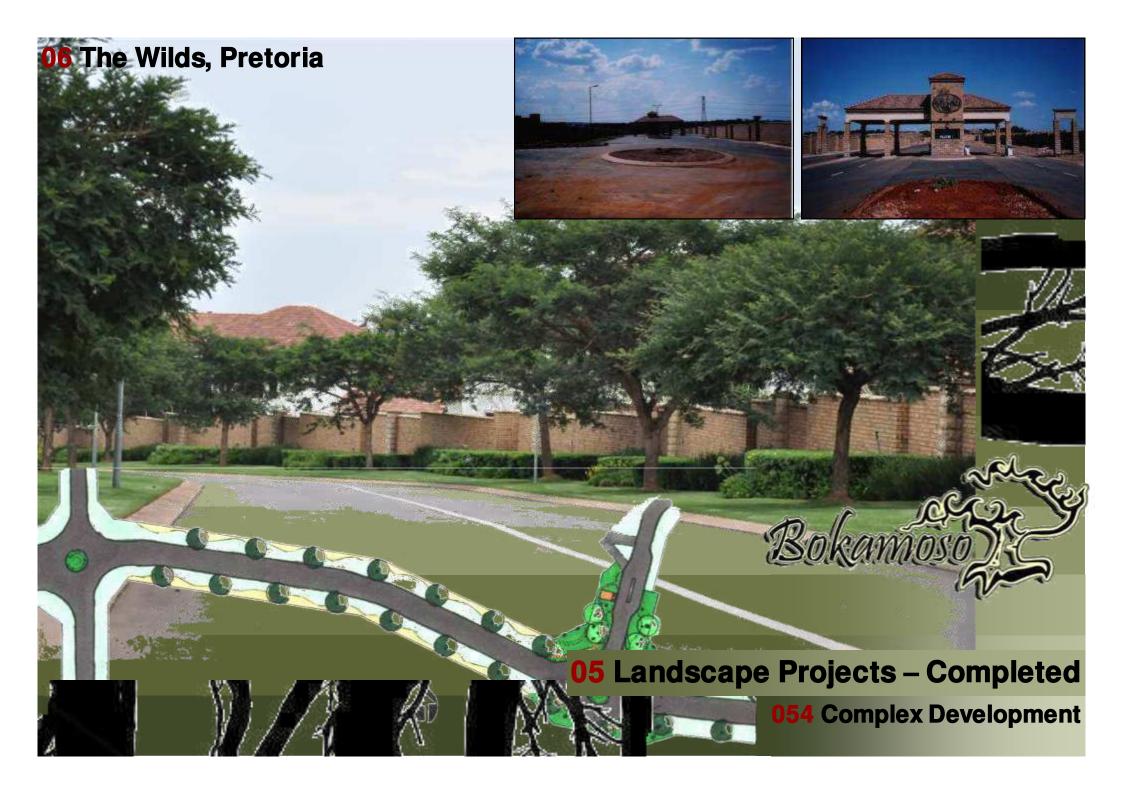








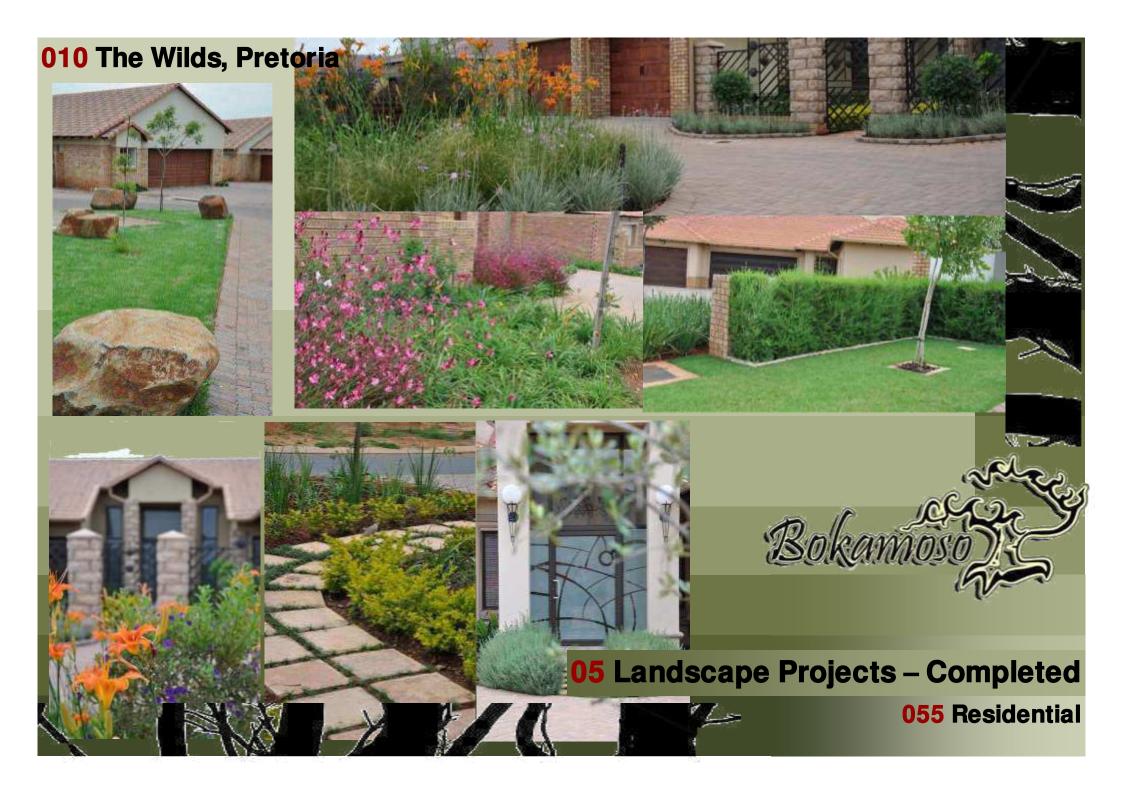






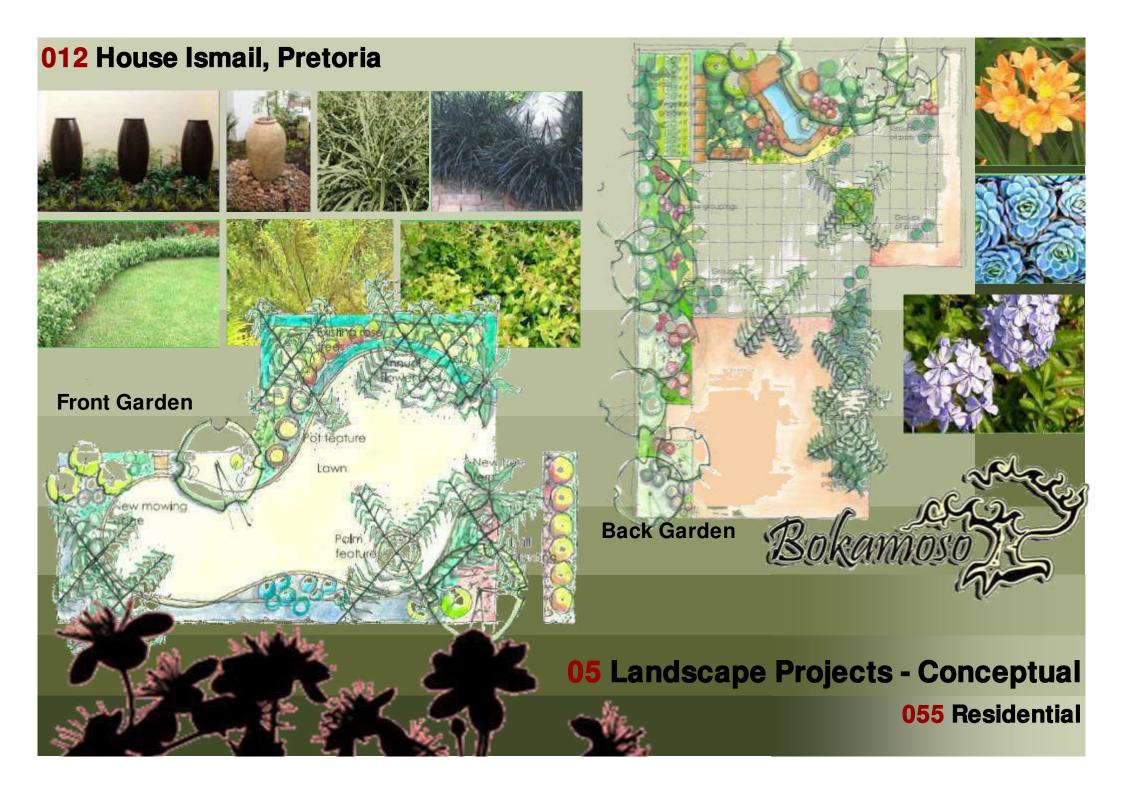






Governor of Reserve Bank's Residence, Pretoria











02 UNISA Sunnyside Campus, Pretoria **Best Commercial Paving Plan in Gauteng, 1997 06** Corporate Highlights 061 Awards

Project Name	Status	Project	1
Environmental Impact A	Assessment(EIA) and	d Scoping Report	
Junction 21	ROD	EIA	
5 O'clock site access	In Progress	EIA 🕹	
Bokamoso X 1	In Progress	Scoping & EIA	0
Doornvallei Phase 6 & 7	In Progress	EIA	
Engen Interchange	In Progress	Scoping & EIA	4
Erasmia X15	In Progress	EIA	1
Franschkloof	In Progress	EIA	7
K113	Amendment of ROD	EIA	Ti Ti
K220 East	ROD	EIA	
K220 West	ROD	EIA	
K54 ROD conditions	In Progress	EIA	
Knopjeslaagte 95/Peachtree	ROD	EIA	8
Knopjeslaagte portion 20 & 21	ROD	EIA	١_
Lillieslief/Nooitgedacht	In Progress	EIA	Ţ
Mooiplaats 70 (Sutherland)	In Progress	EIA	0
Naauwpoort 1 - 12/Valley View	In Progress	EIA	S
PeachTree X5	In Progress	EIA	⊣ a
Strydfontein 60	In Progress	EIA	
Thabe Motswere	In Progress	Scoping & EIA	
Vlakplaats	In Progress	EIA	
Waterval Valley	In Progress	EIA	
Envi	ronmental Opinion		
Doornkloof 68 (Ross)	In Progress	Opinion	
Monavoni X 53	In Progress	BA & Opinion	
Mooikloof (USN)	In Progress	Opinion	
Norwood Mall/Sandspruit	In Progress	Opinion 07 C	ırr
Riversong X 9	In Progress	Opinion	
Sud Chemie	In Progress	Opinion	
USN Benjoh Fishing Resort	In Progress	Opinion	



The adjacent list host the status of our current projects. Only a selected amount of projects are displayed.

rent Environmental Projects

071 EIA, Scoping& Opinion

Project Name	Status	Project
Basi	c Assessment(BA)	
Annlin X 138	In Progress	BA
Clubview X 29	ROD	BA
Darrenwood Dam	In Progress	BA
Durley Holding 90 & 91	In Progress	BA
Elim	In Progress	BA
Fochville X 3	In Progress	BA
Hartebeeshoek 251	In Progress	BA
Klerksdorp (Matlosana Mall)	In Progress	BA
Monavoni External Services	ROD	BA
Monavoni X 45	Amendment of ROD	BA
Montana X 146	In Progress	BA
Rooihuiskraal X29	In Progress	BA
Thorntree Mall	In Progress	BA

Environmental control officer (ECO)		
Grace Point Church	In Progress	ECO
R 81	In Progress	ECO
Highveld X 61	In Progress	ECO
Mall of the North	In Progress	ECO
Olievenhoutbosch Road	In Progress	ECO
Orchards 39	In Progress	ECO
Pierre van Ryneveld Reservoir	In Progress	ECO
Project Shelter	In Progress	ECO

	S24 G		07.0
Wonderboom	In Progress	S24 G	07 Ct
Mogwasi Guest houses	Completed	S24 G	

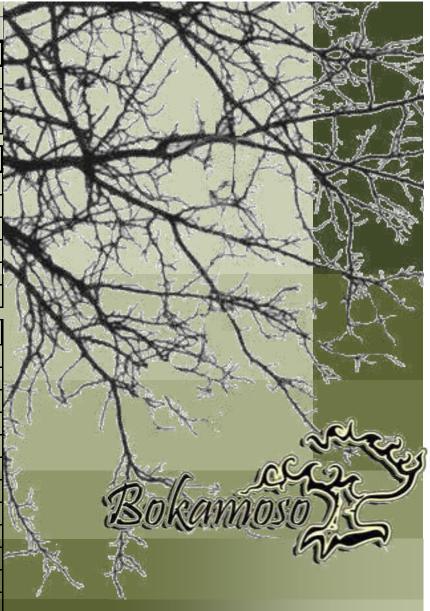


urrent Environmental Projects
072 BA, ECO & S24 G

Status	Project	
Objection		
In Progress	Objection	3
Completed	Objection	2
Completed	Objection	
	Objection In Progress Completed	Objection In Progress Objection Completed Objection

Development facilitation Act- Input (DFA)		
Burgersfort	In Progress	DFA & BA
Doornpoort Filling Station	In Progress	DFA & EIA & Scoping
Eastwood Junction	In Progress	DFA
Ingersol Road (Erf 78, 81 - 83)	In Progress	DFA
Roos Senekal	In Progress	DFA & EIA & Scoping
Thaba Meetse 1	In Progress	DFA & EIA & Scoping

Water Us	se License Act (WUL	.A)
Britstown Bulk Water Supply	In Progress	WULA
Celery Road / Green Channel	In Progress	WULA
Clayville X 46	In Progress	WULA
Dindingwe Lodge	In Progress	WULA
Doornpoort Filling Station	In Progress	WULA+DFA+EIA+SC
Eco Park Dam	In Progress	WULA
Groote Drift Potch	In Progress	WULA
Jozini Shopping Centre	In Progress	WULA+BA
K60	Completed	WULA
Maloto Roads	In Progress	WULA
Kwazele Sewage Works	In Progress	WULA
Monavoni External Services	In Progress	WULA+BA
Nyathi Eco Estate	In Progress	WULA 07 Ct
Prairie Giants X 3	In Progress	WULA
Waveside Water Bottling Plant	Completed	WULA



urrent Environmental Projects

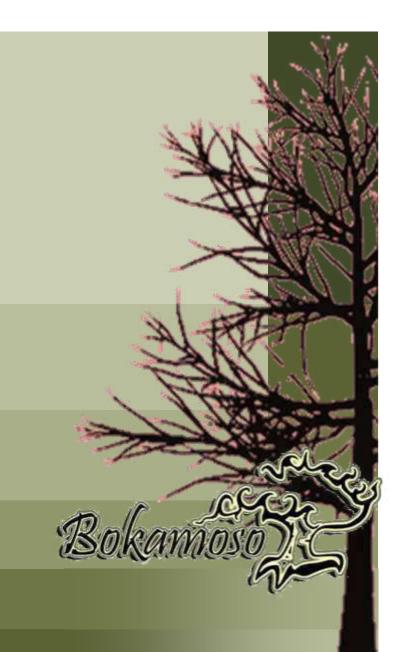
073 Objection, DFA & WULA

Project Name	Status	Project
Environmen	tal Management Pla	n(EMP)
Heidelberg X 12	ROD	EMP
Monavoni Shopping Centre	Completed	EMP
Forest Hill Development	Completed	EMP
Weltevreden Farm 105KQ	Completed	EMP+EIA
Raslouw Holding 93	Completed	EMP+BA
Durley Development	Completed	EMP+BA
Rooihuiskraal North X 28	Completed	EMP

Rehabilitation Plan		
Norwood Mall/Sandspruit	In Progress	Rehabilitation
Project Shelter Heidelberg	In Progress	Rehabilitation
Sagewood Attenuation Pond	ROD	Rehabilitation
Velmore Hotel	Completed	Rehabilitation
Grace Point Church	Completed	Rehabilitation
Mmamelodi Pipeline	Completed	Rehabilitation

Visual Impact Assessment		
Swatzkop Industrial Developme	Completed	Assessment +DFA
Erasmia	Completed	Assessment

	Signage Application	on
Menlyn Advertising	Completed	Signage
The Villa Mall	Completed	Signage+EMP+BA



07 Current Environmental Projects

074 EMP, Rehabilitation, Waste Management & Signage Application





Company of Company Profile and copy of CV from Nali Sustainability

Annexure C

PIRATE NCUBE: ABRIDGED CV

Positions:

Currently:- Director- Nali Sustainability Solutions

Previous: - Chief Director: Sustainable use of Environment, Gauteng

Province

- Senior/Town Planner.

Qualifications

- Honours in Town and Regional Planning 1993;

- Masters in Business Administration 2007;

- Masters in Real Estate 2014;

- Currently pursuing certification as a Green Star SA Accredited Professional

- Certificate in Sustainable Development

- Certificate in Sustainability Reporting

Experience

More than 20 years' experience in environmental planning and management as well as land use/spatial planning. Served in various capacities, including as a consulting town planner, reviewer and manager of EIAs, head of environment and conservation in Gauteng and a member of the Gauteng DFA Tribunal.

- Served as Head of Environment and Conservation (Chief Director),
 Gauteng Department of Agriculture and Rural Development (GDARD)(2007-2012);
- Head of Environmental Planning and Impact Assessment Unit (Director), GDARD (2005-2007);

- Deputy Director- Environmental Planning and Impact Assessment,
 GDARD, (2005-2007);
 - Senior Town Planner, SJN Development Planning, (1998-2001);
 - Town Planner, 1993-1998, BCC
 - Leading the Gauteng Environment Team taking part in the development of the New EIA Regulations, 2010.
- Served as Member of the Magaliesberg Protected Environment Advisory Committee, (2002-2006);
- Served as a Member of the Gauteng Development Tribunal constituted in terms of the Development Facilitation Act (2004-2010);
- Coordinating environmental inputs into spatial plans in the Gauteng Province (2002-2006);
- Managing the development of Environmental Strategies, Policies and Plans including Environmental Management Frameworks, SEAs, Environmental Implementation Plans, Waste Management Plans

List of Projects

- Overseeing processing and decisions on ±6000 EIA applications and associated Appeals and queries in Gauteng;
- Managing environmental applications (S/EIR, BAR and EIA/EMPr amendments) and providing advisory services on environmental matters. Nature of projects include:
 - Residential townships;
 - Mixed use townships;
 - Engineering services/infrastructure;
 - Roads;
 - Commercial/industrial townships;
 - S24G matters
 - Projects affecting geographic areas.

Clients:

Mr P Ncube has managed various projects for both government and the private sector. Some of the major clients include:

- Gauteng Department of Housing
- City of Tshwane Metropolitan Municipality
- M&T Development
- Century Property Development
- Eye of Africa
- Home Talk Development
- Lebra Property Development
- Fire Ring Trading
- Innoland Property Group
- Cool Runnings
- Universal Pulse Trading
- etc

CERTIFICATION:

I, the undersigned, certify that to the best of my knowledge and belief,
this CV correctly describes myself, my qualifications, and my experience. I
understand that any willful misstatement described herein may lead to my
disqualification.

 Date: 15 October 2014

Minutes – Workshops with Specialist Forum

Annexure D

LEBOMBO GARDEN BUILDING 36 LEBOMBO ROAD ASHLEA GARDENS 0081

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MINUTES OF THE SPECIALIST MEETING HELD FOR THE LINKSFIELD PROJECT HELD AT THE OFFICES OF BOKAMOSO ON 8TH OF MAY 2014

SPECIALISTS ATTENDING THE MEETING:

Dr M. Levin. Aurecon.

Dr E. Fourie. Ampath.

Mr Louis van Rooy. J.L. van Rooy.

Dr Johan van der Waals. Terrasoil.

Dr Valerius de Vos. Private.

Mrs Lizelle Gregory. Bokamoso Environmental.

Mr Pirate Ncube. Bokamoso Environmental.

Ms Anè Agenbacht. Bokamoso Environmental.

Mrs Loura du Toit. Bokamoso Environmental.

CENTURY:

Mr Michael Bishop. Client.

Ms Joanne Reynolds. Client.

INTRODUCTION:

The meeting at Bokamoso Environmental started at 11h00 on the 8th May 2014. Mrs Lizelle Gregory, Manager of Bokamoso Environmental welcomed all attendants and especially Dr Valerius de Vos to the meeting. The client also confirmed to be present but the meeting continues without Michael Bishop and Joanne Reynolds.

THE PURPOSE OF THE MEETING:

It is necessary to finally conclude that all disciplines had been thoroughly investigated by the different specialists, because of the sensitivity of the Linksfield Project, as well as the many challenges involved in this Project, especially from an environmental point of view. If there are any more risks, it can be identified on time, discussed and addressed. If there are any more mitigation measures to be taken, it could be addressed immediately. Also the specialists perused each other's reports. This can all ensure a thorough Impact Assessment in the end.

Bokamoso Environmental is committed to ensure that there will be no risk involved with the continuing of the Linksfield Mixed Development. She mentioned again that this development could be a typical Carte Blanche story/investigation. Everything should be investigated especially from an environmental point of view, otherwise the EIA Study could be challenged.

She mentioned that it would be a big risk to allow the developer just to continue with the development. There should be no come backs. Also no one to come back afterwards and complain of any sickness or disease contracted on the site of development.

Lizelle commented that she feels confident that the project can go ahead, especially in the light of all the investigations done. She referred to the specialists' studies and all the interviews Bokamoso Environmental had with various people.

With certain mitigation measures in place, this project can continue without risk. She also referred to Bokamoso Environmental's appointment with Dr Wouter Basson in Cape Town the 14thMay 2014, in order to require his opinion on the anthrax issue.

She recommended that there should be a doctor and a Pathologist also to be part of the team. Even a geologist, especially to investigate the groundwater

movement. The surface water and the groundwater move in different directions. Also to determine in which direction contamination may occur. She referred to Louis van Rooy, the engineering geologist. Lizelle mentioned the newspaper advertisements placed in various newspapers in order to gather more information in connection with the history concerned of the site. It is better to cope with any reactions presently than rather later on.

She explains that Bokamoso Environmental has all the issues and these related issues will be addressed. Bokamoso established a forum of specialists and circulated the reports done by these to everyone in order to peruse it.

At the end of the process every specialist will be expected to submit a 1to3 pager of comments, inputs and an agreement that they are satisfied that all related issues had been addressed. Their 1to3 pager must be signed by them.

We have to be confident that the project can go ahead. All specialists had been appointed to assist Bokamoso Environmental. Whatever the latter is going to recommend will be based on the studies and investigations received from the various specialists. Bokamoso Environmental will rely on these expert scientific findings and opinion.

Lizelle suggested that the specialists seated around the table, should introduce themselves and to give a short background of their viewpoint and whether they still see any risk whatsoever concerning this project and what mitigation measures should then be put in place. One combined Report can then be compiled, containing all specialist Reports.

LG: Introduced herself as the Manager of Bokamoso Environmental again and confirmed that Bokamoso Environmental is responsible for the compilation of the EIA Report of the Mixed Development on the Linksfield site.

She introduced Ane as the Project Manager of Bokamoso Environmental.

Dr Johan: Terrasoil: He conducted a soil investigation together with Dr Henriette van Heerden, a microbiologist. Also to determine where the graves are, a soil sampling exercise on terms of physical and chemical parameters of the soil had been done and that will be discussed later on.

Dr Henriette: Introduced herself. She is a lecturer at the UP – she is not a vet. She is a microbiologist. She was asked to give her opinion on the occurrence of the outbreak of spores (anthrax) on the Linksfield site. She also tried to address other pathogens, viruses or bacteria that could maybe remain in the environment. She also referred to the emotional issue that should be addressed concerning this site, which probes to be an issue as people have specific pre conceived ideas about this specific site because of the graves. Here she referred to the emotional articles

in the newspapers after people come to know of the proposed development on the site. People tend to ask 'what about smallpox and what about anthrax?' She did a study to ascertain that none of these pathogens will remain a risk after such a long period of time had lapsed.

Leoni Botes: She is involved in the investigation of the cultural history of the site.

Pirate: Part of the Bokamoso Environmental team.

Dr Mannie Levin: From Aurecon. The latter is doing the groundwater and geohydrological study of the Linksfield site. Also to investigate and see how many boreholes if any could be on the site? Also to perform a study of the possible pollution that could maybe present.

(The clients: Michael Bishop and Joanne Reynolds arrived at this point of time and LG introduced them to the rest of the meeting).

LG: Explained again that the main purpose of today's meeting is to wrap up the specialist's inputs. Bokamoso Environmental distributed the different reports amongst the specialists to peruse and to receive their opinions, as well as to look at anymore risks associated with the development – whether the development should continue.

Michael Bishop: the Principal of Century. He is assigned to co-ordinate the Project.

Joanne Reynolds: Introduced her and declared she co-ordinates the Project together with Michael.

Jon: Urban Dynamics: He is the Town planner. He is sitting in on the meeting to observe what the specialists discuss concerning the EIA Report. Mentioned that the Development received very negative and emotional comments from the public. Most of the information and opinions on the project is very out dated and biased. Urban Dynamics would like to shield Bokamoso Environmental from all the negative criticism.

Louis van Rooy: Introduced himself as the Geo-technologist assigned to the project.

Dr E. Fourie: Introduced himself as the guy where the bug stops. The pathologist.

Dr v de Vos: He is present at the meeting because of his knowledge of anthrax. He has been working on this since 1966. Busy with the latest chapter of Veterinary Science. A pet project of his.

LG: Gave her appreciation especially for Dr de Vos coming all the way from Mpumalanga.

Dr d V: Worked on the Linksfield site before to look for certain strains of anthrax. Lorraine at NCID gave him the idea to look at the Edenvale Health Precinct, but they had no records. The investigation did not work according to plans – he could not continue with the investigation. He told about his experience at Cape Town, Mowbray. There he had to introduce mitigation measures at a building site.

LG: Mentioned that anthrax was a problem at this site. It was a gravesite. A parking area was constructed over the grave site which was susceptible of being contaminated with anthrax – Everyone is still alive, she mentioned. Thus there was no risk/danger in the construction of the development.

Dr d V: Thought it was a very successful project and suggested that they could talk about it later on.

LG: Mentioned that Dr d Vos's input could be of great value when it comes to possible mitigation measures. Lizelle explained Bokamoso Environmental had meetings with various people living in the Linksfield area. She mentioned the meeting with Marian Laserson which Joanne Reynolds of Century also attended. Marian Laserson mentioned that there were more graves on the study area. She also promised to provide info about people with the knowledge of the area.

Apparently, close to the nursery, there is a strip of land with graves. Bokamoso is still waiting for more information. There is also someone else with knowledge and proof of a child's grave which had been moved and relocated.

Bokamoso requested that this should be indicated on the map we have. Some specialists can then go and attempt to find the very spot referred to. Bokamoso will provide Dr Johan with an aerial photograph and will also investigate the existence of such a grave.

Apart from all the specialists' studies, LG has an appointment with Dr Wouter Basson. Bokamoso Environmental only wants his opinion on the anthrax question/problem. Lizelle mentioned the 2 types of anthrax: the first kind for biological warfare which is lethal and the second strain found in bones and soils. He is not going to be part of the team though. Bokamoso only requires a two page right up from him to be part of our documentation.

Dr d V: Spoke to the CEO of the Sizwe Hospital in 2006, Ms Elizma van Staden about the mentioned 7000 graves in the area. They had no records and it could not be found – the exact area could not be found.

LG: Indicated that only three cemeteries had been found. The specialists can confirm the information we can provide.

Dr Johan: Went down to Mowbray to go and access high resolution aerial photographs to identify any soil disturbances. 1948/1957 aerial photographs. The assumption he worked on was that if it was a hospital, they would have had a formal burial procedure. People would not have been buried haphazardly. Looking at the current sites they are very well set out. There was a black cemetery, a white cemetery and according to Marian Laserson, a Jewish cemetery and a children's cemetery.

The only cemeteries that could be identified were the black and white cemeteries and a cemetery dating to the turn of the century (1900). This was on the flood plain of the Jukskei River itself. So it was the aerial photographs used to identify areas of disturbance. He could not find any indication of an area where carcasses could have been burnt. (a haphazard shape/form on the map). There is one area that could possibly the spot, but it looks like an excavation. Samples taken there, showed literally nothing.

Then they went out to the site (Dr Johan and Dr Louis v Rooy) to collect samples based on the geo-technical report. They sampled at the same time when those pits were dug and also looked at where the water would move in the landscape. They were looking for indications of those especially in the top soil – the 50cm to 100cm and also sampled an area that looked like a seepage wetland. One of the areas situated downslope from the graves and also areas in and outside the gravesites had been sampled. Specific samples had been taken from the grave site.

They came across extensive mole activity. It was situated in the shallow soil profile going into a weathered green stone area, which is hard and more difficult to dig into. There is a quartz stone line in this area. The topsoil on top the latter is quite sandy. They found a clear distinction in the soil profile itself. The stone line manifests itself in many places where there is mole activity. The moles tend to bring all the soil material that is mixed to the surface. When it rains all the fine material is washed away and these mounds of course material are left on the surface.

They collected soil samples there, assuming that the moles had been active within the area that had been a grave site and if anything came up, they could have access to it through the mole heaps. They preferred not to dig in the grave site itself and cause disturbance there. All those samples were collected on site and submitted for tests. Outside the grave sites they used the profiles and also collected samples for chemical analysis. Dr Johan was specifically looking for signatures of elevated Ca which one could expect from weathering bones or phosphorous. (The pH levels). There was no correlation between in and out of the

grave sites. The calcium levels seemed to be quite variable throughout. The potassium and phosphorous levels were significantly higher inside the grave site. It could have a twofold reason: gardens could have been tended there before. On the other hand it could be nutrients that become available from weathering bones.

The pH of the soils measured in water was +- around 5. A chance of finding intact bone in such a soil environment is almost nil. It would have dissolved systematically, especially with the mole activity. On grounds of the latter Dr Henriette perused the results of the samples and will refer to anthrax and the persistence of anthrax in soil and the influence of a low pH.

Dr Johan could not find anything concerning the soil perspective. He could not see that there could maybe a major risk concerning an anthrax outbreak, through the soil sampling done. Other areas of the site did not show any signs of disturbance that one would associate with graves and digging and that could be confirmed in terms of the profiles that were identified during the geo-technical survey. He is confident that they were investigating in the right area. There is dumping of rubble on a large area of the site and it also occurs in the grave site area.

They could not dig through those very huge dumps of rubble. Though they did not depict anything significant on the historical aerial photographs, which would indicate graves in the area where the building rubble had been dumped.

Dr Henriette: went to the site with Dr Johan. She explained that anthrax spores thrive in Ca rich soils. That is where anthrax spores will be found. It is a soil borne pathogen. The soil on the Linksfield site does not indicate that anthrax occurred naturally in this specific area's soil. There are soils where the organism can harbour for almost 200 years. She referred to Dr de Vos and the area of the Kruger National Park. It was difficult to find any scientific material related to any of the mentioned diseases.

Dr Henriette mentioned the article written by a certain Adler. There is an Adler Museum, which is part of the Wits Medical School. She inquired about any records maybe kept there. There was a lady person who confirmed to have some material about the Linksfield site.

Then in an article small pox was mentioned. The latter's organisms can live up to only 8 years. Small pox is a virus and viruses need a host. Small pox actually is not really a big issue.

From the hospital fluent only, DNA, micro bacteria and tuberculosis germs had been found. It could not be cultured as it is a very slow growing organism. (3 months). She recommended that it should be looked into, as workers can get

infected from the effluent. She also found food poisoning cultures there. She could not find any traces of anthrax spores on the site.

Dr Johan confirmed that the analysis of the samples she took also did not show anything linked to anthrax.

Dr Henriette: She contacted Lorraine Art at the NICD about Bacillus cereus, a human pathogen, associated with food poisoning. From NICD she learned that almost 10 years ago there was the consideration of developing the area. There was bone found when they were called out and also the Bacillus cereus pathogen had been picked up. It was bovine bone found around the hospital at that time. This pathogen holds no major threat.

She also is of the opinion that there is a lot of heresy. Anthrax is only a risk when the remains are found. When such a find is made, it will be the developer's responsibility to neutralise the soils.

Dr Johan: said that from a heritage perspective, if any bones are discovered, certain procedures have to be followed. If those procedures are in place and workmen trained, there will be no risks. When bones are discovered, a police investigation is inevitable. If everyone works to the book the occurrence of risks are very low.

Dr Johan thinks that the water of the Jukskei River is of a much bigger health concern. He surmises that people there could be exposed to a whole range of pathogens. He explained about all the pathogens coming from Bruma Lake, flowing down the Jukskei River. He also added that there should be a serious briefing of the workers once the development starts.

Michael Bishop: Declared that the whole site should be screened conclusively. He mentioned the empty bottles and other rubbish dumped there. He suggested a health and safety plan to be inducted. He does not want to do a separate thing, but to have everything in place in case of an emergency. He also mentioned the emotional aspect involved with the project.

LG: Suggested that the effluent of the hospital should be emphasised as well as the water quality of the Jukskei River.

Dr Johan: Confirmed that there is a definite strong effluent from the hospital. It is uncontrolled as well and is a definite health risk.

Dr d V: Asked whether Dr Johan came across any area where livestock could have been buried.

Dr Johan: The aerial photographs had been perused for any such site. He could not identify any. He mentioned that when the soils in this area are disturbed, that quartz pebble markers are brought to the matrix of the surface and then the rain washes it away. So one clearly sees where the soil had been disturbed. There is nothing to be found on the rest of the site.

Dr d V: Answered that a burial pit had been used in precious years. According to him there was an anthrax outbreak amongst animals in this area: 1923 - it was the height of the anthrax outbreak. It was pandemic at that stage. More than 60,000 animals died during this outbreak.

Dr Henriette: Answered that there is unfortunately no evidence thereof and also no official record available.

Dr d V: Declared that there must be somewhere in that area a place where animals had been buried.

Dr Johan: Answered that he scoured the aerial photographs for any such potential site, but could not find anything. He focussed on the areas where there might have been such a possibility. He could not identify such a site. There is one site that has the signature of a possible burial place, as the excavations were like a burrowed pit. He did a soil test there, but it came out negative. It was disturbed soils and they could not dig into rubble.

Dr Henriette: Mentioned that they dug only 60cm deep at this specific spot. She emphasized that there is real danger when one does find any remains. (bones). Nothing could be found in the top soils. There is also a lack of documentation – it is like looking for a needle in a haystack, because of the size of the area.

She mentioned the 2 different strains of anthrax to be found. She also referred to the 2011 attack. She mentioned anthrax here and calls it a bacteria. She described it to be almost like a DNA/ plasma that one can put antibiotic resistant genes into. This is what happened in 1911. Anthrax is usually well treated with the penicillin group of antibiotics. In this attack the bacteria/organism was made resistant to the treatment. There was no reaction after people had been treated with penicillin and so many people died. The Linksfield site is a different matter though. Here it could only be in the soil. She referred to the anthrax question as a very emotional occurrence. If workers do get contaminated they could be treated easily, though the anthrax is still pathogenic. There will not be a laboratory kind of strain to be found there. There is absolutely no risk of a biological warfare here.

LG: Asked Dr Henriette how the workers will know whether they contracted the disease and how they could be treated.

Dr Henriette: Told the meeting that the workers should be screened and informed about the symptoms. They can receive a week's prescribed penicillin or otherwise amoxylin.

Dr d V: Mentioned a factory where they worked with goat's hair. It had been investigated here that the workers could inhale the anthrax spores. It had been found that they inhaled +- 1,300 spores per day and did not contract the disease. He is of the opinion that it is not such a scare. People react very emotionally towards the mention of anthrax.

All attendants agreed that the public/workers must be educated and enlightened about the disease.

Michael B: Education very necessary. He mentioned that during the PP that some documentation, a kind of a gazette to be made available.

Dr Johan: One of the main things to emphasize is that the anthrax that we hear about for the past 20 years in terms of these scares, were manipulated. Strains of anthrax had been cultivated for specific nefarious purposes. The challenge is to educate people to change their wrong perceptions. Also to explain the different strains of anthrax to be found.

LG: Mentioned that a very thorough exercise should be made to gather all scientific facts. GDARD will in the end make the decision, whether the development continues or not. Bokamoso should be able to defend its decision in recommending the continuation of the proposed development. She mentioned that the team did a thorough exercise and Bokamoso Environmental is satisfied with the investigations done. This is also the reason for having all these discussions and meetings.

Dr E Fourie: Asked Dr de Vos how many spores should be inhaled to be effective in the contamination of humans. If there is a known site where there are bones.

Dr d V: Worked on Impala in the Kruger National Park and found LE50 affecting them orally by +- 20,000 spores. Dr d V explained that the anthrax spore is not invasive. 1 or 2 spores mean nothing actually. More than the latter is needed to be fatal. The spores need a break in the skin or a cut on a finger enabling it to enter. He explained that he did more than 50 post mortems on anthrax carcasses, he was covered in blood sometimes and he never contracted the disease.

Dr E Fourie: Asked about gravesites. (inaudible). Burial places?

Dr d V: Answered everything depends on a carcass being opened up before. The anthrax organism circulates in the body; it is the biotic part of the cycle. It tends to

use all the oxygen in the body. The animal dies and when it is opened up shortly afterwards, it (the anthrax) is exposed to oxygen again and in actual fact it starts to grow again. The spore formation happens towards the end of the development phase. This process happens inside the body as well. If the infected animal is not open up, there will be fewer spores.

Dr E Fourie: Discussed this phenomenon further with Dr d V. – inaudible conversation on his part.

Dr d V: Explained that the only place to find anthrax spores in a carcass unopened, will be in the bones and the bone marrow.

Dr Johan: Inquired whether this is not the way other animals get infected. Those that eat bone.

Dr d V: Agreed on the latter statement and added that even Kudu eat bones.

Dr Henriette: Some literature conveys that a human to get infected, there needs to be an invasion of a 1000 spores. The soil with a low pH will not foster the growth of anthrax spores.

Dr E Fourie: He stated that he has a problem with the ground to be opened up by building activities.

Dr d V: Said that in the acid environment as that of the proposed site, it is a good reason for development. In soil the anthrax spores eventually die off. In bone structure it is a different matter. Look within the bones.

Dr E Fourie: Argued about the scenario to be taken if anyone does get infected. What measures will be taken? (a short discussion followed – everyone talking)

LG: Asked that while the construction phase continues, if it is possible to take dust samples.

Dr Johan: Answered that it is possible.

Dr d V: Inquired about what specific is planned to be constructed on the site. Will there be a basement? Is the contractor going to dig down? He declared it will be quite safe if the digging will go down for about 1m to 1'5 m. Further down it might not be so safe. A concrete foundation will curb any problems.

Urban D: Tests done. Agreed to put the necessary measures in place.

Dr Johan: The benefit of this site is that the soils grade quickly into weathering rock. It is very difficult to dig beyond 1'5m. He explained that people digging by hand would have dug quite shallow. They looked at the types of disturbances and signatures they could see in the area for surface disturbance.

Dr d V: Commented that there are many mitigation methods and procedures that could be taken e.g: If bones are dug up, there is a specific procedure to follow.

LG: Suggested damping down of the soil during the construction to diminish the dust problem.

Dr d V: Explained that when a problem has been dug up (bones) formalin could be used to decontaminate the area. (5% formalin).

Dr Henriette: Answered that the environmentalists have a problem with formalin. But it could be a Pandora's Box using bacteria phases. She also mentioned the use of peracetic acid. Her concern is that the use of peracetic acid is in an experimental stage. She mentioned that solid peracetic acid breaks down sooner than formalin.

Dr d V: Mentioned the use of formalin after World War II on an island in Italy. He also used formalin down in the Cape, on the Mowbray site. Formalin also breaks down.

Dr Johan: Suggested when necessary they can decide on a pollution free chemical to use, with water resources in mind, the specific soil profile and the persistence of this specific product in the soil will determine whether there is any risk to ground water pollution.

Michael B: Suggested that the discussion should go back one step when it was assumed that animals used to graze on the discussed site; that there could have been a dairy farm.

Dr d V: Answered that there was once a dairy farm and the milk was used by the hospital. He also mentioned poultry farming as a possibility for the use of the eggs.

Dr Johan: Mentioned areas of agriculture.

Michael B: Asked how long the anthrax spores could survive in soil.

Dr d V: Explained that the spores found in the bones could survive many years. At Mowbray in the Cape, 80 years after animals had been buried there, it was an extreme acid area and also wet. They had to dig down and could only find 4

graves. It was marked as an anthrax grave. In that area there was a grave of an old man as well. They found these by digging down 1'5m.

LG: Mentioned that maybe basements could be risk areas.

Michael B: Also assured the meeting about taking special measures concerning the risk areas. They will not do anything there to cause any uncertainty.

Dr d V: Suggested that where basements are involved the contractor must have a microbiologist on site to do the necessary tests. With surface construction there will be no problems.

Dr Johan: Emphasized that the soils found deep down are completely different to the top soils. These soils have a systematically grading from coarse sandy material into very fine clay weathered green stone material. So there is from a water invocation perspective, as supposed to what happened in the Cape, you go down to that water table in that sandy area. Here we have poached water and there is actually very little water further down.

Dr Johan does not fore see any problem with the contractor digging into the weather drop. He explained that he does not see any chances of spores migrating out of the bone into a relatively acid weathering rock, unless the contractor while in a process of digging does come upon a grave – they will be able to pick it up immediately. It will be unconsolidated material.

Jon/Dr Johan: Discuss procedures to be taken here, shortly, as well as some implications to consider if something (anthrax/bones) could come up. Jon: Twofold measures will be taken.

Dr d V: Thought the best way to manage this aerial/site is to contain it. Put something on top.

LG: The site is a mystery. It is a risk to develop a golf course or botanical garden there with all the soil movement involved. She suggested one should be brave, identify everything and make a memorial of all the cemeteries and to cover it.

The locality is strategic for development and there is actually no risk. People are scared of the site now. There is actually a risk of children playing on the property. There is currently illegal dumping and people excavating there. Lizelle also mentioned the danger of the effluent coming from the hospital.

The no-go alternative in this case will be far worse than any development to take place. Lizelle stressed the factor that she would like to make this all her recommendation and for this to happen she needs support.

Something else she had in mind, was what if the site was used for agriculture? Is there not a possibility that the animal carcasses were buried somewhere else? She also wondered what the original size of the farm was. Was it not perhaps bigger than the site of development?

Dr Johan: Commented that the grave sites people refer to, could well be under the golf course. He investigated as far as he could. He also mentioned that some of the urban areas are very old and could have been developed over these sensitive areas mentioned. (grave sites).

LG: Asked whether it is possible to get hold of information through historical records concerning the size of the original farm. Then it would be possible to depict where those grave sites were, because they could find nothing on the proposed Linksfield site.

(a discussion followed by all about the site and where the grave sites may possible be.)

Dr Johan: Suggested that the approach to this problem is twofold. The one is to say we assessed according to current and we write up all the scientific methods we use, and we say we could not find anything. The other route is to sample every m2 and to dig further. All had been done to eliminate all risks, scientifically.

That draws the line, but we have a protocol in place in case of any eventuality. Should bones be dug up; should one identify areas that had been unconsolidated. (e.g. a 3m deep burial pit of the past) This will show up immediately, because of the geology there. The signs will be there.

Dr d V: According to his opinion there is a very good reason for developing the site. He further commented after all he heard about the activities going on at the site at present, it would be better to develop the area. People busy excavating and living there use the water in the area. They can be contaminated by many diseases as well as anthrax. He made mention of a similar case in the Cape. Erosion could become a problem.

Dr Johan: By developing the site one has got controlled access to the area, though more feet my come onto the area, it would be controlled. He mentioned all the people sleeping and living in the area. There are even shelters erected on this site.

Dr Johan also suggested that more sampling could be done once the construction commences.

Michael Bishop: They prefer to do it on a per site basis. He also said they can proof reasonably that they did take the necessary precautions diligently. They will ensure all sites to be 'clean': They will be alert to the fact that workers should stay healthy. There is the question though about what measures should be taken in case of workers getting infected.

Dr Johan: Mentioned the typical symptoms and what to look for.

Michael Bishop: Mentioned other infectious diseases: small pox.

Dr Henriette: Many people as well as scientists, she spoke to, were worried about small pox. She investigated to see how long small pox spores will persist, but found it could only persist up to 8 years. Actually scientists have to be educated in this matter. A scientific opinion concerning anthrax could be the biggest threat.

Dr d V: Said when he worked on the Linksfield site, he heard that some bodies were buried in caskets lined with lead.

Louis v R: The possibilities of graves on this site are very remote. The development should carry on and should have the correct protocol in place in case of any event. He and Dr Johan did the soil samples together and nothing was found. (anthrax). Therefore no contamination could possible happen there. It was proven that in this soil profile nothing had been found.

Dr Johan: Added that it relates to the heritage aspects of old landfill sites and so on. Those are quite easy to see and are classified as garbage soils as well as their indicators. If one sees any of these things or fake artefacts, inform the foreman of the construction team on site. Anything out of the order should be reported – anything other than the standard soil profile.

Louis v R: Spoke about the soil profiles on the site: one is typical green stone and then the granite profile. The possibility of graves there is almost zero.

Dr Johan: Asked what the chances could be that all the carcasses had been burnt and that nothing was left.

(A general discussion followed on the above mentioned).

Michael Bishop: Asked what the procedures were in those days. (Discussion)

Dr Johan: Said that they are looking for ash residues and to distinguish the latter from ash coming from dumpsites is very difficult. He also mentioned an old dump

site to be in one corner of the site close to the highway. Could it be that anything had been dumped there and burnt?

Louis v R: Said if anything was burnt there, ash would have been scattered all over.

Dr d V: Thought the carcasses were either buried or incinerated. It all depends on whether they had enough wood. A lot of wood is needed for the purpose of burning carcasses. (Laughing and talking followed) He also meant it would have been easier to make use of a landfill site for this purpose to cover carcasses.

Dr Johan: Agreed and said that was most likely the case.

Dr Henriette: Inquired about the area down by the Jukskei River's side.

Dr Johan: According to the aerial photographs he discussed with Dr Mannie Levin, the area contained granite. Also according to his report and the first aerial photograph taken in 1937 or so, the Jukskei River was barely channelled. There was almost no channel there. Apparently there was extensive agriculture on the banks of the river. Today that river is eroded 3-4m, 5m deep and at least 10-20m wide. So the previous agriculture and the deepest soil had been removed at some time.

LG: Explained why she asked Dr Mannie Levin to become involved. She thought it is also important to keep in mind that spores could move down to the Jukskei River through groundwater. She suggested that there should be looked at boreholes round the sight and to see if anything can be detected from the water there. Also when soils are moved by construction, it must be tested to make sure.

Lizelle thought it would be a good thing to have groundwater samples as a baseline. Tests could be done downstream from the landfill sites – a borehole – and one upstream and then also where the graves are. Lizelle suggested tests to be done also lower down where there are excavations. She asked if there is a possibility that spores could have moved downstream over the years.

Dr d V: Answered that spores do move, but that there is a dilution factor involved. He was of the meaning that so few spores could hold no danger.

LG: Mentioned that maybe someone in the neighbourhood could complain of polluted water.

Dr d V: Answered that down at Mowbray when he did the investigation work there, they found in demarcated areas, the actual burial site nearby. A highway was built right alongside this sensitive area. There was a cutting down made. He went down there to investigate and to take ground samples. Anthrax was found

there. It did actually maybe go to the nearby fields. It was reported, but nothing was done about it and nothing serious happened.

LG: Answered that it is good to know when mitigation measures have to be put in place.

Louis v R: Anthrax spores can only move through preferential flow.

Michael Bishop: commented on the above discussions.

LG: Suggested that their reports should show the risk areas and also show areas where there is no risk at all.

Dr Mannie Levin: Declared at this stage that there is no knowledge of how many boreholes there could be. He did not do any census at this stage. Also not of how many users there are, except maybe the golf course. He contacted the Johannesburg Council as they had a database, but he is not sure it is still relevant concerning boreholes, even dating back.

LG: Answered that it will be a good thing if he can maybe mention in his report what the risks are concerning surface water contamination as well as groundwater contamination. We also have to take samples of the Jukskei River. Certain monitoring points should be certified.

Dr Johan: The most of these specific spores in groundwater need to be drawn down to the chemistry of the site as well. Any water that goes into the soil is typically reduced as de-oxygenated – oxygen is depleted in most of these cases.

Now iron levels are higher in these soils as well as magnesium levels. His question is, 'what is the persistence of a spore like this (anthrax)'? The possibility of a spore without a host e.g. bone, could persist over time in fluctuating conditions, plus a whole lot of elements. Iron plays a major role in the germination of certain fungi. Whether this is the case with bacteria----?

Dr Henriette: Referred to an outbreak of anthrax amongst animals in the Northern Cape. There severe mitigation measures had been taken: animals were burnt and areas were sprayed with formalin. Her team went in 3 years later and took samples where bone had been found.

A viable spore will grow and so a culture is formed one can also detect if the DNA is/or was present. In the Northern Cape event DNA was found. They verified whether the toxins were present, but they could not isolate the organism. They come to know anthrax was present, but the mitigating measures taken there were

quite well, as they could not grow anthrax out of what they found in the soils. It could be detected through the DNA as well as culturing.

Dr Johan: Referred to the DNA sample and asked whether it is easier to detect it through water sampling or a soil sample.

Dr Henriette: Answered that it is possible to culture from both soil and water samples.

LG: Addressed Leoni and asked whether she has anything to add from a historical point of view.

Leoni: In her search she could not find any documentation. She specifically looked for maps and for some place where they slaughtered animals. She could find only one document referring to the slaughter of an ox, but nothing else. The problem with the gravesites now, is that no borders can be determined as the vegetation is too high. They are waiting for winter to pass so that it will be possible to determine those.

(Discussion followed: everyone talking about where the surface area of the graves would be).

Dr d V: Mentioned the 7,000 graves that had been mentioned.

Dr Johan: Mentioned the man – the quad bicker – who did not want a development on this site, because of his riding there regularly. This person could only identify and show Johan the exact graves that are depicted on the aerial photos.

Dr Johan mentioned that the burial procedures in the 1920's – 1930's were a different matter than it is today. He assumed that people would not have been buried haphazardly, especially not with a doctor with the stature of Dr Mehlis, running the Rietfontein hospital.

Jon: Said that what he came to know is that the above mentioned hospital was not that big. It had about 216 beds.

Dr Johan: Again referred to Dr Mehlis and declared that he believes Dr Mehlis worked in an organized, structured way, especially in burying people. Every grave had a plaque and a number, which were all of cast iron and had been stolen. The clearest signature is the pebble marker that came to the surface. The signature of a gravesite is clear. There is clear distinction between a disturbed and an undisturbed area. It also seemed that these gravesites were very nicely lined with trees. The signatures of these are on the aerial photographs. There had been changes over time. All the trees had been chopped down. Dr Johan said that he

can provide the boundaries of the above. He also described the gravesite as a gravesite where there were headstones.

Joanne R: Mentioned that one must keep in mind that Jewish people always look after their cemeteries. From one generation to the other they diligently tend the graves of their loved ones that passed away. So if the stories about such a grave site are true, where is this grave site?

Dr d V: Discussed the probable size of the graves.

(Discussion followed on the size of the gravesites, the graves itself and the surmised stories about all the graves – horror stories.)

Leoni: Concluded by saying they could not find a formulation of a cemetery anywhere.

(Again a discussion followed – all together talking).

Pirate: Mentioned the Adler Museum.

LG: Replied that they should keep on contacting the Adler Museum, though the people there do not come back to us.

Dr Henriette: Said that she contacted the museum. She first contacted Wits University and came to know about it. The Adler museum is still part of the university. She got hold of their telephone number. She spoke to a friendly lady who said they were very busy at that time, but would get back to Dr Henriette.

Dr Johan: Will get someone from his office to phone the Adler Museum.

(Discussion)

Dr Fourie: Said that people dying in hospitals do not get buried on hospital sites. 'So what happened to the bodies and what procedures had been followed', he wondered.

Dr d V: Mentioned that the Rietfontein Hospital was a special hospital. They had to be buried there or were incinerated.

Dr Fourie: Asked what happened at other similar hospitals in SA. (unclear what was then discussed) He asked about the procedures to be taken in a case of leprosy.

Jon: Also investigated and come to know of a district surgeon in Krugersdorp, through the Adler Journal. This district surgeon had apparently control over the site.

Dr Fourie: Speaking – inaudible (burying of people).

Dr Johan: proclaimed that he got the idea that the cemeteries on the site were ordinary cemeteries. The signatures indicate that the graves were square, the trees had been planted around the cemetery.

Dr Fourie: Talked about certain procedures followed in the burial process.

Dr d V: Exclaimed that it should be remembered the height of the anthrax outbreak was in 1923 – 1928. A good vaccine had been developed. The occurrence of anthrax from that day onwards went down. He also suggested that treatment at the hospital would occur around the 1920's.

Michael Bishop: Referred to newspaper reports: notice of people and animals dying of anthrax. Check for lead.

(Discussion: Dr Fourie, Dr Johan Michael Bishop and Dr d Vos.)

Dr d V: Anthrax in humans is secondary to anthrax in animals. Anthrax cannot be contaminated from another human being. Anthrax in livestock is dangerous.

Dr Johan: Declared that this phenomenon is very interesting. It means then that human bones contaminated with anthrax, would indicate that these humans had been infected by animals and not with contact of another human.

Discussion by all: Anthrax outbreaks / the last one from 1959 according to tombstones/penicillin discovered: 1948.

Dr Henriette: The oldest grave site, the first graveyard was close to the river; it was developed there at the turn of the century: 1890 to 1900. The other graves they saw were from the 1920's and the last from 1959 according to the tombstones.

Dr Johan: Dr Mehliss was trained in Germany just before World War II. He studied with the Kaiser's son and the Kaiser at that time awarded Dr Mehliss as the best student of that year and outshone the Kaiser's son.

Dr Henriette: He was the one who came up with the treatment of syphilis. The latter was treated with mercury.

Dr Fourie: - inaudible.

Dr Johan: Mentioned the perspective on lead contamination. If there is lead involved on this site somewhere, then it triggers the guidelines on treatment of contaminated land. If any such thing is picked up, there is a certain guideline to follow, introduced by the Department of Environmental Affairs.

The framework for this is in place and does mean that one has to proof that the source of the pollution is not you, but it is there historically. If they dig up the caskets, screening should be done to see if there is any lead contamination. Lead is very insoluble. The main driving factor for lead solubility is pH. In a low PH one can expect a more soluble environment. (increase.)

Michael Bishop: that could be done easily up front.

Dr Johan: Said that there are a lot of other factors also to keep in mind. The more phosphorous in the system, the more the increase of insolubility will rise. In case of any metal detected, a fractionation must be done. One has to look at the most soluble fraction and then start working to increase the aggressive extractants up to a total digestion. Water tests will be able to up any lead pollution and trace quantities.

Michael Bishop: Would the team be able to assist them? Assumed that if there are no fragments of lead, then there were no coffins.

Dr Johan: Explained that if you do not pick up any fragments of lead, it does not mean that there were not any coffins buried. He is of the opinion that lead in a weathering ambiance, would be mobilized quickly. There is a lot of iron, etc.

Louis v R: No graves in the green stone belt area during their investigation. They found no signs of graves there – No source for lead contamination there.

Jon: When something is found, one has to put mitigation measures in place immediately and start giving advice.

Louis v R: Mentioned the greenstone belt area and the greenstone bedrock area again. He assured the meeting that it cannot be seen as a source of contamination.

Dr Johan: Suggested that if the team do get a water sample from somewhere to just put it through an ICP NS scan. If you pick up iron levels of manganese and nickel, etc. just assume that it is part of the natural background.

LG: Declared that on the way forward on this development, she would like every specialist attending this meeting, to refer to this meeting and that all had an integrating discussion. She would like everyone to write a 2 page report to state their agreement in favour of the commencement of this development.

Also to give their opinions on any kind of risk if present and make maybe a few proposals.

Lizelle said that at this stage she feels comfortable that everything possible had been done to eliminate any risks relating to the development. She feels strongly that a no go option is no option at all.

The minutes will be circulated and made part of the Public Participation process. She inquired of the specialists to provide Bokamoso Environmental with anything else of importance that may come up.

The recommendations of the DRAFT EIA will be circulated amongst all the specialists involved before it is made available.

During the construction phase some of the specialists should get involved for instance Dr de Vos, Because of his previous experience. She is of the opinion that with all the specialists involved today and the discussions that followed, it was actually a very good session. She also said it would not be necessary for another meeting.

She asked Dr Levin how soon and when could Bokamoso Environmental expect his report.

Dr Levin: Promised to submit his report on the 6th June 2014.

LG: Inquired from the specialists about how long will it be before they submit their final reports to Bokamoso Environmental. She also reminded them that the Adler Museum must be contacted persistently. Leoni could try as well as Dr Henriette and then also Bokamoso's staff. The received information can then be made available to everyone.

She asked that all who attended the meeting to sign the register of attendance.

Michael Bishop: Suggested that Bokamoso Environmental also supplies a booklet of some sort to explain the whole situation, together with the EIA Report at the time that the EIA Report will be submitted to the public to peruse.

LG: In the event of a public meeting Lizelle does not think all specialists need to be present.

Jon: Suggested if something comes up there could be a special meeting scheduled with the specialist who can address certain issues causing a problem.

LG: Said that the most important thing is what is put in writing. In a public meeting people tend to say many things, but what you put in writing is important. GDARD is going to look at what is in writing – all facts.

LG: Thanked every specialist for attending the meeting. Mentioned again it was a good meeting.

(Discussion followed – everyone talking – how to get access to the Linksfield site and what mitigation measures should be taken during construction (Michael Bishop).

Dr Johan: Added that there is one thing he did not mention and that is the dust factor. Dust suppression must be a standard procedure taken during the construction phase. There are other health related issues linked to the respiratory organs.
LG: Dust control is very important – there should be no dust. She suggested an educational pamphlet should be compiled.
CLOSURE.

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AGENDA

- Welcome Lizelle Gregory (Bokamoso)
- Introduction and background Lizelle Gregory (Bokamoso)
- 3. Risk Associated with the proposed development (All specialists)
- 4. Inputs required from the specialists (All specialists)
- 5. Other interests of concern (All)
- 6. Approach regarding the mitigation measures and guidelines to completion of the project (All)
- 7. All specialists must feel comfortable and confident that the development can go ahead (All)
- 8. Way forward Lizelle Gregory
- Each specialist needs to provide Bokamoso with a signed two page document whereby confirmation is given that the proposed development may continue and that with the relevant mitigation measures minimum to no risk will be involved with the future development.
- 9. Closure

- Lizelle Gregory (Bokamoso)

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MINUTES OF THE SPECIALIST MEETING HELD FOR THE LINKSFIELD PROJECT HELD AT THE OFFICES OF BOKAMOSO ON 20TH OF MARCH 2014

SPECIALISTS ATTENDING THE MEETING:

Dr. M. Levin. Aurecon.

Dr. E. Fourie. Ampath.

Mr. Louis van Rooy. J.L. van Rooy.

Dr. Johan van der Waals. Terrasoil.

Mrs. Lizelle Gregory. Bokamoso Environmental

Mr. Pirate Ncube. Bokamoso Environmental

Ms. Anè Agenbacht. Bokamoso Environmental

Mrs. Loura du Toit. Bokamoso Environmental

INTRODUCTION:

The meeting at Bokamoso Environmental started at 15h00 on the 20th March 2014. Ms Anè Agenbacht Project Manager of Bokamoso Environmental welcomed all attendants to the meeting.

THE PURPOSE OF THE MEETING:

The main purpose of the meeting was to introduce all specialist consultants to each other and consolidate specialists discussions on the project. Because of the sensitivity of the project, it was necessary that integration of the relevant disciplines be discussed at this meeting. This could avail to determine which additional studies to be conducted. Studies already done could then be updated or amended.

The latter could ensure a thorough Impact Assessment and also could provide informed, responsible recommendations concerning the way forward with this project.

Dr. Johan vd. Waals: Some people believe that are graves of whites, blacks and also a Jewish grave site and apparently a children's grave site. The challenge is to identify these graves on sites.

Through assessment, they could only identify two formal grave sites. There was no animal grave site to be found. He specifically looked for the latter, but there was no signature to be found to indicate the existence of such a grave site.

He also declared that he could find no bones, nothing, as he fine-tooth combed the area. Nothing could be found also through the analysis of areal photograph dating back to 1930. He also took soil samples near the stream flowing there.

Other soil samples indicated a low ph level, due to the potassium, magnesium and calcium levels present in the soil samples. It is a mystery to what happened to the animals, surmised to be buried there.

He also consulted a specialist from Onderstepoort, Dr. Henriette van Heerden. Dr. Henriette only referred to spores of two possible illnesses to be found at the site: smallpox and anthrax. The anthrax spores found in the soil are the kind only problematic to animals – it is a natural strain of anthrax.

Although there is an assumption that humans also died of this anthrax strain, there was no record or evidence to be found. The only thing that tested positive was the Mycobacterium Tuberculosis spores which can remain in the soil for up to 88 days.

Dr. Johan assumed there could be leaching from the grave sites and sampled soil there and the nearby stream where they identified some of a hill slope seep. They also sampled soil around and through the grave site and collected samples for microbic analysis. They also took soil samples to determine the ph levels of the calcium, potassium, sodium and magnesium levels. This could refer to bones that became soluble and whether there could be any signature of these present in the soil samples. But the ph of the soil was low.

He then started a survey on the history of the Rietfontein Hospital and to identify all the diseases that were mentioned. He went through the whole process of screening all the diseases mentioned and included any other possible disease.

Dr. Henriette also screened all of these and came up with literally two possibilities that could persist in soil. The one is small pox which has a limited time period of existence of eight years. Then there were the anthrax spores but prooved to be the kind only problematic to animals.

Dr. Fourie: Referred to other strains of anthrax but none of these strains' spores had been found in the soil tests done by Dr. Johan.

Pirate: Asked whether there is a copy of the survey.

Dr. Johan: Took out his hard copy of the survey and referred to those tests done as mentioned above.

He again said that the assumption was made that humans also died of anthrax, so they tested all soil samples for evidence to confirm this claim, but nothing was found.

Lizelle Gregory: Referred again to the importance and reason for this integrated meeting. It is basically Bokamoso Environmental's responsibility to gather the comments and findings of an integrated group of specialists investigating everything.

She consulted a veterinary surgeon Dr. Maryke Henten, who did her doctorate on anthrax. It could only be to the projects advantage to draw her in. She worked on specific anthrax projects for the Government. She also

worked with Dr. De Vos, who is actually the retired veterinary surgeon at the Kruger National Park.

During their discussion Dr. Maryke mentioned that a few years ago they were appointed for a secret government project, in the Western Cape, where a shopping centre was developed over an anthrax grave yard in Mowbray, Cape Town. The contractor put the entire site under concrete and since these measures had been taken nothing has happened there.

Lizelle also mentioned that she would personally like to speak to Dr. De Vos in view of the fact that at the Mowbray site, soil had been moved and the activities of a building construction took place. Apparently they did quite an extensive research before the building project commenced.

Dr. Maryke Henten is willing to peruse all reports compiled thus far concerning the Linksfield project. Lizelle mentioned that it is very important that different views of expertise should be considered. Dr. Maryke actually recommended that the Linksfield site should be made into a golf course or a botanical garden.

LG: Does not agree with Dr. Maryke with this suggestion as there will be exposed soils and moved soils as well as other disturbances of soil: escalation for the bunkers and the herringbone irrigation system must all be taken into consideration.

LG is of the opinion that it would be a better option to put the site under concrete. As it is now the site is permeable. When it rains there is

underground movement. Putting the area under concrete with shallow foundations and not basement parking could be the best solution.

Dr. J vd W: There are many people browsing around the site, also busy digging around the area for artifacts and so on.

LG: Agreed with Dr. Johan on the fact that there are many people around the site. She is of the opinion that this (people digging around the site) is a no-go option, actually a risk.

Dr. E. Fourie: Asked about the animal carcasses buried there.

LG: Lizelle answered that Dr. Maryke Henten told her it is common knowledge that animal carcasses had been buried there, though she had no evidence. She also referred to a different area to where the graves supposed to be and also to the Jewish grave site that was there.

She surmised that the animals might have been burnt and buried into one hole, away from human graves. So if one can determine where these burial places are, then it would be possible to do a survey on that specific area. This Vet provided Lizelle with the name of a book on the history of the anthrax outbreaks to be found in the library of the Pretoria University: INFECTIOUS DISEASES OF LIVESTOCK, Volume 3, edited by J.A.W. Coetzer and P.C. Tustin.

Lizelle also mentioned to Dr. Maryke Henten that no spores of these strains of anthrax could be found, though the soil tests had been done.

Dr. J vd W: Confirmed what Lizelle said and explained that it took him 5 months to complete his survey because of all the soil studies he performed. He worked extensively through the site area and tested soil for different anthrax spores and to find all the graves everyone referred to.

Dr. E. Fourie: Referred to the different strains of anthrax spores to be found and asked whether the soil tests include those as well.

Dr. J vd W: Answered that he did not find any of these. He then referred to Louis Van Rooy's investigation – his Geo-technical survey – as they went out to the site together.

He said that the interesting thing about this site is that a mixed vegetative cover occurs with predominately grassland with pebble markers to be found often with typical course material on top. Another unusual occurrence they came across at the site was the molehills or human diggings of some sort in the grave site area. Quarts pebbles were to be found here and these pebbles were very visible where humans or moles disturbed the soil.

He explained that by walking through the site one could immediately see where the soil had been disturbed by human activity or molehill activity with different signatures present. Then there were other areas where nothing had been disturbed. The latter mentioned is used to identify different impacts on the soil.

One impact which Dr. Johan could not assign anything specific to, was an

excavation close to the graves. It is an excavation where humans stay, burn

tires and all sorts of activities take place there. He took soil samples there -

he actually took a soil sample from the middle of this excavation.

Referred again to Dr. Maryke Henten saying about one excavation LG:

where all animals or whatever were supposed to be buried.

Dr. vd W: Referred to one of his maps from the hard copy of his study

indicating the site of the graves.

LG: Indicated an area on the map where an excavation site used to be, but

Dr. Johan disagreed there with her, reminding her that it could not be so

close to where crops had been cultivated. Dr. Johan pinpointed to the

excavation site on the map from his study as well as the wetland.

LG: Mentioned that Dr. Maryke Henten is of the opinion that the excavation

site is near the entrance of the hospital.

Dr. J vd W: Answered that he walked that specific area extensively.

Pirate: Also studied the map and agreed.

Dr. J vd W: Showed a potential area on the map that could be the referred to

site. The area here is disturbed and was used until not too long ago for crop

production purposes. He doubt whether the hospital would allow an

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excavation as burial ground for animals so close to crop productions. The hospital also grew crops and vegetables.

LG: Referred to a penetrating radar investigation. She also mentioned that she has a contact person to do this kind of survey and walk the site to see if they can find anything. If this investigation indicates to anything else, then a further investigation could be done.

Dr. vd W: Remarked that the site is not suited to such type of investigation and that the person assigned to walk across the site is going to find all sorts of things. (laughter).

LG: Replied that it is a step taken to be on the safe side. The other measure to be taken is to place 6 to 8 newspaper advertisements, inquiring people to come forward if they have any knowledge of the grave sites. Some graves were there since 1948 and some of the people from that time, might still be living and being able to come forward with the knowledge they have. There actually are no archives to be found according to the Vet.

Dr. J vd W: Indicated that it would have been ideal to have the sequence of the outbreak of anthrax so as as to analyse soil/ground disturbance before, during and after these periods.

LG: Again referred to the history book on anthrax: INFECTIOUS DISEASES OF LIVESTOCK: Volume 3: Edited by J.A.W. Coetzer and P.C Tustin. Apparently all outbreaks of anthrax had been recorded in this book.

Dr. E. Fourie: Enquired whether we contacted Prof. Koornhoff of the Witwatersrand University. Lizelle contacted them already. The latter had no information.

Dr. J vd W: Replied that the most fail safe thing to do is to compare those specific photographs before and after the outbreak of anthrax, in terms of the impact on the area. Soil areas that had been disturbed can then be identified. Pirate: Agreed.

Dr. J vd W: The hospital had detailed records of the people buried, but everything was destroyed by fire in the 1980's. Now there are no existing records to be found on the site. In the end Dr Johan went to the Sizwe Hospital itself who declared they had a map. It took a month to get the 'map' from them and then it turned out to be a town planning application done in the past. The latter was all that the Sizwe Hospital could provide.

LG: Referred to Marion Laserson who proclaims that she knows the history of the area and Lizelle is going to have discussions with her again.

Dr. J vd W: Said he also spoke to her. Apparently she is the person to claim that there is a Jewish grave site near the hospital.

LG: Answered that Bokamoso Environmental already contacted Saffas, Doves, Avbob and others are mentioned. Lizelle declared that she herself personally spoke to many people. She also mentioned that she is going to make an appointment with Dr. de Vos as he knows all about the anthrax outbreaks from the past.

According to Dr. Maryke Henten, Dr. de Vos is the best person in South Africa with regards to the history of anthrax. This is also because of his involvement in the development of the shopping centre in Mowbray, Cape Town, which is a similar case. She would appreciate his advice.

Dr. Maryke Henten is of the opinion that the best thing to do is to burn the buildings. Dr. Henton also referred to an incident in Italy where an island infected with anthrax, had been treated entirely with formaline to get rid of the anthrax spores. Formaline is known to be toxic. A ph level of 7 is mentioned here.

Dr. J vd W: Answered that the ph levels of the soils tested on this site were low. He did not find any ph above 6.

A discussion followed on the ph levels of soil and what it indicates.

Dr. J vd W: Also mentioned that Dr. Henriette van Heerden from Onderstepoort meant the soil's ph levels of 6 and below were acceptable. He also mentioned that the treatment of graves with bones is done through the use of acidic acid.

The acidic acid washes away the calcium and the ph levels drop. Dr Johan does not recommend the treatment of this site with acidic acid. His view being that this will acidify the soil on this specific site further, could open a can of worms.

LG: Asked whether the planting of certain plants could not further the acidity of the soil in the longer term. She mentioned pine trees – the needles of the pine trees use to acidify soil.

Dr. J vd W: Does not recommend these mitigation measures to be taken, because of the rockiness of the soil.

Louis v R: Means that this site would be the most unlikely site to bury bones of any kind.

Dr. J vd W: Agreed to Louis van Rooy's statement.

(Everybody talking)

Dr. J vd W: Then referred to all the snails he found on the site. Snails need calcium to build their shells. He thought that there should have been an increase of calcium, because of the snails. Snails can only survive in a calcium rich area. He then did a calcium analysis test of the soil in this area. The only element that showed up in a high concentration was phosphorous potassium. The latter cannot be related to human remains but rather plant matter. In other words there could have been gardens that had been tended to. He mentioned that the human body cannot contain such high levels of potassium.

He mentioned that these people must have been buried very shallow due to the nature of the soils. He again mentioned the activity of moles in the area. The moles do churn up everything. This is where they (Louis v R also), saw the snails; the soil at the molehills had been analysed.

LG: Addressed Dr. Manny Levin and suggested that he should also discuss his findings with the other specialists. She suggested that his study should also be integrated with these studies already done and that he should relook his proposal. She also means it would be a good thing if all present could meet together again. She refers to the Geotechnical investigation that should be more detailed. She intends to get a medical doctor involved for his opinion – for health and safety's perspective.

Lizelle again referred to Dr. Maryke Henten who could analyse and cultivate spores and provide the specialists with her opinion. She added that all fields scientific, health and safety and geotechnical should be considered and compiled to this study.

The Environment Management Plan should also include the above mentioned. She referred to people actively working on the site during construction, could maybe shower before going home. This is to ensure that they do not contaminate their home environment.

Dr. J vd W: Explained that 90% of the site could be cut out as a risk.

LG: Referred again to people working close to the hospital, and mentioned that they could wear masks. People working on the site should be screened – health wise – they should be healthy. It could be that anyone working on the site could be a TB carrier and a carrier of various other illnesses, which they can blame on to working on this specific site.

Dr. J vd W: Agreed with Lizelle. Extended measures should be taken especially in the areas of activity. As it is, there is no control over people/workers working and digging in the rubble area. Caution must be taken.

LG: Mentioned that the engineers, building contractors and artisans should take precautions by adding to their employees' contracts, the necessity of the employees to provide a health clearance certificate when employed.

Dr. J vd W: There should be special precautions taken at the hospital, because of the fact that there is a sewer effluent coming from the hospital. This constitutes a much bigger danger of contamination. This could also be the reason why TB spores had been picked up in the flood line of the river. He also mentioned that any water contact on the site must be screened.

Dr. J vd W: Referred to someone (he could not remember the name of the company), This person mentioned that they planned to do the storm water irrigation in the channels. Dr. Johan disagreed and said that no one should have contact with the storm water outlet.

LG: Felt it is imperative to contact as many people as possible to obtain all possible facts and solutions to possible uncertainties. She declared that this project could be a 'typical Carte Blanche story' concerning all the objections that came in.

Dr. J vd W: Meant that many of the objections against the project is typical of for instance: the Dave Fisher incident. He met this man on the site who said he does not want the site to be developed, because he drives around on the site on his quad bike every Sunday!

LG: Answered that it is actually a bigger risk to drive around in the dust which carries all kinds of spores.

Dr. J vd W: Affirmed that if this specific site is left as it is, it constitutes a water risk and people moving around causing a dust problem. Any dust contamination in the area could be more dangerous to people in the hospital.

Dr. J vd W & Dr. E Fourie: A discussion followed on all kinds of diseases to be treated at the hospital.

LG: Asked Dr. Eugene Fourie for his opinion on Dr. J vd W.'s investigation study recently done. Also to comment on what he found in the soil and what specific diseases are being treated at the hospital.

Dr. J vd W: Suggested that Dr. Fourie should study his report. He mentioned that all diseases treated at the hospital, are mentioned in his report and had been looked at when he compiled his study.

He referred to the time when people died of different diseases treated at the hospital, but today all these diseases are easily treatable. This also probes a problem with people living in the area. Many objections will come in from people who grew up with this hospital in their area. They might remember all the horror stories related to this hospital, more than 80 years down the line. People who grew up in this area may still have the idea that this is not a place to go to.

LG: Said what is really important about this project, is that it will affect people living there. People to come and live there, must be convinced that there will be no risk to buy property in this specific area. People oppose the idea of living where there is a possibility of grave sites to be in an area. They have to be convinced that there is no risk of contaminating any disease from this specific site.

That could be attained by providing an in depth study and compilation of all the reports as proof of the safety of the area, for instance: the ph of the soil tested on the site is not suitable for anthrax spores to live in. Nothing else could be found through the numerous soil tests done.

The 'no go' option in this case is a very important alternative to discuss. It would be a far higher risk to take the 'no go' option.

Dr. J vd W: Said the reason why he did not include the above mentioned in his report, is because of the fact that he does not want to be an alarmist.

LG: Stressed the importance of the fact that all disciplines should be taken into consideration. All the specialists involved should be forthcoming with all detail and facts concerning this project. All of this should be contained in the various reports to be compiled and then made available.

Everything can then be investigated on the ground, underneath the ground, in the ground water and all different places. After all this had been put into place, there cannot be arguments held against the project.

Lizelle even made an appointment with Dr. Wouter Basson in Cape town, in order to present all these studies to him to obtain his opinion, as he worked for the government previously. Dr. Basson will also provide Bokamoso Environmental with his written opinion and conclusions and is willing to assist us.

Lizelle declared that the team of specialists working on this project, is a strong and efficient team. So if Carte Blanche maybe want to investigate the viability of the project, they will realize that the team's investigation was thorough.

This site is situated in an urban area. It is also a fact that Bokamoso Environmental deals with impacts on the environment on a daily basis: pollution, roads, wetlands, groundwater movement, etc.

This site actually cannot be left untouched forever. It is approximately two hundred years since the farm Rietfontein with the hospital commenced work. The other reason for developing something on this site, is that there is constant movement of people there: children playing around, others digging for artefacts and others come with their quad bikes. The Jukskei River is polluted and all of this can be prevented by an acceptable development.

Dr. E. Fourie: Inquired about the mole activity on the site. (The golden mole is a protected species)

LG: Answered that Dr. Naas Rautenbach who is a mammal specialist at the Transvaal Museum, could be contacted in connection with the moles.

(A discussion followed between the specialists: presumably it is a discussion on the objections against the project to come in)

Dr. J vd W: Suggested that somewhere a line has to be drawn, although he agrees with Bokamoso's approach. One's point of view should be, if any bones or any material unearthed on the site resembles bones, all activities concerning the development should be stopped. The police should be alerted and they have to determine whether it is a recent human find. Only then can the process and development continue.

Should it be bones, it could be sampled and determined whether it contains anthrax. It is a quick test; it is PCR together with other analytical techniques that will show up any anthrax spores.

If it is anthrax in the end, then the whole site should be identified and treated with acidic acid; the latter which is a standard approach.

Dr. E Fourie: Questioned the method of using acidic acid: 'Vinegar?' he asked.

Dr. J vd W: Answered that the use of acidic acid drops the ph immediately. He also referred to veterinarians who also make use of this specific method.

Dr. E. Fourie: Asked for how long this treatment will be effective.

Dr. J vd W: Declared it would not be necessary to resample the area, if that would be the case. Potential high risk areas could be identified as the whole site will not be affected.

Pirate: Inquired about the areas where possible burial sites could be.

Dr. J vd W: Answered that burial took place in very specific areas and Dr. Johan identified those. He also said that the burial of animals is a different story. Carcasses would typically not be buried and closed up, but just thrown away somewhere and lit. So then there would have been ash signatures to indicate to any burning activities.

Dr. Johan also mentioned the reference to the children's grave site. He is of the opinion it was never developed. Pirate: Referred to the map at some area on the site, below the Linksfield Road and asked if that was not a burial site as well.

Dr. J vd W: Replied that, that part is indicative of a Greek school.

LG: Agreed with Dr. Johan and suggested that she will make his report available to Dr. M Levin and to Dr. E. Fourie. She will also make it available to Dr. Maryke Henten and the Geotechnical Engineer. She asked all of them to give their feedback and to indicate whether they agree with the report. They could also provide other recommendations if it probe to be necessary.

Lizelle addressed Dr. Johan and Louis van Rooy and assured them of Bokamoso's assistance if they should need any other information. She also suggested that Dr. Johan could liaise with Dr. Fourie in connection with the use of acidic acid in treatment of soils.

She is of the opinion that the environmental specialists should maybe meet again to discuss and compile all necessary facts together, before the submission of the final EIA Report. Bokamoso would aim to have this Final EIA Report to be sound, before making it public.

Lizelle encouraged the specialists to come with other and new suggestions. She also felt that the success of the project like this one could be a good example of what possibly could be done successfully.

She suggested to Louis van Rooy that he should do borehole tests upstream and downstream of the Jukskei River.

Dr. E. Fourie: Addressed Louis van Rooy and asked him whether he saw any boreholes.

Louis van Rooy: Answered that he saw no boreholes at all.

LG: Mentioned that there is a golf course there.

Louis v Rooy: Presumed that the golf course uses water coming from the Jukskei River.

LG: Asked about the ground water movement in that area.

Dr. J vd W: Answered that from what he and Louis van Rooy saw, there was no groundwater movement. They also referred to the rockiness of the area. According to Dr. Johan it looks like a rechargeable area, but there were no signs of water movement.

LG: Referred to areas that could maybe contaminated by ground water movement and surface water movement, especially when soil will be loosened during the construction period.

Louis v Rooy: Explained that the area there is high so there is some water movement and it moves into two directions.

Dr. J vd W: Explained that there are diverging water flows. There is also a little seepage zone which Louis v Rooy sampled.

Dr. M. Levin: Inquired whether test pits had been done. He could not see it in the study done by Dr. Johan. He also asked about the ferry crate substance of the soil.

Dr. J vd W: Referred to the greenstone texture of the soil. He also said that the surface of the soil is sandier of texture and in some cases; not in the grave sites though, but off the grave sites the surface soils seem to be bleached.

(A discussion of soil textures followed)

Dr. J vd W: Actually said that there are slopes and sandier soil material present there, indicating to surface water movement.

LG: Required of the attendants a fee proposal for their work to be done and what exactly their input would be. Bokamoso Environmental will also provide them all with a report. She asked Dr. Levin to look at his fee proposal again. He said he only received a desktop copy of the report.

(A discussion followed on whether they received a desktop or a digital report) Lizelle added she might have sent Dr. Levin the wrong report.

LG: Suggested that all specialists present at this meeting should again meet in 4 weeks' time to discuss and give their feedback. Bokamoso will confirm the date of appointment with all.

She also suggested that there could be one more integrated meeting before Bokamoso finalizes the EIA Report. It would be possible to answer questions better in a public meeting, after the completion of the report.

Dr. J vd W: Suggested that Henriette should also be roped in into discussions.

LG: Asked Dr. Johan to work out a proposal in connection with what Dr. Henriette can assist the team with.

Dr. J vd W: Declared that Dr. Henriette is the one to talk about the PCR of soil, etc. He added that he is not confident enough to give his opinion on the subject.

LG: Answered that Dr. Johan must recommend what he thinks Henriette should do.

Dr. J vd w: He is of the opinion that Dr. Henriette could maybe assist Bokamoso Environmental with the public meetings, etc. there is no additional work on the area to be done now.

LG: Mentioned the penetrating radar survey again.

Dr. J vd W: Is of the opinion that the radar investigation could be a tricky one, because of the different soils, the rockiness and variable profiles to be found on this site.

LG: Answered that the option was mentioned by quite a few people.

Dr. J vd W: Thought that Lizelle has to assess the radar survey first before the specialist goes onto the site. He advised that the radar specialist should observe the geotechnical report first. It also should be explained to this specialist what the soils look like. Dr. Johan also mentioned the rock formations to be found on the site. Dr. Johan also commented that radar works excellently in deep sandy soil, but nowhere else.

LG: Thought it wise that this specialist she referred to should contact both Dr. Johan and Louis van Rooy, before he goes onto the site.

Lizelle again mentioned the advertisement through which people could maybe come forward to identify a grave or graves and provide the team with valuable information about the area.

More tests could then be performed on the designated area if necessary. It is actually a fact that many years lapsed since anyone visited the grave sites. The Jewish grave site was also mentioned.

Dr. J vd W: Confirmed to the fact that Jewish people would have maintained their grave site as it is according to their cultural beliefs, if there was a grave site specific for Jewish people.

(A common discussion on the above followed everyone involved in this discussion)

Dr. Manny Levin: Asked whether the site falls under the jurisdiction of the Municipality of Johannesburg or Erkurhuleni Municipality.

Anè: Replied that it falls under both these mentioned municipalities.

LG: Once again stressed the importance of the involvement of all the specialists linked to this project; their integration with each other and that all their inputs are needed.

Dr. E. Fourie: Mentioned that ammonium sulphate could be used to clean the soil.

Dr. J vd W: Did not agree with Dr. Fourie on the above mentioned. He meant that there is too high a degree of aluminum in the soil depicted on this site. Acidic acid is safer to use.

Acidic acid is safer to use. He also mentioned that if the ph of the soil drops lower than what it is now, which means it will drop lower than 4,5, there will be a mobilization of aluminum to ground water. That could probe additional and much bigger problems.

Acidic acid is used in small concentrations. It is not a strong acid like sulpheric acid. Acidic acid forms good complexes with calcium. It immobilizes the calcium; it basically competes for calcium when it comes to access for anthrax specific.

Dr. E Fourie: Discussed the treatment of soil through other methods.

Dr. J vd W: Referred to the specific test Dr. Fourie was discussing. He said he cannot vouch for the success of that kind of test, but he can find out what the standard methodology is being used in that kind of test. He promised to discuss this matter again with Dr. Henriette. There is a standard measure that is used and she has the detailed knowledge thereof.

Dr. E Fourie: Commented on the above. (inaudible)

Dr. J vd W: Further discussed the matter of the importance of the low ph levels that should be obtained and tested in soils. A 7,6 to 8 ph level soil test indicates a too high presence of calcium in that system.

LG: Commented on all the discussions that took place in the meeting. She also mentioned the meeting with the public could be very difficult.

Dr. J vd W: Was of the opinion that a lot of emotion from the public's side could be expected. He suggested that Bokamoso Environmental appoints a mediator. A credible person and this person should not be associated with anyone involved with the study or the team. He added hopefully not someone like Steve Hofmeyer. (sic!) It must be a level headed person.

LG: Came forward and explained that through many previous scenarios and meetings in which mediators had been used, she came to the conclusion that a mediator was not the answer. A mediator normally does not really have the deep understanding and knowledge of the small details of a site/ project. Lizelle prefers to facilitate a meeting herself. The other reason is that one cannot resolve an issue through a mediator conducting the meeting. She herself would like to take up all issues, address the issues and to resolve it. Therefore she as an Environmental Specialist must be confident that all issues had been addressed.

She is not affected by people screaming or shouting. The purpose of the meeting is to get the issues and comments so that it can be addressed. She experienced that a mediator cannot answer critical and other relevant questions.

Dr. J vd W: Still referred to a mediator who can then only communicate the issues to the specialist after the meeting.

LG: Declared that her aim is to win the trust of the people as an Environmental Specialist. Therefore she prefers to facilitate such a public

meeting herself. It is the responsibility of the Environmental Consultant to gather issues, address it and find solutions in order to build up that trust with a community.

The future of the project relies/ depends on the answers that the Environmental Consultant will be able to provide.

She felt it would be a very positive experience for the experts to attend such a public meeting. It is mainly also important for the experts to get the questions, hear the arguments and to understand what the issues are about. Maybe they could provide answers on these questions right there.

Lizelle said it never works to fight and argue with people or to resist the complainants. (Lizelle referred to the Valpre meeting where Dr. Manny Levin lost his temper). She thinks these public meetings are a circus anyway. The crunch of the matter really is to have the issues on paper and that those issues could be addressed and resolved.

Pirate: Asked about Dr. Henriette van Heerden of Onderstepoort. He also mentioned a certain professor, Prof. John Freau, who declared that there is no anthrax on the Linksfield site and the development should go ahead.

LG: Asked that Professor John Freau should put his findings and comments in writing.

Dr. J vd W: Declared that he heard of so many people with the opinion that there is actually no risk involved in developing this site. He is also of the opinion that what is flowing down the Jukskei River is far more toxic than

anything you can get on the Linksfield site.

Referred to Prof. Lucille Blumberg of NICD. She also has an Anè:

appointment with her the coming week.

A discussion followed on the tests done by Dr. Johan and Louis van Rooy

Just after the rains in November 2013. Dr Johan paged through his Report

and mentioned that there was no yellow material to be found anywhere in the

soil. The soils were high in Fe, also in an oxidized state; a well irrigated

regime. There were no signs of perching of the water or reduction in the

water levels.

A discussion followed about the water situation on the Linksfield site: (Louis

van Rooy, Dr. Manny Levin, Dr. Johan, Dr. E. Fourie:) whether the

information concerning the water use on the site was obtained from DWA.

Dr. J vd W: Mentioned that the water use comes from rainfalls and the

Edenvale pipeline.

CLOSURE:

Anè: Thanked everyone attending the meeting.

LG: Referred to the next meeting again. She also thanked the attendants for

being present at the meeting and for their support

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Two-pager Inputs from Specialist Forum

Annexure E

J LOUIS VAN ROOY

Practive Proximors/legingssa Engineering Geologist P O Box 36786 MENLOPARK PRETORIA SOUTH AFRICA 0102

Report 1339/add/2

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BOKAMOSO P O Box 11375 Maroelana 0161

9 October 2014

Att: A Agenbacht

ENGINEERING GEOLOGICAL INPUT INTO THE LINKSFIELD DEVELOPMENT

The Phase ! Geotechnical Report (Report 1339 Van Rooy, 2014) on the proposed Linksfield Development in Johannesburg refera.

The geotechnical site investigation is undertaken to determine the:

- 1. Geological conditions:
- Outcrop and soil cover;
- 3. Presence of groundwater, perched water tables, seepage areas

The guideline and specification documents by the SANS 643:2009, South African Institute of Engineering and Environmental Geologists and South African Institution for Civil Engineers (1997), the National Department of Housing (2002) and National Home Builders Registration Council (1999) are used during these investigations.

The results from the trial pits, soil profiles and soil laboratory testing indicate the following expected geotechnical constraints for this site:

- Collapsible soil
- Seasonal shallow groundwater: perched groundwater and surface seepage near the floodplain,
- Moderate erodability of surficial soils, and
- Localised difficulty of excavation to 1,5 m below surface.

General findings can be summarised as follows:

- General topography is dominated by the river and a small tributary flowing from the southeastern corner joining the river in the central eastern part. The slopes are towards the river channel with slopes from 1 600 m in the south and north sloping down to 1540 m at stream level. Locally in the southeast the slopes are towards the smaller drainage channel.
- The north and north-eastern portion showed slightly voided profiles of transported and residual soils. Intermediate excavation is expected due to the refusal of the TLB within the upper 1.5 m of the profile, on weathered greenstone bodrock.

- The central portion of the site up to the river and it's surrounding floodplain (including the hospital site) also had voided and pinholed residual greenstone profiles. Shallow perched groundwater levels are expected.
- The southern and south-western portion of the site adjacent to the site boundary is underlain by granitic bedrock. Closer to the floodplain boundary and drainage channels, seepage conditions with perched water tables of less than 1,5 m below ground surface is expected. These soils are also erodible.
- Localised portions in the north are covered by thick uncontrolled dumped meterials of various origin. The underlying soils could not be investigated in this area.

The main objective of the geotechnical investigation was to determine the soil mechanical properties. During this investigation some of the 39 test pits were shared with the soil science specialist Dr Johan van der Waals. No evidence of any specific graves or other human or animal remains were found in any of the soil profiles described in the test pits.

The soil tests were executed to determine the soil mechanical properties and no biological or chemical tests were included in the geotechnical investigation. The greenstone bedrock area, making up the largest part of the site, is typically covered by greenstone rock boulders and most of the test pits refused within the upper 1,5 m or shallower. This is therefore not the best area to locate a cemetery. The deeper profiles on the granite bedrock zones to the south and west, that are already developed, may in general be more suitable as burial sites that the greenstone bedrock area.

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20 May 2014

Bokamoso Environmental 36 Lebombo Road Ashley Gardens 0081

GEOMYDROLOGY OF THE LINKSFIELD MIXED USE DEVELOPMENT SITE

Our investigation kicked off with a dock study of all the available geological, geolydrological mformation regarding the site area. The expert reports on soils, wetland and agricultural potential of the selected site area were studied. The report on the geotechnical investigation was also studied to establish any perch water in the area. A request for borehole data in the area was submitted to the City of Johannesburg but no data was received. No boreholes on the site are recorded on the National Groundwater Archive data base.

The site is undertain by both matic and granitic rocks. The geotechnical investigation shows that the soil and weathered zone is only about 1.5 m deep and consist of alluvium soil and weathered rock. No mineral deposits are present on the site and no shear zones, faults or any linear structures are shown on geological maps within the site area. The presence of ferraginised sails is an indication of potential perched water during the rainy season. Groundwater in the granitic and matio rocks is usually restricted to the weathered zone and fractured rock. As shown on the hydrogeological map the groundwater resource potential of the aquifer is low yielding only between 0.5 and 2.0 l/s.

A site visit was undertaken to familiarise ourselves with the locality, outlay and topography of the

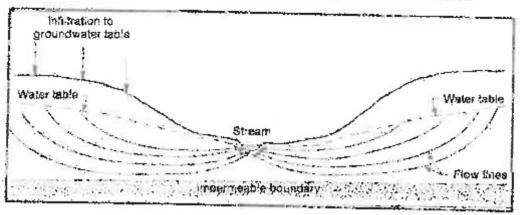
The general topography is dominated by the Jukskel River which crosses the site from the east of the site to the northwest corner. Two perennial tributaries join the river, one from the southeast comer joining the river in the central eastern part and the other flowing from the southwest corner to join the river in the central area. Local runoif from the cemeteries is down towards the drainages.

This was followed by a hydrocensus of any groundwater users in the area and to record and sample existing boveholes. The only boreholes found were on the Huddle Park Golf and Recreation land. The borehole close and upstream from the small eastern cametery was damaged and could not be recorded. The other boreholes are further away but could not be recorded as the owner of the golf course refuse access to the boreholes. They however are only upstream and have tittle contribution to the investigation. The only borehole located is the one at the Siswe Hospitel that was used in the past but now not in use. The groundwater is seeping out (artesian flow) of the borehole and the water was sampled and the locality recorded.

During the hydrocensus samples were taken in the Jukskei River upstream and downstream below the hospital as well as in the two perennial drainages. The four surface water samples and the one borahole sample were submitted to Aspirate Microbiological & chemical Laboratory for macro chemical analysis and Virus analysis. The virus analysis include Bacillus anthracis. Clostridium and

Mycobactarium. The results will only be available towards the end of May month.

Pollution of the groundwater will percolate down slope towards the river and drainages feeding into the river. As recorded no shallow perched water was intersected in the geotechnical test pits. However, during the rainy season water will percolate down to the solid rock and move down slope or some will percolate deeper into fractures into the deeper aquifer. The groundwater in the aquifer will also flow down slope to the nver and drainages as shown in the attached diagram. Any pollution from the cometenes will therefor end in the river or drainages. The surface water samples should therefore indicate any impact from the cemeteries.



It is concluded that there are no groundwater users in the area that can be impacted by the cemeteries, however, the surface water can be impacted and may indicate any impact from the cemeteries. Should the need for a borehole in the area arise then the groundwater need to be tested for virus pollution and monitored on a regular basis, if the borehole is not used then it should be closed and sealed. The surface development planned will certainly impact on the runoff and reduce water percolating down to the deeper aquifer, if pollution presently is derived from groundwater baseline flow then it could be reduced by the development.

Or Mannie Levin Pr Sci Nat PhD (Geoliydrology)

Curriculum vitae: Mr M LEVIN

Name LEVIN, MANNIE Date of Birth 23 December 1942

Profession/Specialisation Geohydrologist and Hydrogeochemist 18

Years with Firm

Nationality South African

Years experience 48

Key qualifications

Dr Levin is a Senior Geohydrologist for Aurecon, currently based in Pretoria. He is an expert in groundwater exploration, supply and resource, and withdrawal evaluation. He also specialises in groundwater resources, ground water quality, waste disposal and pollution studies.

Dr Levin has successfully handled several complex hydrogeochemical projects using ground water chemistry and environmental isotopes as tracers, and used these techniques in evaluating the sustainability of the ground water resources in South Africa, Angola, Botswana, The Gambia, Swaziland, Abu Dhabi and Madagascar. Domestic, hazardous and radioactive waste disposal site selection and investigations were done in South Africa, Taiwan, Ghana and Mozambique.

Or Levin is a registered expert on isotope hydrology with the International Atomic Energy Agency (IAEA) in Vienna, was involved in the Southern African Regional Cooperation Programme and is a member of the Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology (AFRA) Team of Experts on Dam Leakages and Dam Safety. Several expert missions on dam leakages have been undertaken for the IAEA in Ghana. Ethiopia, Syrla and Algeria.

Or Levin has served on various advisory groups on ground water quality management policies and standards in South Africa. He also serves on various project steering committees of the Water Research Commission by evaluating research on resources, pollution and waste disposal.

Employment record

03/2009 - Date	Aurecon (previously Africon, Ninham Shand and Connel Wagner), Senior
	Geohydrologist
1994 - 02/2009	Africon, Senior Geohydrologist
1974 - 1994	Atomic Energy Corporation of South Africa, Chief Scientist/Head of the
	Environmental Group of Earth and Environmental Technology Department
1970 - 1972	Atomic Energy Board, Experimental Officer
1966 - 1970	Fisons Fertilisers, Works Chemist/Plant Superintendent
1964 - 1966	Gypsum Industries, Works Chemist

Management experience

1994 - Date	Associate and Senior Geohydrologist at Africon, project manager for various
	groundwater, waste disposal and environmental investigations.
1984 - 1994	Chief Scientist and Head of the Environmental Group of Earth and Environmental
	Technology Department at the former Atomic Energy Corporation of South Africa
	responsible for giving advice on all geohydrological, hydrogeochemical and other
	environmental aspects of waste and environmental management.

Experience record

Water Research Commission Project 2010 - 2013. The use of isotope hydrology to characterise and assess water resources in South Africa. Input in studying isotope tracing of pollution in Waste Disposal Sites and applying Isotope techniques in Dam Leakage and Safety studies. WRC Report K5/1907 dated March 2013

Limpopo Basin Monograph study(SADC) 2012 - 2013. Study of the occurrence, availability, quality and supply potential of groundwater as part of the monograph study which include South Africa, Botswana, Zimbabwe and Mozambique. (GiZ - Deutsche Gesellschaft für Internationale Zusammenarbeit)

Monitoring boreholes at the Tshwane Wastewater Treatment Works (Gauteng, South Africa) 2010 -

2013. Senior Geohydrologist. Monitoring of the impact of the facilities on groundwater at the Tshwane Wastewater Treatment Works (WWTW), (City of Tshwane).

Monitoring of the Emfuleni solid waste sites using environmental isotopes (South Africa) 2010 - 2012. Project Leader. Sampled all monitoring boreholes and leachate ponds at Emfuleni's solid waste sites to establish the Impact of pollution through the application of artificial tritium accumulation in leachate to trace pollution migration in the environment. (Emfuleni Local Municipality).

Environmental impact Assessment (EIA) study of four dam sites in Mozambique (Mozambique) 2010 - 2011. Senior Geohydrologist. Conducted an EIA study focussing on the groundwater at four dam sites. The dam project consisted of raising a dam wall, construction of two weirs and one new dam at Gorongosa. Stable isotope data on groundwater and surface water was collected as background information for post construction monitoring. (Austral-Cowi Mozambique).

Zululand Anthracite Colliery Flooding isotope study (South Africa) 2010. Senior Geohydrologist, Conducted an environmental isotope study on surface and groundwater at the Zululand Anthracite Colliery to establish the origin of water flooding underground workings in the mine. (Golder Associates South Africa).

Etosha National Park infrastructure improvements (Namibla) 2010. Senior Geohydrologist. The project comprised a study to establish available groundwater resources for selected sites at Ombika and Galton Gate. Evaluated the potential development impact on the groundwater resources at these sites. (Ministry of Environment and Tourism, Namibla).

Mostize Mine Expansion Environmental Impact Assessment (EiA) (Mozamblque) 2009 - 2010. Senior Geohydrologist. Headed an EIA study focussing on groundwater in the area for the expansion of the Mostize coal mine. (Vale Mozamblque Ltda).

Evaluation of the groundwater resources along the Tsumeb-Katwitwi Project Road (Namibia) 2009 - 2010. Senior Geohydrologist. Groundwater investigation along the project road between Tsumeb and Katwitwi involving deak study, geophysics and a drilling program. (Roads Authority, Namibia).

Nacala Corridor Environmental Impact Assessment (EIA) (Mozambique) 2009 - 2010. Senior Geohydrologist. The project comprised an EIA of the impacts of the Nacala rail line and port development on groundwater resources along the route. (Vale Mozambique Ltda).

Steering Committee on Witwatersrand Regional Closure Strategy (Gauteng, South Africa) 2008. Senior Geohydrologist. Review and comment on the reports prepared by the Council for Geoscience for regional mine closure in the Witwatersrand.

Hydrogeochemical study of the Sappi Enstra Springs landfill site on the groundwater (Gauteng, South Africa) 2008. Senior Geohydrologist. The project entailed sampling and investigating the potential impact of the landfill site on regional groundwater.

Hydrogeological Study for the Al Ageer Forest in Abu Dhabi (Abu Dhabi Emerate) April 2008. Expert Hydrogeologist. A desk study was done of the aquifers and groundwater availability and quality required for the Al Ageer forest in eastern Abu Dhabi. (Part of RSA team)

Assessment of water ponding within the potential landfill site area at Marie Louis Landfill (Gauteng, South Africa) 2008. Senior Geohydrologist. Investigation of the connection between the pond water, groundwater and the impact of emptying the pond to extend the landfill.

Investigation for landfill site (Mpurnalanga, South Africa) 2007. Senior Geohydrologist. Investigation into the suitability of a selected landfill site for waste disposal. (Department of Water Affairs and Forestry (DWAF)).

Groundwater Ingress into Tshwane sewer system (Gauteng, South Africa) 2007. Senior Geohydrologist. The project investigated the ingress of groundwater into sewer pipelines during rainfall events through the application of conventional hydrochemistry and isolope hydrology. (City of Tshwane Metro Council).

Groundwater resources for bottling purposes (Heidelberg, South Africa) 2006 - 2007. Senior Geohydrologist. Investigation of the suitability and risks of potential groundwater resources for bottling

purposes. (Coca-Cola South Africa (CCSA)).

Evaluation of dam leakage and dam safety problems (Algeria) 2006. Senior Geohydrologist. Evaluating dam leakage problems and advising the Algerian government on the application of conventional and nuclear techniques in dam leakage and safety studies. (International Atomic Energy Agency (IAEA)).

Sanitation feasibility study at Ilanga Estate Development (The Free State, South Africa) 2006. Senior Geohydrologist. Feasibility study for the development of the Ilanga Estate.

Letaba Catchment groundwater reserve (South Africa) 2005. Senior Geohydrologist. Determination of the Letaba Catchment groundwater reserve. (Department of Water Affairs and Forestry (DWAF)).

Geohydrologist for the Gautrain Project (South Africa) 2005. Specialist Geohydrologist. Interpretation and modelling of the geohydrological data along the tunnel section. (Bombela Consortium).

Sanitation feasibility study at Mococeng Township (North West, South Africa) 2005. Senior Geohydrologist. Feasibility study for the development of the Ikemeleng Township. (Mafikeng District Council).

Sanitation feasibility study at Ikemeleng Township (North West, South Africa) 2005. Senior Geohydrologist. Feasibility study for the development of the Ikemeleng Township. (Bojanala District Council).

Evaluation of dam leakage and dam safety problems (Syria) 2005. Senior Geohydrologist. Evaluating dam leakage problems and advising the Syrian Government on the application of conventional and nuclear techniques in dam leakage and safety studies. (International Atomic Energy Agency (IAEA)).

Gardner and Ross Golf Estate geohydrological investigation (South Africa) 2004 - 2005. Senior Geohydrologist. Geohydrological investigation of the groundwater resources of the Gardner and Ross Golf Estate. (Afridev).

Professional Service Provider (PSP) for the evaluation of East Rand Proprietary Mine (ERPM) (South Africa) 2004. Senior Geohydrologist. Review and evaluation of ERPM and water license reports assessment of the impacts of these activities. (Department of Water Affairs and Forestry (DWAF)).

Monitoring of the impact of sludge handling at Tshwane Wastewater Treatment Works (WWTW) (Gauteng, South Africa) 2003 - 2007. Senior Geohydrologist. Monitoring of the impact of the sludge handling facilities on groundwater at the Tshwans Wastewater Treatment Works (WWTW). (City of Tshwane).

Evaluation team on dam safety and leakage (Algeria) 2003. Team Member. Serving on the evaluation team of experts. (International Atomic Energy Agency (IAEA)).

Northern Cape water services strategic plan (South Africa) 2003. Senior Geohydrologist. Development of a strategic plan for water services. (Department of International Development (DFID)).

Compilation of a system design manual for rural water supply (Swaziland) 2003. Senior Geohydrologist. Compilation of a system design manual for rural water supply.

Limpopo Province groundwater resource feasibility studies (South Africa) 2002 - 2003. Project Leader. Conducting studies in the Glyani, Middle Letaba and Soetfontein areas. (Department of Water Affairs and Forestry (DWAF)).

Mavoco toxic waste site Environmental Impact Assessment (EIA) (Mozambique) 2002 - 2003. Senior Geohydrologist. EIA study for toxic waste site. (Danish International Development Agency (DANIDA)).

Massullo island Environmental Impact Assessment (EIA) (Angola) 2002. Senior Geohydrologist. EIA for the development of Massullo Island. (Government of Angola).

implementation of the North West Water Supply Authority's rural water supply programme (South Africa) 2001 - 2002. Project Leader. Acting as implementing agent for the rural water supply programme, including the Bophirima, Ganyesa, Molopo, Central, Lehuruthsi, Madikwe and Ditsobotla districts. The project included siting and drilling of new boreholes, and pump testing and quality testing of existing and new

boreholes. (North West Water Supply Authority).

Siting and evaluation of landfill sites (Ghana) 2000. Senior Geohydrologist. Part of the Urban Environmental and Sanitation Project. (Ministry of Works and Housing).

Groundwater resource exploration of the Mankwe area (North West, South Africa) 2000. Senior Geohydrologist. Exploration for groundwater supply to villages and agricultural projects. (Central District Council).

Groundwater resource exploration and evaluation of the Qumbu and Qunu areas (Eastern Cape, South Africa) 2000. Senior Geohydrologist. responsible for the groundwater resource exploration and evaluation of the Qumbu and Qunu areas.

Groundwater resource investigations for Valpre (KwaZulu-Natal, South Africa) 1999 - 2007. Senior Geohydrologist. Evaluation and management of the groundwater resources available at Valpre farm in Fricona Valley for bottling purposes. (Valaqua (Pty) Ltd).

Borehole investigations at Britslown (Northern Cape, South Africa) 1999 - 2005. Senior Geohydrologist. Geohydrological resource assessment and drilling of exploratory and production boreholes at Britstown. (Emthanjeni Local Municipality).

Groundwater exploration and resource evaluation of the Taaibosch fault zone (Limpopo, South Africa) 1999. Senior Geohydrologist. The project involved the groundwater exploration studies and resource evaluations in the Taaibosch fault zone in the Limpopo Province for water supply to 28 villages in the Bochum District. (Department of Water Affairs and Forestry (DWAF)),

Status quo and future requirements for a business plan for water supply and sanitation (The Gambia) 1999 - 2000. Senior Geohydrologist. Compilation of a status quo and future requirements for The Gambian National Water and Electricity Company (NAWEC)/Eskom Enterprises business plan for water supply and sanitation. (The Gambian National Water and Electricity Company (NAWEC)).

Strategic study for the reconstruction and development plan for water supply and sanitation (Mpumalanga, South Africa) 1998. Senior Geohydrologist. The project involved a strategic study for water supply and sanitation in the Mpumalanga Province. (Department of Water Affairs and Forestry (DWAF)).

Geohydrological investigations of the groundwater resources of the Euphoria Golf Estate (KwaZulu-Natal, Sout Africa) 1997 - 2005. Senior Geohydrologist. Geohydrological resource assessment and drilling of exploratory boreholes for the Valpre farm in the Fricona Valley, Paulpietersburg. (Valpre).

Groundwater resources study of the Valaqua Springs in northern KwaZulu-Natai (KwaZulu-Natai, South Africa) 02/1997 - 04/1999. Senior Geohydrologist. The project included geohydrological work, exploration and drilling of boreholes to evaluate the resource. Based on findings, three production boreholes equipped with stainless steel casings were installed. A soil survey and Environmental Management Programme (EMP) was drawn up. (Valaqua (Pty) Ltd).

Strategic study for water and groundwater utilisation (South Africa) 1997. Senior Geohydrologist. The project entailed conducting a strategic study on water and groundwater. (Western Gauteng Services Council).

Selection, geohydrological and geotechnical investigations for the Hatherly waste disposal site (South Africa) 04/1996 - 07/1998. Senior Geohydrologist. Imminent closure of existing landfill sites in the north east of Pretoria necessitated the development of a mega site in the Hatherly area for general waste disposal. The transport infrastructure deemed Hatherly to be an Ideal location. Three sites were investigated to obtain a permit. To comply with regulations, a comprehensive Environmental Risk Assessment (ERA) was conducted before development proceeded. (Greater Pretoria Metropolitan Council).

Expert mission on Madagascar's proposed national project (Madagascar) 1994 - 2000. Team Member. The project involved a two-man team to advise the International Atomic Energy Agency (IAEA) on the viability of Madagascar's national project for the regional cooperation programme. ((IAEA)).

Study of geological structure through the Radon emanation technique (South Africa) 1994 - 2002. Senior Geohydrologist. The technique was used to study the presence of geological structures at the

Pinetown waste disposal site and the Taaibosch fault regional International Atomic Energy Agency (IAEA) project. (Department of Water Affairs and Forestry (DWAF)).

Groundwater exploration end resource evaluation for the Louis Trichardt Air Force Base (AFB) (South Africa) 1994 - 2000. Senior Geohydrologist. The project involved the evaluation of groundwater exploration and resource evaluation. (South African Air Force (SAAF)),

Review of the Environmental Impact Assessment (EIA) report on the Mosel Florestal Project (Mozamblque) 1994 - 2000. Senior Geohydrologist. Review of the Environmental Impact Assessment (EIA) report on the Mosal Florestal Project for the forestation of 35 000ha in the southern parts of Mozamblque, (Mosal).

Geohydrological and environmental impact study for demolition (South Africa) 1994 - 2000. Senior Geohydrologist. The project entailed a study on the demolition project at Alkantpan, near Copperton in the Prieska District. (South African Defence Force (SADF)).

Geohydrological investigations of the Kynoch gypsum waste dump in Potchefstroom (South Africa) 1994 - 2000. Senior Geohydrologist. Geohydrological Investigations for permitting the gypsum waste disposal dump in Potchefstroom. (Department of Water Affairs and Forestry (DWAF)).

Groundwater exploration and resource evaluation (Northern Cape, South Africa) 1994 - 2000. Senior Geohydrologist. The study involved conducting groundwater exploration studies, and evaluating the resources in Britstown. (Ethanjeni Local Municipality).

Bulbul toxic waste site investigations (South Africa) 1994 - 2000. Senior Geohydrologist. The project involved toxic waste site investigations at Bulbul. (Davis Lynn & Associates).

Environmental Impact Assessment (EIA) for soil and groundwater contamination (South Africa) 1994 - 2000. Senior Geohydrologist. Evaluation of soil and groundwater contamination for a corporation located in Epping. (Fine Chemicals Corporation).

Tritium levels investigation at landfill sites (South Africa) 1994 - 2000. Senior Geohyrologist, Investigation in the leachates from landfill sites (Department of Water Affairs and Forestry (DWAF)).

Pollution investigation at Sutherland Tannery near Pietermaritzburg (KwaZulu-Natal, South Africa) 1994 - 2000. Senior Geohydrologist. Pollution investigation near Pietermaritzburg (Sutherland Tannery).

Pollution studies at the Bellville-South waste disposal site (South Africa) 1994 - 2000. Senior Geohydrologist. The project involved conducting studies at the Bellville-South waste disposal site. (Bellville Municipality).

Research on the development of a groundwater supply assessment and strategy (South Africa) 1994 - 2000. Sentor Geohydrologist. The project involved a steering committee to conduct research on the development of a groundwater supply assessment and strategy for the western Karoo, Namaqualand and Bushmanland. (Water Research Commission (WRC)).

Waste disposal site investigations at Bon Accord, Nigel and Sappl Enstra (South Africa) 1994 - 2000. Senior Geohydrologist. Investigations of waste disposal sites.

Geohydrological census around Pelindabe (South Africa) 1994 - 2000. Senior Geohydrologist. The project involved a census to establish possible impacts on groundwater. (Atomic Energy Corporation).

Evaporation pond investigation 1994 - 2000. Senior Geohydrologist. The project involved conducting an investigation around the former Atomic Energy Corporation's (AEC) evaporation ponds. (Atomic Energy Corporation (AEC)).

Toxic waste site investigations at Holfontein (South Africa) 1994 - 2000. Senior Geohydrologist. The project entailed conducting toxic waste investigations. (Department of Water Affairs and Forestry (DWAF)).

Correlation between chemical element values in groundwater and the occurence of Leukaemia (South Africa) 1994 - 2000. Seniar Geohydrologist. The project involved a steering committee to investigate the correlation between high uranium, arsenic and other chemical element values in groundwater and abnormal baematological values related to the occurrence of Leukaemia in the north of the Western

Cape (Water Research Commission (WRC)).

Groundwater supply for the community on the farm Viakdrift (South Africa) 1994 - 2000. Senior Geohydrologist. 163 IQ for the Tariton Land Reform Project in the Magaliesburg rural area. (Department of Land Affairs).

Investigation of a polluted borehole (South Africa) 1988 - 1994. Consulting Scientist. The project comprised investigations of the extent, sources and possible remedial action for polluted boreholes in the Pretoria-Witwatersrand-Vereeniging dolomites. (Water Research Commission (WRC)).

Study on control of geological structures on quality and yields of aquifers (South Africa) 1988 - 1994. Consulting Scientist. The project entailed a study on the control of geological structures in the Albertina District. (Department of Water Affairs and Forestry (DWAF)).

Monitoring of waste management facilities (South Africa) 1988 - 1994. Member of the Steering Committee. The project involved the determination of the minimum requirements for the monitoring of waste management facilities. (Department of Water Affairs and Forestry (DWAF)).

Demonstration facility for above-ground dry storage of spent nuclear power plant fuel (South Africa) 1988 - 1994. Consulting Scientist. The project entailed the development of a demonstration facility. (Atomic Energy Corporation).

Studies of water quality distribution (South Africa) 1988 - 1994. Consulting Scientist. Studies on the water quality distribution in the Pretoria-Witwatersrand-Vereeniging dolomites, and on the Springbok Flats. (Department of Water Affairs and Forestry (DWAF)).

Pipe storage facility for spant reactor fuel at Pelindaba (South Africa) 1988 - 1994. Consulting Scientist. The project entailed the development of a pipe storage facility. (Atomic Energy Corporation (AEC)).

Geohydrological study of the area between Port Elizabeth and Alexandria (Eastern Cape, South Africa) 1988 - 1994. Consulting Scientist. This geohydrological study formed part of a geotechtonic study. (Water Research Commission (WRC)).

Water quality and regional hydrogeochemical investigation of the Trans Kalahari Road Project (Botswana) 1988 - 1994. Consulting Scientist. The investigation was a joint venture with the Schonland Research Centre, the University of the Witwatersrand, Welffield Consulting services and Atomic Energy Corporation (AEC). (Botswana Department of Water Affairs).

Groundwater quality management policies and research needs (South Africa) 1988 - 1994. Tesk Group Member. Development of groundwater quality management policies and determining research needs. (Department of Water Affairs and Forestry (DWAF)).

Hydrogeochemical and quality investigations for the Palla Road water resources (Botswana) 1988 - 1994. Consulting Scientist. The investigation for water resources at Palla Road was a joint venture with the Schonland Research Centre, the University of the Wilwatersrand, Wellfield Consulting Services and the Atomic Energy Corporation (AEC) (Botswana Department of Water Affairs).

Investigation of the Tugela-Vasi Transfer Scheme (TVTS) (South Africa) 1988 - 1984. Consulting Scientist. The project involved investigations into leakage in the transfer shafts. (Eskom).

Water resource and quality studies in the rural areas of the north-western Cape (South Africa) 1988 - 1994. Member of the Advisory Penel/Consulting Scientist. The project entailed environmental isotopes for evaluating the recharge used for the water resource and quality studies at Rietfontein (Gordonia), Steinkopf, Kharkams, Komaggas, Leliefontein, Bulletrap and Nouriver. (House of Representatives).

Site suitability for waste disposal of dolomite (South Africa) 1988 - 1994. Consulting Scientist. The project comprised an investigation of the suitability of a site for the waste disposal of dolomite. (Water Research Commission (WRC)).

Investigation of the environmental impact of the fire at the Rhone Poulenc chemicals warehouse in Midrand (South Africa) 1988 - 1994. Consulting Scientist. The project involved the investigation of the pollution dispersion into the air, soil, and surface and groundwater. (Rhone Poulenc).

Geohydrological and geotechnical studies for a nuclear research facility (South Africa) 1979 - 1988. Chief Scientist. The study included base-line water quality, water supply and environmental management for a nuclear research facility at the Gourique site near Mossel Bay. (Atomic Energy Corporation (AEC)).

Base-line regional and site specific geohydrological and geotechnical studies for the selection of sulfable sites for a power plant (South Africa) 1979 - 1988. Chief Scientist. The study was concerned with the investigation of four coastal areas along the South African coastline, including the west coast between Hondeklip Bay and Port Nolloth, the south coast between Arniston and Gansbaai, the south-east coast between Tsitsikama and Cape St Francis, and the east coast between Blythedale Beach and Richards Bay. (Eskom).

Criteria and strategies for long-term radioactive waste disposal (Taiwan) 1979 - 1988. Chief Scientist. The project entailed advising the Taiwanese Nuclear Authority on long-term radioactive waste disposal on the Island of Taiwan. (Taiwanese Nuclear Authority).

Selection and evaluation of the Vealputs Radioactive Waste Disposal Facility in Namaqualand (South Africa) 1979 - 1985. Chief Scientist and Project Leader of the Geohydrological Team. This was a multidisciplinary study, and the expertise gained during the study was applied on a wide front, concerning geohydrology, hydrogeochemistry, recharge studies, groundwater resources, neutron moisture meter studies and pollution control. The study led to the award of a PhD in 1988 under Professor JF Botha of the Institute for Groundwater Studies at the University of the Free State. (Atomic Energy Corporation (AEC)).

trivestigations of a national radioactive waste disposal facility (South Africa) 1974 - 1979. Scientist. The investigations entailed re-evaluating the Gordonia area during the selection of a national radioactive waste disposal facility as a potential area for hosting a site, and evaluating the Khuboos Pluton and surrounding area in the Richtersveld as a potential national radioactive waste disposal facility. (Atomic Energy Board (AEB)).

Investigation of uranium resources outside the Witwatersrand (South Africa) 1974 - 1979. Scientist. The Investigation was focused on the granitic and surficial deposits of the Kenhardt, Poffedder, Keimoes, Kakamas and Upington districts, and the sand-covered areas in South Africa, concentrating on the Kalahari north of Upington. It further included a detailed study of the area between the Namiblan border and the Koranna Mountains. The investigation of the area between Koranna Mountains and Vryburg was based on the outcomes of previous geological and geohydrological studies. Due to the thick sand covering all the radiometric signals, hydrogeochemistry and geohydrology were used, assisted by down-the-hole borehole logging. (Atomic Energy Board (AEB)).

Separation of the Platinum Group Metals (PGMs) by ion exchange (South Africa) 1970 - 1972. Experimental Officer. Four publications on this subject were co-authored, and are referred to in the Gmelin Handbook of Chemistry, in the volume of Platinum Group Metals (PGMs). (Atomic Energy Board (AEB)).

Production and packaging improvements for fertiliser products (South Africa) 1986 - 1970. Works Chemist and Plant Superintendent. The project was concerned with research and development for improving production and packaging of various fertiliser products. (Fisons Fertilisers).

Product quality control and research in the use of by-product gypsum (South Africa) 1964 - 1966. *Industrial Chemist.* The project involved product quality control, research and development on the use of by-product gypsum from phosphoric acid production. (Gypsum Industries Ltd).

Research supervision

Investigating tritium levels in waste disposal site leachates. Joint research with School and Research Centre, University of Witwatersrand.

Environmental isotope, hydrological and hydrogeochemical studies of groundwater pollution associated with waste disposal. Water Research Commission Project K5/311, 1990 - 1991.

Education

1988 : PhD Geohydrology, University of the Free State, South Africa

1979 : MSc Geology, University of Pretoria, South Africa

1973 BSc Geology (Hons), University of Pretoria, South Africa 1964 BSc Chemistry, University of Pretoria, South Africa

Professional affiliations

Member, Groundwater Division of the Geological Society of South Africa Registered Professional Natural Scientist, SACNS

Languages

English Afrikaans	Reading Excellent Excellent	Writing Excellent	Speaking Excellent
Dutch Zulu	Good Poor	Excellent Poor Paor	Excellent Poor Poor

Research projects

Joint research with Schonland Research Centre. "Investigating tritium levels in waste disposal site leachates". University of the Witwatersrand.

Water Research Commission Project K5/311 1990 - 1991. <u>*Environmental isotope, hydrological and hydrogeochemical studies of groundwater pollution associated with waste disposal*</u>. Water Research Commission Project.

Publications

Levin M. April 1980. "A Geological and Hydrogeochemical Investigation of the Uranium Potential of an Area between the Orange and Kuruman Rivers, North Western Cape Province (Vol 182)". MSc Thesis, University of Pretoria.

Levin M. December 1982. "A Preliminary Hydrological Assessment of the Richtersveld". Site selection programme for the disposal/storage of radioactive waste in South Africa.

Levin M and Joubert WR. April 1985. *Gouriquea Project Geological Site Selection Program*. Regional geohydrological investigation of the area between the Gouritz and Kafferskuil Rivers, Riversdale district.

Levin M. June 1986. <u>"Regional and Geohydrological Investigation of the area between Krom and Tsitsikama Rivers, Humansdom District"</u>. Eskom Eastern Cape Project. Investigations for the siting of nuclear power stations. Progress Report No 8.

Levin M. 1988. "A Geohydrological Appraisal of the Vaalouts Radioactive Waste Disposal Facility in Namaqualand, South Africa". PhD Thesis, University of the Orange Free State (Bloemfontein).

Levin M. January 1988. <u>"Regional Geohydrological Investigations of the area between the Uilkraals and Heuningness Rivers, Bredasdorp and Caledon Districts"</u>. Eskom Southern Cape Project. Investigations for the siting of nuclear power stations.

Levin M. November 1990. <u>"Regional Geohydrological Investigations of the area between Port Nolloth and Hondeklip Bay on the Cape West Coast"</u>. Investigations for the siting of nuclear power stations. Progress Report No 9.

Levin M, Walton D and Verhagen BTH. 1990 - 1991. *Environmental Isotope, Hydrological and Hydrogeochemical Studies of Groundwater Pollution associated with Waste Disposal." Joint Water Research Commission project of the Atomic Energy Corporation of South Africa (AEC) and the Schonland Research Centre, Wits. Water Research Commission, Project K5/311.

Levin, M. 27-29 September 1994. "The Influence of Geology on the Geohydrology, and thus the Future Use

of a Waste Disposal Site - a case history*. Wastecon.

Verhagen BTH and Levin M. 1996. <u>"Environmental Isotopes Assist In the Site Assessment of the Vaalputs Radioactive Waste Disposal Facility"</u>. Rad Waste Conference, Cape Town.

Levin M and Verhagen BTH. 13 - 14 November 1997. <u>"The Use of Environmental Isotopes in Pollution Studies"</u>. Conference on Geology for Engineering, Urban Planning and Environment, Eskom Centre, Midrand.

Verhagen BTH, Levin M and Fourie A. May 1998. "High Level Tritium in Leachate from Landfill Sites in the Republic of South Africa with Emphasis on its Distribution and Value as an Environmental Tracer". WISA, the Water Institute of South Africa's Biennial Conference, Baxter Theatre Centre, Cape Town.

Fourie A, Verhagen BTH, Levin M and Robinson HD. 13 - 15 October 1998. "Tritlum as an Indicator of Contamination from Landfill Leachate". Wastecon 1998, Kempton Park.

Levin M. May 1999. "Fingerprinting of Water for Pollution Studies". Third Conference on Environmental Engineering, Kwa Maritane, pp. 27-28.

Verhagen BTH, Levin M and Walton DG. 20 - 23 August 1999. "Environmental Isotopes and Hydrochemistry Identify Pollution Sources in Waste Disposal Study". Proceedings Biennial Groundwater Convention, Midrand.

Levin M and Verhagen BTH. October 1999. <u>"A Unique Approach to Evaluate the Utility of Landfill Moniforing Boreholes"</u>. ISSMGE, 12th African Regional Conference, Geotechnics for Developing Africa, Durban, pp. 25-27.

Butler MJ, Verhagen BTH and Levin M. 2000. <u>"Application for Environmental Isotope Techniques to Hydrological and Pollution Problems in the Urban Environment"</u>. Groundwater: Past achievements and future challenges - Procs XXXI International Association of Hydrogeologists (IAH) Congress (Edited by Oliver Siillo et al) Balkema, pp 459 - 464.

Verhagen BTH, Butler MJ, Levin M and van Wyk E, 2000. "Environmental Isotopes assist in Groundwater Sustainability Assessment of the Taaibosch Fault Zone, Northern Province, South Africa". Groundwater: past achievement and future challenges - Procs XXXI International Association of Hydrogeologists (IAH) Congress (Edited by Oliver Sililo et al), Balkema, pp 673 - 678.

M Levin 2010 <u>Isotope Hydrology in Dam Studies Related to Dam Safety and Sustainability. South African National Committee on Large Dams (SANCOLD)</u> Symposium 11 to 13 October 2010, CSIR, Pretoria.

Referees

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Former Atomic Energy Corporation	Elwin Raubenheimer	+27 12 305 6425
Greater Pretoria Metropolitan Council	Koos Snyman	+27 12 358 0664
International Atomic Energy Agency	Prof Balt Verhagen	+27 11 786 9555



By my signature below Γ certify the correctness of the information above and my availability to undertake the assignment.				
Signature of Staff Member	Date			

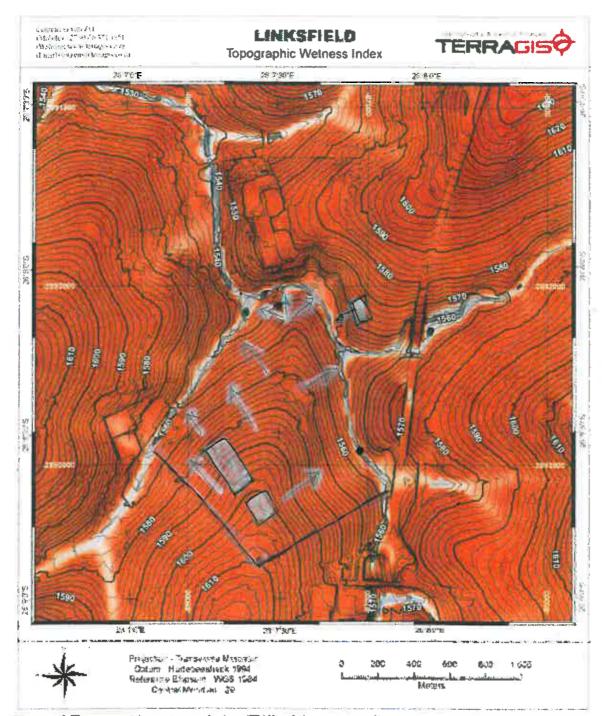


Figure 6 Topographic wetness index (TWI) of the survey site

DE VOS LANDGOED/ESTATE (PTY) LTD

(2012/033992/07)

Tel: 082 9279414 Faks/Fax 086 5104177

E-pos/mail: v.devos@vodamail.co.za

Prof V de Vos Pasbus/PO Box 14724 Nelspruit,1200



ABBREVIATED CURRICULUM VITAE VALERIUS DE VOS

PERSONAL DATA

Date of birth: 28 July 1939.

Marital status: Married (since 8th February 1964).

Children: Two (daughter 35, son 31)

Recreation: Rughy, cricket, tennis, long distance running (completed 10 Comrades marathons successfully), triathlons, biathlons (achieved full provincial colours),

swimming (Midmar Mile) and cycling (Argus), Contact particulars: P.O. Box 14724, Nelsonit, 1200

Cellphone: 082 9279414

E-mail: v.devos@vodamail.co.za

EDUCATION

Secondary: Matriculation: 1956. Hoërskool Carolina, Carolina, South Africa. Tertiary: BVSc: 1961. Faculty of Veterinary Science, University of Pretoria.

Tertiary : BSc (Hons) Wildlife Management: 1965. Eugene Marais Chair of Wildlife

Management, University of Pretoria.

CAREER

1957/1961: Full time student at Veterinary Faculty, University of Pretoria,

1962/64: State Veterinarian, based at Calvinia, Tsumeb-Grootfontein, Ermelo and Onderstepoort.

1965: Full-time student at the Eugene Marais Chair of Wildlife Management, University of Pretoria.

1965/73: State Veterinarian, based at Skukuza, Kruger National Park.

1974/79: Veterinary Ecologist, National Parks Board, based at Skukuza, Kruger National Park.

1979/96: Head of Research, S.A. National Parks, based at Skukuza, Kruger National Park.

1996/2001: Awarded a post as Specialist Scientist on a personal scale.

2001/2013: Consultant on veterinary ecology and infectious diseases and Macadamia farmer in the Nelspruit district.

MEMBERSHIP OF PROFESSIONAL SOCIETIES

1. Registered as a veterinarian with the South African Veterinary Council. 2. Life membership granted by the South African Veterinary Association. 3. Honorary member of the Wildlife Group of the South African Veterinary Association. 4. Member of the African Division of Wildlife Disease Association. 5. Committee member of the South African

Veterinary Association History Committee. 6. Founder member of the World Association of Wildlife Veterinarians. 7. Committee member of Agri Lowveld. 8. Member of the Crocodile Irrigation Board of Directors. 9. Member of the S.A. Macadamia Association Board of Directors(SAMAC).

RECOGNITIONS AND AWARDS

- Paracooperia devossi n. sp. named after Dr V de Vos of the Kruger National Park "in recognition of his efforts for furthering the study of the parasites of wild animals in this country" Boomker, J. and Shirley A. Kingsley 1984. Paracooperia devossi n. sp. (Nematoda: Trichostrongylidae) from the bushbuck, Tragelaphus scriptus (Pallas, 1766). Onderstepoort Journal of Veterinary Research 51: 21-24.
- 2. Awarded Research Fellowship of NOAHS Centre during 1991. "NOAHS" stands for "New Opportunities in Animal Health" and is associated with the Smithsonian Institute, Washington D.C., U.S.A. The following is part of the address: "Because of your important contributions to the progress of NOAHS Centre research, we are pleased to recognise your contribution by inviting you to become a Research Fellow of NOAHS Centre. The title acknowledges your prior and active collaboration with our staff in the various research endeavours that we support".
- Awarded the Silver Medal of the South African Veterinary Association "for outstanding service to veterinary science in South Africa", 20th September 1991.
- 4. Nominated and accepted by the Office International des Epizooties (OIE) as a Wildlife Disease Consultant. 1994.
- 5. Invited as a member of the World Health Organization (WHO) Working Group on Anthrax Control and Research. 1992 and again in 1995.
- 6. Appointed as consultant to the Food and Agricultural Association (FAO) of the United Nations on anthrax, 1995.
- 7. Awarded an honorary professorship by the, Department of Tropical Diseases, Faculty of Veterinary Science, University of Pretoria. 1992 –2007 -.
- Received the "Lycaon Award" of the Wildlife Group of the South African Veterinary Association "In recognition of an outstanding contribution to wildlife conservation and ecology", 25 July 2002.
- 9. Received an award from the SA Veterinary Association as a "Legend" for outstanding contributions in the field of veterinary wildlife, 16 October 2014,

SCIENTIFIC PUBLICATIONS/ PRESENTATIONS

Author and co-author of 172 scientific publications on a wide range of topics such as ecology, epidemiology, parasitology, game capturing, game immobilisation, control of wildlife diseases, pathology and genetics. Of these 44 publications are on anthrax. A total of 95 papers were presented during scientific congresses, symposia, seminars or study courses.

May 20, 2014 AD.

DE VOS LANDGOED/ESTATE (PTY) LTD

(2012/033992/07)

Tel: 082 9279414 Faks/Fax 086 5104177 E-pos/mail: <u>v.devos</u>@vodamail.co.<u>za</u> Or Valerius de Vos Posbus/PO Box 14724 Neispruit,1200



REPORT FROM V DE VOS, TO BOKAMOSO LANDSCAPE ARCHITECTS & ENVIRONMENTAL CONSULTANTS ON THE IMPLICATIONS OF DORMANT ANTHRAX POSSIBLY OCCURRING IN PORTION 4 OF RIETFONTEIN 61-IR, THE AREA DESIGNATED FOR THE LINKSFIELD MIXED-DEVELOPMENT PROJECT.

No conclusive and concrete evidence could be found that anthrax actually occurred in carlier years on Portion 1 of Rietfontein 61-IR, the area designated as the *Linksfield Mixed-Development*. However, word of mouth and earlier land-use practices provide circumstantial evidence that both livestock and human cases of anthrax occurred on the premises and that fatalities were buried there. The old burial register has been lost and the amount and localities of such burials are unknown.

Assuming that anthrax and other infectious diseases occurred on Rietfontein and taking the size of the terrain and the old and present land-use practices into consideration, preliminary recommendations are made for future development of the area. The viewpoint is held that the present laissez faire situation outside the old hospital complex is unsafe with uninhibited entrance by people and erosion taking place leading to possible exposure of contaminated material. With decontamination of the area considered impossible, it is believed that the safest option is to adopt the containment principle and develop the area in such a manner that what is down below the surface stays there. A building development such as the Linksfield Mixed-development project, meets this objective, but with the proviso that certain mitigating procedures be followed. These are inter alia the following:-

- 1. One of the accepted ways of tackling a potentially anthrax contaminated environment is to isolate or contain the area in such a manner that it cannot do any harm. Surface development should be used as far as possible. Not knowing where previous burials took place, relatively shallow or "floating" reinforced concrete foundations should preferably be used. Foundations and trenches deeper than one metre, or deeper basements, will increase the possibility of unearthing burial rests with further implications and complications (vide infra). The rest of the area should also be actively managed in order to fix and/or prevent crosion; such as tarmac or brick roads/parking areas and grass lawn coverage on the rest of the premises.
- There is no sense in doing a comprehensive microbiological survey for anthrax at this stage. Without knowing the exact localities of anthrax burial places such a survey

over such a big area will be futile. It will probably take hundreds and even thousands of samples to locate anthrax, and at great cost. Even if the survey is limited to the building sites only, it will take vast quantities to prove or disprove the presence of anthrax. Even if after such a survey positive or negative results are obtained, it should not affect future action. If positive, it only proves what is already suspected. If negative, it will still not prove that anthrax is absent. Every cm³ cannot be covered!

- 3. However, where an anthrax burial site has been identified or where burial rests, such as bone fragments, are uncovered (vide supra), microbiological testing for the presence of Bacillus anthracis, should be performed.
- 4. In the event that the tests prove to be positive for anthrax the site should be decontaminated by drenching it with a 5% formaldehyde (formalin) solution.
- 5. Protective clothing, anti-dust masks and protective eyewear should be used when doing excavations. An excavator (TLB) with closed cabin and fitted with a dust and chemical filter is probably the best option.
- Where excavations are performed water in a mist spray should be used continuously in order to cut down on dust.
- Cemeteries and other known burial sites should be identified, demarcated, isolated and avoided.
- Workers on the premises should be aware and have knowledge of early symptoms of anthrax, which are easily and successfully treatable with the correct antibiotics.

Conclusions

The viewpoint is held that a *laissez faire* or *status quo* land use option for Portion 1 of Rietfontein 61- IR is unsafe in respect of anthrax and possibly other infectious diseases that occurred within the area during previous land use practices. It is concluded that the safest and best option is to adopt the containment or isolation principle and do surface development as far as possible in such a manner that what is down below the surface stays there. The proposed *Linksfield Mixed-Development project* meets this objective, but with the proviso that proper mitigating procedures be followed during construction.

Dr V de Vos Veterinary Ecologist May 20, AD

A PRELIMINARY RISK ASSESSMENT FOR ANTHRAX ON PORTION 1 OF RIETFONTEIN 61-IR, JOHANNESBURG METROPOLITAN MUNICIPALITY (PROPOSED LINKSFIELD MIXED-DEVELOPMENT).

Compiled by

V. de Vos Scientific Advisor: Infectious Diseases, P.O Box 14724, Nelspruit, 1200. 6 May 2014 AD

Objective.

The objective of this exercise is to do a preliminary risk assessment for anthrax on the Rictfontein terrain, with the view on further development, as proposed by the Linksfield Mixed-Development project. A report was requested by *Bokamoso Landscape Architects & Environmental Consultants*.

Historical and relevant land-use practices for the EHP.

The EHP was originally (1895) established on the farm Rietfontein as a lazaretto and later a hospital for the treatment and isolation of smallpox. It was "a day's march" from the centre of Johannesburg and therefore considered a safe distance for the isolation of smallpox. It was so successful that it was also used for leprosy and bubonic plague epidemics. Later, highly infectious diseases such as anthrax, tuberculosis, venereal diseases and the haemorrhagic virus diseases such as Marburg, Congo and Lassa fever, were also accommodated. These diseases often proved fatal, and being considered highly infectious, bodies were buried on the premises. It is estimated that more than 7000 bodies were buried on the premises. Most of the burials took place in cemeteries, of which most have been located, although some burial apparently also took place outside these areas. The register containing particulars on the cause of deaths and locality of graves has unfortunately been lost. Efforts to locate the register have thus far been unsuccessful. The net result is that anthrax burial sites cannot be pinpointed and can be virtually anywhere on the precinct.

Thereafter outbreaks escalated exponentially and in 1923, the year during which its prevalence peaked in South Africa, it was estimated that 60 000 animals died of anthrax. Judging from farming conditions and inadequate veterinary services at the time, this is most probably a gross underestimate. It was only after the introduction of an effective spore vaccine in 1928 and a compulsory vaccination regime in 1945, using the highly effective Sterne spore vaccine, that anthrax was effectively combated. Burial of anthrax carcasses was the policy at the time and there is no doubt that many, as yet unidentified, anthrax burial pits exist in South Africa. This should be kept in mind when subsoil activities, such as soil excavations for basements and road cuttings or bore holes, are planned in areas with a former history of land-use practices involving livestock with a possibility of anthrax outbreaks.

It was the policy during those earlier years to bury animals that died from an infectious disease right on the spot, about two meters down, and to cover it with quick lime. Sometimes burial pits were used. There must therefore be an unknown amount of burial places for domestic animals on the premises. This perception is further corroborated by the fact that animal bones were uncovered when excavation was performed for the extension of one of the wards. Unfortunately these bones were not tested for anthrax.

Human anthrax in South Africa, being secondary to the disease in animals, ran parallel to anthrax in animals, peaking around 1923/24. As the only facility available that could have handled dangerous infectious diseases, human anthrax cases must have been referred to the Rietfontein Hospital. For this report it must therefore be assumed that some anthrax cases were handled at Rietfontein Hospital in earlier times. In the era before the advent of penicillin the death rate for anthrax was very high and it must be accepted that most cases ended fatally and was buried on the premises. There is however no existing record of such deaths.

What is the significance of the burial of anthrax corpses/carcasses? Let us look shortly at the life cycle of the anthrax bacillus (*Bacillus anthracis*)(Fig: Anthrax cycle). The multiplication or biotic phase consists of the vegetative form actively circulating and multiplying in the body of an animal (bacteraemia or septicaemia). Ultimately, towards the end of the exponential growth phase within the body, it grows itself out of

Rietfontein burial must have taken place in coffins and about two meters down, as was the practice during those earlier years. The chances that spores will work itself up to the surface, is therefore considered negligibly remote. Livestock burial pits, however, provide a different scenario. During the time burial took place it was the policy in South Africa to dispose of all animals found dead of anthrax, or suddenly dying without showing any signs of illness, by deep burial or incineration. Live virulent anthrax organisms in an old (±70 - 80 years) burial site, such as Rondebosch, also testifies to the unreliability of burial procedures for long term control of the disease.

This leaves only soil excavations, such as with construction work and erosion, as possibilities of exposing anthrax in Rietfontein, if present.

Despite the notoriety attached to anthrax, the actual risk to human health from material, such as possible contaminated soil at Rietfontein, is considered relatively low. Human infection generally occurs after direct contact with tissues of diseased animals or their products, and extremely seldom from human to human. Human anthrax comes in three forms, i.e. pulmonary anthrax by inhalation of spores, intestinal anthrax by ingestion of contaminated food and cutaneous anthrax. Paradoxically, the infectivity of anthrax spores for humans is normally regarded as low. It has been found that in the dustiest parts of an industrial plant processing goat hair in America, the workers were inhaling between 600 and I 300 anthrax spores during a working day, without suffering any ill effect. The low infectivity of anthrax spores for man was further borne out by recovering B. anthracis from the upper respiratory tracts of 14 out of 101 healthy, unvaccinated workers at two goat hair mills. Also, in the Kruger and Etosha National Parks, during major anthrax epidemics in wildlife, many necropsies were performed and large teams of workmen were used to track down, sometimes cut up and burn anthrax carcasses, but none contracted the disease. This is further borne out by the fact that the terminal blood smear counts for man is relatively low, which indicate that man is relatively resistant to infection, but highly susceptible to the effects of the anthrax toxin. It must also be kept in mind that the B anthracis organism is not invasive. It needs a break in the skin or mucosa to enter the body and although theoretically only one anthrax spore is needed to cause disease manifestations, in actual practice many thousands is needed. In the Kruger Park the oral LD50 rate of live virulent anthrax spores were found

provide circumstantial evidence that both livestock and human cases of anthrax occurred on the premises and that fatalities were buried there. The old burial register has been lost and the amount and localities of such burials are unknown.

Assuming that anthrax and other infectious diseases occurred on Rietfontein and taking the size of the terrain and the old and present land-use practices into consideration, preliminary recommendations are made for future development of the area. The viewpoint is held that the present *laissez faire* situation outside the old hospital complex is unsafe with uninhibited entrance by people and erosion taking place leading to possible exposure of contaminated material. With decontamination of the area considered impossible, it is believed that the safest option is to adopt the *containment principle* and develop the area in such a manner that what is down below the surface stays there. A building development such as the *Linksfield Mixed-development project*, meets this objective, but with the proviso that certain mitigating procedures be followed. These are *inter alia* the following:-

- 1. One of the accepted ways of tackling a potentially anthrax contaminated environment is to isolate or contain the area in such a manner that it cannot do any harm. Surface development should be used as far as possible. Not knowing where previous burials took place, relatively shallow or "floating" reinforced concrete foundations should preferably be used. Foundations and trenches deeper than one metre, or deeper basements, will increase the possibility of unearthing burial rests with further implications and complications (vide infra). The rest of the area should also be actively managed in order to fix and/or prevent erosion; such as tarmac or brick roads/parking areas and grass lawn coverage on the rest of the premises.
- 2. There is no sense in doing a comprehensive microbiological survey for anthrax at this stage. Without knowing the exact localities of anthrax burial places such a survey over such a big area will be futile. It will probably take hundreds and even thousands of samples to locate anthrax, and at great cost. Even if the survey is limited to the building sites only, it will take vast quantities to prove or disprove the presence of anthrax. Even if after such a survey positive or negative results are obtained, it should not affect future action. If positive, it only proves what is

World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO) and the Office Internationale Epizootique (OIE).

User1

From:

Bokamoso < lizelleg@mweb.co.za>

Sent:

Thursday, May 22, 2014 10:22 AM

To:

user1@bokamoso.net

Subject:

FW: HERITAGE COMMENTS AND CV (attention: Ane)

Attachments:

HERITAGE COMMENTS LINKSFIELD pl.docx; Heritage Comments p2.pdf;

CurriculumVItae Leonie Marais-BotesZ.doc

From: Leonie Marais-Botes [malito:leoniembotes@gmall.com]

Sent: 22 May 2014 10:07 AM

To: Uzelle Gregory

Subject: HERITAGE COMMENTS AND CV (attention: Ane)

Dear Ane

Please find attached as requested.

Kind Regards



Leonie Marals-Botes Heritage Practitioner HERITAGE COMMENTS FOR THE PROPOSED ESTABLISHMENT OF A MIXED-USE DEVELOPMENT ON THE REMAINDER OF PORTION 1 OF THE FARM RIETFONTEIN 61-IR JOHANNESBURG METROPOLITAN MUNICIPALITY (ALSO REFERRED TO AS THE PROPOSED LINKSFIELD MIXED-USE DEVELOPMENT)

The proposed Linksfield Mixed-Use Development aims at creating an integrated living environment and distinct urban character defined by a mixed use approach to land use and building typology. The concept seeks to achieve high quality urban environment providing spaces to live, work and play. The approach is in line with the urban densification strategy and will provide a mixed-use node connecting with other polycentric nodes within the city.

The site earmarked for development comprise of 158 hectares of prime estate surrounded by Sandringham, Glenhazel, Sunningdale, Lyndhurst, Corlett Gardens, Rembrandt Park, Edenvale Ext 1, Marais Steyn Park, Dowerglen, Senderwood and the goffing ground, Huddle Park. Approximately 15 hectares of the site is occupied by the Sizwe Hospital. The N3 Highway and the main arterial connector routes around the development create an edge condition that defines the boundaries of the proposed Linksfield Mixed-Use Development.

The following heritage resources are situated on the above site:

- 3 cemeteries
- 3 graves within the boundaries of the Sizwe/Rietfontein hospital.
- Structures older than 60 years

The boundaries of the 3 cameteries are well defined (soil studies)

Structures older than 60 years can be divided in 4 layers

- Circa 1895-1910 (structures associated with Mehliss period)
- Circa late 1920's early 1930's (hospital structures and staff housing).
- Circa 1940's Department of Public Works structures opposite Sandringham SAPS
- Modern

Conclusion

- The Rietfontein (Sizwe) Hospital site is of historical and to a certain degree of scientific significance.
- The above site is also important to the community because of its work under the underprivileged.

Recommendations

- It is recommended that the historical significance, scientific and community
 contributions of the Rietfontein (Sizwe) Hospital be commemorated at a central point
 in the new development. As some of the hospital buildings may need to be
 demolished the layout of the hospital site should form part of this display.
- It is further recommended that to assist in the site development process the known graves on the south west comer be plotted, a centre be determined and a 50 metre buffer zone determined. In the case of outlaying graves being discovered - the options being exhumation and reburial nearer to the other graves or conservation in situ.
- It is also recommended that the three graves situated in the hospital grounds be exhumed and the remains reburled at the Mehliss residence. This will aid in future conservation of the said graves.
- It is accepted that new access roads may mean that some of the hospital buildings
 may need to be demolished. The Mehliss residence and first wards are the significant
 layer and should be regarded as important and conservation worthy. As soon as the

final site development plan is available the structures earmarked for demolition are listed and submitted to the Heritage Impact Assessment Committee of the Provincial Heritage Authority of Gauteng (PHRAG) for approval/comment. In addition alterations to buildings older than 60 years must also be submitted to the Provincial Heritage Resources Authority of Gauteng (PHRAG) for approval.

- Management Plans be written and implemented for all remaining structures older than 60 years as well as grave sites to ensure regular maintenance on these structures and grave sites in future.
- 3.2.6 and 3.2.7 be written into the Environmental Management Plan.

Leonie Marals-Botes Heritage Practitioner 2014-05-22 Heritage Authority of Gautens (PHRAG) for approval/convisent, in addition alterations to buildings older than 60 years must also be submitted to the Provincial Heritage Resources Authority of Gauteng (PHRAG) for approval.

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3.2.6 and 3.2.7 be written into the Environmental Management Plan.

Leonie Marais Botes Hentage Practitioner

2014-05-22

Curriculum Vitae

Leonie Maraís-Botes

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Excellent

Yes

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Identity number:

Home language:

Other language skills:

Health:

Computer literate:

Short courses attended

Institution	Course
KwaZulu-Natal Provincial Museum Service	Conservation and Restoration
SAMADOC	Documentation of museum collections
KwaZulu-Natal Provincial Museum Service	Architectural Conservation
Southern Africa Museums Association	Collection and documentation of contemporary collections
OWL Education	Writing English for the Workplace
Cultural Heritage Research Centre, University of Canberra, Australia	Conservation of Traditional Buildings
South African Management Development Institute	Hearing procedures
Conservation Management Plan Study Tour, UK	Conservation Management Plan development and management
University of Pretoria	PFMA Course
International Quality and Productivity Centre	Environmental Impact Assessment Regulations

11	Experience :	Section 38	(Heritage Impact	Assessment)	applications to	Heritage	Authorities	Section 34	applications to	Heritage	Authorities	General heritage	management	Project	Management	• Financial	Management	Public and Client	Relations	•	Management	 Budget and 	expenditure	management	• Personnel	management	Contractor	appointments and	quality control of	work
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Responsibilities																			<u> </u>	South African Heritage	Nesources Agency	SAMKA) graves project	raile ceneraming projects							
Position			_			_					_									Senior Manager: Projects										
Institution	Independent Heritage	Consultant (Leonie	Marais-Botes Heritage	Consultant)		_														nemage roundation										

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Analytical, problem-solving decision making skills. Social skills includes: Interpersonal communication, delegation, negotiation, conflict resolution and dealing with authority and power. Stress control	Office Administration Writing of reports, letters, internal memoranda, agendas, minutes and faxes. Data base use. Research Background research for reports and enquiries. Managerial Experience Manager for administration staff and research assistant.
	1 Dec 1897 ► 31December
	 Assist the manager with the caring and restoration of all war graves (1795 to July 1914) in South Africa Research Manage archives and library Manage administration staff Co-ordinator of Victims of the Liberation Struggle Information Function planner and co-ordinator
	Assistant-Manager: War Graves and Victims of Corflict Division
	National Monuments Council (NMC)

3. References

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	KZN Department of Works
	0845884081/0823767000

- October 2001, "Some days are diamond..."
- February/March 2002, Fresh Air and Open Spaces
- September/October 2003, Heritage Conservation in Post-Apartheld South Africa
 - January 2006, The Union Buildings
- February/March 2006, The history of Tuynhuls, Cape Town
 - April/May 2006, History of King's House
 - May/June 2006, Castle of Good Hope
- July/Aug 2006, The Value of Heritage Conservation
 - Sept/Oct, Conservation of Heritage Buildings
- Nov/Dec., Did you know that heritage buildings and sites are protected by law?
 - March/April 2007, SAND +STONE=SANDSTONE=DO NOT CLEAN

4.4 Contributions to PBAI publications

2 articles for PBAI publications (international)

Electricity shortage in South Africa

Heritage Sites with special reference to the Rand Steam Laundries

Workshops and information sessions arranged, co-ordinated and facilitated

- September 1999: Management of Heritage Sites seminar (international speakers)
- September 2001: Conservation course focussing on Masonry (international course leader)
- National Department of Public Works Heritage Road Show (March 2002▶ December 2002)
- Documentation workshops for officials dealing with heritage items in presidential and ministerial residences (Durban and Cape Town Regional Offices)
 - · Guide training (literature and practical sessions) for Presidency staff at Union Buildings
- November 2006: Consorvation of Heritage Buildings. Nederlandse Monumente Commissie
 - June 2009: Department of Defence, training of officials in Heritage Conservation
 - Rand Water Heritage Awareness Workshop, Nemai Consulting

- Phase 1Heritage Impact Assessment for Danville/Elandspoort Phase 1 housing development, Pretoria, Nemai Consulting
- Phase 1Heritage Impact Assessment for the consolidation of erven R/33, 1/33, 2/33, R/32, 1/32, Hatfield, Pretoria for Louis Cloete
- Phase Theritage Impact Assessment Bessie Ngwana Care Centre, Rustenburg, North West Province for Nemai Consulting
- Phase 1Heritage Impact Assessment for the rehabilitation of Alpha Central and East Mine, Vryheld district, KwaZulu-Natal, Chemo
- Phase 1Heritage Impact Assessment for consolidation of Erf R/22, 1/22, R23 and 415 Eloffsdal, Pretoria, Balido (Pty) Ltd
- Phase 1Heritage Impact Assessment Erf 538 (111 Jan Smutsrylaan), Saxonwold, Johannesburg, Franz Jesche Architects
 - Phase 1Heritage Impact Assessment, "Gallows" C Max Prison, Pretoria, National Department of Public Works
 - Phase 1Heritage Impact Assessment Hammanskraal Housing Project, Chemc Environmental
 - Phase1Heritage Impact Assessment for Weir 19, Kliprivier, Vereeniging, Nemai Consulting
- Phase 1Heritage Impact Assessment proposed new Anderson Substation, Broederstroom, North West, Nemai Consulting
- Phase 1Heritage Impact Assessment DinaledI Anderson 400kV Transmission Powerline, North West Province, Nomai Consulting
- Phase 1Heritage Impact Assessment Bloemendal/Delmas Rand Water deviation pipeline, Gauteng/Mpumalanga, Nemai Consulting
 - Phase 1 Heritage Impact Assessment for the proposed Leratong Internodal Transport Facility, Nemai Consulting
 - Heritage Impact Assessment Barrage structure, Vereeniging, Gauteng for Nomai Consulting
 - Heritage Impact Assessment, Marikana Housing Development, Nemai Consulting

 - Rand Water Heritage Awareness Workshop, Nemai Consulting
- Heritage Impact Assessment for PROPOSED DEVELOPMENT OF A CHICKEN EGG PRODUCTION FACILITY ON PORTION 109, FARM ELANDSFONTEIN 412-JR, ROCK Environmental Consulting
 - Heritage Impact Assessment for PROPOSED DEVELOPMENT OF A BROILER CHICKEN PRODUCTION FACILITY ON PORTION 120 OF THE FARM ELANDSFONTEIN 412-JR, ROCK Environmental Consulting
- Heritage Impact Assessment for the PROPOSED EXTENSION OF A CHICKEN REARING FACILITY OM PORTION 29 (A PORTION O F PORTION 4) OF THE FARM DANIELSRUST 518 JQ, Rock Environmental Consulting
 - Phase 1 Heritage Impact Assessment, St Paulus School, Lydiana, Pretoria, NANOX Architects
 - Phase 1Heritage Impact Assessment, Erf 1570, George Avenue, Eastwood

- Phase 1 Heritage Impact Assessment for the proposed residential development for portion 63 and the remainde of portion 30 of the farm Daspoort 319-JR – currently known as the "Willie Marais Afrikanersentrum" previously known as the Italian Social Club, Balido (Pty) Ltd
 - Phase 1 Heritage Impact Assessment for the extension of a Chicken Rearing Facility on the Farm Bovenste Oog van Mooirivier 271 IQ North West, Envillora
- Phase 1 Heritage Impact Assessment for the proposed development of a piggery and cattle feedlot on Portion 3 of the Farm Varkenskuil 605 KR, Limpopo Province, Envillora
- Phase 1 Haritage Impact Assessment for the proposed establishment of a residential township on Portion 2 of the Farm Twesfontein 94JR Gauteng Province, Envillora
- Phase 1 Heritage Impact Assessment for the proposed establishment of a piggery (200 sow unit) on Portion 1 of the Farm Waaikraal 556-JR for Sivuyile Phambili Project, Mpumalanga Province, ROCK Environmental Consulting
 - Phase 1 Heritage Impact Assessment for Erven 1152, 1153, 1294 and 1295 Capital Park, Pretoria, iBunti Trade 79 (Pty) Ltd
- Phase 1 HIA for the proposed Kromdraai Development (Portion 15 of the Farm Diepsloot 368-JR, Gauteng Province), LEAP Landscape Architect and Environmental Planner
- Phase 1 Heritage Impact Assessment for Portion 366 of the Farm Nooitgedacht 534-JQ, Gauteng Province, Bokamoso Landscape Architects and Environmental Consultants
- Phase 1 Heritage Impact Assessment for the porposed transformation and subdivision of the Remainder of Portion 4 of the Farm Kleinfontein 388 for agricultural and residential purposes, ROCK Environmental Consulting
 - Phase 1 Heritage Impact Assessment (HIA) along the D1944 Gravel Road, Rust De Winter, Enviflora
- PHASE 1 HERITAGE IMPACT ASSESSMENT FOR PORTION 818 (A PORTION OF PORTION 76) OF THE FARM THE WILLOWS 340 JR (ALSO KNOWN AS DIE WILGERS X80) SITUATED ON THE CORNER OF BOTTERKLAPPER AND ILANGA STREETS (S 25*48'01.3" # 028*18*43.2"), VAN **BLOMMENSTEIN AND ASSOCIATES**
- RETROSPECTIVE PHASE 1 HERITAGE IMPACT ASSESSMENT FOR DIE WILGERS X92 (CONSOLIDATED ERF IS ERF 1387) AND DIE WILGERS X87 (CONSOLIDATED ERVEN ARE 1382 AND 1383) PREVIOUSLY KNOWN AS PORTION 5 OF THE FARM HARTBEESPOORT 362 JR (S 25°46'08.0" E 028"18'25.9"), ELMADO PROPERTY PROJECTS
- RETROSPECTIVE PHASE 1 HERITAGE IMPACT ASSESSMENT FOR ERF 1802, EQUESTRIA X246 (PREVIOUSLY KNOWN AS ERVEN 48 AND 48/1 OF WILLOW GLEN AH), DWELLING DEVELOPMENT (PTY) LTD

REPORT

Comments, from a medical perspective, on the meetings of experts, from various sciences, into the potential pathological risks associated with development of the Linksfield site, Gauteng Province that were held on 20 March 2014 and 8 May 2014.

Date of report: 12 May 2014

Compiled by:

Dr. E D FOURIE M.B.Ch.B, (UP), M Med Pathology (Microbiology) (UP), MBL (Unisa) Registered with:

Health Professions Council of South Africa, Registration Number MP0126411 Category: Pathology (Microbiological). HPCSA 2014 card number: 17364430

Member of:

South African Medical Association
Infectious Diseases Society of Southern Africa
Gauteng Conservancy and Stewardship Association
Archaeological Society – Transvaal
Paleontological Society – Pretoria

The proposed development on the Linksfield site encompasses the, Rietfontein infectious Diseases Hospital and the cometeries associated with it, as well as open land where burial pits for animals that had died of anthrax may be located.

In the pre-antibiotic era, bacterial diseases like bubonic plague, scarlet fever, diphtheria, whooping cough, typhoid fever and mycobacterial infections were often deadly. Because they are contagious, patients were isolated in fever hospitals, like the Rietfontein Infectious Diseases Hospital. Viral diseases like smallpox and various haemorrhagic fevers were also Isolated.

Reasonably, the bodies of the deceased would have been repatriated, by their families, to their places of residence in sealed caskets. Some bodies, of local residents and indigent persons, would probably have been buried close by in the three demarcated cemeteries on the Linksfield development site. Of the human diseases, only smallpox viruses pose a risk of long-term survival.

I recommend that all cemeteries remain undisturbed in perpetuity, and be secured with a covering layer after full archaeological documentation.

During the meetings of experts, the soil chemistry, geology and mole interaction were discussed in the context of anthrax pits and unidentified graves. The acid pH of the soil precludes long term bone preservation and their associated bacteria. The shallow soil profile, above the bedrock, precludes deep burials, making them prone to mole disturbance.

0. J. Zomir

No pits or graves could be identified outside the demarcated cemeteries. No trace of anthrax bacteria or anthrax DNA could be identified. The effluent of the Rietfontein Infectious Diseases Hospital yielded tuberculosis DNA. The sewage drainage plume of the hospital must be fully sanitised before redevelopment commences.

Anthrax last caused an epidemic under bovines in 1925. The anecdotal reference to burial pits is probably related to that incident. The possibility remains that some of these bacteria could have survived. The whole area had been examined by the experts for possible ground disturbance. Because no signs were found on exposed surfaces, it is reasonable to postulate that the pit(s), if any, were on the adjacent, already developed, properties. In spite of the negative finding, graves or animal burial pits may be concealed under rubble or ground fill. Therefore, I recommend that a knowledgeable, archeologically trained investigator be in attendance where and whenever new ground is broken, to observe if the soil had previously been disturbed, and if any animal remains are exposed. In the unlikely event that this should happen, all activity must stop. Bacteriological and DNA specimens must be taken and analysed for anthrax. If positive, the site must be disinfected with acetic acid or paraformaldehyde under expert supervision. Exposed workers can be protected prophylactically with ciprofloxacin, until a definite finding is available.

To cause disease anthrax must first penetrate the body's intogument. Skin scratches, intestinal ulceration or inhalation into the alveolar air sacks of the lungs are the usual entry routes. In the case of exposed contaminated burial sites vegetative bacteria would have transformed into a stripped down dormant form, the so called "anthrax spore". The outermost layer of the spores consists of napped glycoproteins that form a scaffold like exosporium in which the spores are held together. This arrangement restricts airborne dispersal but facilitates ingestion by grazing animals. The pathogenicity of anthrax is caused by liberated toxins after the bacteria had gained access to the body, germinated and transformed to the vegetative state. The incubation period varies from one to ten days, depending on the infective dose and virulence of the organism. Inhaled anthrax is the most lethal form of the disease.

Anthrax bacilli are used in biological warfare. However, to "weaponise" them the bacteria must be very finely dispersed on a mineral salt to be able to enter the lung alveoli. Scaffold mounted bacteria particles are too large to be inhaled into the alveoli.

in the event of anthrax bacilli being liberated at Linksfield, dispersal in an infective dose to the lungs is very unlikely. Workers breaking new ground can be protected by wearing respirators equipped with filters, as additional protection. A push-cart mounted ground penetrating radar can identify disturbed soil, alerting machine operators to be extra careful. The grave identification project can be a good subject for a master's thesis. The involvement of a university will add gravitas to the seriousness with which the developers wish to ensure safety.

If care is diligently applied, I am of the opinion that the Linksfield site can be developed without danger to the construction crew or to residents of the development.

O. Zowir

CURRICULUM VITAE DR E D FOURIE

Qualified M B, ChB at University of Pretoria, 1968

Qualified M Med Pathology (Microbiology), 1973

Registered as specialist pathologist with the Health Professions Council, 1974.

Became a partner in Drs du Buisson and Partners, 1975.

Qualified Master in Business Leadership, University of South Africa, 1989.

Practiced as managing pathologist of Drs du Buisson and partners from 1987 and later as Regional Managing Pathologist of Ampath and Drs du Buisson, Bruinette and Kramer until retirement in 2008.

lactively participated in medical congresses and continuing professional development throughout my career.

My last successful audit of professional training by the HPCSA was in 2012.

Recently I attended the congress of the Infections Diseases Society of South Africa in 2013 and the International Infectious Disease Conference in 2014.

C 2 Zo.

CURRICULUM VITAE: DR. JOHAN H. VAN DER WAALS (13 January, 2014)

1. Personal Particulars

Full names: Johan Hilgard van der Waals

Title: Dr.

Date of birth: 1969 - 05 - 22

Place of Birth: Pretoria

Race: White

RSA ld no: 690522 5224 082

Marital status: Married Language Proficiency:

Afrikaans: Excellent all round English: Excellent all round

Spanish: Read and speak very good, writing fair

Portuguese: Understand fair

French: Understand fair (having completed two years of classes with the

Alliance Francaise in Pretoria)

Computer Literacy/Proficiency: Highly proficient in a range of software packages including MS Word, MS Excel, MS Outlook, MapSource, Fugawi, ACDSee as well as varying experience in a range of GIS/GPS software applications.

2. Contact Detail

Work physical address:

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Garsfontein.

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Pretoria

Work postal address:

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0060

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Work telephone number: +27 (0)12 993 0969

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Emali address:

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3. Academic Qualifications

- 3.1 BSc Soil Science and Botany Curn Laude, 1995, Potchefstroom University for CHE
- BSc Honours Soil Science and Plant Nutrition, 1999, University of Pretoria 3.2
- MSc Soil Science and Plant Nutrition, 2001, University of Pretoria 3.3
- PhD Soil Science, 2006, University of Pretoria 3.4

4. Academic Output

4.1 Peer Reviewed Journal Publications

- 4.1.1 Van der Waals, J.H., & Claassens, A.S. 2002. Accurate lime recommendations under South African conditions. Commun. Soil Sci. Plant Anal., 33(15-18), p 3059-3074.
- 4.1.2 Van der Waals, J.H., Snyman, H.G. & Claassens A.S. 2005. Increase in metal extractability after liming of sacrificial sewage sludge disposal soils. Water SA 31(2) p. 271-273.
- 4.1.3 Jackson, C.R., Lubbe, N.R., Robertson, M.P., Setsaas, T.H., Van der Waals, J. & Bennett, N.C. 2008. Soil properties and the distribution of the endangered Juliana's Golden Mole. *Journal of Zoology* 274(2008) 13-17.
- 4.1.4 Van der Waats, J.H. 2013. Soll colour variation between topsoil and subsoll horizons in a plinthic catena on the Mpumalanga Highveld, South Africa. South African Journal of Plant and Soil 30(1): 47–51

4.2 Peer Reviewed Book Chapters

4.2.1 Van der Waats, J.H. & Laker, M.C. 2008. Micronutrient deficiencies in crops in Africa with emphasis on Southern Africa. In Alloway, B.J. (Ed.) Micronutrient deficiencies in global crop production. Springer Science, pp 201-224

4.3 Conference Proceedings Publications

- 4.3.1 Van der Waals, J.H., Kaiser, C., & Stronkhorst, L.D. 2003. Challenges concerning fertilizer use and management practices in the banana industry in South Africa. In Schnug, E., Nagy, J., Németh, T., Kovács, Z., & Dővényi-Nagy, T. (Eds.), Proceedings of the 14th International Symposium of Fertilizers (CIEC), June 22-25, 2003, Debrecen, Hungary, pp 386. ISBN 963-9274-44-5
- 4.3.2 Van der Waals, J.H. & Claassens, A.S. 2003. Long-term heavy metal pollution risk due to the use of slags as agricultural times on the South African Highveld. In Spiers, G., Beckett, P., & Conroy, H. (Eds.), Sudbury 2003 Mining and the Environment Conference Proceedings, May 25–28, 2003, Sudbury, Ontario, Canada. ISBN 0-88667-051-9.
- 4.3.3 Van der Waals, J.H., Van der Merwe, C. & Erdmann, R. 2007. Detail assessment of metal distribution in polluted soil a South African case study. *In Fourle*, A., Tibbett, M. & Wiertz, J. (Eds.), Proceedings of the Second International Seminar on Mine Closure, Santiago, Chile, 18-19 October, 2007. pp 815-820.

4.4 Technical Research Reports

4.4.1 Snyman, H.G. & van der Waals, J.H. 2004. Laboratory and field scale evaluation of agricultural use of sewage studge. WRC Report No. 1210/1/04. ISBN: 1-77005-230-5. Water Research Commission, Pretoria.

4.5 National Conference Presentations

- 4.5.1 Van der Waals, J.H., & Claassens, A.S. 2001. Successful use of the RH-value in determining lime requirements. Joint Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Weed Science Society), Pretoria, 16-18 January 2001. (Oral Paper)
- 4.5.2 Van der Waals, J.H., & Claassens, A.S. 2001. The plant availability of selected heavy metals and phosphorus from applied slags. Joint Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Weed Science Society), Pretoria, 16-18 January 2001. (Oral Paper)

- 4.5.3 Viljoen,A., Van der Waals, J.H., Nel, B., and Wiese, L. D. 2002. The potential application of disease suppressive soils in the management of *Fusarium* wilt of banana. 13th Annual Soil-borne Disease Symposium, Stellenbosch. (Oral Paper)
- 4.5.4 Van der Waals, J.H., & Claassens, A.S. 2003. Long-term heavy metal pollution risk due to the use of slags as agricultural limes on the South African Highveld. Golden Jubilee Congress (Soll Science Society of South Africa, South African Society of Crop Production, Southern African Society for Horticultural Sciences), Stellenbosch, 20-23 January 2003. (Oral Paper)
- 4.5.5 Stronkhorst, L.D., Viljoen, A., Claassens, A.S., Nel, B., & Van der Waals, J.H. 2003. The effect of N-fertilization and pH on the incidence of Fusarium Wilt (Panama disease) of banana in greenhouse trials. Golden Jubilee Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Society for Horticultural Sciences), Stellenbosch, 20-23 January 2003. (Oral Paper)
- 4.5.6 Kaiser, C., & Van der Waals, J.H. 2003. Effects of different mineral element foliar sprays and soil application on Panama disease (Fusarium oxysporum f.sp cubense) of bananas. Golden Jubilee Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Society for Horticultural Sciences), Stellenbosch, 20-23 January 2003. (Oral Paper)
- 4.5.7 Van der Waals, J.H., & Snyman, H.G. 2004. Selected chemical and physical soil properties of three sacrificial sewage sludge disposal sites. Water Institute of South Africa (WISA) Conference, Cape Town, 2-6 May 2004. (Oral Paper)
- 4.5.8 Van der Waals, J.H. & Claassens, A.S. 2005. Influence of increasing lime rates on ammonium EDTA (NH4-EDTA) extractable metals and organic matter from two acid long-term biosolids disposal soils. Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, South African Weed Science Society, Southern African Society for Horticultural Sciences), Potchefstroom, 11-14 January 2005. (Oral Paper)
- 4.5.9 Van der Waals, J.H. & Claassens, A.S. 2006. Heavy Metal Uptake by Wheat from Two Sacrificial Biosolids Disposal Soils at Differential Liming Rates. Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Society for Horticultural Sciences), Durban, 24-26 January 2006. (Oral Paper)
- 4.5.10 J.H. van der Waals, L.D. Stronkhorst, A.S. Claassens, A. Viljoen. 2006. Chemical Analysis of Soils Suppressive and Conducive to Fusarium Wilt of Banana in South Africa. Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Society for Horticultural Sciences), Durban, 24-26 January 2006. (Oral Paper)
- 4.5.11 Van der Waals, J.H., Rossouw, P.S., Potgieter, J.J.C. & de Jager, P.C. 2007. Uranium mobility in soils a South African case study. Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Society for Horticultural Sciences), Badplaas, 22-25 January 2007. (Orai Paper)
- 4.5.12 Van der Waals, J.H.; de Jager, P.C., Rossouw, P.S. & Claassens, A.S. 2008. Mobility of Cr, Ni and V in long-term slag applied soils of Mpumalanga. Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Society for Horticultural Sciences, South African Weed Science Society), Stellenbosch, 19-22 January 2009. (Oral Paper)
- 4.5.13 Van der Waals, J.H., de Jager, P.C., Rossouw, P.S. & Claassens, A.S. 2009. Mobility of Cr, Ni and V in long-term slag applied soils of Mpumalanga. Combined Congress (Soil Science Society of South Africa, South African Society of Crop

Production, Southern African Society for Horticultural Sciences, South African Weed Science Society), Stellenbosch, 19-22 January 2009. (Oral Paper)

4.5.14 Van der Waals, J.H. 2009. Generalised soil characteristics of the wetland zones of the Halfway House granites, Gauteng Province. Wetlands Indaba, Langebaan, 27 - 30 October 2009. (Oral Paper)

4.5.15 Van der Waals, J.H., & Rossouw, P.S. 2010. Refining area specific wetland delineation criteria through the use of land type data. Wetlands Indaba,

Kimberley, 26 - 29 October 2010. (Oral Paper)

4.5.16 Rossouw, P.S., Van der Waals, J.H., & De Jager, P.C. 2011. The extractability of chromium(III) and nickel as influenced by soil water potential levels. Combined Congress (Sall Science Society of South Africa, South African Society of Crop Production, Southern African Weed Science Society, Southern African Society for Horticultural Sciences), Durban, 17-20 January 2011. (Oral Paper)

4.5.17 Van der Waals, J.H. Rossouw, P.S. & Van Zyl, L.G. 2011. Long-term land use induced soll chemical variation on the Mpumalanga Highveld. Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Weed Science Society, Southern African Society

for Horticultural Sciences), Durban, 17-20 January 2011. (Oral Paper)

4.5.18 Van Zyl, L.G., & Van der Weals, J.H. 2011. Geomorphometry as indicator for slope position. Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Weed Science Society, Southern African Society for Horticultural Sciences), Durban, 17-20 January 2011. (Oral Paper)

4.5.19 Pretorius, M.L., Van Huyssteen, C., Van der Waals, J.H., & Grundling, A.T. 2011. Soll colour as indicator of wetland boundaries on the Maputaland Coastal Plain. Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Weed Science Society, Southern African Society for Horticultural Sciences), Durban, 17-20 January 2011. (Oral Paper)

4.5.20 Van der Waals, J.H., & Fairall, E. P. 2011. Pan African Parliament Development - The case for a wetland. National Wetlands Indaba, Didima, KwaZulu-Natal, 18-

21 October 2011 (Ora) Paper)

4.5.21 Rossouw, P.S., & Van der Waals, J.H. 2011. Blue-green colouration in soil as a tool in understanding wetland hydrology. National Wetlands Indaba, Didima, KwaZulu-Natal, 18-21 October 2011 (Oral Paper)

4.5.22 Van der Waals, J.H., Rossouw, P.S., & Fairall, E.P. 2012. Proposed hydric soil indicators for the soils of the Halfway House Granite Dome. Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Weed Science Society), Potchefstroom, 16-19 January 2012. (Oral Paper)

4.5.23 Van der Waals, J.H., & Rossouw, P.S. 2012. Occurrence and implications of topsoil/subsoil colour variation along a hillslope on the plinthic catena. Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Weed Science Society), Potchefstroom, 16-19

January 2012. (Oral Paper)

4.5.24 Rossouw, P.S., & Van der Waals, J.H. 2012. Blue-green colouration in soil: indicator of modal gleyed/wetland conditions. Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Weed Science Society), Potchefstroom, 16-19 January 2012. (Oral Paper)

4.5.25 Van der Waals, J.H. 2012. Proposed Classification of Organic Matter Enriched Topsoil Horizons in the South African Taxonomic System. National Wetlands Indaba, Klein Kariba, Limpopo Province, 23-26 October 2012 (Oral Paper)

4.6 International Conference Oral and Poster Presentations

- 4.6.1 Van der Waals, J.H., & Claassens, A.S. 2001. Accurate lime recommendations under South African conditions. 5th International Symposium Plant-Soil Interactions at Low pH, Alpine Heath, 12-16 March 2001. (Poster Paper)
- 4.6.2 Van der Waals, J.H., Snyman, H.G., & Claassens, A.S. 2003. Extractable heavy metal fractions of three soils from sewage sludge disposal sites in South Africa. 8th International Symposium on Soil and Plant Analysis, Somerset West, 13-17 January 2003. (Poster Paper)
- 4.6.3 Van der Waals, J.H., Snyman, H.G., & Claassens, A.S. 2003. The effect of liming on pH and extractable heavy metals from soils at two sewage sludge disposal sites. 8th International Symposium on Soll and Plant Analysis, Somerset West, 13-17 January 2003. (Poster Paper)
- 4.6.4 Stronkhorst, L.D., Viljoen, A., Claassens, A.S., Nel, B., & Van der Waals, J.H. 2003. The effect of N-fertilization and pH on the Incidence of Fusarium Witt (Panama disease) of banana in greenhouse trials. 8th International Symposium on Soil and Plant Analysis, Somerset West, 13-17 January 2003. (Poster Paper)
- 4.6.5 Van der Waals, J.H. & Claassens, A.S. 2003. Long-term heavy metal pollution risk due to the use of slags as agricultural limes on the South African Highveld. Sudbury Mining and the Environment Conference, May 25-28, 2003, Sudbury, Canada. (Oral Paper)
- 4.6.6 Van der Waals, J.H., Kaiser, C., & Stronkhorst, L.D. 2003. Challenges concerning fertilizer use and management practices in the banana industry in South Africa. 14th International Symposium of Fertilizers (CIEC), June 22-25, 2003, Debrecen, Hungary. (Oral Paper)
- 4.6.7 Snyman, H.G., Van der Waals, J.H. & Van Niekerk, C. 2003. Aspects of the beneficial agricultural use of sewage sludge in South African soils. (WA Conference on Environmental Biotechnology: Advancement on Water and Wastewater Applications in the Tropics Kuala Lumpur, Malaysia, 9-10 December 2003. (Oral Paper)
- 4.6.8 J.H. van der Waals, A.S. Claassens & W.F.A. Kirsten. 2004. Reactivity and metal content of slags used on the Mpumalanga Highveld: How applicable are current guidelines? 15th International Scientific Center for Fertilizers Symposium, September 27-30, 2004, Pretoria, South Africa. (Oral Paper)
- 4.6.9 J.H. Van der Waals, P.C. de Jager & A.S. Claassens. 2004. Factors affecting the mobility of trace elements added to agricultural soils through the use of slags as liming materials. 15th International Scientific Center for Fertilizers Symposium, September 27-30, 2004, Pretoria, South Africa. (Oral Paper)
- 4.6.10 Van der Waals J.H. & Claassens, A.S. 2005. Influence of increasing lime rates on ammonium EDTA (NH₄-EDTA) extractable metals and organic matter from two acid long-term blosolids disposal soils. 9th International Symposium on Soll and Plant Analysis, Cancun, Maxico, January 30th to February 4th, 2005. (Poster Paper)
- 4.6.11 Rossouw, P.S., Van der Waals, J.H., Claassens, A.S. & De Jager, P.C. 2007. Chromium and nickel transformation in South African Highveld catena soils. 10th International Symposium on Soil and Plant Analysis, Budapest, Hungary, 11-15 June 2007. (Poster Paper)

4.8.12 Van der Waals, J.H., Van der Merwe, C. & Erdmann, R. 2007. Detail assessment of metal distribution in polluted soil – a South African case study. Second International Seminar on Mine Closure, Santiago, Chile, 16-19 October, 2007. (Oral Paper)

4.7 Awards

- 4.7.1 Best student (PhD) presentation: "Van der Waaís, J.H. & Claassens, A.S. 2003. Long-term heavy metal pollution risk due to the use of slags as agricultural limes on the South African Highveld." At the Sudbury Mining and the Environment Conference, May 25-28, 2003, Sudbury. Canada.
- 4.7.2 Best Paper: 'Van der Waals, J.H. & Claassens, A.S. 2005. Influence of increasing lime rates on ammonium EDTA (NH₄-EDTA) extractable metals and organic matter from two acid long-term biosolids disposal soils." Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, South African Weed Science Society, Southern African Society for Horticultural Sciences), Potchefstroom, 11-14 January 2005.
- 4.7.3 Best Paper: "Van der Waals, J.H., Rossouw, P.S., Potgleter, J.J.C. & de Jager, P.C. 2007. Uranium mobility in soils a South African case study." Combined Congress (Soil Science Society of South Africa, South African Society of Crop Production, Southern African Society for Horticultural Sciences), Badplaas, 22-25 January 2007.

4.8 Completed Student Supervision: Masters students (University of Pretoria)

- 4.8.1 Berhe, M.A. (Main Supervisor). 2003. The use of ethnopedology as a tool for participatory land use planning in the Eritrean Highlands.
- 4.8.2 Stronkhorst, L.D. (Main Supervisor). 2006. Selected soil properties affecting the incidence of Panama disease in banana.
- 4.8.3 McLea, J. (Co-supervisor). 2007. Assessment of the cultivation of Jatropha curcas L. for the production of bio diesel in the Mafikeng area of the North West Province of South Africa.
- 4.8.4 Stones, R. (Main Supervisor). 2007. Land suitability studies for the growing of deciduous berries in the Limpopo Province of South Africa
- 4.8.5 Rossouw, P.S. (Partial Supervisor). 2008. Environmental extractability of Cr(III) and Ni from soils of South Africa's Eastern Highweld.
- 4.8.6 Lubbe, N.R. (Co-supervisor). 2010. Characterization of the soils of Marlon Island.

4.9 Membership of National and International Bodies

- 4.9.1 Soil Science Society of South Africa (SSSSA) Member
- 4.9.2 South African Soil Surveyors Organisation (SASSO) Accredited Member
- 4.9.3 South African Council for Natural Scientific Professions Reg. no. 400160/08

4.10 International Dedicated Soil Classification Workshops / Field Excursions

- 4.10.1 World Reference Base (WRB) field excursion and soil classification workshop, Wroclaw, Poland, September 2011.
- 4.10.2 World Reference Base (WRB) field excursion and soil classification workshop, Yakutsk (Siberla), Russian Federation, August 2013.

5. <u>Professional/Consulting Output</u>

(<u>Note</u>: Specialist reports are the property of the client and Terra Soil Science. For a complete list of projects and clients please contact Terra Soil Science. A list will be supplied upon signing of a non-disclosure agreement.)

- 5.1 Agriculture potential reports: 350+ throughout South Africa.
- 5.2 EMP/EIA soil surveys: 200+ throughout South Africa
- 5.3 Specialist Soll Surveys: 50+ throughout Southern Africa
- 5.4 Wetland delineation and general soil surveys (Lend-use planning): 100+ throughout Southern Africa
- 5.5 Fertilizer recommendations (various applications): 40+
- 5.6 Short courses presented: 10 (Soil Classification and Wetland Delineation)
- 5.7 Presentation at specialist workshops: Advanced Environmental Crimes Workshop presented by the Department of Environmental Affairs (DEA) and Directorate Public Prosecutions (DPP) (2011)
- 5.8 Specialist Witness:
- 5.8.1 Specialised witness in the Regional Division of North Gauteng for the State in the matter between The State versus 1. Stefan Frylinck and 2. Mpofu Environmental Solutions CC (Case Number 14/1740/2010). Judgement delivered on the 6th of April 2011 in favour of the State.

6. Previous Work Experience

- 6.1 1988 1997: South African National Defence Force. Last position held: Squadron Commander Terrain Evaluation (4 Survey and Mapping Regiment, South African Engineer Corps)
- 6.2 1997 1998: Rehabilitation officer in the gold mining industry with ENVIROGREEN (now Fraser Alexander)
- 6.3 1999 2007: University of Pretoria: Last position held: Senior Lecturer in Soil Science and Land-use Planning
- 6.3.1 Courses Presented/Developed:

Course	Level (e.g. second year, Masters)	Self developed (Yes or No)
ARD 482 Physical- Biological Resources and Development	Fourth year	Yes (50%)
ARD 782 Physical- Biological Resources and Development	Honours	Yes (50%)
GDK 250 Introductory Soil Science Practical	Second year	No
GKD 350 Soil Classification	Third year	Yes

GKD 460 Environmental Management	Fourth year	Yes (50%)
GKD 461 Soil Mineralogy and Genesis	Fourth year	Yes (50%)
GKD 480 Resource Surveying	Fourth year	Yes
LBU 410 Land-use Planning	Fourth year	Yes
LBU 420 Project in Land-use Planning	Fourth year	Yes
GDK 780 Soil Classification	Honours	Yes
SDK 781 Land-use Planning	Honours	
GDK 782 Resource Surveying	Honours	Yes (50%)
GDK 783 Project in Land-use Planning	Honours	Yes (50%) Yes (50%)

- 6.3.2 Other Academic/Industry Collaboration
- 6.3.2.1 Chairman of the organizing committee of the 15th International Scientific Center for Fertilizers (CIEC) Symposium held in Pretoria from 27 to 30 September 2004. The symposium was held at the request of the President (Prof. Christian Hera Romania) and Deputy President (Prof. Ewald Schnug Germany) of the CIEC.
- 6.3.2.2 Collaboration with the personnel from the Department of Zoology on the soil characteristics that influence the distribution of the Juliana's Golden Mole in the Bronberg area.
- 6.3.2.3 Collaboration with the personnel from the Department of Geography on the soils of Marion Island.
- 6.3,2.4 Collaboration with the Forestry and Agriculture Biotechnology Institute (FABI) on Panama disease of banana. Dr. van der Waals' contribution concerns plant nutrition and soil fertility influences on the incidence of the disease.
- 6.3.2.5 Collaboration with the South African Iron and Steel Institute and Pistorius & Co. on the mobility of neavy metals derived from slag applied soils.
- 6.4 2007 present: Managing Director of Terra Soil Science cc. Terra Soil Science was established in August 2007 and has grown to such a point that it has, apart from Johan van der Waals, eight full-time employees (GIS and project management) as well as an association with two part time soil surveyors for a range of soil survey and GIS applications.
- 6.5 2011 present: Research fellow with the Department of Soil, Crop and Climate Sciences, University of the Free State, Bloemfontein.
- 6.6 2013 present: Part-time lecturer (Soil Classification), Department of Plant Production and Soil Science, University of Pretoria.

Resumé

Johan van der Waals completed his undergraduate studies in Soil Science and Botany at the Potchefstroom University for CHE (cum laude) in 1995. He completed his honours degree in Soil Science and Plant Nutrition (University of Pretoria) in 1999 (part-time), Masters In Soil Science and Plant Nutrition (University of Pretoria) in 2001 and PhD in Soil Science (University of Pretoria) in 2008. Both his Masters and PhD degrees focussed on heavy metal mobility in soils as a result of the use of metal containing waste products. He was a staff member in the department of Plant Production and Soil Science of the University of Pretoria from 1999 to 2007 and presented 13 courses of which many were self developed. His favourite and strongest course was Soil Classification in which the students were Intensively exposed to the South African Taxonomic System as well

as to the **World Reference Base for Soll Resources (WRB)** of the Food and Agriculture Organisation (FAO) of the United Nations (UN) and the United States Department of Agriculture's (USDA) **Soil Taxonomy**. During his tenure at the University of Pretoria he was actively involved in research on:

- heavy metal mobility in soils and the correlation of this mobility with easily classifiable soil properties,
- soll borne plant pathogens and the soil properties governing the incidence of the diseases (in collaboration with a number of other departments and institutes), and
- the influence of soil properties on the distribution of plants and animals (especially the Juliana's Golden Mole) in collaboration with a number of other departments and institutes.

In addition, Johan has been involved with the streamlining and optimization of fertilizer recommendations in the banana growing regions of SA with the alm of increasing profitability and yield as well as the decreasing of disease incidence. He has also been involved with the conducting of numerous ad-hoc pot and field trials on the yield of and nutrient and heavy metal uptake by maize, wheat, spinach, banana and other crops.

Since the establishment of Terra Soil Science CC, Johan has been involved in a range of soil consulting services. The bulk of the contribution to the industry entails soil surveys for EIAs as well as soil management plans and soil based wetland surveys and delineations. The recent focus on wetland conservation in SA led to a range of surveys to determine the status and extent wetlands that have had some form of human impact. The culmination has been the successful defence of the Wetland Delineation Guidelines and wetland description criteria in the recent court case on the destruction of Pan African Parliament Complex Site in Midrand, Gauteng.

Johan van der Waals has an active interest in the understanding of soils and their properties and their influence on a range of natural and anthropogenic processes and as such is actively involved in research. Key to this understanding is a proper grounding in the Soil Classification, Soil Chemistry, Plant Nutrition and Soil Biology disciplines and therefore these form the core of his academic interests.

DR. J.H. VAN DER WAALS

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22nd May, 2014

Contact person	Dr. Johan van der Waals
Tel:	082 570 1297
E-mall:	Johan@terrasoil.co.ze

To Whom It May Concern:

LINKSFIELD DEVELOPMENT

I. Dr Johan Hilgard van der Waals (PhD Soil Science) compiled a report entitled "Baseline forensic soil investigation into potential pathological risks associated with development of the Linksfield site.

Gauteng Province" in collaboration with Dr Henriëtte van Heerden (PhD Plant Pathology, MSc Microbiology). The report addressed the following aspects:

- Detailed investigation into the distribution of graves on the Linksfield site
- Literature survey regarding the history of the Rietfontein Hospital (now Sizwe Hospital) and the fatal diseases of patients buried on the Linksfield site.
- Detailed literature survey on the persistence of relevant pathogens in soil.
- Soil survey and sampling on the site for:
 - Soil survey, profile description and classification.
 - b. Soil microblological analysis.
 - Soil physical parameters.
 - Soil chemical parameters.
- Analysis of samples.
- 6. Interpretation of the data and site survey results.
- Reporting on the findings and provision of conclusion and recommendations.

The only pathogen that could survive in soils for extended periods was found (from literature and experience) to be anthrax (*Bacillus anthracis*). None of the organism could be isolated or identified in the soil samples. The chemical characteristics of the soil on the site indicated that the organism could not survive in the soils outside of a host as the soils were acidic (as opposed to alkaline that favours

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the organism's persistence). The only human pathogen that was identified was (Bacillus cereus) that is ubiquitous in the environment and poses a negligible and manageable risk to human health.

Dedicated gravesites for humans were found on the site but no indications of large scale animal burial sites were found. No potential hosts in terms of the presence of animal bones could therefore be identified.

Provided that adequate and standard measures are implemented for the handling of exposed animal remains during development no risk is foreseen regarding the development of the site. In fact, the current status quo with uncontrolled dumping, squatting and human movement across the site poses a larger risk than development as none of the current activities are structured or controlled. With the development of the site activities can be structured and any risk mitigated adequately.

I therefore support the devolopment of the site in a controlled and structured manner.

Yours sincerely,

(Signed electronically)

DR. J.H. VAN DER WAALS Pr.Sci.Nat.

DR HENRIETTE VAN HEERDEN UNIVERSITY OF PRETORIA CURRICULUM VITAE

1. BIOGRAPHICAL SKETCH

Henriette van Heerden (née Britz) obtained a PhD at the University of Pretoria (UP) where after she joined the ARC-Onderstepoort. Veterinary Institute and worked on the Heartwater programme that completed the sequencing of the entire 1.51 Mb genome of *Ehrlichia ruminantium*. She started her academic career in the department of Biochemistry at the University of Johannesburg (UJ) in 2003. She is a senior lecturer in microbiology in the Department of Veterinary Tropical Diseases (DVTD) at UP since January 2008. At DVTD she is part of research projects in zoonotic diseases, primarily focusing on anthrax and brucallosis with specific emphases on the bacteriology, epidemiology and diagnosis of the diseases as well as vaccine development.

Surname	Van Heerden											
First names	Henriette			ID N	ımbe	r	720300	600330)84			
Citizenship	South African		•	Title	D	r	Female		х	Male	_	
Place of birth	Bloemfontein, So	uth Africa	_	Date	Date of birth			3-06	-06			
Population group	African Co	loured	d Indian		White		Other (Please	e specii	fy)			
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Date of appointment		Permanent full- time					Ten		ary full-			
	EMIC QUALIFICATION	ONS OBT	AINED									
Degree/ Diploma	Field of study	Higi	her educa	tfon ins	titutio	on	Year	Dist	inctic	ons		
BSc	Biological will Chemistry, Microbiology an Biochemistry an main subjects	d State	sity of th	е Оган	nge	Free	1994					
BSc Hons	Microbiology	Univer State	sity of th	ie Orar	ige l	Free	1995				_	
MSc	Microbiology	Univer	sity of the I	Free Sta	te		1998	Yes				
PhD	Plant Pathology	Univer	sity of Pret	oria			2001	 			_	
1.3 WORK	EXPERIENCE TO D	ATE			_	_					_	
Name of emplo			ity and/or	4			_	Perio		(mm//yy	_	

Agricultural Research Council - Onderstepoort Veterinary Institute (ARC-OVI)	Research Scientist	01/2000 - 01-2002
ARC-OVI	Senior Researcher	02-2002-09/2003
University of Johannesburg	Lecturer	10/2003-12/2007
University of Pretoria	Senior Lecturer	01/2008

2. POSTGRADUATE SUPERVISION

Name of student	Degree/Title of dissertation/ thesis and date completed	Supervisor	Co-supervisor(s)
C, M. Kneidinger (Masters Research)	Mastomys natalensis and Mastomys couche identification, habitat preferences and population genetics	Prof F. H. van der Bank	Dr van Heerden
N.M. Sanabria (Doctorate)	Molecular characterization of a lipopolysaccharide-induced S-domain receptor-like kinase from <i>Nicotiana</i> tabacum	Prod I. A. Dubery	Dr. H van Heerden
R.A. Bhamjee (Masters Research)	Comparing suppression subtractive hybridization and bioinformatics approaches for analyzing functional gene expression in <i>Arabidopsis thatiana</i> follwing a heat shook treatment	Dr. M. J. Cronje	Dr. H. van Heerden
S.M. Philifps (Doctorate)	Molecular characterization of elicitor- responsive genes in cotton	Dr. H. van Heerden	Prof I. A. Dubery
B. Gaspar (Masters coursework with dissertation)	Determining the status of <i>Brucella</i> canis in dogs in Maputo region in Mozambique using various techniques	Dr. H. van Heerden	Prof. J. Godfraid
A. Hassim (Masters research)	Molecular characterization of Bacillus anthracis in southern Africa	Dr. H. van Heerden	Dr. J. Rossouw
L. L. Esterhuizen	Ph.D A study of the South African <i>Tomato</i> curly stunt virus pathosystem: epidemiology, molecular diversity and resistance	Dr H. van Heerden	Prof. M. E. C. Rey Dr. S.W. van Heerder
C. Gomo (Masters Research)	Characterisation of <i>Brucella</i> species in Zimbabwe	Dr. H. van Heerden	i -
S.L. Chis	Evaluation of the performance of serological tests in the diagnosis of bovine brucellosis in Kwa Zulu natal in naturally infected cattle	Dr. H. van Heerden	
O. C. Ndumnego	Comparative studies on immunogenicity and protectivity of a five spore <i>Bacillus antivacis</i> vaccine vs. recombinant peptide and DNA vaccine in goats	Dr. H. van Hearden	Dr. W. Beyer Dr. J.E. Crafford
K.E. Lekota	Polyphasic and genome characterization of <i>Bacillus</i> species	Dr. H. van Heerden	Dr. E. Madaroba Dr. F. Muchadeyi

	from anthrax outbreaks in animals in South Africa and Lesotho		Dr. J Mafofo	_
M.B. Ledwaba	Molecular characterization of Bacillus	Dr. H. van Heerden	Me. A. Hassim	
	anthracis and Brucella species			
	isolated from southern Africa			

Name of student	st-graduate stude Degree lenrolled for and date of first registration	Project title	Supervisor	Co-supervisor(s)	Year of registration
J. Burumu	Web-base M. Sc	Following Brucelia DNA detection in seropositive animals until gestation	Dr. H van Heerden	Dr. C. Gamo	2011
B. Weyers	Web-base M. Sc	Characterization of the of Bacilius anthracis vaccine seed material	Dr. H. van Heerden	_	2011
A. Hassim	Ph.D	Distribution and characterization of Bacillus anthracis and bacteriophages in South Africa	Dr. H van Heerden	Dr. W. Beyer	2012
Dr. O. C. Ndumnego	Ph. D	Comparative studies on Immunogenicity and protectivity of a live spore Bacillus anthracis vaccine vs. recombinant peptide and DNA vaccine in goats and mice	Dr. H. van Heerden	Dr. W. Beyer	2013
L. Basson	M. Sc	The role of files and free living amoebae as potential vectors of Bacillus anthracis in South Africa.	Dr. H. van Heerden	Dr. J. Rossouw Dr. W. Beyer	2013
P. H. Phaswana	M. Sc	Model to test protection against anthrax: comparative studies on the immunological response of the live spore anthrax vaccine in goats and monitoring through passive protection test in mice.	Dr. H. van Heerden	Dr. O.C. Ndumnego	2013
A. Buys	Ph.D	Development and evaluation of a multicomponent clostridial and non-clostridial vaccine for the active immunization of sheep	Dr. H. van Heerden	Dr. J. Crafford	2013
A.M. Maputle	M. Sc	Development of multiple serological and molecular assays for Becillus anthracis	Dr. H. van Heerden	_	2014
van Niekerk	M. Sc	Assessing and monitoring vulture populations in Kruger National Park and the role they play in the anthrax life cycle.	Dr. H. van Heerden	Dr. L. van Schalkwyk Dr. A. Botha	2014
5. Goolab	Ph.D	Evaluating cell surface display as a potential brucellosis antigen delivery system.	Dr. H. van Heerden	Dr. M. Crempton Sr. R. Roth Dr. A. Botha	2014

Indicate whether Honours, Masters research, Masters coursework with dissertation or Doctorate

3. RESEARCH OUTPUTS

3.1 Publications in peer-reviewed or refereed journals

Ndumnego, O.C., Crafford, J., Beyer, W., van Heerden, H. (2013). Quantitiave anti-PA IgG ELISA; assessment and comparability with the anhtrax toxin neutralization assay in goats. BMC Veterinary Research 9:265.

Esterhuizen, L.L., Mabasa, K.G., van Heerden, S.W., Czosnek, H., Brwon, J.K., van Heerden, H., Rey, M.E.C. (2013). Genetic identification of members of the Bemisai tabaci cryptic species complex from South Africa reveals native and introduced haplotypes. Journal of Applied Entomology 137: 122-135.

Phillips, S.M., Dubery, I.A., van Heerden, H. (2013). Identification and molecular chracterisation of a lectin receptor-like kinase (GHLecRK-2) from cotton. Plant Mol Biol Rep 31: 9-20.

Phillips, S.M., Dubery, I.A., van Heerden, H. (2013). Molecular characterisation of two homoeologous elicitor-responsive lipin genes in cotton. Mol Genet Genomics 288: 519-533.

Gomo, C., Musari, S., de Garine-Wichatitsky, M., Caron, A., Pfukenyi, D.M., van Heerden, H. (2012). Detection of *Brucella abortus* in Chiredzi district in Zimbabwe. Onderstepoort Journal of Veterinary Research 79. doi: 10.4102/ojvr.v79i1.417.

Esterhuizen, L.L., van Heerden, S. W., Rey, M.E.C., van Heerden, H. (2012). Genetic identification of two sweet potato infecting begomoviruses in South Africa. Archives of Virology 157: 2241-2245.

Phillips, S. M., Dubery, I. A., van Heerden, H. (2012). Molecular characterization of an elicitor-responsive Armadillo repeat gene (GhARM) from cotton (*Gossypium hirsutum*). Molecular Biology Reports 39: 8513-8523.

Sanabria, N. M., van Heerden, H., Dubery, I. A. (2012) Molecular characterisation and regulation of a *Nicotiana tabacum* S-Domain receptor-like kinase gene induced during an early rapid response to lipopolysaccharides. Gene 501; 39-48.

3.2 Books and/or chapters in books

Wingfield, M. J., Wingfield, B. D., Coutinho, T. A., Viljoen, A., Britz, H. & Steenkamp, E. T. (1999). Pitch canker: A South African perspective. In Devey M, Matheson C, Gordon TR (eds). Current and potential impacts of pitch canker in radiata pine. Proceeding of the IMPACT Monterey Workshop, 62-69.

3.3 Published full-length conference papers/keynote addresses

van Heerden, H., Collins, N. E., Allsopp, M. T. E. P. & Allsopp, B. A. (2002). Major outer membrane proteins of *Ehrlichia ruminantium* encoded by a multigene family. *Annals of New York Academy of Science* 969: 131-134.

4. OTHER SCHOLARLY RESEARCH-BASED CONTRIBUTIONS

4.1 Participation In conferences, workshops and short courses - specify type of contribution

Provide full details of participation in national and international conferences etc.

4.1.1 National (2008 onwards)

Bhamjee, R. A., Cronje, M.J. & van Heerden, H. The identification and analysis of hsp 70 genes in wild type (col-o) *Arabidopsis thaliana* using suppression subtractive hybridization (SSH). BIO-08 (South African Society of Biochemistry and Molecular Biology, Biotech-SA and South African Society of microbiology joint conference), 21-25 January 2008, Grahamstown, South Africa.

Hassim, A., van Heerden H., Rossouw, J., Hauck, Y., Amtzen, L. & Vergnaud, G. Molecular characterization of Southern African *Bacilius anthracis* strains using multiple locus variable number tandem repeats analysis. Faculty day, 27 August 2009, Faculty of Veterinary Science, University of Pretoria, South Africa.

Esterhuizen L.L., Van Heerden S.W., Rey M.E.C. & van Heerden H. Epidemiology and molecular characterisation of *Tomato curty stunt virus* and its insect vector *Bemisia tabaci* in South Africa. Talk presented at Proceedings of the 47th Annual Plant Pathology Congress in South Africa. Kruger National Park, 23 - 26 January 2011.

8.1.2 International (2008 onwards)

Phillips, S. M., van Heerden, H. & Dubery, I. A. Characterization of defense-related genes in cotton up- or down regulated by a *Verticillium dahliae* elicitor. Poster and talk presented at the International Gordon Research conference on Plant Molecular Biology at Holderness School, USA13-18 July 2008.

Esterhuizen, L. L., van Heerden, S. W., Rey, M. E. C. & van Heerden, H. Epidemiology and molecular characterization of *Tomato curly stunt virus* and it's insect vector *Bemisia tabaci* in South Africa. Poster and talk presented at the 6th International Symposium on Geminivirus and the 4th Comparative ssDNA Virology Workshop at Guanajuato, Mexico 7-12 November 2010.

Beyer, W., Arntzen, L., Eberle, G. & van Heerden, H. Opening conference in the programme German-African Cooperation Projects in Infectology. 20-22 June 2010, Berlin, Germany.

van Heerden, H., Rossouw, J., Ndumnego, O.C., Turnbull, P. & Beyer, W. Report back of immunoprophylaxis and molecular epidemiology if anthrax and the fate of *Bacillus anthracis* in living vectors and the environment of Namibia and South Africa. Talk presented at 2nd Workshop, 29-30 April 2010, Windhoek, Namibia.

Beyer, W., Eberle, G. & van Heerden, H. (2011). Second meeting for all participants in the German-African Cooperation Projects in Infectology. 23-25 Merch 2011, Accra, Ghana.

van Heerden, H., Ndumnego, O.C., Tumbull, P. & Beyer, W. (2012). Report back of immunoprophylaxis and molecular epidemiology if anthrax and the fate of *Bacillus anthracis* in living vectors and the environment of Namibia and South Africa. Talk presented at 3rd Workshop, 7-8 May 2012, Kruger National Park, South Africa.

- K.E. Lekota, E. Madoroba, J. Rees, H. van Heerden, J. Mafofo, F.C. Muchadey. (2013). Whole genome sequencing and genetic variant analysis of two South African *Bacillus anthracis* strains. The international Conference on *Bacillus anthracis*, *B. cereus*, and *B. thuringiensis*, Victoria, Canada 1-5 September 2013.
- K.E. Lekota, J. Mafofo, J. Rees, F.C. Muchadey, H. van Heerden, E. Madoroba. (2013) Polyphasic characterization of *Bacillus* species from anthrax outbreaks in animals from southern Africa. The international Conference on *Bacillus anthracis, B. cereus, and B. thuringiensis*, Victoria, Canada 1-5 September 2013.
- Hassim, Y. Hauck, J. Rossouw, G. Vergnaud, H. van Heerden. (2013). Chracterization of *Bacillus anthracis* using multiple locus variable number of tandem repeat analysis (MLVA) for the typical african laboratory. The international Conference on *Bacillus anthracis*, *B. cereus*, and *B. thuringiensis*, Victoria, Canada 1-5 September 2013.
- S.M. Koehler, M. Sahin, S. Otlu, M. Doganay, O. Ndumnego, H. van Heerden, W. Beyer. (2013). Recombinant acellular vaccines tested in goats for immunogenicity and ptotectivity. The international Conference on *Bacillus anthracis, B. cereus, and B. thuringiensis*, Victoria, Canada 1-5 September 2013.
- O.C. Ndumnego, S. Koehler, J. Crafford, W. Beyer, H. van Heerden (2013). Immunigenicity and protectivity efficacy of the Sterne 34F2 live spore anthrax vaccine in goats. The international Conference on *Bacillus anthracis, B. cereus, and B. thuringiansis*, Victoria, Canada 1-5 September 2013.
- O. C. Ndumnego, J. Crafford, W. Beyer, H. van Heerden. (2013) Quantitiave anti-anthrax IgG ELISA correlates with the anhtrax toxin neutralization assay in goats. The international Conference on *Bacillus anthracis, B. cereus, and B. thuringiensis*, Victoria, Canada 1-5 September 2013.

Specialist meeting report by Henriette van Heerden

During the Linksfield Specialist meeting on 8 May 2014 the Linksfield development project was discussed amongst specialists to determine whether the development should continue. A major point of concern was the possibility that animals that died of anthrax were buried on the Rietfontein farm that forms part of the Linksfield development. No official record is available to confirm that animals that died of anthrax were buried in the Linksfield area. The specialist group discussed the possible risk(s) that anthrax and other microorganisms pose to humans at the Linksfield area. To understand the risk posed by, mainly anthrax, basic information regarding anthrax will first be provided.

Background information of anthrox

Anthrax is a zoonotic bacterial infectious disease caused by the spore forming bacterium, *Bacillus anthracis*. Primarily it is a disease of domestic and wild animals and can be transmitted to humans but on very rare occasions since humans are resistant towards anthrax. Infection of the pathogen can occur through the entry of spores into the host through insect bites or abrasions (cutaneous) or consumption of contaminated animal products or vegetation (gastrointestinal) or the inhalation of the spores (pulmonary).

Bacilius anthracis is able to form spores that are highly resistant to harsh conditions like chemical disinfection, heat, cold etc. and has the ability to survive in the soil for a long period. The spores are present in abundance in soil at sites where infected animals had died or been buried. The reason that anthrax could pose a risk is because it is a soil-borne bacterium that can remain in the soil for extended periods. All though anthrax affects humans on rare occasions, the negative connectivity linked to anthrax is based on its use as a biological weapon. Use of B. anthracis as a biological weapon usually requires the manipulation of the bacteria making it resistant against penicillin antibiotic which is usually used to treat this disease very effectively in humans and animals. The recombinant (manipulated) bacteria is mixed with magnesium sulphate powder that allows easy inhalation by humans that could results in death if not treated with appropriated antibiotics. In the natural environment B. anthracis occurs in the soil, with endemic B. anthracis occurring in elevated calcium and neutral to alkaline soils and infection through inhalation requires large numbers of spores or continuous exposure over an extended period.

Kisk of anthrax spores present at Linksfield area.

None to low. Low in the event of exposing burial sites where animals died of anthrax.

The public tend to panic or get emotional, due to lack of information, whenever anthrax is mentioned as its most highly publicised use has been as a biological weapon. With the Linksfield development the only risk that anthrax will pose is at a burial site where the animals died of anthrax. Facts that were considered with this assessment include:

Records of burial of animals that dled of anthrax

We could find no records at the hospital, Adler Museum, NICD etc that might have records about animals that died of anthrax and that were buried at the site.

Disturbance in soil where animals were buried in large graves

No burial sites could be identified with aerial photographs and no soil disturbance was observed by the soil specialist that also indicated that the soil structure does not lend itself to burial of animals deeper than 1.0-1.5 m. Another possibility is that animal carcasses that died of anthrax were burned, as it has been an acceptable practise, which would have destroyed the anthrax spores.

Likelihood of humans contracting anthrax from anthrax spores at Linksfield site

As the low pH of the soils in the Linksfield area does not support survival of anthrax in soil, anthrax most likely only occurs at burlal sites where animals or humans that died of anthrax were buried. *Bocillus anthracis* only poses a low risk in burial sites where anthrax related carcasses were buried. Workers will be trained to identify burial sites and a specific operating procedure will be followed which will involve the identification of anthrax at a burial site. In the event that anthrax is identified various options can be considered like; no further development at that specific site or alternatively decontamination of that site. In the event that anthrax is identified at the site, it should be kept in mind that the most lethal form of anthrax infection is through inhalation of spores, but a lethal dose of anthrax will consist of 10 000 spores. Since it is implausible for *B. anthracis* to survive in the non-ideal soil conditions it would require exposure over an extended period for anthrax to become a risk. The most likely form of anthrax infection is cutaneously and humans are fairly resistant towards cutaneous infections. In the improbable event that such an incident could occur; cutaneous lesions can be very effectively treated with antiblotics where abraded skin is exposed to anthrax infected soil.

CONCLUSION: There is no record of anthrax related carcasses being burled at the site; no burial sites could be identified with aerial photographs. In the event of anthrax, anthrax can only be a risk when a human is exposed to spores over a long period which will not be possible during this development or exposure to large amount of spores which has been indicated to be a very unlikely event due to

the type of soil at the site. The risk is mainly cutaneous lesions that can be effectively treated with antibiotics in humans.

Other risk:

Mycobacterium tuberculosis the causal agent of tuberculosis, DNA was found in the effluent from the hospital and needs to be further investigated as it could pose a risk to workers.

J LOUIS VAN ROOY

Pressumer, Photograph PSAMEC MCSSA Engineering Geologist VAT no: 4110218171

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P O Box 36786 MENLOPARK PRETORIA 0102

22 May 2014

BOKAMOSO P O Box 11375 Maroelana 0161

Attention: Anè Agenbacht

DEVELOPMENT OF THE LINKSFIELD ESTATE.

This form was appointed and executed the geotechnical site investigation during November 2013.

The alms of such a Phase I investigation are usually to:

- Determine the geology and the relevant mechanical properties of the soil and rock horizons present on the site.
- Zone the site according to the NHBRC site classes.
- Comment on the excavation characteristics and possible uses of the materials underlying the site.
- · Comment on possible shallow groundwater or seepage.

The results from the trall pits, soil profiles and soil laboratory tests indicate the following expected geotechnical constraints for this site are:

- Collapsible soil
- Seasonal shallow groundwater; perched groundwater and surface seepage near the floodplain,
- · Moderate erodability of surficial soils, and
- Localised difficulty of excavation to 1.5 m depth.

Based on the findings and conclusions no specific constraint are of such negative impact as to render this site unsuitable for development from a geotechnical perpective.

Yours sincerely

J L VAN ROOY

Pr.Sci.Nat.

ABRIDGED CURRICULUM VITAE

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QUALIFICATIONS:

1992 PhD (Engineering Geology) University of Pretoria
 1985 MSc (Engineering Geology) University of Pretoria
 1979 BSc (Hons) Engineering Geology University of

Pretoria.

PROFESSIONAL MEMBERSHIP AND REGISTRATION:

Pr.Sci.Nat 400239/83 FSAIEG; MGSSA, MIAEG.

WORK EXPERIENCE:

12/1979 - 01/1985 Geological Survey of South Africa.

Engineering geological mapping, dolomite investigations, dam site investigations.

02/1985 – 10/2000 Aurecon Consulting Engineers Part-time consultant. Site investigations on dolomite and software systems development.

02/1985 – present Department of Geology, University of

Pretoria. Lecturing in engineering geology and

part-time specialist consultant.

ACADEMIC AND RESEARCH ACTIVITIES: Lecturing geology, engineering and environmental geology to undergraduate geology, civil and mining engineering, landscape architectural and land surveyor students.

Lecturing to postgraduate engineering geology and civil engineering students. Supervise practical projects of postgraduate engineering geology students.

Supervision of field mapping of second year geology and

postgraduate engineering geology students.

Supervised 13 Masters degree projects and 3 PhD research projects.

Published more than 20 papers in scientific journals and 19 in conference proceedings.

External examiner at Universities of Johannesburg, KwaZulu-Natal and Limpopo.

NRF - C2 rated researcher.

SPECIALISATION: Engineering geology of problem soils;

Rock durability;

Characterization of surface stability on dolomite land;

Slope stability:

Foundations for residential & commercial buildings, roads,

pipelines:

Construction meterial.

TECHNICAL REPORTS:

Investigations on water supply projects

Reservoirs, pipeline and materials for Makhado West bulk water supply scheme (2008 - 2010); New reservoirs, pipeline and materials for Doorndraai, Mokopane (2002); Water works Burgersfort (2002); PPL - Polokwane pipeline (2001 - 2003) Investigations on residential developments

More than 300 individual site investigation in the Pretoria, Midrand, Polokwane areas (1998 - present).

investigations on dolomite stability

Various properties in the military areas south of Pretoria and Potchefstroom (1979 - present); Office complex sites in Centurion and East Rand (2006 - 2012); residential land

Recent graveyards and hazardous medical waste (site plan received from I&AP's)

