mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

ENVIRONMENTAL IMPACT ASSESSMENT REPORT
and
ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED)

NAME OF APPLICANT:	THUNDERFLEX 78 (PTY) LTD
TEL NO:	084 208 9088
FAX NO:	086 762 7142
POSTAL ADDRESS:	P.O. BOX 110115 HADISON PARK 8306
PHYSICAL ADDRESS:	6 MILLIN STREET HADISON PARK 8306
FILE REFERENCE NUMBER SAMRAD:	(NC) 30/5/1/2/2/10084 MR

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1)(c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is therefore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process—

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;

(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

(d) determine the—

  (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

  (ii) degree to which these impacts—

    (aa) can be reserved;

    (bb) may cause irreplaceable loss of resources; and

    (cc) can be avoided, managed or mitigated.

(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;

(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;

(g) identify suitable measures to manage, avoid or mitigate identified impacts; and

(h) identify residual risks that need to be managed and monitored.

PART A

SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

a) Details of the EAP

i) Details of the EAP

Name of the Practitioner:	Dr Elizabeth (Betsie) Milne
Tel No.:	082 992 1261
Fax No.:	N/A (*No fax)*
E-mail address:	betsiemilne@gmail.com

ii) Expertise of the EAP

- **The qualifications of the EAP**

  PhD in Botany (NMMU)
  Masters in Environmental Management (UFS)
  BTech in Nature Conservation (TUT)

  (Please find resume and certificates attached as **Appendix 1**)

- **Summary of the EAP's past experience**

  Relevant past experiences in carrying out the Environmental Impact Assessment Procedures include Environmental Impact Assessments, Ecological assessments, Environmental Management Plans/Programmes/ Reports, Performance assessments, Rehabilitation progress assessments, Environmental Liability assessments, Invasive species assessments, Environmental compliance monitoring, Scoping Reports, etc.

  (Please find list of completed projects attached as **Appendix 2**)

b) Description of the property

Farm Name:	**Farm No.:** 23 **Portions:** Remainder, 1, 2, 3 and 4 **Farm Name:** Blaauputs **Magisterial District:** Prieska **Province:** Northern Cape **Title Deed No's.:** Remainder (T4555/2011) Canton Trading 302 (Pty) Ltd Portion 1 (T1015/1992) JJ Botha (ID 4302035012083) Portion 2 (T1015/1992) JJ Botha (ID 4302035012083) Portion 3 (T1975/1989) JJ Botha (ID 4302035012083) Portion 4 (T4555/2011) Canton Trading 302 (Pty) Ltd
Farm Name:	**Farm No.:** 29 **Portions:** Remainder and Portion 2 **Farm Name:** Kliphuis **Magisterial District:** Prieska **Province:** Northern Cape **Title Deed No's.:** Remainder (T1502/1976) JJ Botha (ID 4302035012083) Portion 2 (T965/2004) Temdale Eiendomme (Pty) Ltd
Application area (Ha):	6641,6276 ha (six thousand six hundred fourty one comma six two seven hectares)
Magisterial district:	Prieska and Hay
Distance and direction from nearest town:	The proposed mining area is located approximately 16 km north of the town Prieska on undeveloped farm land at coordinates 29°31'37.70"S and 22°42'13.42"E. The site is accessed via an unpaved road (approximated 20 km in length) which turns of from the R386 that connects Prieska and Niekerkshoop.
21 digit Surveyor General Code for each farm portion:	Remainder Farm 23 C06000000000002300000 Portion 1 Farm 23 C06000000000002300001 Portion 2 Farm 23 C06000000000002300002 Portion 3 Farm 23 C06000000000002300003 Portion 4 Farm 23 C06000000000002300004 Remainder Farm 29 C06000000000002900000 Portion 2 Farm 29 C06000000000002900002

c) Locality map

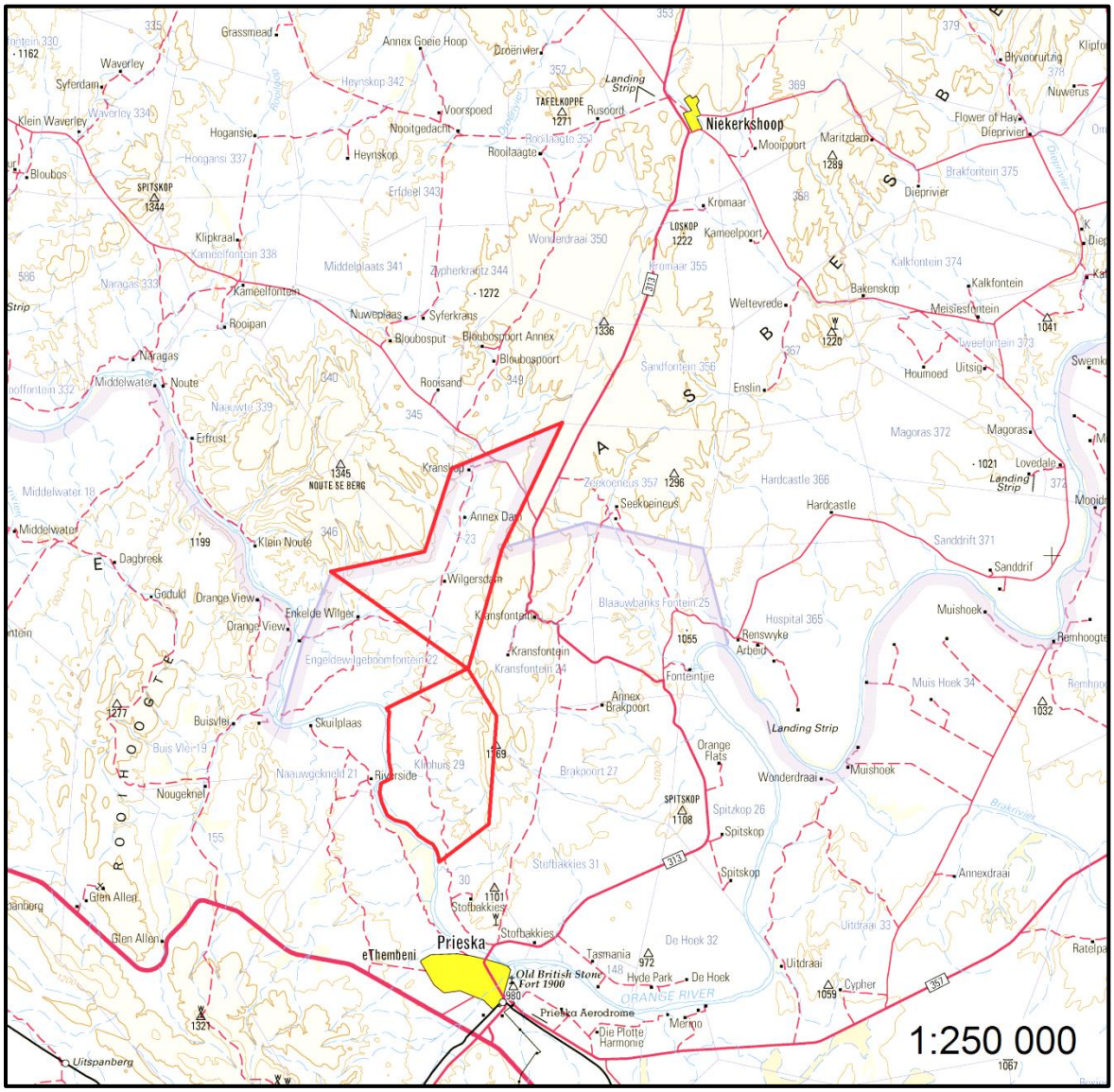


Figure 1. The locality of the proposed mining right area indicated in red.

d) Description of the scope of the proposed overall activity

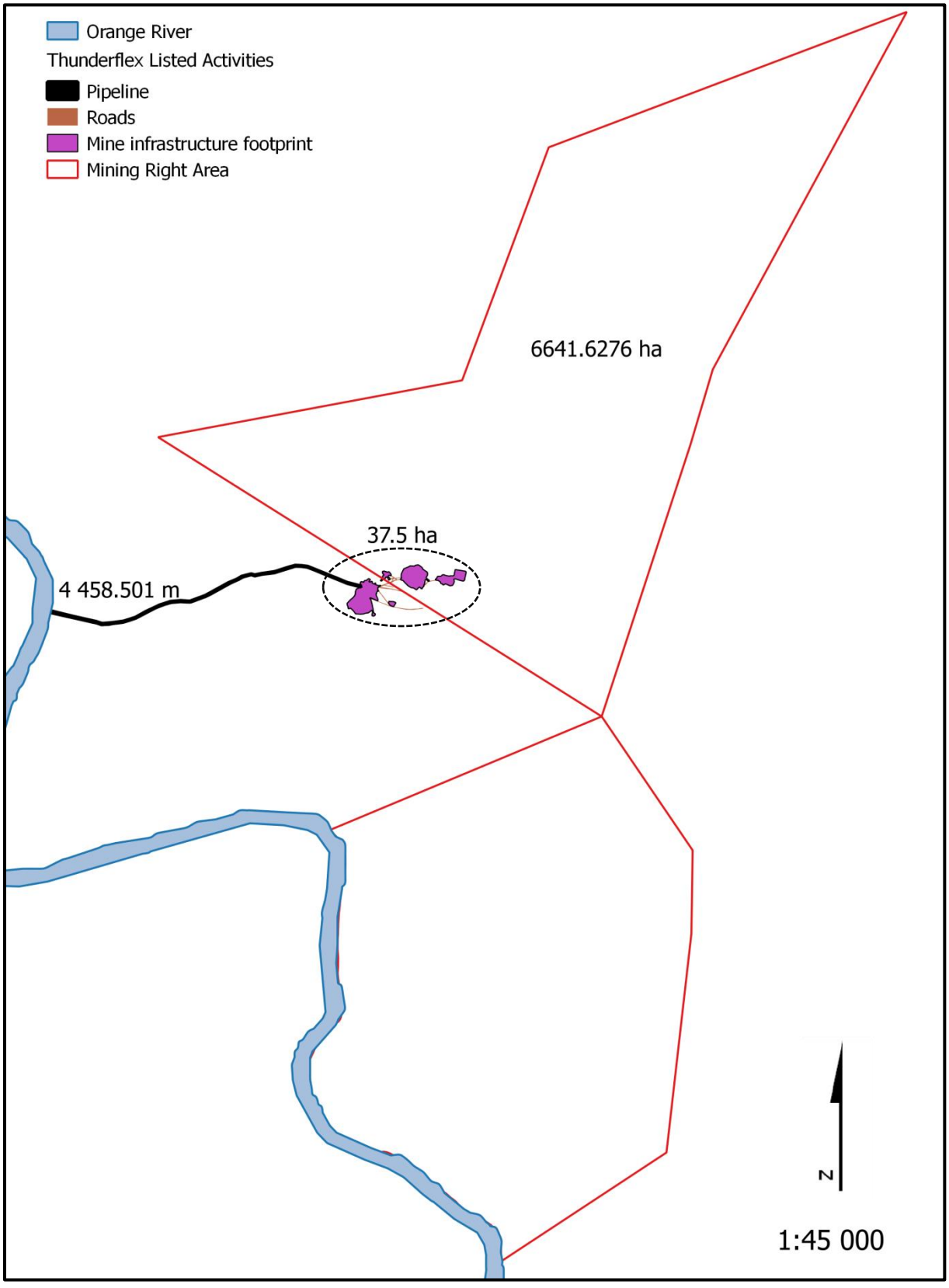


Figure 2. A plan indicating the overall location and extent of listed activities and main infrastructure on the Thunderflex mining site.

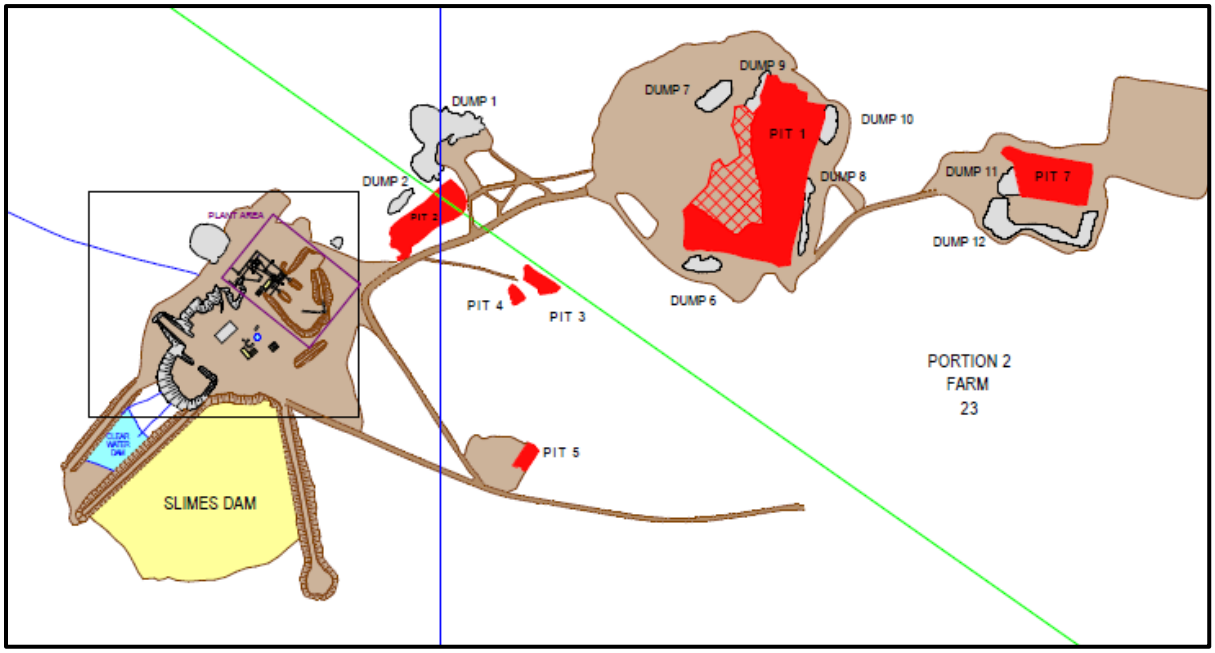


Figure 3. A plan (1:7000) indicating the mine infrastructure footprint on the Thunderflex mining site.

i) Listed and specified activities

NAME OF ACTIVITY (All activities including activities not listed)	Aerial extent of the activity in m, km, m², or ha	LISTED ACTIVITY	APPLICABLE LISTING NOTICE
Activity 9 The construction of a pipeline exceeding 1 000 m in length for the bulk transportation of water from the Orange River.	4 458.501 m	X	GNR 983
Activity 56 Roads will continuously be lengthened to access new excavations and the total length of the roads will exceed 1000 km.	Roads will be longer than 1 km and have a combined extent of approximately 1.5 ha	X	GNR 983
Activity 15 The Thunderflex activities involve the clearance of more than 20 ha of indigenous vegetation.	The total extent of the mining right area applied for is 6641.6276 ha, but not all of this will be mined	X	GNR 984
Activity 17 The Thunderflex mining operation and associated activities require a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002	The total extent of the mining right area applied for is 6641.6276 ha	X	GNR 984
Activity 21 The Thunderflex mining operation and activities are associated with the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating, crushing, screening and washing.	The total extent of the central processing plant is 1 301.40 m^2	X	GNR 984

NAME OF ACTIVITY (All activities including activities not listed)	Aerial extent of the activity in m, km, m², or ha	APPLICABLE LISTING NOTICE
Open pits	The total extent of the open pits is currently 41 759.54 m^2, but the pits will continuously be backfilled and new pits will continuously be excavated.	Not listed
Topsoil stockpiles	The total extent of the topsoil stockpiles is currently 0.65 ha, but these stockpiles will continuously be used for rehabilitation and new stockpiles will continuously be created.	Not listed
Overburden stockpiles	The total extent of the overburden stockpiles is currently 1.8 ha, but these stockpiles will continuously be used to backfill open pits and new stockpiles will continuously be created.	Not listed
Gravel stockpiles	The total extent of the gravel stockpiles is currently 0.05 ha, but these stockpiles will continuously be used to backfill open pits and new stockpiles will continuously be created.	Not listed
Steel storage dam	53 m^2	Not listed
Clean water / return water dam	7 072.36 m^2	Not Listed
Mine roads	The current mine roads cover a total extent of 15 250.65 m^2. Haul roads will continuously be rehabilitated and new haul roads will continuously be created.	Not Listed
Temporary workshop buildings	0.07 ha	Not Listed
French drain	2.97 m^2	Not listed
Slimes dam	The current total extent of the slimes dam is 65 336.69 m^2, but it is possible that the total size of the slimes dam will increase during the course of the operation, if deemed necessary.	Not listed
Diesel depot floor	87.53 m^2	Not listed
Oil diesel depot floor	59.72 m^2	Not listed
Washbay floor	95.95 m^2	Not listed
Break test ramp	655.17 m^2	Not listed
Plant ramps	2 909.57 m^2	Not listed

ii) Description of the activities to be undertaken

A Description of the Planned Mining Method

The mining operation is based on alluvial diamond mine reserves which will be mined by means of an opencast method using heavy earthmoving machinery and occasional blasting. The ore will then be treated through a 4 pan plant. The diamondiferous ore will be screened, scrubbed, crushed and processed on site. The rough diamond product will then be removed from site for further beneficiation. Machinery includes the following:

- Hydraulic excavators
- Articulated dump trucks
- Front End Loaders
- Bulldozers
- Grader
- Water truck

Mineral processing

The orebody consists of diamondiferous alluvial gravels that are mined by means of quarrying, i.e. shallow, open pit mining, by means of a hydraulic shovel and excavator. For basal gravels, blasting might be required. All blasting activities will be performed by Quality Blast in collaboration with Torque Drilling CC. Presently there is a prospecting site with two 16 feet diamond rotary pans and scrubbers with the necessary yellow fleet to support the bulk sampling project, but the mining operation will be enlarged to make provision for two extra 16 feet diamond rotary pans and scrubbers. A typical diamond pan plant will be utilized to process the diamondiferous gravel. The material from the infield screen will be fed into the plant at a rate of 60 t/h for two pans. The mining process flow chart is presented in Figure 4. No ore processing reagents are required or used in the treatment of the ore.

Mine residue disposal

The current slimes dam is approximately 65 336.69 m^2 and is situated on an adjacent farm (Farm 22) that will in future form part of the current proposed operation. The slimes dam is constructed above natural ground level. The sludge is pumped from the plant to the north and gravitated from the north-east to the western wall providing time for settlement to take place and cleaner water to drain towards the western wall. A section of the western slimes dam wall has been constructed to act as a filter in preventing the sludge to filter through the wall and thus allowing only the water to pass through the wall. The sludge will eventually settle and with time reduce the capacity of the slimes dam.

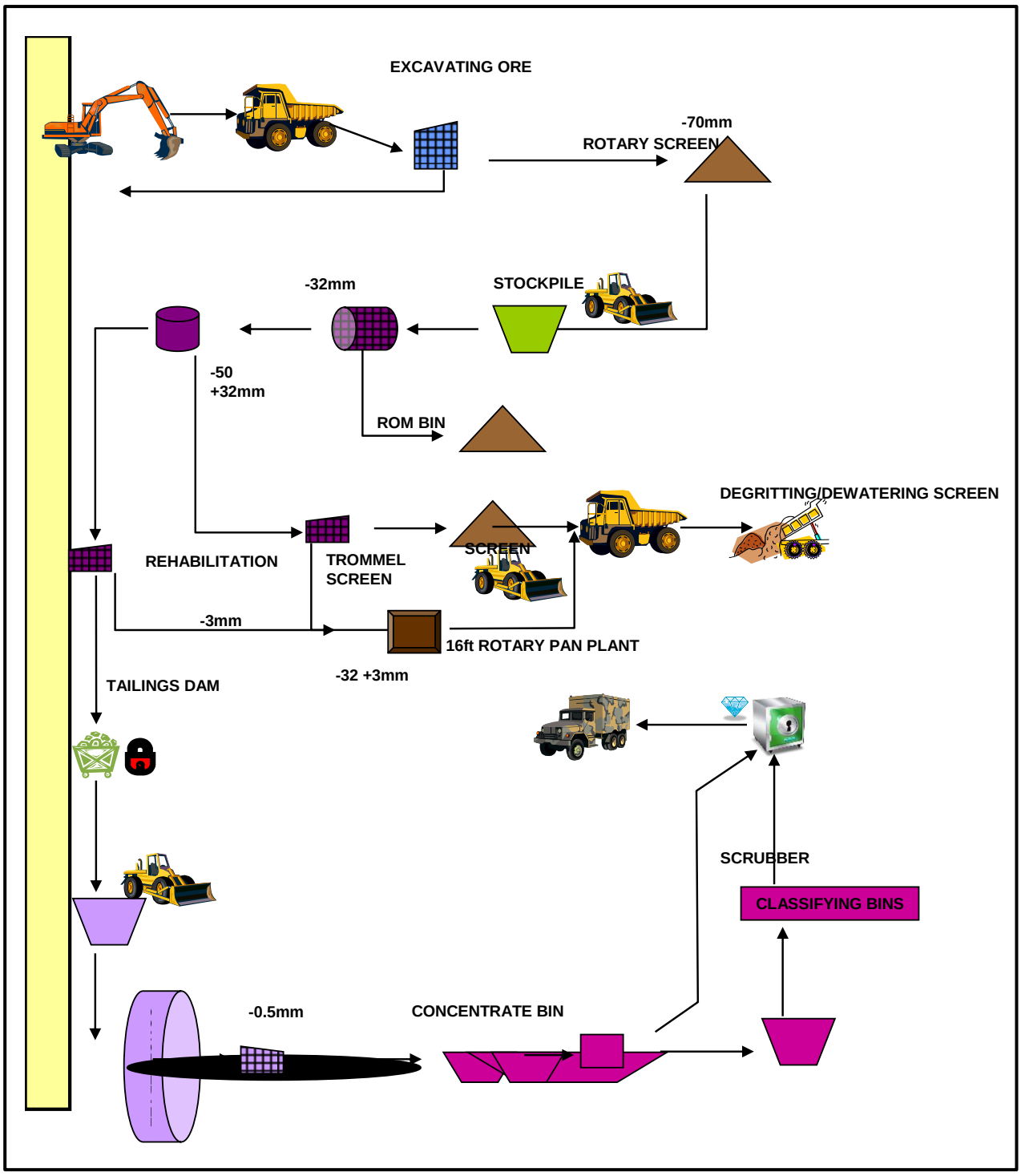


Figure 4. The mining process flow chart.

Rehabilitation

The mining method involves a continuous backfilling open cast mining process. Topsoil will be stripped and hauled to already backfilled areas. If there are no backfilled areas available immediately, topsoil be temporarily stockpiled on the surface for later use. No materials will be permanently dumped on the surface. Washed and screened material will be backfilled into the already mined out areas and will be covered with the overburden and topsoil that has been allocated for this purpose.

Associated infrastructure

The total extent of all mine infrastructure is estimated to be 37,5 ha. There will be a total of three diesel tanks on site. Two of these tanks have a capacity of 23 000 L and one with a capacity of 8 000 L. The combined capacity for these fuel storage tanks is 54 m^3.

The property is connected to the national Electricity Supply Commission (ESKOM) electricity grid, with the necessary transformers and supply lines in place. There is however not enough capacity for the processing plant and therefore a generator is used to supply electricity for the latter. Lighting conductors with a maximum height of 25 m will be installed.

Water

All water for the Thunderflex Mine is pumped from the Orange River under a temporary transfer from agricultural water from DWS. An estimated 105,000 L/hr is pumped using a 600 KvA pump, and transported via a 4.45km pipeline. The water is then stored in one 80 m^3 zinc dam reservoir, from where it is pumped into another 80 m^3 zinc dam at the plant (with a 300 KvA pump). No process water is withdrawn from groundwater sources.

Approximately 105,000 L/hr water is consumed by the rotary pan plants and the final recovery. An estimated 265 783 m^3 is pumped to the Mine Residue Dam per year from the pan plant and 5 091 m^3 from the final recovery goes to the Mine Residue Deposit annually. Water for re-use in the plant is collected from the mine residue deposit return water dam and returned to the plant (recycling is estimated to be at least 50%).

Waste management

General domestic waste is disposed at the Municipal facilities in Prieska. The ablution facilities on site make use of septic tanks. Wash water is collected by interception channels in the wash bay floor which are connected to silt trap and oil separator system. The system in cleaned on an “as and when needed” basis by hazardous waste management contractor Olegra. Scrap yards are used for the temporary storage of materials that are salvaged as needed by the mining operation.

No pollution control dams have been established at the mine, because the processing and treatment are a chemical free process. There are no facilities for the treatment of polluted water, other than the mine residue dam, which act as settling dam, and clean water will be pumped back into the process water once the silt has settled out.

Access roads

The property is easily accessed via a network of regional tarred and gravel roads, as well as farm tracks on the mine property. The mining site is located in the vicinity of the following main roads:

Road R386: This provincial road traverses in a north-south direction in the vicinity of the site. The road links the towns of Prieska in the south with Niekerkshoop in the north.

Unpaved Road: This road is used to access the site. It turns off from the R386 and is approximated 20km in length.

Activities associated with the Thunderflex mine that is expected to make use of these roads include:

- the transportation of mining personnel to and from the site
- delivery of supplies and materials
- the transportation of the rough and uncut diamonds for further beneficiation.

These transport operations will make use of passenger vehicles, light delivery vehicles, security/armoured vehicles and mini-busses/busses and very limited heavy vehicles.

Haul Roads

Haul roads will continuously be created in order to access excavations, but they will also continuously be rehabilitated. Main haul roads will have a minimum width of 8 m, and secondary/pit roads will be 6 m wide. No roads will be wider than 12 m.

Mining schedule

The ore body will be mined according to a mine block design, which were determined by bulk sampling done on the application area and were defined by utilising property boundaries and geological parameters, i.e. bedrock features, gravel type and thickness, and bedrock elevation. The mining schedule and development phases are provided in Table 4 and Table 5 respectively. The overall mining schedule is guided by grade, mining costs and commodity price fluctuation and therefore it may have to be adapted from time to time as determined by these factors.

Expected life of mine for the Thunderflex operation, based on the planned scale of operations and production rate, current mining costs and current diamond prices, is 10 years. Further drilling and mining exploration within the farm could bring in additional gravel volume; thereby extending life of mine.

Mining Procedures

Mine planning is discussed by the General Manager and Mine Manager on the site. The Mine design will have been done by the Mining Department, which design will then be handed down to the necessary persons involved in the mining applications. Any changes in mining areas are discussed with the Mining Department prior to implementation. The general mining procedure is as follows:

- Mining blocks will be set out as discussed with the General Manager according to the equipment at hand.
- Gravel from each block is to be processed separately.
- If two blocks are being processed at any one time then the blocks must be stockpiled separately.
- Any overburden must be stripped to such an extent that the gravel is fully exposed and no overburden is left behind.
- The mining of overburden with gravel to create porrel for density at the processing plant is not allowed.
- Mining into the soft bedrock to depth of between 10 – 30cm is allowed/preferred to ensure the reconciliation of all the gravel.
- Overburden can be ripped with the bulldozer to make stripping easier.
- The pushing off of overburden should be done to such an extent that the minimal area of any open face is disturbed or covered.
- All the gravel units must be ripped and crushed by the bulldozer to ensure proper liberation of the unit.
- Where the bedrock is too undulating to use the bulldozer, gravel should again be ripped, crushed by the bulldozer and then mined using an excavator.
- Ore will be transported to the plant using ADT's.
- Stripping will be moved with ADT's or Rigid Trucks.
- Main haul roads must have a minimum width of 8 m, and secondary/pit roads must be 6 m wide.

e) Policy and Legislative Context

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH / RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT
According to the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) mining operations can only commence once the applicant has received authorisation from the Department of Minerals Resources (DMR) in terms of their Mining Right application.	The title page makes reference to the approved Mining Right	A Mining Right has been applied for and has been accepted ((NC) 30/5/1/2/2/10084 MR).
According to the MPRDA (Act 49 of 2008) Environmental Authorisation is required before mining activities can commence.	This document as a whole serves that purpose	The environmental authorisation process is pending and this document is being compiled in order to fulfil the requirements thereof.
Section 38(1) (a) of the MPRDA requires that effect be given to the general objectives of integrated environmental management laid down in the NEMA. Integrated environmental management (IEM) is a philosophy, which prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development process in order to achieve a desirable balance between conservation and development.	This is contained in Part B: Environmental Management Programme Report	To be implemented upon the approval of the EMPR.
The required determination of a quantum of the financial provision as referred to in regulation 54 of the MPRDA, does not detract from the need for the EMP to identify all the environmental costs necessary to evaluate the achievement of the sustainable development objectives of the MPRDA. The EMP is, therefore, not merely a rehabilitation plan that identifies a quantum for financial provision, but rather a comprehensive programme that identifies all the costs necessary to inform the evaluation of the planning and implementation of a mining project.	This is contained in Part B: Environmental Management Programme Report	The financial provision has already been submitted with bank guarantees to the DMR.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH / RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT
Section 4(a) of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) state that sustainable development requires the consideration of all relevant factors including the following: (i) Disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied; (ii) Pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied; (iii) Disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided or where it cannot be altogether avoided, is minimised and remedied; (iv) Waste is avoided or where it cannot be altogether avoided, minimised and reused or recycled where possible and otherwise disposed of in a responsible manner; (v) Use and exploitation of non-renewable natural resources is responsible, equitable and considers the consequences of the depletion of the resource; and (vi) Development, use and exploitation of renewable resources and the ecosystems, of which they are part, do not exceed the level or 'critical limits' beyond which their integrity is jeopardised.	This is contained in Part B: Environmental Management Programme Report	To be implemented upon the approval of the EMPR.
Chapter 5 of NEMA (as amended), contain the EIA Regulations, as well as a schedule of activities that may have substantial detrimental effects on the environment and therefore require authorisation from the competent environmental authority.	This document as a whole serves that purpose. Listed activities are presented in Part A, Section d (i).	The environmental authorisation process is pending and this document is being compiled in order to fulfil the requirements thereof.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH / RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT
The National Environmental Management Act: Protected Areas Act (NEMPAA) (Act 57 of 2003) provides for the protection of ecologically viable areas that are representative of South Africa's natural biodiversity and its landscapes and seascapes. Chapter 2 lists all protected areas.	A specialist botanical assessment was performed by Dr Hugo Bezuidenhout in order to identify any protected and/or threatened ecosystems and results of the assessment are presented in Part A, section g, subsection iv(1a).	Not applicable. The mining operation does not fall within any protected area.
Section 52 of The National Environmental Management Act: Biodiversity Act (NEMBA) (Act 10 of 2004) states that the MEC/Minister is to list ecosystems that are threatened and in need of protection. Section 53 states that the Minister may identify any process or activity in such a listed ecosystem as a threatening process. A list of threatened and protected species has been published in terms of Section 56(1) GG 29657 GNR 151 and GNR 152, Threatened or Protected Species Regulations.	A specialist botanical assessment was performed by Dr Hugo Bezuidenhout in order to identify any protected and/or threatened ecosystems and/or nationally protected plant species that occur on the proposed mining right area. Results of the assessment are presented in Part A, section g, subsection iv(1a). Control measures are contained in Part B: Environmental Management Programme Report	A permit application regarding protected plant species need to be lodged with DENC. Control measures are to be implemented upon the approval of the EMPR.
According to Section 22(1) of Chapter 5 of NEMBA the following activities are also prescribed as restricted activities - (a) Allowing any specimen of an alien or listed invasive species to grow, breed or multiply; (b) Allowing the movement or spread of a specimen of an alien or listed invasive species; (c) Releasing a specimen of an alien or listed invasive species.	A specialist botanical assessment was performed by Dr Hugo Bezuidenhout in order to identify any alien or listed invasive species that occur on the proposed mining right area. Results of the assessment are presented in Part A, section g, subsection iv(1a). Control measures are contained in Part B: Environmental Management Programme Report	Control measures are to be implemented upon the approval of the EMPR.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH / RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT
In terms of the terms of Section 1 of the National Water Act, (Act No. 36 of 1998), a “water resource” includes a watercourse, surface water, estuary, or aquifer. In terms of Section 21 a licence is required for: a) taking water from a water resource; (b) storing water; (c) impeding or diverting the flow of water in a watercourse; (d) engaging in a stream flow reduction activity (such as in section 36); (e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1); (f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit; (g) disposing of waste in a manner which may detrimentally impact on a water resource; (h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process; (i) altering the bed, banks, course or characteristics of a watercourse; (j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and; (k) using water for recreational purposes.	A specialist surface water assessment was performed by Mr Renier Pretorius in order to identify any surface water features that occur on the proposed mining right area, along with any risks related to the proposed activity. Results of the assessment are presented in Part A, section g, subsection iv(1a). Control measures are contained in Part B: Environmental Management Programme Report	A water use application has been lodged with DWS and is currently in process. Control measures are to be implemented upon the approval of the EMPR.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH / RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT
The World Heritage Convention Act (Act 49 of 1999) Recognises that the cultural heritage and the natural heritage are among the priceless and irreplaceable possessions, not only of the Republic, but of humankind as a whole. It also acknowledges that the loss, through deterioration, disappearance or damage through inappropriate development of any of these most prized possessions, constitutes an impoverishment of the heritage of all the peoples of the world and, in particular, the people of South Africa,	A specialist heritage impact assessment was performed by Paleo Field Services in order to identify any potential cultural and heritage impacts related to the proposed activity. Results of the assessment are presented in Part A, section g, subsection iv(1a). Control measures are contained in Part B: Environmental Management Programme Report	Control measures are to be implemented upon the approval of the EMPR.
The National Heritage Resources Act (Act No. 25 of 1999) legislates the necessity for cultural and heritage impact assessment in areas earmarked for development, which exceed 0.5 ha or linear development exceeding 300 m in length. 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).	The specialist heritage impact assessment identifies any potential heritage impacts related to the proposed activity and results thereof are presented in Part A, section g, subsection iv(1a). Control measures are contained in Part B: Environmental Management Programme Report	Control measures are to be implemented upon the approval of the EMPR.
Section 7 of the National Forests Act (No. 84 of 1998) state that no person may cut, disturb, damage or destroy any indigenous, living tree in a natural forest, except in terms of a licence issued under Section 7(4) or Section 23; or an exemption from the provisions of this subsection published by the Minister in the Gazette. Section 15 prevents any person to cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister.	The specialist botanical assessment identifies all protected tree species that occur on the proposed mining right area. Results of the assessment are presented in Part A, section g, subsection iv(1a). Control measures are contained in Part B: Environmental Management Programme Report.	A permit application regarding protected tree species need to be lodged with DAFF. Control measures are to be implemented upon the approval of the EMPR.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH / RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT
The Northern Cape Nature Conservation Act (Act No. 9 of 2009) aims to provide for the sustainable utilisation of wild animals, aquatic biota and plants. Section 3(a) and 4(a) states that no person may, without a permit by any means hunt, kill, poison, capture, disturb, or injure any protected or specially protected animals. Section 12 (1) states that no person may, on a land of which he or she is not the owner, hunt a wild animal without the written permission from the landowner. Section 49 (1) and 50 (1) states that no person may, without a permit pick, transport, possess, or trade in a specimen of a specially protected (Schedule 1) or protected (Schedule 2) plants. Section 51(2) states that no person may, without a permit, pick an indigenous plant (Schedule 3) in such manner that it constitutes large-scale harvesting.	The specialist botanical assessment identifies all provincially protected plant species that occur on the proposed mining right area. Results of the assessment are presented in Part A, section g, subsection iv(1a). Control measures are contained in Part B: Environmental Management Programme Report.	A permit application regarding provincially protected plant species as well as for large-scale harvesting of indigenous flora need to be lodged with DENC. Control measures are to be implemented upon the approval of the EMPR.
This Conservation of Agricultural Resources Act (Act No. 43 of 1983) makes provision for the conservation of agricultural land. Section 5 prohibits the spreading of weeds, while Section 6 and Regulation 15 and 15 E of GNR 1048 addresses the implementation of control measures for alien and invasive plant species. Bush encroacher species are controlled in terms of Regulation 16; where land users of an area in which natural vegetation occurs and that contains communities of encroacher indicator plants are required to follow sound practices to prevent the deterioration of natural resources and to combat bush encroachment where it occurs.	The specialist botanical assessment identifies alien or listed invasive species and potential encroacher species that occur on the proposed mining right area. Results of the assessment are presented in Part A, section g, subsection iv(1a). Control measures are contained in Part B: Environmental Management Programme Report	Control measures are to be implemented upon the approval of the EMPR.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH / RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT
Section 17 of the Fencing Act (Act No. 31 of 1963) states that any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5m on each side thereof and remove any tree standing in the immediate line of the fence. However, this provision must be read in conjunction with the environmental legal provisions relevant to protection of flora.	Control measures are contained in Part B: Environmental Management Programme Report	Control measures are to be implemented upon the approval of the EMPR.
The National Environmental Management Act: Waste Act, 2008 (Act 59 of 2008) reforms the law regulating waste management in order to protect human health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development.	This is contained in Part B: Environmental Management Programme Report	To be implemented upon the approval of the EMPR.
Section 25 of the Environmental Conservation Act (Act 73 of 1989) as well as the National Noise Control Regulation GNR 154 dated 10 January 1992, regulate activities regarding noise, vibration and shock.	Control measures are contained in Part B: Environmental Management Programme Report	Control measures are to be implemented upon the approval of the EMPR. This is also legislated by Mine Health and Safety from DMR and is to be adhered to.
Section 8 of the Atmospheric Pollution Prevention Act (Act No. 45 of 1965) regulates controlled areas, and Section 27 regulates activities with regard to dust control.	Control measures are contained in Part B: Environmental Management Programme Report	Control measures are to be implemented upon the approval of the EMPR. This is also legislated by Mine Health and Safety from DMR and is to be adhered to.
The Occupational Health and Safety Act, Act No. 85 of 1993 GNR 2281 of 1987 – 10-16 regulates environmental regulations for the workplace.	Control measures are contained in Part B: Environmental Management Programme Report	Control measures are to be implemented upon the approval of the EMPR. This is also legislated by Mine Health and Safety from DMR and is to be adhered to.
The South African Civil Aviation Regulation Act (Act 13 of 2009) controls markings of structures that may influence aviation through the Civil Aviation Technical Standard, SA-CATS-AH 139.01.33 Obstacle Limitations and Markings outside Aerodrome or Helicopters.	The project information is contained in Part A, section d(ii).	Not applicable, the highest structure that would be constructed at the proposed development would be the lighting conductors, which would have a height of 25m.

f) Need and desirability of the proposed activities

A resource statement for alluvial diamonds contains three elements, i.e. size or tonnage, grade and diamond value. Tonnage estimates can be reasonably accurate because of the high degree of continuity of data between boreholes which has been confirmed by drilling and mining operations. Grade estimates are less certain. This is mainly due to the very low concentration and the extreme irregular distribution of diamonds in these deposits. The diamond value or its selling price depends on a number of factors: colour, clarity, stone size and shape. An average value can only be determined from the valuation of a large representative parcel of diamonds recovered from the deposit. Normally parcels of 2 000 carats are regarded as sufficient to evaluate the average diamond value of a deposit.

A Prospecting Right application was lodged and prospecting done with bulk sampling, which indicated that there are areas on the properties that can be viably mined with grade and quality determined with the bulk samples taken off the property.

Exploration results for Farm 23 and Farm 29

Thick upper alluvial gravel terraces are Farm 23 (Figure 5). It has been argued that remnants of the Upper Terrace on Farm 23 are related to a tight abandoned palaeo-channel loop, encircling an out crop of the Kuruman Formation which consists of banded-ironstone and shales.

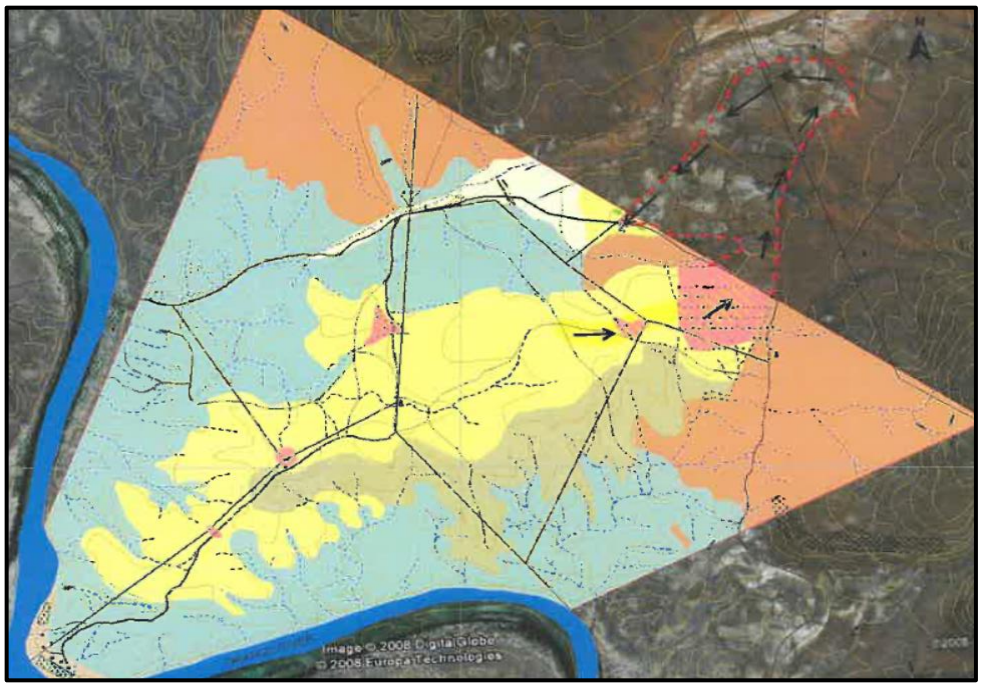


Figure 5. Possible outline of gravels on Farm 23 with palaeo-flow direction.

Drilling

Methodology

The initial drilling programme was designed to broadly outline the areas underlain by primary gravels on a portion of Farm 23 (Figure 6), near the boundary with Engelde Wilgeboomfontein (Farm 22). It was carried out by Saamstaan Boere during August 2008, using conventional truck-mounted 8 inch percussion drilling rig. All borehole positions were recorded using a handheld Garmin GPS ().

During Drilling the level of contamination of the samples was kept to a minimum. Samples representing every 0.5 m advance were collected for observation and, as a result, the depth estimates of lithological contacts could be noted to within 0.25 m. The drill was under constant observation from a field assistant, Mr Christo Lombaard. Each sample per boreholes used in this report was logged by the author based upon macroscopic examination of the drill cuttings on a half meter basis.

Apart from the normal lithological description note was taken of the BIF content as this gives an indication of the concentrating potential of the fluvial system at the time of deposition in terms of heavy minerals. Special note was also made of heavy, well compacted, boulder gravels. The results were noted in field log sheets. The logs were later computerized and summarized.

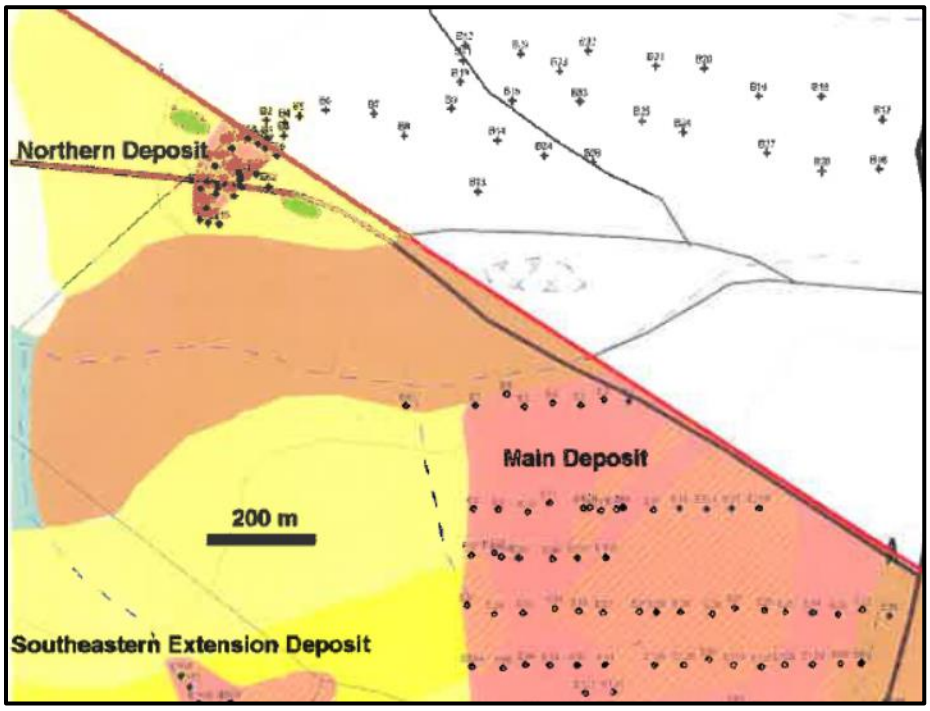


Figure 6. Position of boreholes drilled on Farm 23 (North of red boundary line)

Results

A total of 31 boreholes, totalling 207,5 m were logged. Three boreholes did not reach bedrock. Drilling results are summarized in the two tables below:

	Number	%
Boreholes Drilled	31	
Rooikoppie Intersections	28	90
Primary Gravel Intersections	25	81

	Maximum	Minimum	Average
MAIN DEPOSIT			
Rooikoppie Thickness (m)	2.5	0.1	0.5
Primary Thickness (m)	6.5	0.5	3.3
Overburden Thickness (m)	4.7	0	1.9
Overburden/Primary Ratio	6.6	0	0.9

Average is based on data points and not weighted area average

Drilling has shown the Upper terrace gravels found on Farm 22 continues onto Farm 23. A GIS programme, Didger3, was used to outline the drill intersected gravels on Farm 23 and calculate this outlined area (Figure 7). The average drill gravel intersection was used for both the Primary and Rooikoppie gravels.

The table below summarizes volume and tonnage calculation for an area on Farm 23, which has been subjected to limited drilling:

	Area (m^2)	Volume (m^3)	Thickness (m)	SG	Tonnes
Rooikoppie Gravel	455,000	227,500	0.5	2.80	637,000
Primary Gravel	455,000	1,501,500	3.3	2.20	3,303,300
TOTAL		**1,729,000**			**3,940,300**

Rooikoppie gravel, overlaying possible primary calcretised gravels, occur a few hundred meters further north of the area that has been drilled. This area, which is slightly smaller than the area drilled could well substantially increase the total gravel resource on Farm 23.

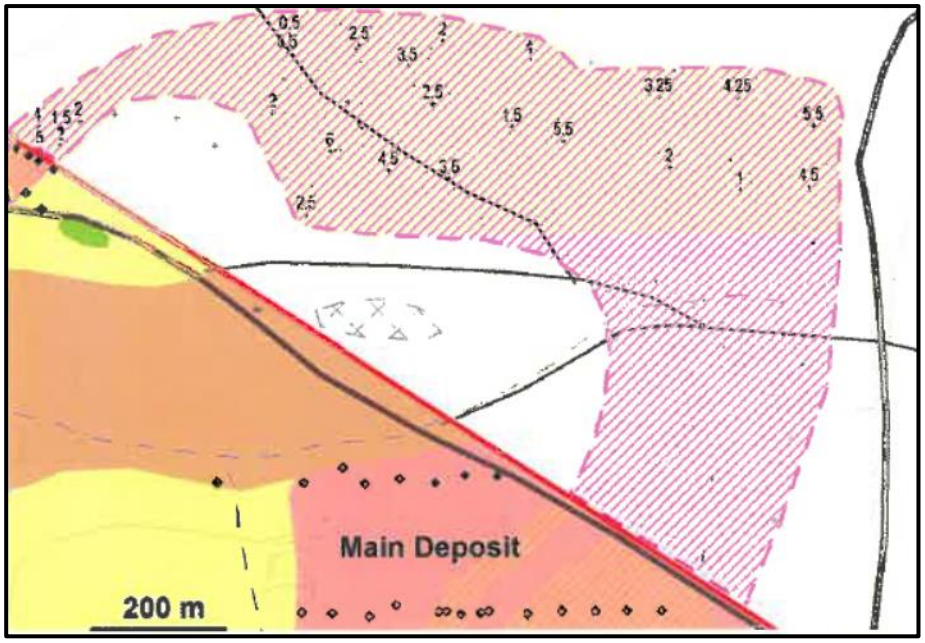


Figure 7. Primary gravel thickness in metre. Area thought to be underlain by primary Gravels and used for resource estimation in indicated by hatching.

Bulk sampling

Methodology

Bluechip Mining and Drilling has started with a bulk sampling operation on the Upper Gravels of Farm 22. Grade and diamond values obtained from this bulk sampling can also be used for the same gravels on Farm 23.

Thunderflex has also done five observation trenches (Figure 8). This allowed for the confirmation of the proposed geological model and some estimate of the likelihood of economic potential of these gravels.

The amounts of material removed on the five trenches were:

220 m x 100 m x 3 m = 66 000m³ amount removed for the first four trenches
50 m x 80 m x 3 m = 12 000m³ amount removed for the fifth trench
Total removed = 78 000m³ excavated up to date (Figure 9)

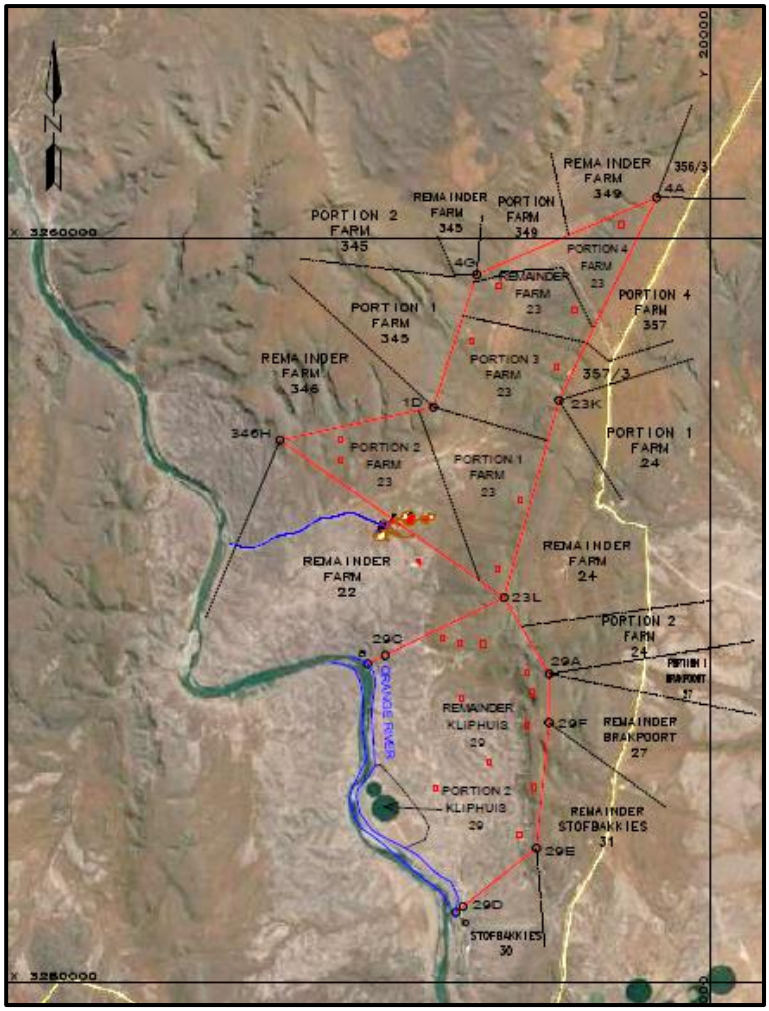


Figure 8. Location of bulk sampling activities.

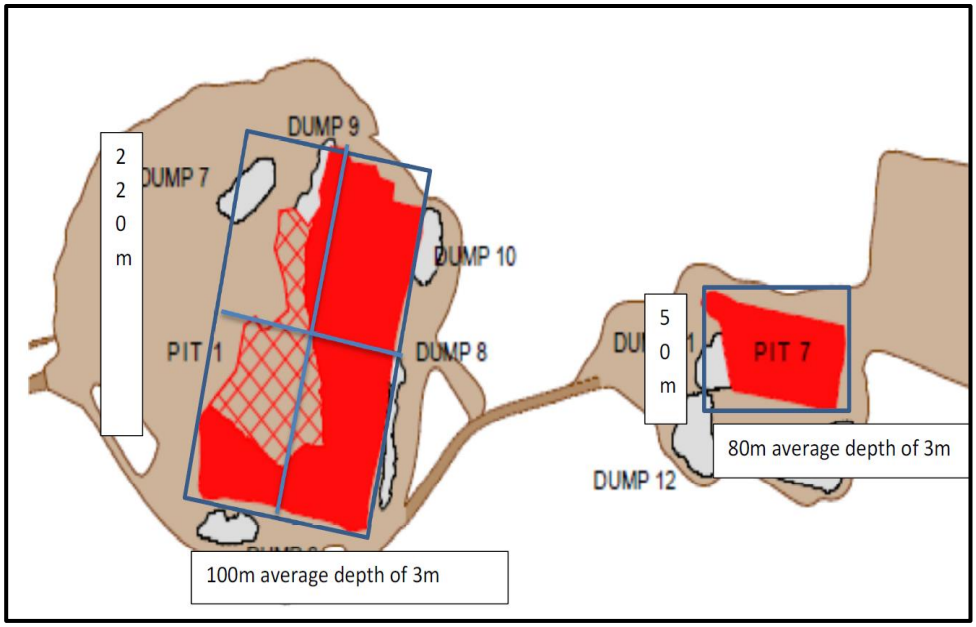


Figure 9. Surveyed map of trenches on the ground with measurements.

About 60% of material was screened, which calculated to about 46 800 m³ materials that was backfilled immediately and 31 200 m³ that was put through the processing plant.

78 000 m³ x 2.2 = 171 600 tons / 100 = 4 783 total carats recovered / 1 716 = 2.78 carats per 100 tons worked up to date.

The excavated gravels from the trenches were processed through a rotary pan plant to determine grade and diamond quality.

Results

Gravel was encountered in the lower lying areas of the farm portions. Overburden comprises of thin layers of Hutton soils and sands, overlying the Calcrete and Calcretised sands covering the gravel deposits. These Calcrete layers vary in thickness as well as consolidation, and can contain minor Ventersdorp lava and/or clasts.

The average gravel composition comprises primarily of high percentages of Ventersdorp lava's and Banded Iron Formation (BIF), with minor constituents of Quartz, Quartzite, Chert, Granite, Agate and Clasts are sub-angular to rounded and varies in size from < 2 mm to > 150 mm. On average the gravels are not sorted, but sorting has been encountered in some of the drill holes. The gravel matrix varies from coarse sand to fine clay rich sand, Calcrete and clay. The thickness of the gravel varies from thin (< 0.5 m) to thick (> 6 m), with sand bars and lenses found as recurring layers in between the gravel deposits.

Conclusion

Diamondiferous gravel deposits have been found on the above mentioned farms as a result of the exploration conducted to date. An average grade of 2.7 carats per 100 tons has been obtained during the period of February 2014 and February 2015. Further drilling and bulk sampling in conjunction with further geological modelling of the drill results will give a defined gravel reserve and grade has thus enabled the applicant to apply for a Mining Right with a reserve determination. Upper terrace gravel resources of nearly 4 million tonnes have been estimated to date from the drilling results. This resource could well exceed 5 million tonnes with further drilling recommended.

g) Motivation for the preferred development footprint within the approved site including a full description of the process followed to reach the proposed development footprint within the approved site

In order to ensure that the proposed development enables sustainable development, a number of feasible options must be explored. Motivation for the footprint of the actual mining operation (i.e. excavations) will not be provided here, as the location of the mine is determined by the geological location of the mineral resource (as discussed in section f). Therefore, only the footprint of additional infrastructure as seen in Figure 10 will be motivated in this section.

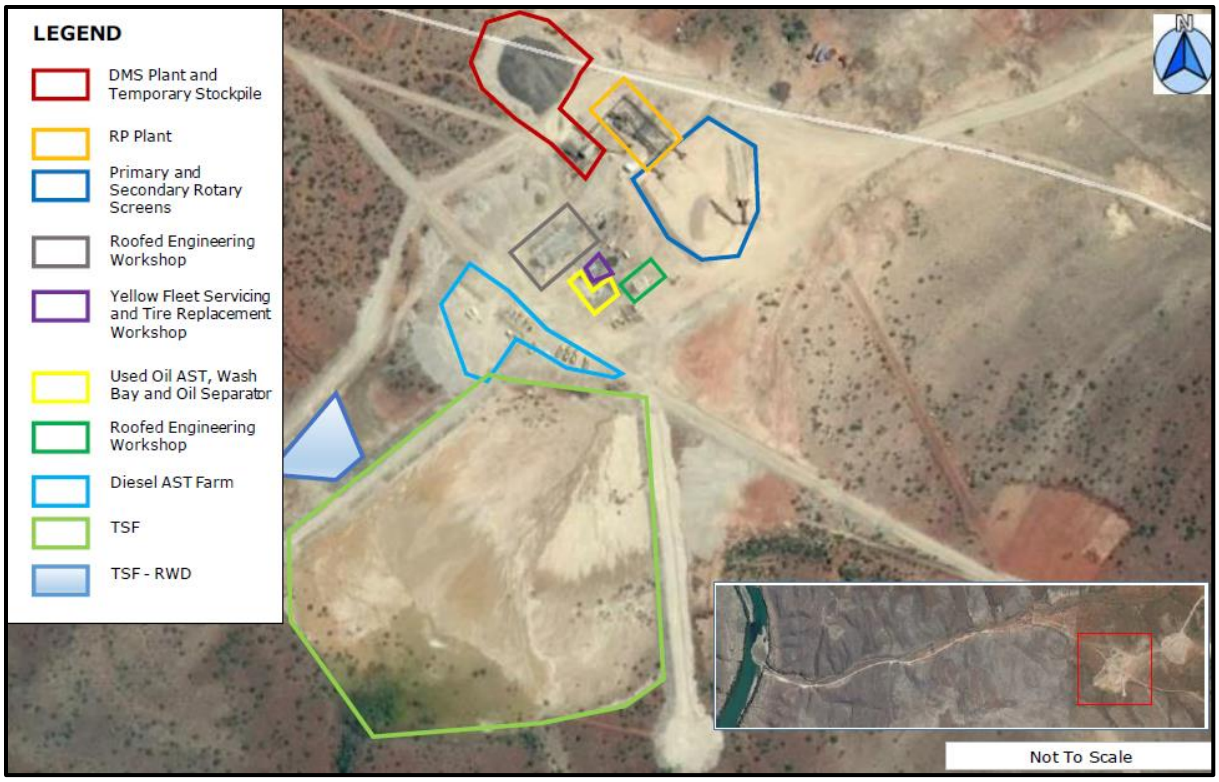


Figure 10. Site layout map of the Thunderflex operation.

Mine site location

Mining infrastructure was strategic placed by incorporating mining project demands, environmental sensitivities and IAP concerns, as identified during the EIA process. Thus, the mining site location is primarily based on proximity to the access roads, proximity to the areas earmarked for mining and limited additional impact on the environment and heritage resource. This renders the consideration of further alternative locations in terms of the mine site location, other than the mine residue deposits, unnecessary.

Fuel storage tanks

Alternatives for fuel storage include surface storage, underground storage and the storage of fuel in mobile tanks with a metal bund wall. Underground storage has an adverse negative pollution potential, because it is not easy to monitor leakages. Remediation measures are also not as effective as compared to surface storage tanks. Mobile tanks are viable option for infield screening activities, but the best viable long term option is the instalment of fuel tanks within a concrete bund wall. The final location of the fuel storage tanks were determined based on proximity to mining operations.

Water use

A pipeline was considered to be the best long term option for transferring water from the Orange River. Therefore, a pipeline route was designed based on the principle of minimum impacts to the environment and to avoid the disturbance of graves.

Mine residue dam

The current locality of the mine residue dam was selected based on the following considerations:

- The locality is already mined out
- It is within reach (1000 m) of the treatment plant
- It is situated near the access road to the mine
- No underlying ore bodies or geological discontinuities
- No geomorphological impacts
- No structures, dwellings or other points of risk on down-stream side
- Convenient material nearby for construction of dam
- Top soil from the treatment process will be available for final rehabilitation

The slimes dam was assessed by MVD Kalahari in order to evaluate the capacity and risks of the current slimes dam. A standard slimes dam design was established by them in order to maximise the holding capacity of the slimes dam and to minimise risks in terms of general safety and the DWS regulations.

i) Details of the development footprint alternatives considered

The consideration of alternatives is a critical component of the EIA process, where an appropriate range of alternatives require consideration whilst achieving the desired objective of the proposed project. In order to ensure that the proposed development enables sustainable development, a number of feasible options must be explored. The various alternatives were assessed in terms of logistical practicality, environmental acceptability and economic feasibility. Alternatives for the locality of the mining operation do not form part of the discussion as the location of the mine is determined by the geological location of the mineral resource (as discussed in section f).

Land use

No specialist comparative land use assessments were conducted, but the mining area has a low agricultural potential. The size and depth of the mining deposit has been determined by means of an extensive exploration programme (as presented in section f). Therefore mining land has been determined as the most feasible alternative. However, to ensure that the grazing use of the farms is not permanently lost due to mining activities, the mine will have to promote rehabilitation strategies to ensure that open pits are backfilled. There will be infield screening to ensure that all oversize material is deposited back into the pits. This material should be covered with the overburden (where available), and topsoil that has been previously put aside for this purpose. The post-mining land use should be determined so that the farms can still be used for grazing after mine closure.

Project infrastructure

Alternatives and considerations pertaining to the project infrastructure were discussed in section g.

Mining method

The mining method of open pits with continued backfilling is the only economic viable method currently being used by the diamond fraternity. There is no alternative mining method for the mining of alluvial diamonds.

Proceed without the mine (no go)

Land use

The current land use is grazing, with a low stocking rate for the region. If the mining operation does not continue, the farming of sheep and game will persist. The most significant activity associated with grazing is the provision of water. This could have a potential impact on the existing surface water features and ground water resource. Therefore alternative water sources are needed. Existing boreholes will be used as a substitute to provide water for animals. The mining operation will not abstract any ground water, while this alternative land use will require the use of ground water. Cumulative impacts associated to grazing include overgrazing, with a potential of desertification.

Socio-economy

The Thunderflex mining project plan is to employ between 35 and 45 people. The non-approval if this mining operation would impact negatively on the employment rate for the region and the families who are likely to benefit from the positive employment opportunities. Simultaneously, it may have a negative effect on the economy of South Africa and the diamond industry as a whole. Substantial tax benefits to the State and Local Government will also be lost.

Furthermore, the mining operation's commitment to invest in Human Resource development, Infrastructure Development Projects, Sustainable local economic development and Small and Medium Enterprises will be lost.

Biodiversity

The implementation of the Thunderflex mine will have a potential impact on the biodiversity through removal of indigenous vegetation and destruction of habitats. If no mining activities were to continue, the status quo would apply and no damage would accrue to the environment.

Heritage and cultural resources

In the event that the mining operation does not proceed, the heritage resources will remain as is. The protection and preservation of these resources are therefore not guaranteed. However, if the mining operation is approved, the heritage resources will be protected through the demarcation of no-go zones and fencing off of graves.

ii) Details of the Public Participation Process Followed

The consultation process with interested and affected parties (neighbouring farmers and land owners) was completed as this was also prerequisite prior to commencing the current prospecting operations on site. It was however repeated for the Mining Right application. There are also agreements in place with some of the surface owners that are affected already (please find agreements attached).

The process as described by NEMA for Environmental Authorisation was followed. Please refer to the table in section h(iii), which lists the identified Interested and Affected Parties. The landowner, and or occupants and direct neighbours were consulted personally and through a letter that was hand-delivered. A site notice was placed at the entrance gate towards Prieska and at the other gate on the Niekerkshoop gravel road. With this site notice, all passers-by were requested to submit any written comments to be forwarded to the designated consultant (response pending). Please refer to **Appendix 6** for photographic evidence as well as proof of consultation.

An advert (Notice) was also placed in the DFA on 12 May 2015 to notify all other interested and affected parties of the proposed mining operation.

iii) Summary of issues raised by I&APs

A list of all Interested and Affected Parties. X indicates that IAPs were consulted with		Date Comments Received	Issues Raised	Consultant's response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or response were incorporated
AFFECTED PARTIES					
Landowner/s					
Remainder Farm 23 T4555/2011 **Canton Trading 302 (Pty) Ltd**	X	21 May 2015	No issues raised	N/A	N/A
Portion 1 Farm 23 T1015/1992 **JJ Botha ID 4302035012083**	X	25 May 2015	No issues raised	N/A	N/A
Portion 2 Farm 23 T1015/1992 **JJ Botha ID 4302035012083**	X	25 May 2015	No issues raised	N/A	N/A
Portion 3 Farm 23 T1975/1989 **JJ Botha ID 4302035012083**	X	25 May 2015	No issues raised	N/A	N/A
Portion 4 Farm 23 T4555/2011 **Canon Trading 302 (Pty) Ltd**	X	21 May 2015	No issues raised	N/A	N/A
Remaining Extent Farm 29 T1502/1976 **JJ Botha ID 4302035012083**	X	25 May 2015	No issues raised	N/A	N/A
Portion 2 Farm 29 T965/2004 **Temdale Eiendomme (Pty) Ltd**	X	No comments received yet			
Lawful occupier/s of the land					
Not applicable					
Landowners or lawful occupiers on adjacent properties					
Mrs HJM Saaiman P O Box 420 Prieska 8940 Cell number: 071 264 1893	X	21 May 2015	No issues raised	N/A	N/A
Municipality					
Siyathemba Local Municipality P O Box 16 Prieska 8940 Mr Piet Papier	X	04 June 2015	Requested a meeting		
Organs of State (Responsible for infrastructure that may be affected Roads Department, Eskom, Telkom, DWA					
ESKOM Environmental Division P O Box 356 Bloemfontein 9300 Attention: Ms A van Gensen Tel: 051 – 402 2040 e-mail: genseal@eskom.co.za	X	No comments received yet			
Communities					
Not applicable					

A list of all Interested and Affected Parties. X indicates that IAPs were consulted with		Date Comments Received	Issues Raised	Consultant's response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or response were incorporated
AFFECTED PARTIES (cont.)					
Dept. Land Affairs					
Department of Agriculture, Land Reform and Rural Development P O Box 28 De Aar 7000 Attention: Ms N Yende Tel: 053 – 631 3631 Fax: 053 – 631 0564 e-mail: nyende@ncpg.gov.za					
Traditional Leaders					
Not applicable					
Dept. Environmental Affairs					
Northern Cape Department of Environment and Nature Conservation Private Bag X6102 Kimberley 8300 Tel: 053 807 7430 Fax: 053 831 3530					
Other Competent Authorities affected					
Department of Agriculture, Forestry and Fisheries Attention: Jacoline Mans Tel: 054 – 338 5909 Fax: 054 – 334 0030 Web: www.daff.gov.za e-mail: JacolineMa@daff.gov.za	X	22 May 2015	Concerned about the potential impact on NFA Listed Protected Tree Species		
OTHER AFFECTED PARTIES					
None					
INTERESTED PARTIES					
None					

iv) The Environmental attributes associated with the development footprint alternatives

(A) BASELINE ENVIRONMENT: TYPE OF ENVIRONMENT TO BE AFFECTED BY THE PROPOSED ACTIVITY

1. GEOLOGY

Regional Geology

The Orange River valley within the vicinity of the site is underlain by flat-lying Dwyka tillite and siltstone of the Karoo Supergroup. Dwyka sediments were deposited by the Dwyka ice sheet with flow direction from the north-east, in a broad valley, roughly corresponding with the present Vaal-Orange system.

The Dwyka comprises matrix supported diamictite, a sedimentary calcareous containing mixture of clay and boulders, of both local and transported lithologies. The clays and boulders include dropstone-bearing mudstone, shale and silt. Underlying the Dwyka, and exposed where the Orange Rive has carved through the sequence, are lavas and pyroclastic material of the Ventersdorp Supergroup, overlain in places by sediments of the Transvaal Supergroup. Transvaal Supergroup sediments comprise shale, quartzite and dolomite.

The bedrock is cut in places by faults and dolerite sheets which are rarely exposed at surface and can only be mapped using geophysics. A series of faults trending north-south is located west and south of the Thunderflex operation and the Orange River.

The present surface of the Dwyka, which also underlays the northern and eastern perimeter of the Thunderflex operation, comprise a gentle undulating terrain lying at an elevation of the between 1 050m and 1 100m above mean sea level (amsl).

The Orange River has carved into the surface to a depth of between 90m and 150m. Due to the irregularity of the pre-Dwyka surface, several reaches of the Orange River are superimposed on pre-Dwyka topography highs, which, due to its relative resistance to erosion, give rise to more rugged topography. In this area, the Orange River is confined to gorges with increased river gradients. In contrast, the easily-eroded Dwyka in the vicinity of the Thunderflex site has been dissected by minor tributaries of the Orange River, giving rise to a trellis-type drainage pattern. Within these regions, the dolomitic Ghaap Plateau represents an ancient surface of Transvaal Supergroup rocks.

The alluvial diamonds of the Middle and Lower Orange systems have several probable primary source areas, including:

- Diamondiferous kimberlite of Lesotho eroded by the present Orange River,
- Diamonds from the same source as the Lichtenburg- Western Transvaal diamond fields that were eroded Vaal-Harts system,
- Diamonds derived from the kimberlites of the Kimberley area,
- Diamonds from Botswana and the Postmasburg fields including the Finch kimberlite.

Local Geology

The Thunderflex operation is situated upon weathered material of the Ghaap Group with iron rich formations located west, north and east of the Diamond Recovery Pans. A surface comprising a mixture of diamictite and tillite of the Dwyka sediments is located south and south west of the Diamond Recovery Pans.

The staff quarters and water pipe line booster unit are situated on the edge of the weathered Ghaap material and a formation of carbonate rocks comprising dolomite and subordinate limestone. Similar carbonate rocks are found approximately 1.5km south of the Diamond Recovery Pans.

Diamond bearing gravels are encountered in the lower lying areas of the Thunderflex site. Overburden comprises thin layers of Hutton soils and sands, overlaying a diamictite and tillite mixture with the gravel matrix composed of calcrete sands and clays. The diamond bearing gravels are found beneath the diamictite and tillite mixture that can vary in thickness.

Average gravel composition comprises high percentages of Ventersdorp lavas and Banded Iron Formations (BIF) with constituents of quartz, quartzite, chert, granite and agate to lesser extent. Clasts are sub-angular to rounded and varies in size from <2mm to 150mm. The thickness of the gravels can vary between <0,5m to 6m.

2. CLIMATE

Regional Climate

The mine is located in a semi-arid region, receiving on average about 250 mm of rain in the west to 500 mm on its eastern boundary. The rainfall is largely due to showers and thunderstorms falling in the summer months October to March. The peak of the rainy season is normally March or February. The summers are very hot with cool winters. The nearest weather station to the mine is at Douglas but due to the limited range of information available from this station and the number of periods with broken records, the data from the weather stations at Kimberley will also be used.

Rainfall

Average monthly and annual rainfall for the site and number of days per month with measureable precipitation is presented in the table below:

MONTH	60 MINUTES	24 HOURS	24 HOURS IN 50 YEARS	24 HOURS IN 100 YEARS
January	35.8	57	65.1	73.8
February	70.1	82	58.9	66.5
March	63.7	67.8	72.1	81.4
April	25.7	51.6	65.9	75.2
May	14.6	54.6	36.8	42.4
June	19.1	67.5	26	30.4
July	12	26.7	26.6	31
August	17	58.2	23.4	27.3
September	16.3	26.7	24.1	28
October	37.6	59.2	53.8	61.8
November	25.2	60.1	41.2	46.7
December	59.9	64.5	70.7	80.9

Source: Directorate: Climatology South African Weather Bureau – Station 0290468:- Kimberley 1970 – 2003

The maximum rainfall intensities are presented in the table below:

MONTH	60 MINUTES	24 HOURS	24 HOURS IN 50 YEARS	24 HOURS IN 100 YEARS
January	35.8	57	65.1	73.8
February	70.1	82	58.9	66.5
March	63.7	67.8	72.1	81.4
April	25.7	51.6	65.9	75.2
May	14.6	54.6	36.8	42.4
June	19.1	67.5	26	30.4
July	12	26.7	26.6	31
August	17	58.2	23.4	27.3
September	16.3	26.7	24.1	28
October	37.6	59.2	53.8	61.8
November	25.2	60.1	41.2	46.7
December	59.9	64.5	70.7	80.9

Source: South Africa (WB42) – Station 0290468:- Kimberley 1961 – 1990

Rainfall

The average monthly maximum and minimum temperatures are presented in the table below:

MONTH	DAILY MAXIMUM ®C	DAILY MINIMUM ®C
January	32.8	17.9
February	31	17.3
March	28.8	15.2
April	24.8	10.9
May	21.4	6.5
June	18.2	3.2
July	18.8	2.8
August	21.3	4.9
September	25.5	8.9
October	27.8	11.9
November	30.2	14.6
December	32.1	16.6
YEAR	**26.1**	**10.9**

Source: Directorate: Climatology South African Weather Bureau © 2000 – Station 0290468:- Kimberley 1960 – 2000

Wind

The prevailing wind direction for the area is north to north-north-west for the months of January to September and changing from north to sometimes westerly winds during October to December averaging 3.5 m/s (Kimberley 01/01/1990 – 31/08/200, Station 0290468).

Humidity and evaporation

The average monthly humidity is presented in the table below:

MONTH	AVERAGE (%)	MAXIMUM (%)	MINIMUM (%)
January	47	91	8
February	54	94	12
March	57	96	15
April	60	96	16
May	56	96	16
June	54	97	15
July	49	97	13
August	42	94	10
September	36	91	8
October	39	89	8
November	42	92	8
December	43	90	7
YEAR	**48**	**94**	**11**

Source: Directorate: Climatology South African Weather Bureau © – Station 0290468:- Kimberley 1960 – 2000

The average monthly evaporation is presented in the table below:

MONTH	EVAPORATION IN mm
	SYMONSPAN
January	365.6
February	279.1
March	235.8
April	169.1
May	135.1
June	108.6
July	130.1
August	181.2
September	252.6
October	314.8
November	345.5
December	378.6
YEAR	**2896**

Source: South African Weather Bureau – Station 0290468:- Kimberley 1957 – 1987

Incidents of Extreme Weather Conditions

- **Hail**

  Hail is sometimes associated with thunderstorms and mainly occurs in early to late summer (November to February). It occurs on average three times a year and although these storms may sometimes be severe and cause much damage, they usually impact on a relatively small area.

- **Frost**

  The period during which frost can be expected lasts for about 120 days (May to August). With extreme minimum temperatures to below -8ºC at night in the winter, frost development can be severe.

- **Droughts:**

  Droughts are common and may vary from mild to severe. During these periods dust storms sometimes occur, depending mainly on denudation of the surface.

- **Wind**

  High winds are unusual but when the do occur can uproot trees and take off roofs.

3. TOPOGRAPHY

The topography in the vicinity of the Thunderflex operation is described as plains with low relief, with a distinct escarpment going into closed hills with moderate and high relief. The topography ranges from terraces with a maximum altitude of 1 037 m above sea level to the flood plain of the Orange River, which lies at 930 m above sea level to the west.

The topography from the Diamond Recovery Plant slopes towards the north, towards an unnamed non-perennial tributary of the Orange River. In a more regional context, the topography slopes towards the Orange River to the west.

4. SOILS

The information on soils was obtained from the specialist botanical report done by Dr Hugo Bezuidenhout.

General terrain description

In terms of the dominant terrain unit and habitat characteristics (Figure 11), the slightly undulating midslope (3) is dominant in the landscape of the proposed mining area, which is closely associated with the Ag141 land type. The shallow (depth 0.1 – 0.3 m), clayey (15 – 20 % clay content) soil is well drained. The soil – rock complex is dominated by shallow Hutton soil form. A portion of the study area's soil surface has been degraded and disturbed by previously mining activities.

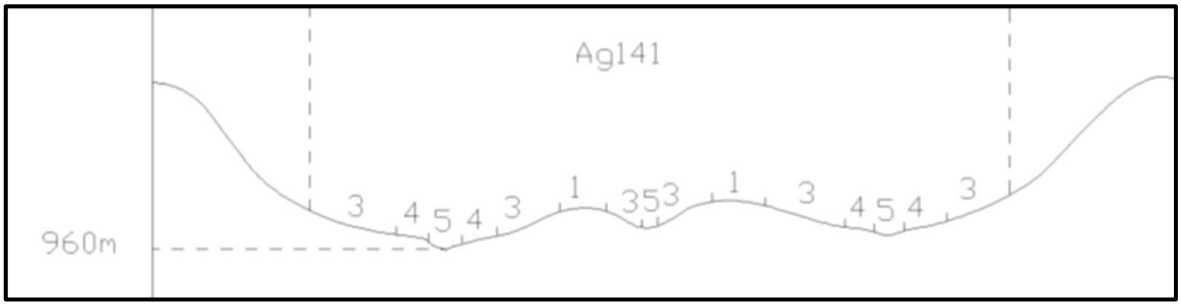


Figure 11. A terrain form sketch of the Ag141 land type of the study area (Land Type Survey Staff 2005)

The adjacent rolling hills are closely associated with the Fb385 and Ag114 land types. These hills were not surveyed because it was not in the identified proposed mining area. The adjacent Fc628 towards, and closely associated with the Orange River, was also not surveyed because it was out of the proposed mining area.

Pre-mining Land Capability

The area has not been irrigated and is engaged by livestock grazing, as a result has a low agricultural potential for cropping production. There are no centre pivots, irrigation schemes or active agricultural fields, which will be influenced by the proposed mining operation.

Prior to any mining activity the land capability correlated directly with the different soil forms. Before any historical mining activity the area would have been suitable for stock grazing and in some places would have had an arable capability.

5. NATURAL VEGETATION

The information on vegetation was obtained from the specialist botanical report done by Dr Hugo Bezuidenhout.

The landscape of the study area is dominated by a sparse shrubland with the woody *Senegalia mellifera* and the shrub-like *Rhigozum trichotomum* dominant. Two plant communities were recorded in the proposed mining area (Figure 12).

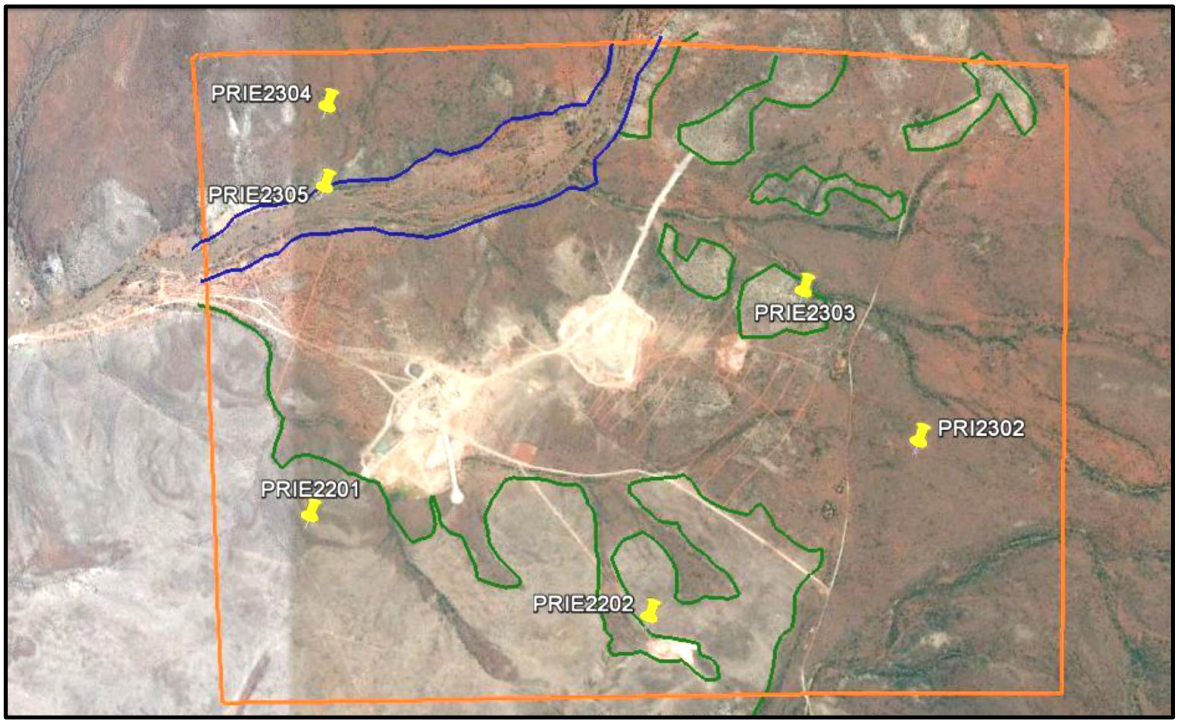


Figure 12. The darker reddish area represents the proposed mining area; while the whiter areas include areas where mining will not take place. The localities of sample plots are marked in yellow. The blue line represents the drainage line running through the proposed mining area.

The most conspicuous shrub in the shrubland is *Senegalia mellifera*, while the shrub-like *Rhigozum trichotomum* forms dense stands on a shallow (< 0.1 m) sandy (wind-blown) substrate. The poorly developed herbaceous layer is being dominated by the inconspicuous annual grass species *Enneapogon desvauxii* and *Oropetium capense*.

The woody layer has a low canopy cover of 10 % in the area, while the average height of the woody plant species is 1.5 m. The herbaceous layer also has a low canopy cover of 5 % while the average height of the herbaceous layer is 0.1 m. Other woody plant species that were recorded are the following: *Aloe dichotoma* (one single individual), *Boscia albitrunca* (sparse individuals), *Rhigozum obovatum, Ziziphus mucronata* (sparse individuals shrub-like), *Ehretia rigida, Lycium cinereum.*

In the herbaceous layer the following forbs and grass species were recorded: succulents *Aloe claviflora, Euphorbia* cf. *hypogaea*, *Hoodia gordonii, Kleinia longiflora*, and the conspicuous yellow flower *Zygophyllum* cf. *incrustatum* and the forbs *Aptosimum* sp., *Asparagus suaveolens*, *Barleria macrostegia, Limeum viscosum, Asclepias* cf. *burchellii*, *Osteospermum* sp., *Peliostomum leucorrhizum, Pentzia globosa, Phyllanthus parvulus, Plinthus sericeus, Pteronia glauca and Monechma incanum* and the grass species *Aristida congesta, Eragrostis lehmanniana, Stipagrostis obtusa and Stipagrostis uniplumis*. The semi-parasite *Loranthus* sp. on the branches of the *Senegalia mellifera* and geophyte *Moraea polystachya* were also recorded.

The sparse shrubland has two variants, the one variant with flat rocky outcrops of dolomite, limestone and chert, which appears whitish on the google image and the other darker reddish variant on the google earth image with shallow rocky soil, consisting of iron formation and jaspillite of the Griquatown Group in which the diamonds occur. The plant species composition is the same in both variants.

The dry drainage line of the *Ziziphus mucronata - Stipagrostis namaquensis* sparse woodland is being dominated by the woody plant species lining both side of the drainage line. Relatively deep (> 0.8 m) sandy soil occur in the middle of the drainage area and is dominated by the tall (> 0.1 m) *Stipagrostis namaquensis* with a canopy cover of 60 %. The dominant woody plant species is Ziziphus mucronata, while other trees like *Vachellia karroo* and *Searsia lancea* was also recorded. The shrubs *Rhigozum obovatum* and *Senegalia mellifera* were also recorded. In the herbaceous layer, apart from the dominant grass species *Stipagrostis namaquensis*, the grass species *Aristida congesta, Cenchrus ciliaris, Enneapogon cenchroides, Eragrostis lehmanniana, Stipagrostis obtusa* and *Stipagrostis uniplumis* were also recorded.

Not many forbs were recorded in the drainage line, but include *Berkheya spinosissima, Codon royenii, Lycium* sp.*, Plinthus sericeus* and *Zygophyllum* cf. *incrustatum*.

No declared invader plant species were recorded in the study area, but *Senegalia mellifera* and *Rhigozum trichotomum* are potential encroaching species. Protected plant species include *Hoodia gordonnii* (under NEMBA and NCNCA), *Aloe* claviflora (under NCNCA), *Aloidendron dichotoma* (under NCNCA) and *Boscia albitrunca* (under NCNCA and NFA).

6. NATURAL FAUNA

Common species

The fauna listed below are common species that have previously been found, or have the potential to occur in the mining area.

- **Birds**

  An extensive bird life can be found on the mine and specifically on the hills and small valleys with dense vegetation growth. A list of birds that have been spotted or are known to occur in the mining area, are listed in the table below.

BIRD LIST	
English Name	**Scientific Name**
Feral Pigeon	*Columba livia*
Rock Pigeon	*Columba guinea*
Redeyed Dove	*Streptopelia semitorquata*
Cape Turtledove	*Streptopelia capicola*
Laughing Dove	*Streptopelia senegalenses*
Namaqua Dove	*Oena capensis*
Diederik Cuckoo	*Chrysococcyx caprius*
Redchested Cuckoo	*Cuculus solitaries*
Barn Owl	*Tyto alba*
Pearlspotted Owl	*Glaucidiumperiatum*
Spotted Eagle Owl	*Bubo africanus*
Whiterumped Swift	*Apus caffer*
Little Switft	*Apus affinis*
Whitebacked Mousebird	*Colius colius*
Redfaced Mousebird	*Urocolius indicus*
Brownhooded Kingfisher	*Halcyon albiventris*

BIRD LIST (cont.)	
English Name	**Scientific Name**
Lilacbreasted Roller	*Coracias coudata*
Purple Roller	*Coracias naevia*
Hoopoo	*Upupa epops*
Scimitarbilled Woodhoopoo	*Rhino omastus cyanomelas*
Grey Hornbill	*Tockus nasutus*
Pied Barbet	*Tricholaema leucomelas*
Crested Barbet	*Trachyphouns vaillantii*
Rufousnaped Lark	*Mirafta Africana*
Clapper Lark	*Mirafta apiata*
Fawncoloured Lark	*Mirafta africanoides*
Chestnutbacked Finchlark	*Eremopterix verticallis*
European Swallow	*Hirundo rustica*
Greater Striped Swallow	*Hirundo cucullata*
Forktailed Drongo	*Dicrurus adsimilis*
Black Crow	*Corvus capensis*
Pied Crow	*Corvus album*
Ashy Tit	*Parus cinerascens*
Pied Babbler	*Turdoides bicolor*
Redeyed Bulbul	*Pycnonotus nigricans*
Groundscraper Thrush	*Turdus litsitsirupa*
Familiar Chat	*Cercomelafamiliaris*
Anteating Chat	*Myrmecocichlaformicivora*
Stonechat	*Saxicolaporquata*
Cape Robin	*Cossypha caffta*
Kalahari Robin	*Erythropygia paean*
Titbabbler	*Parisoma subcaeruleum*
Fantailed Cisticola	*Cisticolajuncididis*
Desert Cisticola	*Cisticola aridula*
Spotted Flycatcher	*Muscicapa striata*
Chat Flycatcher	*Melaenornis infuscatus*
Fiscal Flycatcher	*Sigelus silens*
Cape Wagtail	*Motacilla capensis*
Orange Striated Langclaw	*Macronyx capensis*
Lesser Grey Shrike	*Lanius minor*
Grassveld Pip	*Anthus cinnamomeus*
Fiscal Shrike	*Lanius collaris*
Glossy Starling	*Lamprotornis nitens*
Cape White Eye	*Zosteropspallidus*
Whitebrowed Sparrowweaver	*Plocepasser mahali*
House Sparrow	*Passer*
Great Sparrow	*Passer motitensis*
Masked Weaver	*Ploceus velatus*
Redbilled Quelea	*Quelea quelea*
Red Bishop	*Euplectes orix*
Longtailed Widow	*Euplectesprogne*

BIRD LIST (cont.)	
English Name	**Scientific Name**
Melba Finch	*Amdina erythrocephala*
Quail Finch	*Ortygospiza atricollis*
Pintailed Whydah	*Vidua macroura*
Shafttailed Whydah	*Vidua regia*
Blackthroated Canary	*Serinus atrogularis*
Swallowtailed Bee-Eater	*Merops hirundineus*
Yellow Canary	*Serinusflaviventris*
Kalahari Robins	*Erytrhropygia paean*
Dusky Sunbird	*Nectarinia fusca*
Common Quail	*Coturnix coturnix*
Cardinal Woodpecker	*Dendropicos fuscescens*
White-breasted Commorant	*Phalacrocorax cardo*
Grey Heron	*Ardea cinerea*
Black Headed Heron	*Ardea melanocephala*
Cattle Egret	*Bululcus ibis*
Hammerkop	*Scopus umretta*
Hadeda ibis	*Bostrychia hagedash*
Whitefaced Duck	*Dendrocygna viduata*
Egyptian Goose	*Alopochen aegyptiacus*
Yellowbilled Duck	*Anas undulate*
Redbilled Teal	*Anas erythrorhyncha*
Spurwinged Goose	*Plectropterus gambensis*
Secretary Bird	*Sagittarius serpentarius*
Black-breasted Snake Eagle	*Circaetus pectoralis*
Steppe Buzzard	*Buteo buteo*
Lanner falcon	*Falco biarmicus*
Greater Kestrel	*Falco rupicoloides*
Lesser Kestrel	*Falco naumanni*
Orange River Francolin	*Francolinus levaillantoides*
Helmeted Guineafowl	*Numida meleagris*
Redknobbed Coot	*Fulica cristata*
Whitewinged Black Korhaan	*Eupodotis aftaoides*
Crowned Plover	*Vanellus armatus*
Blacksmith Plover	*Vanellus coronatus*
Common Sandpiper	*Actitis hypoleucos*
Blackswinged Stilt	*Himantopus himantopus*
Spotted Dikkop	*Birhinus capensis*
Doublebanded Courser	*Smutsornus africanus*
Temminck's Courser	*Cursorius temminckii*
Whitewinged Tem	*Childonias leucopterus*
Burhell's Sandgro	*Ptercoles burchilli*

- **Mammals**

A list of all the fauna likely to be found at the Thunderflex Mine is presented in the table below:

MAMMAL LIST	
Scientific Name	**Common Name**
Suncus infinitesimus	Least Dwarf Shrew
Crocidura cyanea	Reddish-grey Musk Shrew
Chlorotohpha sclater	Golden Mole
Tadarida aegyptiaca	Egyptian Free-tailed Bat
Eptesicus capensis	Cape Serotine Bat
Nucteris thebaica	Common Slit-faced Bat
Rhinolophus clivosus	Geoffroy's Horseshoe Bat
Papio ursinus	Chacma Baboon
Tatera lencogaster	Bushveld Gerbil
Tatera brantsii	Highveld Gerbil
Gerbillurus paeba	Hairy-footed Gerbil
Desmodillus aricularis	Short-tailed Gerbil
Mus musculus	Domestic Mouse
Rhabilomys pumilio	Striped Field-Mouse
Saccostomus capestris	Pouched Mouse
Malacothrix typical	Large-eared Mouse (on calcrete)
Graphiuurs ocularis	Spectacled Dormouse
Mus minutoides	Pygmy Mouse
Aethomys namaquaensis	Namaqua Rock Mouse
Parotomys brontsii	Bronts' Whistling Rat
Otomys unisulcatus	Karoo Bushrat
Thallomys nigricauda	Black-tailed Tree Rat (camel-thorn)
Cryptomys hottentotus	Common Mole Rat
Rattus rattus	Domestic Rat
Lepus capensis	Cape Hare
Lepus saxatilis	Shrub Hare
Pedetes capensis	Springhare
Pronologus ruperstris	Smith's Red Rock Rabbit
Helogale parvula	Dwarf Mongoose
Cynictis penicillata	Yellow Mongoose
Atilax paludinosus	Water Mongoose
Galerella sanguinea	Slender Mongoose
Ictonyx striatus	Striped Polecat
Genetta genetta	Small Spotted Genet
Xerus inauris	Ground Squirrel
Funisciurus congicus	Striped Ground Squirrel
Atelerix frontalis	Cape Hedgehog
Felis caracal	Caracal
Felis lybica	African Wild Cat

MAMMAL LIST (cont.)	
Scientific Name	**Common Name**
Felis nigripes	Small Spotted Cat
Otocyan megalotis	Bat-eared Fox
Vulpes charma	Cape Fox
Canis mesomelas	Black-backed jackal
Hystrix africaeaustralis	Porcupine
Orycteropus afer	Aardvark
Phacochoerus aethiopicus	Warthog
Manis temniinckii	Cape Pangolin
Suricata suricatta	Meerkat
Sylvicapra grimmia	Common Duiker
Raphicerus campestris	Steenbok
Tragelaphus strepsiceros	Kudu

Endangered Species

The fauna listed below are endangered species that are most likely to occur in the area according to the Red Data Book – Birds (Barnes, Keith N, 2000) and the Red Data Book – Mammals (Smithers 1989 & Branch 1988). The following definitions apply:

Vulnerable

Taxa of which all or most populations are decreasing because of: over exploitation, extensive destruction or degradation of their habitat, or other environmental disturbances. This means that the species is considered to facing a high risk of extinction in the wild.

Rare

Taxa with small population sizes, which are not permanently endangered or vulnerable; but are potentially at risk.

- **Endangered mammals**

Scientific Name	Common Name	Status
Aonyx capensis	Cape Clawless Otter	Unknown
Felis lybica cafra	African Wild Cat	Vulnerable
Manis temminckii	Cape Pangolin	Vulnerable
Orycteropus afer	Antbear	Vulnerable
Atelerix frontalis	Cape Hedgehog	Rare
Naja nigricollis woodi	Black Spitting Cobra	Rare
Proteles cristatus cristatus	Aardwolf	Rare
Felis nigripes nigripes	Small Spotted Cat	Rare

- **Endangered birds**

Scientific Name	Common Name	State
Gyps coprotheres	Cape Vulture	Vulnerable
Gyps africanus	African Whitebacked Vulture	Vulnerable
Torgos tracheliotos	Lappetfaced Vultures	Vulnerable
Aquila rapax	Tawny Eagle	Vulnerable
Polemactus bellicosus	Martial Eagle	Vulnerable
Anthropoides paradiseus	Blue Crane	Vulnerable
Ardeotis kori	Kori Bustard	Vulnerable
Neotis ludwigii	Ludwig's Bustard	Vulnerable

7. SURFACE WATER

Information on surface water was obtained from the Surface Water Assessment Report, prepared by Renier Pretorius from MojaTerre (Pty) Ltd.

Water Resource Sensitivity

The Orange River is the only perennial water feature within the vicinity of the Thunderflex operation. The river is an important source of water for towns and agriculture downstream of the Thunderflex operation and is considered to be of moderate sensitivity.

The hydrogeological setting within the vicinity of the Thunderflex operation has a low susceptibility and vulnerability to contamination from surface sources and is considered to be of low sensitivity.

Catchment and Process Water Demands

The Thunderflex operation is situated within the quaternary drainage catchments D71D of the Boegoeberg Sub-Catchment. The Boegoeberg Sub-Catchment forms part of the Lower Orange Water Management Area.

There is only one surface water feature within 1 km of the Thunderflex operation, namely an unnamed non-perennial tributary of the Orange River. The tributary originates within the hilly topography located approximately 4 km north east of Thunderflex.

The Thunderflex DRP is located less than 700 m south of the main tributary corridor which trends east to west towards the Orange River whilst the Thunderflex TSF is constructed within a small branch of the tributary which trends south to north towards the main tributary. Plant personnel informed MojaTerre during the site visit that during excessive and prolonged rain events run-off water from the plant and mining area does reach the tributary.

The unnamed tributary flows westwards before joining the Orange River approximately 4 km west of the DRP and roughly 50 m downstream of the DRP river water abstraction pump station. After its confluence with the unnamed tributary, the Orange River flows northwards into the Boegoeberg Dam which is situated more than 70km north west of the Thunderflex operation.

The Department of Water and Sanitation operates two water monitoring stations on the Orange River of which one station is located upstream (D7H2) and the other downstream (D7H8) of the Thunderflex operation.

Flow data for the stations for the period 2010 to 2014 is summarised as average monthly river volumes in million cubic meters in the table below. Also included in this table is the estimated Thunderflex operation water demand on a monthly bases.

Year	D7H2 - Upstream	Thunderflex Demand	D7H8 - Downstream	Difference
2010	577	±0,037	585	8
2011	1932	±0,037	2030	97
2012	195	±0,037	171	-24
2013	191	±0,037	184	-8
2014	288	±0,037	287	-1

The presented data shows that the Thunderflex water demand is approximately 0.02 % of the lowest recorded river volume (171Mm3) for the data set. The calculated differences between upstream and downstream conditions are considered to be influenced by complex relationships between large scale factors such as accumulative abstractions, seasonal rainfall, evaporation, occasional droughts etc.

Water Quality

MojaTerre sourced water quality data for the DWS monitoring localities D7H2 and D7H8. The data set includes data recorded since 1965 to 2015 and are included in Annex C of the specialist report. Data presented in the data diagrams shows that, in general the water quality of the Orange River section between station D7H2 and D7H8 is described by DWS as good to very good. Additionally, no significant change in the concentration ratios of common anions and cations are observed between the two monitoring locations for the data set. Sample frequencies for both monitoring station during the last four years are not as comprehensive as during the earlier monitoring period. It is noted that, although river water quality at both monitoring stations is still describes as good, notable increase in constituent concentrations were evident since 2011.

Thunderflex has undertaken water analyses of water from the tailings stream (sample "MRD Dam"), the TSF RWD (sample "Return Water Dam") and the DRP reservoir (sample "Zinc Dam") in March 2015. A set of laboratory results are included in Annex D of the specialist report. The laboratory results are evaluated against the Resource Water Quality Objectives (RWQOs) developed for the Orange River at Prieska and at the Boegoeberg Dam by DWS in June 2009.

The laboratory results obtained for samples collected by Thunderflex in March 2015 show exceedances of the RWQOs in terms of pH values at all sampled localities as well as sodium and sulphate for the tailing stream (sample MRD Dam). However, the noncompliance in terms of pH values are considered insignificant due to the recorded neutral values. Additionally, it is noted that the TSF has a notable treatment effect on the quality of the delivered tailings which is represented by a significantly improved water quality profile recorded for the TSF RWD (samples Return Water Dam). The DRP reservoir (sample Zinc Dam) presented a water quality profile similar to that of the TSF RWD.

The improved water quality may be ascribed to the calcareous nature of the material used to construct the TSF dam wall through which water from the tailing filters before entering the TSF RWD. It is considered likely that subsurface seepage from the TSF will be subject to similar chemical change due to the underlying geology.

MojaTerre collected two water samples from the Orange River during the site walkover. A summary of sampling observations is provided in the table below. Laboratory results and certificates are provided in Annex D of the specialist report.

Sample ID	Sample Description
TSW01	• Orange River water sampled downstream of the Thunderflex operation and in the vicinity of the river abstraction pump inlet. • Sampled on 29 July 2015 at 14:15. • Sample water is opaque and green with no odours or significant suspended solids. ▪ River flow conditions are considered to be low.
TSW02	• Orange River water sampled upstream of the Thunderflex operation, 20m downstream of the R386 bridge. • Sampled on 29 July 2015 at 16:00. • Sample water is opaque and green with no odours or significant suspended solids. • River flow conditions are considered to be low.

The data evaluation table presented in Annex D of the specialist report show river quality profiles upstream and downstream of the Thunderflex operation, similar to that recorded for the DRP reservoir and TSD RWD. Additionally negligible changes in river water quality is observed towards the downstream environment.

Wetlands

No natural wetlands or dry pans occur on the mining area except for the numerous reed beds along the banks of the Orange River.

8. GROUND WATER

Information on surface water was obtained from the Surface Water Assessment Report, prepared by Renier Pretorius from MojaTerre (Pty) Ltd.

Underlying Aquifers

The hydrogeological terrain beneath the Thunderflex operation comprise a combination of three different water bearing units.

Underneath the DRP and northwards groundwater generally occurs in the BIF of the Asbestos Hills Subgroup and Ghaap Group (Fractured Rock Aquifer). Groundwater availability in this unit is usually limited with aquifer yields less than 0.5 L/s. Diabase intrusions and faults are commonly associated with this geological unit, however, none of these structures are found in close proximately to the Thunderflex operation. The quality

of un-impacted groundwater within this hydrogeological unit is generally excellent with salinity values less than 50 mS/m.

Groundwater south of the DRP groundwater is expected to occur in joints hosted in the diamicitie of the Dwyka. Groundwater yield from these units is generally very low and less than 0,1 L/s (Fractured Rock Aquifer). Due to the chemical composition of the host rock, un-impacted groundwater quality within this unit is generally poor with salinity values above 700mS/m. This aquifer unit extends southwards and also underlays the Town of Prieska. Due to the yield potential and groundwater quality associated with the aquifer, Prieska reportedly relies solely on the Orange River as water source.

Two separate and isolated aquifers, that coincide with the location and extend of the carbonate rocks formations of the Ghaap Group comprising dolomite and subordinate limestone are located beneath and south of the staff quarter as well as approximately 1.5 km south of the DRP. Groundwater within these aquifers occurs irregularly in the karstic cavities and joints in the dolomite unit as well as interlayered chert band contact zones (Karst Aquifer).

As a combined hydrogeological unit, the underlying aquifers are considered a minor aquifer with low susceptibility and vulnerability to contamination from surface sources. However, due the variation in host rock, groundwater quality (prior to any surface related contamination) across the Thunderflex site is expected to vary significantly with salinity values ranging between 30 mS/m and 300 mS/m.

Aquifer recharge in the vicinity of the Thunderflex operation is very low and generally not more than 2.5 mm/a. Aquifer transmissivity beneath the operation generally ranges between 1.51 m^2/d and 6,25m^2/d. The groundwater harvest potential of the subsurface terrain beneath the Thunderflex operation ranges between 0.4L/s and 06L/s. Volumes of effective storage restricts the harvest potential of the aquifers and the storage coefficient for the area is expected to be less than 0.001.

Shallow groundwater flow direction is likely to follow the regional topography. From the DRP groundwater is anticipated to flow towards the unnamed tributary located north of the operation as well as towards the Orange River west of the Thunderflex Operation. However with groundwater levels within the area generally ranging between 40 mbgl and 80mbgl (depending on topography), no aquifer base flow to these rivers is expected.

Boreholes and Springs

MojaTerre interrogated the National Groundwater Archive managed by the DWS to identify available boreholes within the vicinity of the Thunderflex operation that are registered in the archive. The search identified no registered borehole 5 km radius of the site. They identified and inspected six boreholes during the site visit, all of which are former or still functioning wind pumps. Three of the boreholes are destroyed by blockages whilst two were fitted with submersible pump equipment. Therefore, only two groundwater samples could be collected during the site visit.

Unfortunately, due to no access (blockages or pump infrastructure), no groundwater levels could be measured. However, site personnel informed MojaTerre during the site visit that the groundwater level in the abstraction borehole for the staff quarters is approximately 12 mbgl which was determined during routine maintenance of the pump equipment. MojaTerre also noted a spring in the valley below the staff quarters and abstraction borehole.

A summary of the identified and assessed boreholes are provided in the table below.

Borehole ID	Coordinates	Sample Description
TBH01	29°31'25.66"S, 22°41'10.33"E	• Abstraction borehole used for domestic use at the staff quarters. • Borehole situated downgradient of the mining and process activities. • ±22 400 L of groundwater is abstracted from the borehole on a monthly basis (calculated average of 0.0093L/s). • Pump infrastructure specifications not known. • Groundwater level reportedly at 12mbgl. • Water sample collected from tap. Sample water is clear with no odour or suspended solids.
TBH02	29°32'17.78"S, 22°43'05.12"E	• Abstraction borehole used by landowner. • Borehole situated upgradient of the mining and process activities, located next to mine access road approximately 1.8km south east of the DRP. • Abstraction rate and groundwater use not certain. However, site observations suggest that the water is used for livestock watering. • Pump infrastructure specifications not known. • Groundwater level not known. • Water sample collected from cement dam. Sample water is clear with no odour or suspended solids.
BH Census 01	29°31'27.44"S, 22°41'13.36"E	• Borehole not in use and destroyed (reportedly blocked with rocks). • Borehole reportedly ran dry.
BH Census 02	29°31'30.02"S, 22°41'14.48"E	• Borehole not in use and destroyed (reportedly blocked with rocks). • Borehole reportedly ran dry.

Borehole ID	Coordinates	Sample Description
BH Census 03	29°31'27.88"S, 22°41'14.13"E	• Borehole not in use and destroyed (reportedly blocked with rocks). • Borehole reportedly ran dry.
BH Census 04	29°31'46.38"S, 22°43'35.64"E	• Abstraction borehole used by landowner. • Abstraction rate and groundwater use not certain. However, site observations suggest that the water is used for livestock watering. • Pump infrastructure specifications not known. • Groundwater level not known.

Operation Demand

Thunderflex is dependent on 22 400 m^3 per month (calculated average of 0.0093 L/s) of groundwater for domestic use only. No groundwater is used in the Thunderflex process.

The total Thunderflex groundwater demand is three orders of magnitude smaller than the available groundwater harvest potential of the area which ranges between 0,4L/s and 0,6 L/s.

Groundwater Quality

Un-impacted groundwater underneath the Thunderflex operations may vary by one order of magnitude in terms of groundwater salinity values (30mS/m to 300mS/m).

MojaTerre collected two groundwater samples during the site walkover. A summary of sampling observations is provided in the table below. Laboratory results and certificates are provided in Annex D of the specialist report. These results were evaluated against the South African Water Quality Guideline Ranges for Domestic Use, prepared by DWS in 1996.

Sample ID	Sample Description
TBH01	• Sampled from a tap in the staff house on 29 July 2015 at 13:15. • Sample water is clear with no odours, discoloration or suspended solids.
TBH02	• Sampled from the cement dam next to the wind pump on 29 July 2015 at 15:30. • Sample water is clear with no odours, discoloration or suspended solids.

Laboratory results presented in Annex D of the specialist report are representative of the described underlying geology with chemical attributes which influence general water salinity recorded at concentrations exceeding the evaluation criteria for domestic use. Concentration recorded upgradient and downgradient of the Thunderflex operation are in the same order of magnitude with slightly higher concentrations recorded for the abstraction borehole at the staff quarters. The higher concentrations in the vicinity of the staff quarters are also considered a result of aquifer quality (dolomite).

9. CULTURAL AND HERITAGE RESOURCES

Information on cultural and heritage resources was obtained from the Heritage Impact Assessment Report, prepared by Dr Lloyd Rossouw of Paleo Field Services.

Farm 23 is primarily underlain by banded ironstone, haematite, and chert layers located in the basinal facies of the Ghaap Group (Asbestos Hills Subgroup, Transvaal Supergroup) (Figure 13A). Older strata lower down in the facies (e.g. Cambell Rand Subgroup) are exposed along the Orange River to the south and west at Farm 22 and Kliphuis 29, and consist of stromatolite- and microfossil-bearing dolomite, dolomitic limestone and chert members, that were formed by the precipitation of carbonate rocks when colonies of stromatolites thrived in shallow, tropical marine environments towards the end of the Archaean Eon, 2.6 billion years ago (Figure 13B).

Smaller outcrops of Early Permian Dwyka Group tillites, mudstones, sandstones and conglomerates (cf. Mbizane Formation, Karoo Supergroup, c. 320-290 Ma) have been recorded along the southern parts of Farm 23 (Figure 13C and D). The Transvaal Supergroup and Dwyka Group sediments in the region are generally considered to be moderately significant in terms of palaeontological heritage (SAHRIS Palaeontological Sensitivity Map, 2015) (Figure 14).

The study area is generally devoid of surface calcretes. Superficial deposits capping the basement rocks are made up of variable clasts of surface gravels and scree, Quaternary sands (including small dune formations), and well-developed alluvial deposits flanking the Orange River (Figure 15).

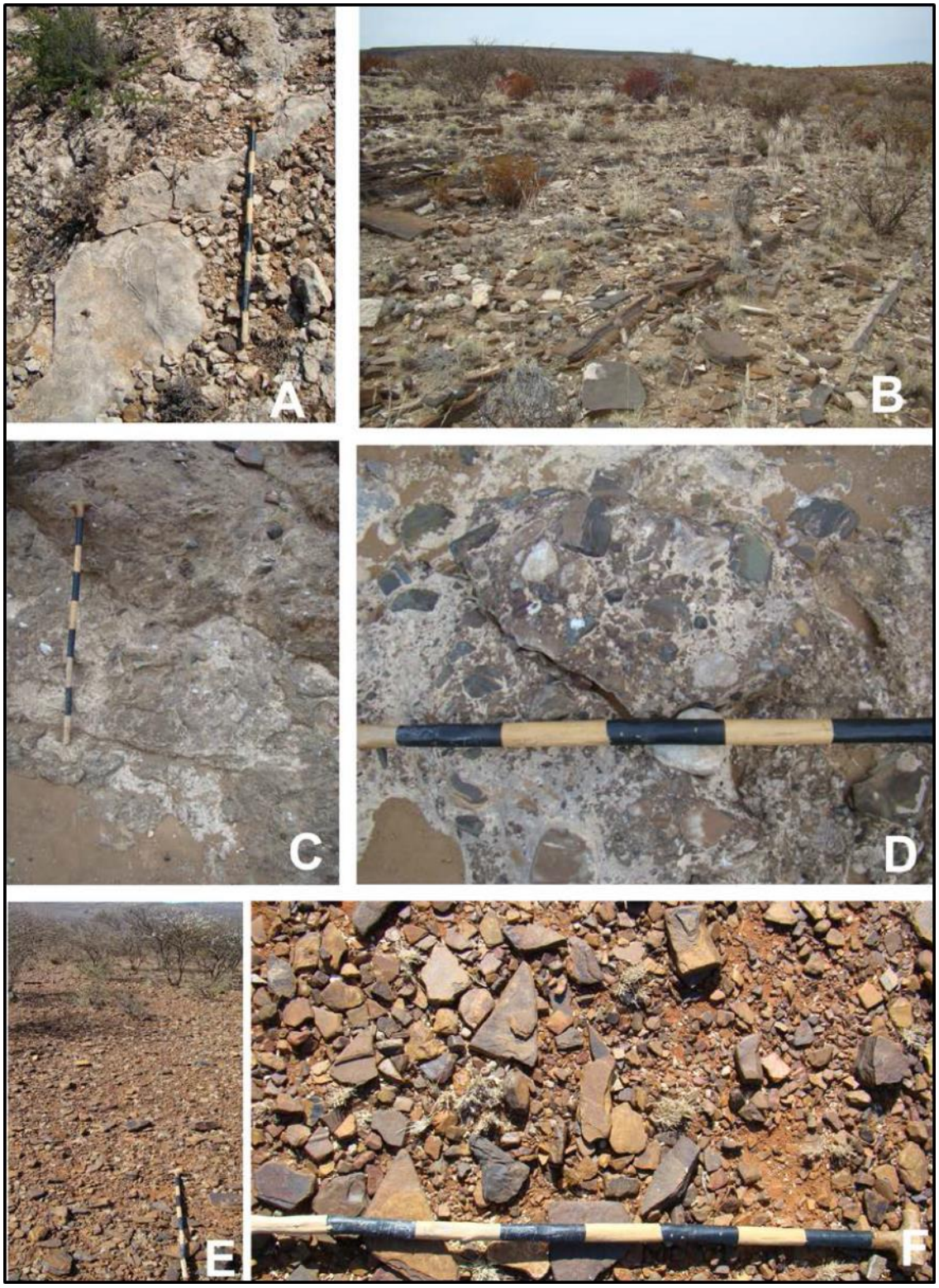


Figure 13. Basement rocks are represented by Ghaap Group carbonate rock and banded iron formation (A and B) as well as Dwyka Group tillites and conglomerates (C and D). Surface gravels and scree are widespread on the landscape (E and F).

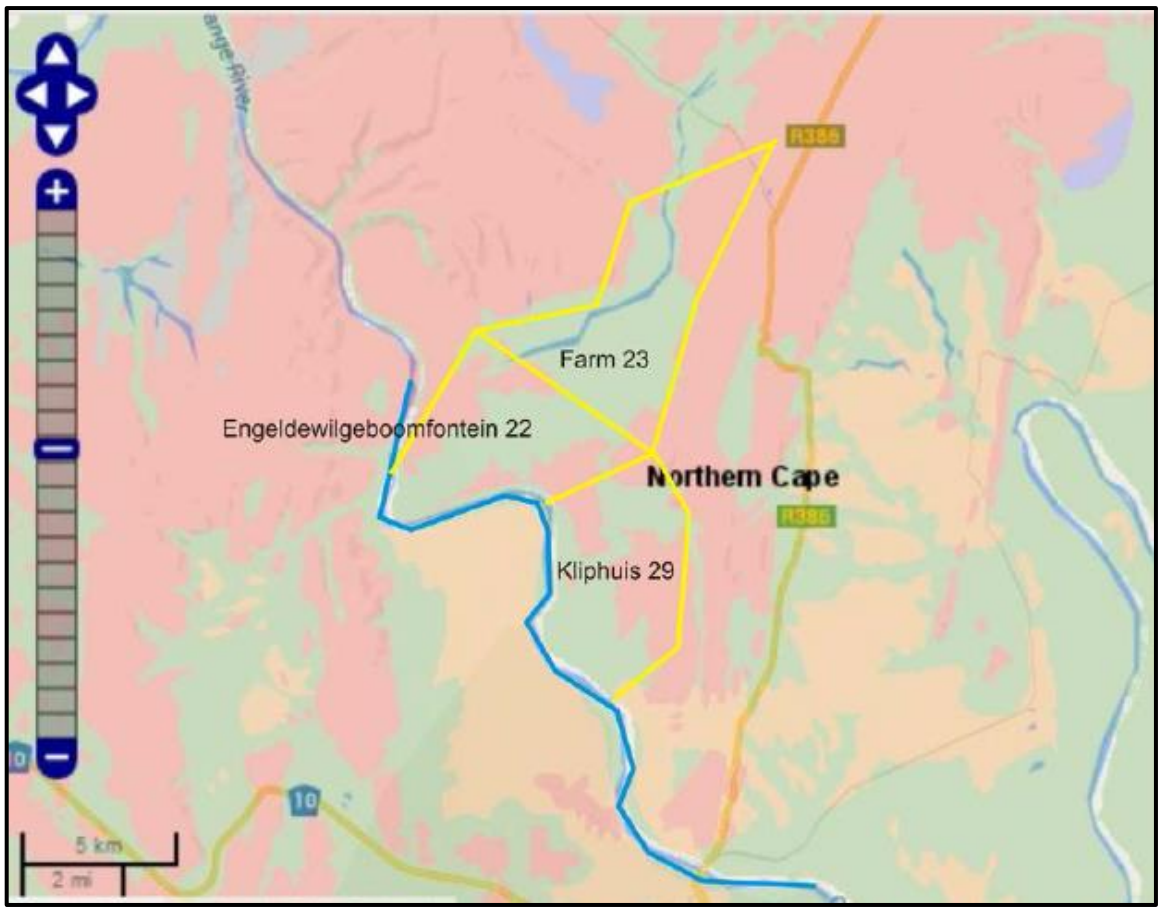


Figure 14. Indication of paleontological potential at the study area according to the SAHRIS Paleontological Sensitivity Map of 2015. Red indicates high paleontological sensitivity, while green indicates moderate paleontological sensitivity.

The archaeological footprint of the study area is primarily represented by uncapped as well as potentially intact Stone Age archaeological assemblages and isolated finds (surface scatters), stone-walled structural remnants dating back to the early part of the 20th century, as well as graveyards and other historical structures older than 60 years (Table 2 of the specialist report). The stone-walled ruins of two large historical terrains cover about 75 ha and 4.5 ha at Kliphuis 29 and Engeldewilgeboomfontein 22, respectively (Figure 16). The sites are associated with the asbestos mining industry that prevailed in the region more than a hundred years ago.

Figure 15. Superficial sediments made up of windblown or fluvial Quaternary sandy deposits are widespread on Farm 23 (top left and right), while geologically recent overbank sediments are well-developed along the Orange River at Kliphuis 29 (centre left and bottom).

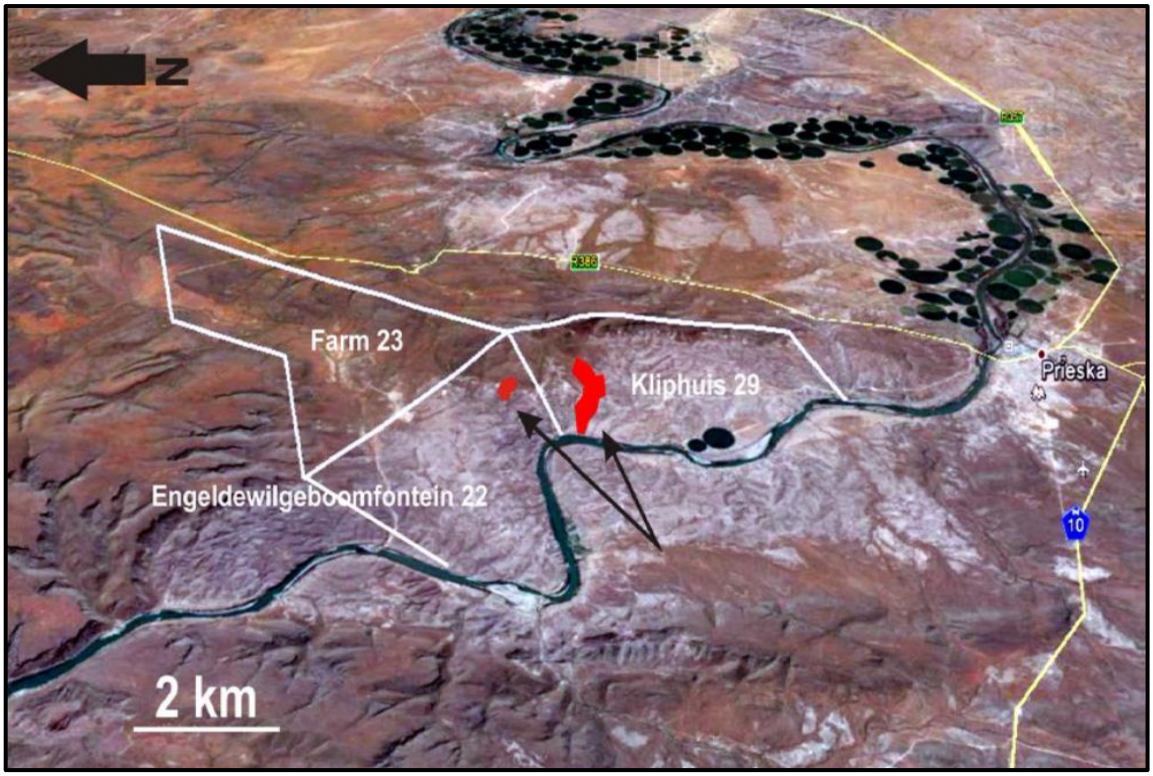


Figure 16. Locality map of the ruins of two historical stone-walled complexes at Kliphuis 29 and Farm 22.

10. AIR QUALITY

With reference to the Scheduled Processes under the Second Schedule to the Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965), no scheduled process relates to any proposed mining activity.

Existing Sources

The current source of air pollution in the area stems from numerous mining operations along the Orange River and from vehicles travelling on the gravel roads of the area. Farming activity, especially ploughing of the irrigation fields, may generate dust during certain periods of the year.

New Source

The source of air pollution on the farm will be nuisance dust generated by the opencast mining process, the loading of gravels onto the transport trucks, the dumping of gravels over each sites primary screen or feeder bins as well as from the movement of trucks and vehicles on the mining roads. Gas emissions from machinery will be within legal limits.

Areas of Impact

As the prevailing wind direction for the area is north to north-west for the months January to September and changing from north to sometimes westerly winds during October to December, there is a potential for fall-out dust to impact on the surrounding farm properties, which can be described as the nearest potential area of impact. The dust management programme recommended should include daily dosing of access roads and stockpile areas.

If dust is generated, it is expected to be visible from the surrounding farmland or mine along the Orange River.

11. NOISE

Noise on site will be generated by the large vehicles (tip trucks, front-end loaders, back actors and bulldozers), from the working pans, and from the possible blasting activities. Noise impact from blasting is high, but is limited to very short, infrequent periods of occurrence.

There are numerous mining operations on both sides of the mining operations as well as across the Orange River. Although these operations do generate noise the overall impact can be described as negligible.

12. VISUAL ASPECTS

The mining area is only visible from a secondary gravel road serving the farming community along the Orange River and not from any regional road network. There are no residential areas within the surrounding area. Dust that is generated will be visible to the surrounding landowners and from across the Orange River. The mine is not located on any tourist route and will not be visible to the average tourist.

13. SOCIO-ECONOMIC STRUCTURE OF THE REGION

Population density, growth and location

The local and regional population is illustrated in the table below. From this table, it is evident that Siyathemba had a local population of just more than 21 000 people during 2010. In regional context, this meant that Siyathemba contributed 11.9 % to the District population (i.e. the second largest LM in the District by population) and 1.9 % to the population of the Northern Cape.

Region	2004	2006	2008	2010
South Africa	46,745,940	47,827,370	48,911,245	49,991,472
Northern Cape	1,088,672	1,089,227	1,093,823	1,103,918
Pixley Ka Seme	190,396	185,334	180,082	179,507
Siyathemba	21,441	21,312	21,239	21,333

Local Municipality Source: Quantec Research, 2012

The population of Siyathemba declined from just over 21 370 people in 2000 to about 21 330 in 2010 (Figure 17). This implies that the population contracted by 0.4 % on average per annum. This growth rate is slightly lower in the Pixley Ka Seme DM, which contracted 0.7 % p.a. The decline of the Siyathemba population was mainly driven by lower fertility rates.

The death rate (i.e. the number of deaths per 1 000 people in year) experienced a relative increase from 11.2 deaths per 1 000 people in 1995 to 11.6 during 2010. During 2010, the death rate for Pixley Ka Seme was 11.9 deaths per 1 000 people, while it was 13 for the Northern Cape and 16.4 for the South African population. The reason for the lower death rate in the study area was mainly the result of lower HIV/AIDS prevalence rates when compared with South African averages.

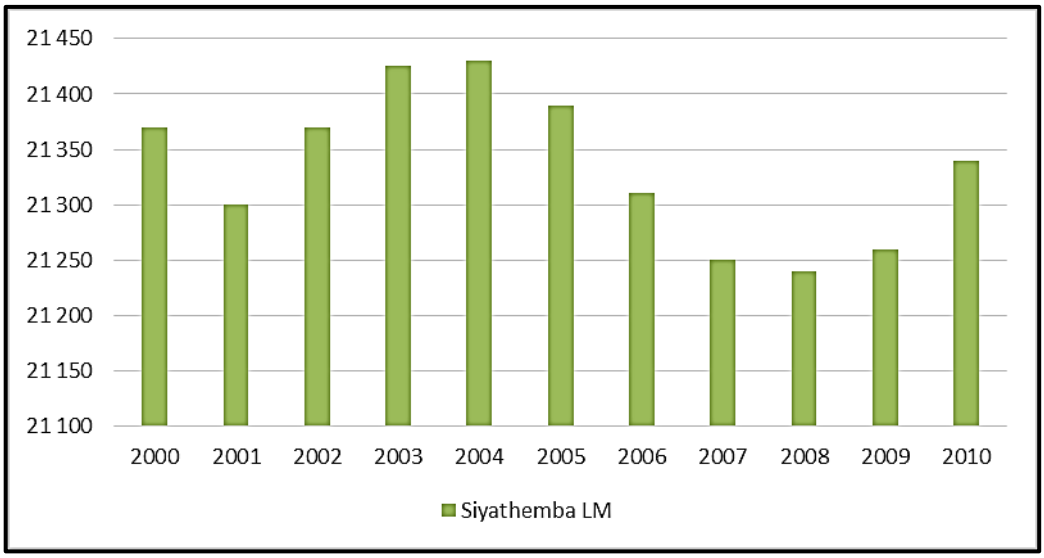


Figure 17. Population statistics for the Siyathemba Local Municipality

The municipal area encompasses a geographic area of some 8 197 km² which implies that Siyathemba accounts for some 8.0 % of the total District surface area. The local economy is mainly agriculture based and highly dependent on the Orange River, which flows through the area.

Siyathemba is one of eight Local Municipalities in the Pixley Ka Seme District. The other seven Municipalities are:

- Thembelihle Local Municipality
- Emthanjeni Local Municipality
- Siyancuma Local Municipality
- Umsobomvu Local Municipality
- Ubuntu Local Municipality
- Kareeberg Local Municipality
- Renosterberg Local Municipality

De Aar is the seat of the Pixley Ka Seme District Municipality (located in the Emthanjeni LM). Prieska is located some 182 km from De Aar and 236 km from Kimberley. Spatially, Siyathemba is very distant from South Africa's largest consumer markets. In this regards, the road transport distances illustrated by the table below would apply to LED initiatives.

City	Distance from Prieska (km)
Upington	249
De Aar	182
Kimberley	236
Bloemfontein	397
Cape Town	835
Johannesburg	714
Pretoria	775
Durban	1029

Major economic activities and sources of employment

The local economy grew by 1.7 % during 2009/10 compared to the District (1.7 %), Provincial (2.3 %) and National (2.8 %) growth rates. From 2000 to 2010, an average growth rate of 2.0 % can be observed in Siyathemba, which was inadequate to create sufficient jobs in the local economy to reduce the unemployment rate. Local economic growth is not strongly linked with that of the District, which reflects a local economy that is highly concentrated (in Agriculture) with a less balanced profile when compared with the larger region. This implies that the local economy is more vulnerable to market fluctuations (especially in terms of fluctuations that have an impact on regional agriculture).

Figure 18 illustrates the ten year average annual economic growth rates (2000 to 2010) in Siyathemba and the larger region. From this Table is evident that growth in the local economy was mainly driven by Manufacturing (10.2% p.a.), Construction (6.6%) and Finance (5.6% p.a.). The other sectors in the local economy contracted over the past ten years (most notably in the Mining, Utilities and Transport).

When compared to the larger region, it can be observed that local growth in the Finance sector (5.6 % p.a.) is relatively in line with the District (6.2 % p.a.), indicating a strong growth correlation and the importance of Siyathemba to Pixley Ka Seme in terms of its contribution to District Financial Services.

From 2010 sectoral distribution of the labour force in South Africa, the Northern Cape, Pixley Ka Seme and Siyathemba it is evident that most workers in Siyathemba are employed in the Government Services sector (around 1 700 workers), followed by Agriculture (about 1 100 workers) and the Trade (about 670 workers) sectors.

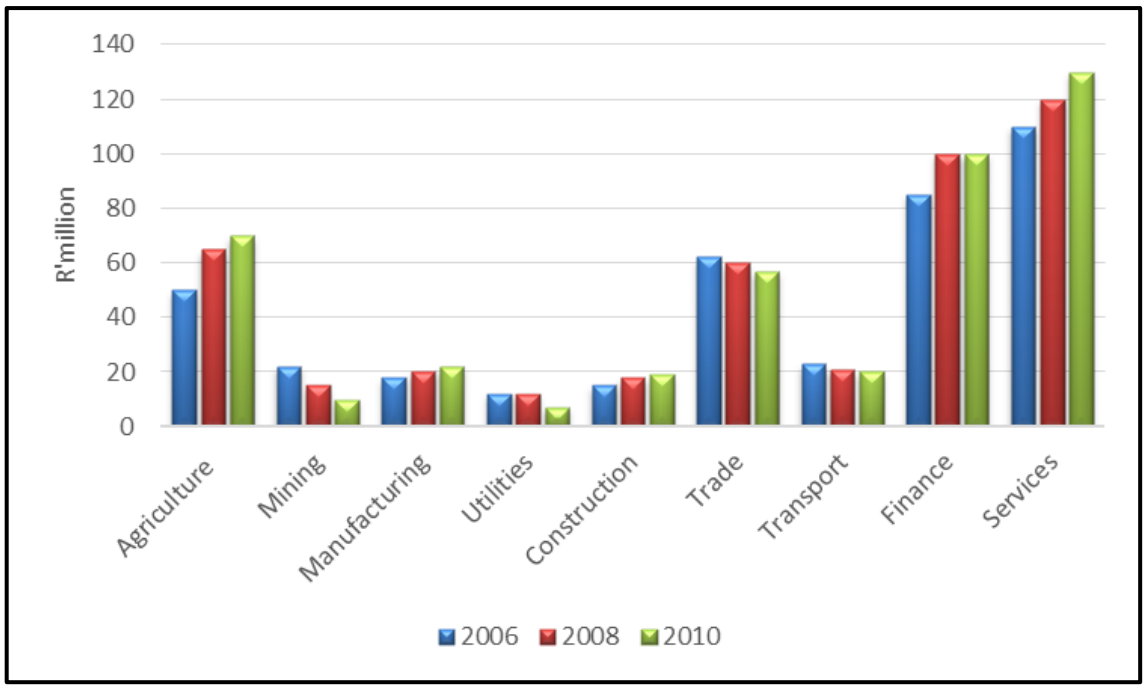


Figure 18. A presentation of the ten year average annual economic growth rates (2000 to 2010) in Siyathemba and the larger region (Quantec Research, 2012)

Estimated unemployment

Total employment in Siyathemba has been in fluctuating over the last ten year. Moreover, employment in the study area declined marginally from some 4,800 jobs during 2000 to just below 4 700 in 2010. Over a ten-year period, this could be translated to an average annual decline of 0.2%. Over the same period, employment in Pixley Ka Seme declined by 1.3% on average per annum, while that of the Northern Cape and South Africa increased by 0.9% and 0.5% respectively.

Local employment trends are not well–integrated with that of the larger region, which could be attributed to the concentrated nature (in the Agriculture sector) of the local economy. In contrast, employment trends in Pixley Ka Seme, the Northern Cape and South Africa follow growth profiles that are better correlated due to higher levels of diversity in these economies. The threat presented by employment vulnerability and its socio-economic implications for local communities in Siyathemba cannot be emphasized though.

Housing-demand and availability

A total of around 5 500 household dwellings were estimated to exist in the Siyathemba municipal area during 2010. This accounted for some 11.7 % of all household dwellings in the District, which ranked Siyathemba fourth among Pixley Ka Seme's Local Municipalities. Since 2000, the number of dwellings increased by 0.8 % on average per annum compared to 0.1 % decline in the District and 0.5 % growth in the Province.

The table below illustrates the type of dwellings found in Siyathemba and the level of household access to municipal services.

Household Indicator	2000	2010	Access	Growth
House or brick structure	4,303	4,419	81.8%	0.3%
Electricity	4,305	4,812	87.3%	1.1%
Piped water	5,001	5,356	97.5%	0.7%
Refuse removal	4,066	4,546	83.5%	1.1%
Flush or chemical toilet	3,597	4,323	78.6%	1.9%

Source: Quantec Research, 2012

More than 81 % of household dwellings found in Siyathemba can be classified as houses or brick structures on separate stands. This indicator is slightly higher when compared with the average for Pixley Ka Seme (80.1 %) and the Northern Cape (77.4 %). Some 8.6 % of local dwellings can be described as shacks.

Around 87 % of household dwellings found in Siyathemba have access to electricity. This indicator is on par with the District and Provincial average. Around 97 % of household dwellings found in Siyathemba have access to piped water while the remainder mostly rely on boreholes as a source. The area rated on par in terms of this indicator when compared with Pixley Ka Seme (96.8 %) and the Northern Cape (96.2 %). Around 83% of local households enjoyed a weekly refuse removal service by the Local Municipality, compared to 76.2 % in Pixley Ka Seme and 68.8% in the Northern Cape.

Approximately 78.6% of local households have access to flush or chemical toilets. This indicator is relatively higher when compared with the District (67.8 %) and Provincial (67.8%) average. Those households that do not have access to flush or chemical toilets, mainly make use of pit latrines as their main source of sanitation.

The demand for housing in the Northern Cape Province is critical as can be seen in the number of informal settlements being built on an almost daily basis in the nearby towns and Kimberley.

Social infrastructure

The town of Prieska have formal infrastructure such as schools, hospitals, sport- and recreation facilities and shops.

Water supply

Water is available to almost 50 % of the population in the Northern Cape in the form of water piped to their dwelling. The next most used source of water supply is piped water on-site or in yards, which is available to around 33 % of the population.

Surface water from the Riet-, Vaal- and Orange River is the major source of water in the region, although some smaller communities are totally dependent on groundwater for supply.

(B) DESCRIPTION OF THE CURRENT LAND USES

Land Use before Mining

Farm land adjacent to the Orange River has for decades been used extensively for irrigated agricultural development within the Boegoeberg Dam Irrigation Area. The earliest available aerial imagery for the Prieska area is from 2001 which shows evidence of large scale pivot systems adjacent to the Orange River from the R386 and Prieska (upstream of Thunderflex) and further upstream towards the east. Agricultural development adjacent to the Orange River appears to decrease notable from the R386 towards the downstream environment and towards Thunderflex.

Additionally, livestock farming is also practiced within the area. In summary livestock farming within the Prieska area comprises:

- Livestock: Goats, sheep, cattle and dairy production to a lesser extent.
- Crop production: Grapes, wheat, groundnuts, cotton, maize and Lucerne.

The farms on which the Thunderflex operation is situated were formally and are currently used for livestock farming and is characterised with a low agricultural potential. Additionally, small scale asbestos mining of the surrounding hills and diamond mining of the underlying gravels were undertaken on the farms in the past (period not certain).

Evidence of Disturbance

Old timers mining activities have caused a high degree of disturbance in the area (especially for asbestos and tigers eye). The mining of alluvial deposits will never go near any of those areas as the target minerals are so different.

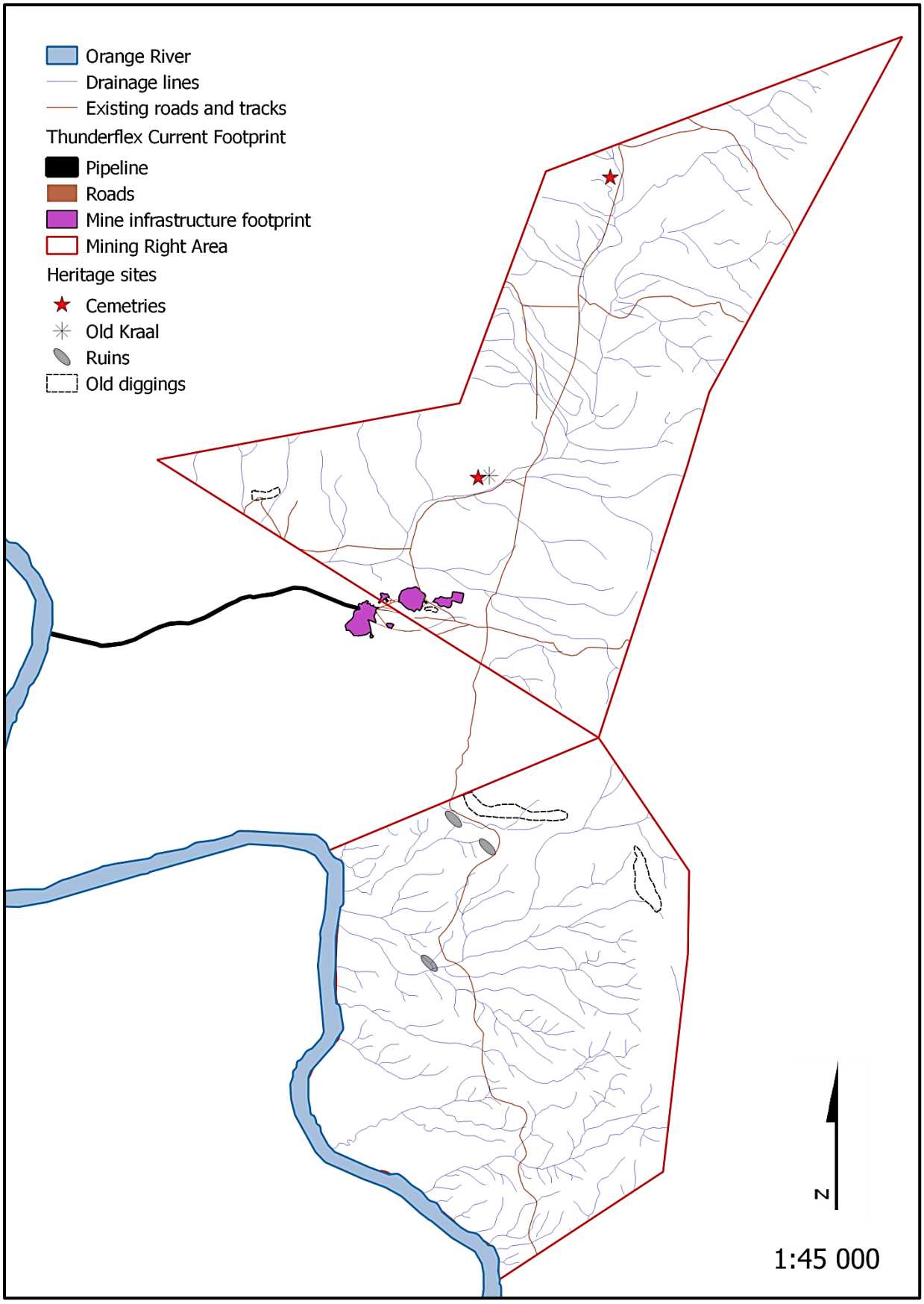
Existing Structures

The mining area has a series of access roads, a farm house, a store and a demarcated formal grave yard. The house are being utilized for accommodating employees and an office block. Furthermore, toilet facilities are available on site.

(C) DESCRIPTION OF SPECIFIC ENVIRONMENTAL FEATURES & INFRASTRUCTURE ON THE SITE

The infrastructure on site is comprehensively discussed in section d(ii) as part of the mining methodology discussion, as well as in section g as part of the mine footprint description. Furthermore, a comprehensive description of the environment was presented in section g (iv) (A) as part of the baseline report.

(D) ENVIRONMENTAL AND CURRENT LAND USE MAP



v) Impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts

Environmental factor	Nature of impact	Significance	Probability	Duration	Consequence	Management
PHYSICAL						
Geology and mineral resource	Sterilisation of mineral resources.	Very low	Highly unlikely	Decommissioning	Insignificant	Ensure that optimal use is made of the available mineral resource.
Topography	Changes to surface topography due to topsoil removal, excavations, blasting, placement of infrastructure and development of mine residue deposits.	Low to medium	Certain	Post-closure	Moderate	Backfill all excavations continuously and employ effective rehabilitation strategies to restore surface topography of excavations and plant site, and to stabilise the mine residue deposit.
Soils	Soil erosion by water and wind on disturbed and exposed soils; potential for dust production and soil microbial degradation; potential contamination of soils due to spillages.	Low	Possible	Life of operation	Minimal	Employ appropriate management strategies to preserve soil resources.
Land capability	Loss of land capability through topsoil removal, disturbances and loss of soil fertility.	Very low	Possible	Short term	Minimal	Employ appropriate rehabilitation strategies to restore land capability.
Land use	Loss of land use due to poor placement of surface infrastructure and ineffective rehabilitation	Very low	Possible	Short term	Minimal	Carefully plan the placement of infrastructure and employ rehabilitation strategies to restore land capability.
Ground water	Pollution of underground water sources.	Low	Possible	Decommissioning	Minimal	Construction of measures to prevent seepage into the groundwater by biological and engineering means. Implementation of the necessary management programs to ensure the integrity of ground water resources.

Environmental factor	Nature of impact	Significance	Probability	Duration	Consequence	Management
PHYSICAL (cont.)						
Surface water	Deterioration in water quality through spillages.	Low	Certain	Decommissioning	Critical	Frequent monitoring of surface water resources. Prevention of overspill of mine associated activities into the surrounding streams or rivers. Implementation of the necessary management programs to ensure the integrity of surface water resources.
Indigenous flora	The clearance of vegetation; potential loss of floral species with conservation value; potential loss of ecosystem function.	Low to medium	Certain	Life of operation	Major	Prevention of overspill of mine associated activities onto the surrounding ecological environment. Employ proper protection and rehabilitation strategies.
Alien invasive plants	Proliferation of alien invasive plants species.	Low to medium	Certain	Decommissioning	High	Eradicate, and control the spread, of alien invasive species.
Fauna	Displacement of faunal species.	Low	Possible	Life of operation	Minimal	Prevention of overspill of mine associated activities onto the surrounding ecological environment. Employ proper protection strategies.
Habitat	The loss, damage and fragmentation of floral and faunal habitats; potential loss of ecosystem function.	Low to medium	Certain	Residual	Critical	Prevention of overspill of mine associated activities onto the surrounding ecological environment. Employ proper protection and rehabilitation strategies.
Air quality	Sources of atmospheric emission associated with the mining operation are likely to include fugitive dust from materials handling operations, wind erosion of stockpiles, and vehicle entrainment of road dust.	Minimal	Certain	Decommissioning	Minimal	Effective soil management; identification of the required control efficiencies in order to maintain dust generation within acceptable levels.

Environmental factor	Nature of impact	Significance	Probability	Duration	Consequence	Management
SOCIAL SURROUNDINGS						
Noise and vibration	Increase in continuous noise levels; the disruption of current ambient noise levels; and the disruption of sensitive receptors by means of increased noise and vibration.	Low	Certain	Decommissioning	Minimal	Minimise the generation of excessive noise and vibration; Ensure all vehicles and equipment is in a good working order; proper communication and management of blasting activities.
Visual impacts	Visual impact of the mine infrastructure, excavations, mine residue deposits, and waste rock stockpile; visibility of dust.	Low	Possible	Decommissioning	Minimal	Effective planning of the location of infrastructure and operations to minimise visual impact.
Traffic	Potential negative impacts on traffic safety and deterioration of the existing road networks.	Low	Low likelihood	Decommissioning	Minimal	Utilise existing access roads, where applicable; implement measures that ensure adherence to traffic rules.
Heritage resources	The deterioration of sites of cultural and heritage importance.	Low to medium	Certain	Residual	Major	Preservation and protection of heritage and cultural resources identified within a no go zone; further resources uncovered during mining activities need to be reported to a suitably qualified archaeologist.
Socio-economic	Negative: Loss of agricultural potential; influx of workers to the area increases health risks and loitering (resulting in lack of security and safety); negative impact of employment loss during mine closure.	Low and Low to medium	Certain	Shert-term and Closure	High and Major	Application of commitments made in the Social and Labour Plan; implementation of community development programmes.
Interested and affected parties	Loss of trust and a good standing relationship between the IAPs and the mining company.	Low to medium	Possible	Decommissioning	High	Ensure continuous and transparent communication with IAPs.

vi) Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks

The criteria used to assess the significance of the impacts are shown in the table below. The limits were defined in relation to mining characteristics. Those for probability, intensity/severity and significance are subjective, based on rule-of-thumb and experience. Natural and existing mitigation measures were considered. These natural mitigation measures were defined as natural conditions, conditions inherent in the project design and existing management measures, which alleviate impacts. The significance of the impacts was calculated by using the following formula:

(Severity + Spatial Scope + Duration) x Probability weighting

For the impact assessment, the different project activities and associated infrastructure were identified and considered in order to identify and analyse the various possible impacts. These include roads and hauling, excavations, temporary waste dumping, topsoil storage, mine residue deposit dam, plant and processing area, temporary office, workshops and ablution facilities, water tanks, diesel tanks, pipeline, other temporary buildings, etc. Please also refer to **Appendix 7** for a map of the mining operation location.

Significance of impacts is defined as follows:

No Impact - There will be no impact on the system or any of its parts.

Very Low - Impact would be negligible. Almost no mitigation and/or remedial activity would be needed, and any minor steps which might be needed would be easy, cheap and simple.

Low - Impact would have little real effect. Mitigation and/or remedial activity would be either easily achieved or little would be required or both.

Medium - Impact would be real but not substantial within the bounds of those which could occur. Mitigation and/or remedial activity would be both feasible and fairly easily possible.

High - Impacts of substantial order. Mitigation and/or remedial activity would be feasible but difficult, expensive, time consuming or some combination of these.

Very High - Of the highest order possible within the bounds of impacts which could occur. There would be no possible mitigation and/or remedial activity to offset the impact at the spatial or time scale for which was predicted.

Weight	Severity	Spatial scope (Extent)	Duration
6	Disastrous	Trans boundary effects	Residual
5	Catastrophic / major	National / Severe environmental damage	Residual
4	High/ Critical / Serious	Regional effect	Decommissioning
3	Medium / slightly harmful	Immediate surroundings / local / outside mine fence	Life of operation
2	Minimal/potentially harmful	Slight permit deviation / on-site	Short term / construction (6 months – 1 yrs)
1	Insignificant / non-harmful	Activity specific / No effect / Controlled	Immediate (0 – 6 months)

Weight number		**1**	**2**	**3**	**4**	**5**
Frequency						
Probability	**Frequency of impact**	Highly unlikely	Rare	Low likelihood	Probable / possible	Certain
		Practically impossible	Conceivable but very unlikely	Only remotely possible	Unusual but possible	Definite
	Frequency of activity	Annually or less	6 monthly / temporarily	Infrequent	Life of operation	Life of operation

CONSEQUENCE
(Severity + Spatial Scope + Duration)

PROBABILITY (Frequency of activity + Frequency of impact)															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Colour code	Significance rating	Value	**Negative impact** Management strategy	**Positive Impact** Management strategy
	VERY HIGH	126 – 150	Improve current management	Maintain current management
	HIGH	101 – 125	Improve current management	Maintain current management
	MEDIUM – HIGH	76 – 100	Improve current management	Maintain current management
	LOW – MEDIUM	51 – 75	Improve current management	Maintain current management
	LOW	26 – 50	Improve current management	Maintain current management
	VERY LOW	1 – 25	Improve current management	Maintain current management

vii) The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and the community that may be affected

During construction and operation of the mine, there is a possibility of sterilisation of the mineral reserves and resources due to improper placement of infrastructure. The infrastructure and slimes dam will alter the topography by adding features to the landscape. Topsoil removal, excavations and blasting will unearth the natural topography. The construction of infrastructure and various facilities in the mining area can also result in loss of soil due to erosion. Vegetation will be stripped in preparation for placement of infrastructure and excavations, and therefore the areas will be bare and susceptible to erosion. The topsoil that is stripped and piled on surrounding areas can be eroded by wind and rain. The soil will be carried away during runoff. The cleared areas will be rehabilitated, but full restoration of soils might only occur over a number of years, subsequent to the re-establishment of vegetation. Furthermore, improper stockpiling and soil compaction can result in soil sterilisation. Leaching can also occur, resulting in the loss of nutrients.

During the construction and operation of the mine, there is a possibility that equipment might leak oil, thus causing surface spillages. The hydrocarbon soil contamination will render the soil unusual unless they are decontaminated. The storage of fuels on site might have an impact on soil if the tanks that are available on site are not properly monitored and maintained to avoid leakages. Then there is the potential that contaminated soil can be carried through runoff to contaminate water resources and soil stockpiled for rehabilitation. Soil pollution is therefore possible, but through mitigation it can be minimised.

The loss of land capability and land use can occur in two ways. Firstly, through topsoil removal, disturbances and loss of soil fertility; and secondly through the improper placement of infrastructure. The site has a land capability for grazing, but grazing activities can still be performed in areas not earmarked for mining, and with proper rehabilitation the land capabilities and land use potential can be restored.

If oil and fuel spillages occur, then it will seep into the underlying aquifers and contaminate ground water. Improper handling of hazardous material will cause contamination of nearby surface water resources during runoff episodes. Lack of storm control structures will lead to erosion of stockpiles during heavy rains and runoff will carry suspended solids into the downstream environment. This might cause high silt load and affect stream flow. If no, or inadequate ablution facilities are available then workers might feel the need to use the nearby river or streams for this purpose. However, a recent water sample analyses did not reveal any pollution potential.

Construction and mining activities on site will reduce the natural habitat for ecological systems to continue their operation. It is not expected that the areas of high ecological function will rehabilitate following disturbance events. Vehicle traffic generates lots of dust which can reduce the growth success and seed dispersal of many small plant species. It is possible that protected species (e.g. *Boscia albitrunca*, *Hoodia gordonnii* and *Aloidendron dichotoma*) will be destroyed during the mining operation.

While general clearing of the area and mining activities destroy natural vegetation, invasive plants can increase due to their opportunistic nature in disturbed areas. If invasive plant establish in disturbed areas, it may cause an impact beyond the boundaries of the mining site. These alien invasive species are thus a threat to surrounding natural vegetation and can result in the decrease of biodiversity and ecological value of the area. Therefore, if alien invasive species are not controlled and managed, their propagation into new areas could have a high impact on the surrounding natural vegetation in the long term. With proper mitigation, the impacts can be substantially reduced.

The transformation of natural habitats to mining and associated infrastructure will result in the loss of habitat affected individual species, and ecological processes. In turn this will result in the displacement of faunal species dependent upon such habitat. Increased noise and vibration due to mining activities will disturb and possibly displace birds and other wildlife. Fast moving vehicles take a heavy toll in the form of road kills of small mammals, birds, reptiles, amphibians and a large number of invertebrates. The construction of the mine and associated infrastructure will result in the loss of connectivity and fragmentation of natural habitat. Fragmentation of habitat will lead to the loss of migration corridors, in turn resulting in degeneration of the affected population's genetic make-up. This results in a subsequent loss of genetic variability between meta-populations occurring within the study site. Pockets of fragmented natural habitats hinder the growth and development of populations.

During the mining operation the abovementioned activities have potential for dust generation. It is anticipated that the extent of dust emissions would vary substantially from day to day depending on the level of activity and the specific operations. The surface infrastructure of the Thunderflex mine is situated in a rural environment, with typically low levels of noise, dominated by the natural sounds vegetation, wildlife, and man-influenced sounds such as livestock, farming activities, and very occasional remote road and air traffic. The proposed mine will add a certain amount of noise to the existing noise in the area. However, levels of noise generated by mining activities are low.

The impact of site generated trips on the traffic of the existing roads is expected to be low. Nevertheless, if road safety is not administered it can have a high impact on the safety of fellow road users.

The mining activities on site have the potential to impact upon heritage resources. Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon these resources will be permanent and irreversible. Any movement of vehicles, equipment or personnel through areas containing these artefacts could result in the permanent destruction of the artefacts and loss of heritage resources. The impacts of the mining activities are however anticipated to be low, because the highest density of heritage resources was found to be outside the area earmarked for mining. Nevertheless, if any impact should occur, it would be of national significance and definite.

The mining operation, especially during construction, will create a number of new employment opportunities. The magnitude of this impact will depend on the number of people that will be employed and the number of contractors sourced. An influx of people into the rural area will possibly impact on safety and security of local residents. During the decommissioning and at closure of the mine, staff will most likely be retrenched. This can potentially flood the job market, resulting in people being unable to find new employment for a long period of time. It is normally more difficult for people with highly specialised skills to find employment immediately. Those with fewer skills have more flexibility in the job market.

Economic slump of the local towns after mine closure is an associated potential impact. Income streams from wage bills as well as goods and services contracts (at all geographical levels) will come to an end, reducing the monetary income of individuals and mine-related businesses. People who have derived income directly or indirectly from the project may be inclined to leave the region in search of employment or business opportunities. This could result in further decline of the economy of the region as well as the abandonment of infrastructure. The loss of mine workforce income will also impact upon non-mine related industries within the local and regional areas, particularly the rental property market and retail and service industries who would have received income during the life of mine from the salaried workforce.

It is likely, however that there will be residual positive economic impacts that are not fully reversed with the closure of the mine, and that the economy will not decline to its original level prior to the development of this project. This is because the mine will generate substantial income for the regional and local economy, both directly and indirectly, during its life.

It is difficult to predict the actual impact of the mine closure in advance, but it is acceptable to assume that the mine closure will have a negative impact on the local and regional economy with a high probability of occurrence, a high severity and a high significance.

Positive impacts include employment and training opportunities for people in the local community and local contractors; social upliftment and community development programmes; economic benefits.

viii) The possible mitigation measures that could be applied and the level of risk

Geology and mineral resource

Level of risk: Very low

Mitigation measures

- Ensure that optimal use is made of the available mineral resource through proper planning.
- The mine blocks should be delineated first and all infrastructure positions should be selected with the main aim of avoiding sterilization of future resources.
- No dumping of materials prior to approval by exploration geologist.

Topography

Level of risk: Low

Mitigation measures

- Backfill all excavations continuously.
- Employ effective rehabilitation strategies to restore surface topography of excavations and plant site.
- Stabilise the mine residue deposits.
- All temporary infrastructure will be demolished during closure.

Soil erosion

Level of risk: Very low

Mitigation measures

- At no point may plant cover be removed within the no-development zones.
- All attempts must be made to avoid exposure of dispersive soils.
- Re-establishment of plant cover on disturbed areas must take place as soon as possible, once activities in the area have ceased.
- Ground exposure should be minimised in terms of the surface area and duration, wherever possible.
- The mining operation must co-ordinate different activities in order to optimise the utilisation of the excavated trenches and thereby prevent repeated and unnecessary excavations.
- Construction that requires the clearing of large areas of vegetation and excavation should ideally occur during the dry season only.
- Construction during the rainy season (November to March) should be closely monitored and controlled.
- The run-off from the exposed ground should be controlled with the careful placement of flow retarding barriers.
- The soil that is excavated during construction should be stock-piled in layers and protected by berms to prevent erosion.
- All stockpiles must be kept as small as possible, with gentle slopes (18 degrees) in order to avoid excessive erosional induced losses.
- Excavated and stockpiled soil material are to be stored and bermed on the higher lying areas of the footprint area and not in any storm water run-off channels or any other areas where it is likely to cause erosion, or where water would naturally accumulate.
- Stockpiles susceptible to wind erosion are to be covered during windy periods.
- Audits must be carried out at regular intervals to identify areas where erosion is occurring.
- Appropriate remedial action, including the rehabilitation of the eroded areas, must occur.
- Rehabilitation of the erosion channels and gullies.
- The mining operation should avoid land with steep slopes.
- Dust suppression must take place, without compromising the sensitive water balance of the area.
- Linear infrastructure such as roads and pipelines will be inspected at least monthly to check that the associated water management infrastructure is effective in controlling erosion.

Soil pollution

Level of risk: Very low

Mitigation measures

- Refuelling must take place in well demarcated areas and over suitable drip trays to prevent soil pollution.
- Spill kits to clean up accidental spills from earthmoving machinery must be well-marked and available on site.
- Workers must undergo induction to ensure that they are prepared for rapid clean-up procedures.
- All facilities where dangerous materials are stored must be contained in a bund wall.
- Vehicles and machinery should be regularly serviced and maintained.

Land capability and land use

Level of risk: Very low

Mitigation measures

- Ensure that optimal use is made of the available land through consultation with land owner and proper planning of mining activities.
- Surface agreement to be signed with land owners.
- Employ effective rehabilitation strategies to restore land capability and land use potential of the farm.
- All activities to be restricted within the demarcated areas.
- Ensure that land which is not used during construction is made available for grazing.

Ground water

Level of risk: Very low

Mitigation measures

- Refuelling must take place in well demarcated areas and over suitable drip trays to prevent soil pollution.
- Spill kits to clean up accidental spills from earthmoving machinery must be well-marked and available on site.
- Workers must undergo induction to ensure that they are prepared for rapid clean-up procedures.
- All facilities where dangerous materials are stored must be contained in a bund wall.

Ground water (cont.)

Mitigation measures (cont.)

- Vehicles and machinery should be regularly serviced and maintained.
- Monitor the quality of the boreholes located down-gradient of the mining site.
- Sample according to the sampling method and parameters for analysis as indicated in the Geohydrological study.

Surface water

Level of risk: Very low

Mitigation measures

- Sufficient care must be taken when handling hazardous materials to prevent pollution.
- Under no circumstances may ablutions occur outside of the provided facilities.
- No uncontrolled discharges from the staff camps to any surface water resources shall be permitted.
- If servicing and washing of the vehicles occur on site, there must be specific areas constructed for these activities, which must have concrete foundations, bunding as well as oil traps to contain any spillages.
- A walled concrete platform, dedicated store with adequate flooring or bermed area and ventilation must be used to accommodate chemicals such as fuels, oils, paints, herbicide and insecticides.
- Oil residue shall be treated with oil absorbent and this material removed to an approved waste site.
- Spill kits must be easily accessible and workers must undergo induction regarding the use thereof.
- At all times care should be taken not to contaminate surface water resources.
- Store all litter carefully to prevent it from washing away or blown into any of the water courses within the study area.
- Provide bins for staff at appropriate locations, particularly where food is consumed.
- The mining site should be cleaned daily and litter removed.
- Conduct ongoing staff awareness programmes in order to reinforce the need to avoid littering, which contributes to surface water pollution.

Indigenous flora

Level of risk: Low to medium

Mitigation measures

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of mined areas.
- Encourage the growth of natural plant species.
- Ensure measures for the adherence to the speed limit.
- Footprint areas of the mining activities must be scanned for Red Listed and protected plant species prior to mining.
- It is recommended that these plants are identified and marked prior to mining.
- These plants should, where possible, be incorporated into the design layout and left in situ.
- However, if threatened of destruction by mining, these plants should be removed (with the relevant permits from DAFF and DENC) and relocated if possible.
- A management plan should be implemented to ensure proper establishment of ex situ individuals, and should include a monitoring programme for at least two years after re-establishment in order to ensure successful translocation.
- All those working on site must be educated about the conservation importance of the fauna and flora occurring on site.

Alien invasive plants

Level of risk: Very low

Mitigation measures

- Minimise the footprint of transformation.
- Encourage proper rehabilitation of mined areas.
- Encourage the growth of natural plant species.
- Mechanical methods (hand-pulling) of control to be implemented extensively.
- Annual follow-up operations to be implemented.

Fauna

Level of risk: Very low

Mitigation measures

- Careful consideration is required when planning the placement for stockpiling topsoil and the creation of access routes in order to avoid the destruction of pristine habitats and minimise the overall mining footprint.
- The appointment of a full-time ECO must render guidance to the staff and contractors with respect to suitable areas for all related disturbance.
- The extent of the proposed mine should be demarcated on site layout plans, and no construction personnel or vehicles may leave the demarcated area except those authorised to do so. Those areas surrounding the mine site that are not part of the demarcated development area should be considered as a no go zone for employees, machinery or even visitors.
- All those working on site must be educated about the conservation importance of the fauna and flora occurring on site.
- The ECO must ensure that all contractors and workers undergo Environmental Induction prior to commencing with work on site.
- The environmental induction should occur in the appropriate languages for the workers who may require translation.
- Reptiles and amphibians that are exposed during the clearing operations should be captured for later release or translocation by a qualified expert.
- Employ measures that ensure adherence to the speed limit.

Habitat

Level of risk: Low

Mitigation measures

- Mining activities must be planned, where possible in order to encourage faunal dispersal and should minimise dissection or fragmentation of any important faunal habitat type.
- The extent of the mining area should be demarcated on site layout plans (preferably on disturbed areas or those identified with low conservation importance). No construction personnel or vehicles may leave the demarcated area except those authorised to do so.

Air quality

Level of risk: Very low

Mitigation measures

- Vegetation must be removed when soil stripping is required only. These areas should be limited to include those areas required for mining only, hereby reducing the surface area exposed to wind erosion. Adequate demarcation of these areas should be undertaken.
- Control options pertaining to topsoil removal, loading and dumping are generally limited to wet suppression.
- Where it is logistically possible, control methods for gravel roads should be utilised to reduce the re-suspension of particulates. Feasible methods include wet suppression, avoidance of unnecessary traffic, speed control and avoidance of track-on of material onto paved and treated roads.
- The length of time where open areas are exposed should be restricted. Mining should not be delayed after vegetation has been cleared and topsoil removed.
- Dust suppression methods should, where logistically possible, must be implemented at all areas that may / are exposed for long periods of time.
- Blasting and drilling (if required) should be delayed under unfavourable wind and atmospheric conditions.
- For all mining activities management should undertake to implement health measures in terms of personal dust exposure, for all its employees.

Noise and vibration

Level of risk: Very low

Mitigation measures

- Restrict mining activities to daytime unless agreements obtained to do 24 hr operations.
- Systematic maintenance of all forms of equipment, training of personnel to adhere to operational procedures that reduce the occurrence and magnitude of individual noisy events.
- Where possible material stockpiles should be placed so as to protect the boundaries from noise from individual operations.
- Standardised noise measurements should be carried out on individual equipment at the delivery to site to construct a reference data-base and regular checks carried out to ensure that equipment is not deteriorating and to detect increases which could lead to increase in the noise impact over time and increased complaints.
- Environmental noise monitoring should be carried out at regularly to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted.

Visual impacts

Level of risk: Very low

Mitigation measures

- Infrastructure should be placed to optimise the natural screening capacity of the vegetation.
- Where practical, protect existing vegetation clumps during in order to facilitate screening during the mining operation.
- Remove rubble and other building rubbish off site as soon as possible or place it in a container in order to keep the mining site free from additional unsightly elements.
- Locate the staff camps and the material stockpiles outside of the visual field of sensitive visual receptors.
- Dust suppression procedures should be implemented especially on windy days during earth works.
- Rehabilitation should aim to establish a diverse and self-sustaining surface cover that is visually and ecologically representative of naturally occurring vegetation species.
- Implement a management plan for the post-mining site in order to control the invasion of alien vegetation and to manage erosion, until the site is fully rehabilitated.

Traffic and road safety

Level of risk: Very low

Mitigation measures

- Implement measures that ensure the adherence to traffic rules.

Heritage resources

Level of risk: Very low

Mitigation measures

- The heritage and cultural resources (e.g. graveyards, ruins, historic structures, etc.) must be protected and preserved by the delineation of a no go zone.
- Intact bedrock strata should be avoided during mining of terrace gravels where possible.
- Stone tools should be avoided where possible and fresh exposures should be recorded before destruction. All stone tool artefacts should be recorded, mapped and collected before destruction.
- Should development necessitate impact on any building structures, the developer should apply for a SAHRA Site destruction permit prior to commencement of construction.

Socio-economic

Level of risk: Very low

Mitigation measures

- The mine must ensure that false expectations are not created regarding job creation.
- Jobs must be allocated as advertised and in so far as is possible to local inhabitants.
- Contractors and employees should not be permitted to wander outside the mining area.
- Uncontrolled settlement of contractors and workers outside of the site will be prevented.
- The expectations of what benefits can accrue to the community must be managed from the initiation of the project.
- Commitments as set out in the SLP must be attained.

Interested and affected parties

Level of risk: Very low

Mitigation measures

- Maintain active communication with IAPs.
- Ensure transparent communication with IAPs at all times.
- IAPs must be kept up to date on any changes in the mining operation.
- A complaints management system should be maintained by the mine to ensure that all issues raised by community members are followed up and addressed appropriately.

ix) Motivation where no alternative sites were considered

The locality of the mining operation is based on the location of the diamondiferous deposits that have been identified through extensive exploration activities. There is therefore no other alternative with regard to the overall operation footprint.

The location of the central mining site and associated infrastructure is primarily based on proximity to the access roads, proximity to the areas earmarked for mining and limited additional impact on the environment and heritage resource. The property was already under a prospecting right with bulk sampling and all the infrastructure had already been constructed during this operation. It will therefore cause additional impacts if this infrastructure is moved and render the consideration of alternative mining sites useless.

The mining activities and methodologies associated with alluvial diamond mining (i.e. open pits with continued backfilling) is the only economic viable method currently being used by the diamond fraternity. There is no alternative mining method for the mining of alluvial diamonds.

x) Statement motivating the alternative development location within the overall site

Not applicable. There is no alternative development location for the site.

h) Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (In respect of the final site layout plan) through the life of the activity

Not applicable. There is no alternative development location for the site and therefore the initial site locality is considered to be the final site locality. The impact assessment provided in section g(v) is therefore sufficient and the process undertaken to identify impacts is the same as in section g(vi).

i) Assessment of each identified potentially significant impact and risk

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE	MITIGATION TYPE	SIGNIFICANCE
Roads	Air quality	Nuisance dust will be created by the prospecting equipment hauling material between the open excavation areas and the plant area.	Construction	High	Dust control Water spraying Well maintained equipment	Medium
	Fauna	Where new haulage roads will be created the natural habitat of the animals will be disturbed and/or destroyed.	Construction	High	Speed limits Environmental Awareness	High
	Flora	Where new haulage roads will be created the vegetation will be disturbed and/or destroyed.	Construction	High	Stripping of topsoil and concurrent rehabilitation	High
	Ground water	No impact to groundwater is expected from the roads that will be used by the planned prospecting operation.	Construction	No significance	Pollution control and good housekeeping practice	No significance
	Noise	Noise from the prospecting equipment on the haulage roads will be created.	Construction	Medium	Noise control Well maintained equipment	Low
	Soil	No impact to soil is expected from the roads that will be used by the planned prospecting operation.	Construction	No Significance	Stripping of topsoil and concurrent rehabilitation	No Significance
	Surface water	No impact to surface water is expected from the roads that will be used by the planned prospecting operation.	Construction	No significance	Pollution control and on-going housekeeping	No Significance
	Topography	No impact to topography is expected from the roads that will be used by the planned prospecting operation.	Construction	No Significance	Concurrent rehabilitation	No Significance
	Visual	The haulage roads will be visible to some extent from the immediate surroundings.	Construction	No Significance	Concurrent Rehabilitation	No Significance

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE	MITIGATION TYPE	SIGNIFICANCE
Pitting/excavating	Air quality	Nuisance dust will be created by mining equipment excavating material from the prospecting pits.	Operational	High	Dust control Well maintained equipment	Medium
	Fauna	Where new pits/ excavations will be created the natural habitat of the animals will be disturbed and/or destroyed.	Operational	High	Speed limits Environmental Awareness	High
	Flora	Where new pits/ excavations will be created the vegetation will be disturbed and/or destroyed.	Operational	High	Stripping of topsoil and concurrent rehabilitation	High
	Ground water	No impact to groundwater is expected from the creation of excavations.	Operational	No Significance	Pollution control and good housekeeping practice	No Significance
	Noise	Noise impact from the prospecting equipment will be created.	Operational	High	Noise control Well maintained equipment	Medium
	Soil	The disturbance of the soil structure during excavation activities.	Operational	High	Stripping of topsoil and concurrent rehabilitation	High
	Surface water	No impact to surface water is expected during excavation activities.	Operational	No Significance	Pollution control and on-going housekeeping	No Significance
	Topography	Changing of natural slopes by prospecting pitting activities.	Operational	Medium	Concurrent rehabilitation	Low
	Visual	The excavations will be visible to some extend from the immediate surroundings.	Operational	No Significance	Concurrent Rehabilitation	No Significance

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE	MITIGATION TYPE	SIGNIFICANCE
Temporary waste dump area & topsoil storage area	Air quality	Nuisance dust will be created by the prospecting equipment when the material is dumped/ stockpiled in these areas.	Commissioning	High	Dust control Well maintained equipment	Medium
	Fauna	The natural habitat of the animals will be disturbed and/or destroyed in these areas.	Commissioning	High	Speed limits Environmental Awareness	High
	Flora	The vegetation will be disturbed and/or destroyed in these areas.	Commissioning	High	Stripping of topsoil and concurrent rehabilitation	High
	Ground water	No impact to groundwater is expected.	Commissioning	No Significance	Pollution control and good housekeeping practice	No Significance
	Noise	Noise impact from the prospecting equipment will be created.	Commissioning	High	Noise control Well maintained equipment	Medium
	Soil	The disturbance of the soil structure.	Commissioning	High	Stripping of topsoil and concurrent rehabilitation	High
	Surface water	No impact to surface water is expected.	Commissioning	No Significance	Pollution control and on-going housekeeping	No Significance
	Topography	Changing of natural slopes.	Commissioning	Medium	Concurrent rehabilitation	Low
	Visual	These temporary storage areas will be visible to the immediate surroundings.	Commissioning	No Significance	Concurrent Rehabilitation	No Significance

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE	MITIGATION TYPE	SIGNIFICANCE
Mine residue disposal dam	Air quality	No impact to air quality is expected.	Commissioning	No Significance	Dust control Well maintained equipment	No Significance
	Fauna	The natural habitat of the animals will be disturbed and/or destroyed when the mine residue dam is created.	Commissioning	High	Speed limits Environmental Awareness	High
	Flora	The vegetation will be disturbed and/or destroyed when the mine residue dam is created.	Commissioning	High	Stripping of topsoil and concurrent rehabilitation	High
	Ground water	No impact to groundwater is expected.	Commissioning	No Significance	Pollution control and good housekeeping practice	No significance
	Noise	No noise impact is expected.	Commissioning	No Significance	Noise control Well maintained equipment	No significance
	Soil	The disturbance of the soil structure when the mine residue dam is created	Commissioning	High	Stripping of topsoil and concurrent rehabilitation	High
	Surface water	No impact to surface water is expected.	Commissioning	No Significance	Pollution control and on-going housekeeping	No Significance
	Topography	Changing of natural slopes.	Commissioning	Medium	Concurrent rehabilitation	Low
	Visual	The mine residue dam will be visible to the immediate surroundings.	Commissioning	No Significance	Concurrent Rehabilitation	No Significance

NAME OF ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	SIGNIFICANCE	MITIGATION TYPE	SIGNIFICANCE
Plant & processing area	Air quality	Nuisance dust will be created by the prospecting equipment.	Operational	High	Dust control Well maintained equipment	Medium
	Fauna	Where the plant and processing area will be created the natural habitat of the animals will be disturbed and/or destroyed.	Operational	High	Speed limits Environmental Awareness	High
	Flora	Where the plant and processing area will be created the vegetation will be disturbed and/or destroyed.	Operational	High	Stripping of topsoil and concurrent rehabilitation	High
	Ground water	No impact to groundwater is expected.	Operational	No Significance	Pollution control and good housekeeping practice	No Significance
	Noise	Noise from the plant and processing equipment will be created.	Operational	High	Noise control Well maintained equipment	Medium
	Soil	The disturbance of the soil structure when the plant and processing area is created.	Operational	High	Stripping of topsoil and concurrent rehabilitation	High
	Surface water	The utilization of water from the Orange River for the processing of material.	Operational	High	Pollution control and on-going housekeeping	Medium
	Topography	No impact to the topography is expected from the plant and processing area.	Operational	No Significance	Concurrent rehabilitation	No Significance
	Visual	The plant and processing area will be visible to some extent from the immediate surroundings.	Operational	No Significance	Concurrent Rehabilitation	No Significance

j) Summary of specialist reports

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED
Flora and Soil Botanical and Soil Reconnaisance study for Farms 22 and 23, Engelde Wilgeboomfontein, Prieska. Compiled by Dr. Hugo Bezuidenhout	- A provided a proper rehabilitation program must be drafted and implemented to assist the natural ecological processes and patterns of the Northern Upper Karoo to recover. - Invader or exotic plant species are categorized either as prohibited plant species which must be controlled, or eradicated where possible. All alien plant species should also be eradicated and a plan for such eradication should be incorporated into the Environmental Management Programme report (EMPr). - The rehabilitation must be carried out hand-in-hand with the mining operations. - Rehabilitation must run concurrently with mining operations. - Erosion should be mitigated by developing a plan for run-off water, which is a problem in the study area with thunderstorms part of the climate of the study area. - A mitigation plan should be part of the rehabilitation EMPr for current mining activities and also for proposed mining activities in terms of mining the drainage lines. - A permit from DENC is needed to remove any protected plant species.	X	Contained in the mitigation measures and EMPR

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED
Heritage Resources Phase 1 Heritage Impact Assesssment of farm Engelde Wilgeboom-fontein 22, Portion of the Farm 23 and Remainder and Portion 2 of the farm Kliphuis Prieska. Paleo Field Services Dr. Lloyd Rossouw	- Avoidance of intact bedrock strata during mining of terrace gravels where possible. - Record, map and collect stone tool artefacts in association before destruction. - Avoid stone tools where possible and recording of fresh exposures before destruction. - Should development necessitate impact on any building structures, the developer should apply for a SAHRA Site destruction permit prior to commencement of construction. - Any graveyards, ruins or historical structures should be conserved and avoided.	X	Contained in the mitigation measures and EMPR
Groundwater and Surfacewater Thunderflex Phase 1 Groundwater and Surface Water Assessment Thunderflex 78 Pty Ltd. Done by Moja Terre Pty Ltd	- A suggested site specific water monitoring programme is provided in Annex E of the specialist report; along with suggested monitoring locations, implementation periods, monitoring frequencies and analytical schedules for the suggested programme. - It is recommended that inline water softeners combined with activated carbon filters are installed if the taste of groundwater and scaling becomes a problem.	X	Contained in the mitigation measures and EMPR

k) Environmental impact statement

i) Summary of the key findings of the environmental impact assessment

The nature of impacts can vary widely depending on the type of physical environment, the size of the activity and the perceptions and values of each of the affected parties. It was the objective of the assessment to identify both positive and negative impacts. The existing information was reviewed to assess the present status of the environment and the extent to which they have already been modified. The planned activities and associated infrastructure was used as reference to assess potential impacts.

In general, the environmental impacts associated to the mining operation are rather negative, while the social impacts are more beneficial. Impacts on vegetation are likely to be most profound, because the mining operation will constitute large-scale clearance of indigenous vegetation and most likely also the removal of protected species. The paleontological resources confined to the gravel terraces are also likely to be destroyed. Soil erosion and surface water deterioration are likely to be possible important impacts if appropriate management strategies are not practised.

Positive impacts include the demarcation and subsequent protection of heritage resources and the eradication of alien invasive species. Positive social impacts include the creation of jobs, social upliftment, training opportunities, community development and numerous economic benefits.

To conclude, it must be accepted that any activities will have both physical and social impacts. Therefore the destruction of the natural environmental features within the mining area is inevitable. The significance of the impacts will however be affected by the success of the mitigation measures implemented and the rehabilitation programme for the mining area.

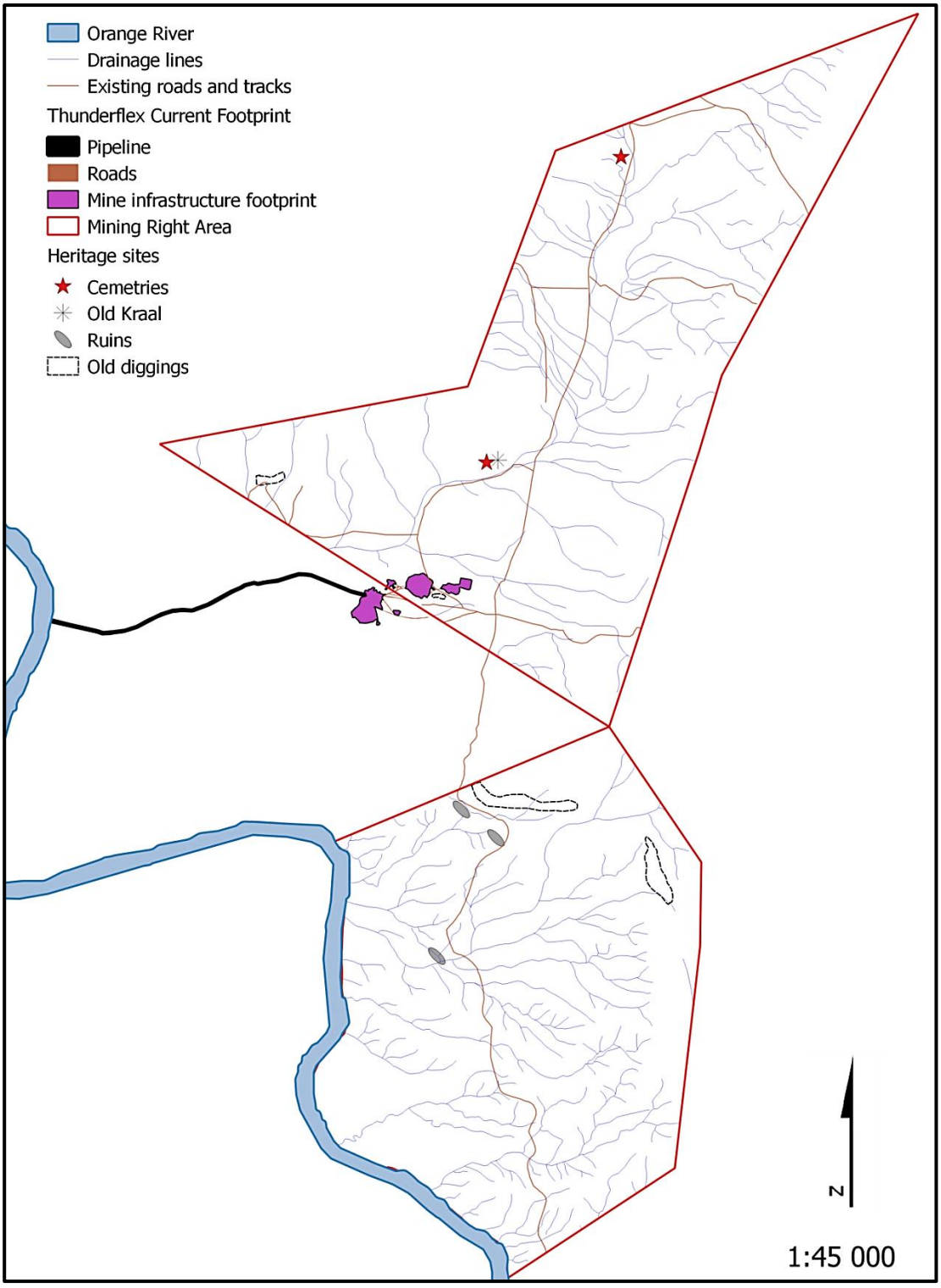
ii) Final Site Map

The final site map below indicates the mining right application area in which all mining will take place. Existing roads are also depicted. The associated infrastructure relating to the mining site will be placed in the area marked as the “mine infrastructure footprint”. The sensitive areas include the Orange River, drainage lines, cemeteries, ruins and old kraal.

The only buffers that must be implemented is the 100 m away from any fixed infrastructure like the tar road and the farm house and out buildings in terms of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) Regulations relating to surveying, mapping and mine plans.

The stone-walled ruins of two large historical terrains cover about 75 ha and 4.5 ha at Kliphuis 29 and Engeldewilgeboomfontein 22, respectively. The sites are associated with the asbestos mining industry that prevailed in the region more than a hundred years ago. A buffer of 100m should also be kept away from these sites.

Please see Final Site Map below.


Orange River
Drainage lines
Existing roads and tracks
Thunderflex Current Footprint
Pipeline
Roads
Mine infrastructure footprint
Mining Right Area
Heritage sites
Cemetries
Old Kraal
Ruins
Old diggings
N
1:45 000

iii) Summary of the positive and negative implications and risks of the proposed activity and identified alternatives

As mentioned before, the specific occurrence of alluvial diamonds in the area dictates the selection of the specific mining site and there are no alternatives in terms of project location.

In terms of alternative land use, the proposed mining operation will be done in such a way that farming will still be possible as the site will be rehabilitated in such a way that it allows the establishment of grass cover again. The rest of the farm will still be able to be used for grazing purposes.

The mining operation will provide 35 to 45 jobs and will also add to the increased economic activity and the area surrounding the farm.

Negative impacts on the area are expected to be temporary and can be mitigated to a large extent if the recommendations of the EMPR are adhered to e.g. rehabilitation.

l) Proposed impact management objectives and the impact management outcomes for inclusion in the EMPR

The impact management objectives for the Thunderflex Mining operation should include:

- To ensure efficient extraction of the diamond resource.
- To limit the alteration of the surrounding topography.
- To manage and preserve sensitive soil types.
- To prevent the loss of land capability.
- To ensure the continuation of economically viable land use.
- To ensure that the surrounding ground water resources are not adversely affected to the detriment of the health and welfare of nearby communities; and to ensure suitable quality of ground water resources.
- To ensure that the surrounding surface water resources are not adversely affected to the detriment of the health and welfare of nearby communities; and to ensure suitable quantity and quality of ground water resources.
- To contain soils and materials within demarcated areas and prevent contamination of storm water runoff.

- To minimise the loss of natural vegetation.
- To prevent the proliferation of alien invasive plants species.
- To protect the wildlife and bird species.
- To protect the natural habitat of wildlife and bird species.
- To maintain visual integrity; and to minimise the extent of the generation of dust in order to minimise the aspect of nuisance and health impacts to sensitive receptors.
- To minimise noise and vibration to a level that disturbances felt by the communities are limited.
- To reduce the impact on visual quality due to intrusive mine infrastructure, activities and facilities.
- To ensure that all traffic generated by the proposed mining development does not negatively impact on existing road networks and infrastructure; and to ensure traffic safety.
- To preserve the historical and cultural artefacts located on site in compliance with the South African Heritage Resources Act, 1999 (Act No 25 of 1999).
- To ensure that the current socio-economic status quo is improved.
- To be transparent and practise effective communication; in order to maintain good relationships with all interested and affected parties.

m) Final proposed alternatives

The locality of the mining operation is based on the location of the diamondiferous deposits that have been identified through extensive exploration activities. There is therefore no other alternative with regard to the overall operation footprint.

The location of the central mining site and associated infrastructure is primarily based on proximity to the access roads, proximity to the areas earmarked for mining and limited additional impact on the environment and heritage resource. The property was already under a prospecting right with bulk sampling and all the infrastructure had already been constructed during this operation. It will therefore cause additional impacts if this infrastructure is moved and render the consideration of alternative mining sites useless.

The mining activities and methodologies associated with alluvial diamond mining (i.e. open pits with continued backfilling) is the only economic viable method currently being used by the diamond fraternity. There is no alternative mining method for the mining of alluvial diamonds.

n) Aspects for inclusion as conditions of Authorisation

There are no aspects which have not formed part of the EMPR that must be made conditions of the Environmental Authorisation

o) Description of any assumptions, uncertainties and gaps in knowledge

This report was compiled by incorporating information provided by the applicant and the various specialists and no warranty or guarantee, whether expressed or implied, is made by the EAP with respect to the completeness, accuracy or truth of any aspect of this document with reference to the instructions, information and data supplied by the aforementioned parties.

The impact assessment was conducted based on the EAPs knowledge and experience. The probability, intensity/severity and significance pertaining to the criteria used to assess the significance of the impacts were based on rule-of-thumb and experience.

p) Reasoned opinion as to whether the proposed activity should or should not be authorised

i) Reasons why the activity should be authorized or not.

There are no significant reasons why the activity should not be authorised. However, if the proposed management and mitigation measures are not properly applied or if the mining operation intentionally disregards any of these measures, it will negatively affect the environment and have more long-term consequences. Therefore, the competent authority should take all the necessary steps to ensure that the mining operation complies with the conditions set out in the approval of the EMPR.

ii) Conditions that must be included in the authorisation.

Specific conditions to be included in the compilation and approval of EMPR

Apart from ensuring that the necessary permits are obtained for restricted activities, all recommendations and mitigation measures as set out in the EMPR should be adhered to.

Rehabilitation requirements

Infrastructure Areas

On completion of the prospecting operation, the various surfaces, including the access road, the office area, storage areas and the screening plant site, should finally be rehabilitated as follows:

- All remaining material on the surface should be removed to the original topsoil level. This material should then be backfilled into the depressions. Any compacted area should be ripped to a depth of 300 mm, where possible, the topsoil or growth medium returned and landscaped.
- All infrastructures, equipment, screening plant, and other items used during the operational period should be removed from the site.
- On completion of operations, all buildings, structures or objects on the office site should be dealt with in accordance with Regulation 44 of the Minerals and Petroleum Resources Development Act, 2002.

Topsoil and Stockpile Deposits:

Disposal Facilities: Waste material of all description inclusive of receptacles, scrap, rubble and tyres should be removed entirely from the mining area and disposed of at a recognized landfill facility. It should not be permitted to be buried or burned on the site.

Ongoing Seepage, Control of Rain Water: It is not foreseen that any monitoring of ground or surface water should take place after mine closure, except if so requested by the DWS – Kimberley.

Long Term Stability and Safety: It should be the objective of mine management to ensure the long term stability of all rehabilitated areas including the backfilled depressions. This should be done by the monitoring of all areas until a closure certificate has been issued.

Final rehabilitation in respect of erosion and dust control: Self-sustaining vegetation will result in the control of erosion and dust and no further rehabilitation is deemed necessary, unless vegetation growth is not returned to a desirable state by the time of mine closure.

Final Rehabilitation Roads:

- After rehabilitation has been completed, all roads should be ripped or ploughed, fertilized and seeded, providing the landowner does not want them to remain that way and with written approval from the Director: Mineral Development of the Department of Mineral Resources.

Submission of Information:

- Reports on rehabilitation and monitoring should be submitted annually to the Department of Mineral Resources – Kimberley, as described in Regulation 55.

Maintenance (Aftercare):

- Maintenance after closure should include the regular inspection and monitoring and/or completion of the re-vegetation programme.
- The aim of the Environmental Management Programme is for rehabilitation to be stable and self-sufficient, so that the least possible aftercare is required.
- The aim with the closure of the mine should be to create an acceptable post-mine environment and land-use. Therefore all agreed commitments should be implemented by Mine Management.

After-effects Following Closure:

Acid Mine Drainage: No potential for bad quality leachate or acid mine drainage development is associated with alluvial diamond mine closure.

Long Term Impact on Ground Water: No after effect on the groundwater yield or quality is expected.

Long-term Stability of Rehabilitated Land: One of the main aims of any rehabilitated ground should be to obtain a self-sustaining and stable end result. The concurrent cleaning of all tailings material and replacement of topsoil where available should be ensured.

q) Period for which the Environmental Authorisation is required

Environmental Authorisation is required for **10 years**.

r) Undertaking

The undertaking required to meet the requirements of this section is provided at the end of the EMPR and is applicable to both the Environmental Impact Assessment Report and the Environmental Management Programme Report.

s) Financial Provision

The progressive rehabilitation cost that will be paid into the fund to make provision for premature closure and end of life closure is estimated at **R4 041 417.00**

i) Explain how the aforesaid amount was derived

The quantum of the financial provision contemplated in Regulation 54 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) will be revised and adjusted accordingly annually, based on a survey assessment of the environmental liability of Thunderflex 78 (Pty) Ltd. Surveys of excavations are conducted by a registered surveyor and results are forwarded to the Environmental Manager who calculates the outstanding rehabilitation as per the agreed rate in the DMR Guideline. A bank guarantee is prepared for the amount and submitted to the DMR.

Financial provision for the rehabilitation or management of negative environmental impacts caused by the mining operation [as required by Section 41 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)] will be made in the form of a financial guarantee from a South African registered bank. This document will guarantee the financial provision relating to the Environmental Management Programme in a format as approved by the Director-General.

ii) Confirm that this amount can be provided from operating expenditure

The amount has already been submitted with bank guarantees to the DMR.

t) Deviations from the approved scoping report and plan of study

i) Deviations from the methodology used in determining the significance of potential environmental impacts and risks

The scoping report was not compiled by the EAP that compiled the impact assessment report and accompanying EMPR. Therefore it is not possible to provide any information on the methodology used in determining the significance of potential environmental impacts and risks.

ii) Motivation for the deviation

Not applicable.

u) Other information required by the competent Authority

i) Compliance with the provisions of sections 24 (4)(a) and (b) read with section 24 (3)(a) and (7) of the National Environmental Management Act (Act 107 of 1998), the EIA Report must include the:

(1) Impact on the socio-economic conditions of any directly affected person

The mining operation was thoroughly discussed with the landowners and some surface use agreements have already been in place for a year. The landowner requested rehabilitation to be done to enable the area to revert back to grazing capacity. Applicable mitigation measures have been provided.

(2) Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act

The archaeological footprint of the study area is primarily represented by uncapped as well as potentially intact Stone Age archaeological assemblages and isolated finds (surface scatters), stone-walled structural remnants dating back to the early part of the 20th century, as well as graveyards and other historical structures older than 60 years. The stone-walled ruins of two large historical terrains cover about 75 ha and 4.5 ha at Kliphuis 29 and Engeldewilgeboomfontein 22, respectively the sites are associated with the asbestos mining industry that prevailed in the region more than a hundred years ago. Applicable mitigation measures have been provided.

v) Other matters required in terms of sections 24(4)(a) and (b) of the Act

There are no alternatives, as the application area applied for is the area where the applicant has prospected and has found potential for a diamond mining operation (see **Appendix 4**).

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

1) Draft environmental management programme

a) Details of the EAP

I hereby confirm that the requirements for the provision of the details and expertise of the EAP are already included in PART A, section 1(a).

Confirmed	**X**

b) Description of the Aspects of the Activity

I hereby confirm that the requirements to describe the aspects of the activity that are covered by the draft environmental management programme are already included in PART A, section 1(h).

Confirmed	**X**

c) Composite Map

The final site map below indicates the mining right application area in which all mining will take place. Existing roads are also depicted. The associated infrastructure relating to the mining site will be placed in the area marked as the "mine infrastructure footprint". The sensitive areas include the Orange River, drainage lines, cemeteries, ruins and old kraal.

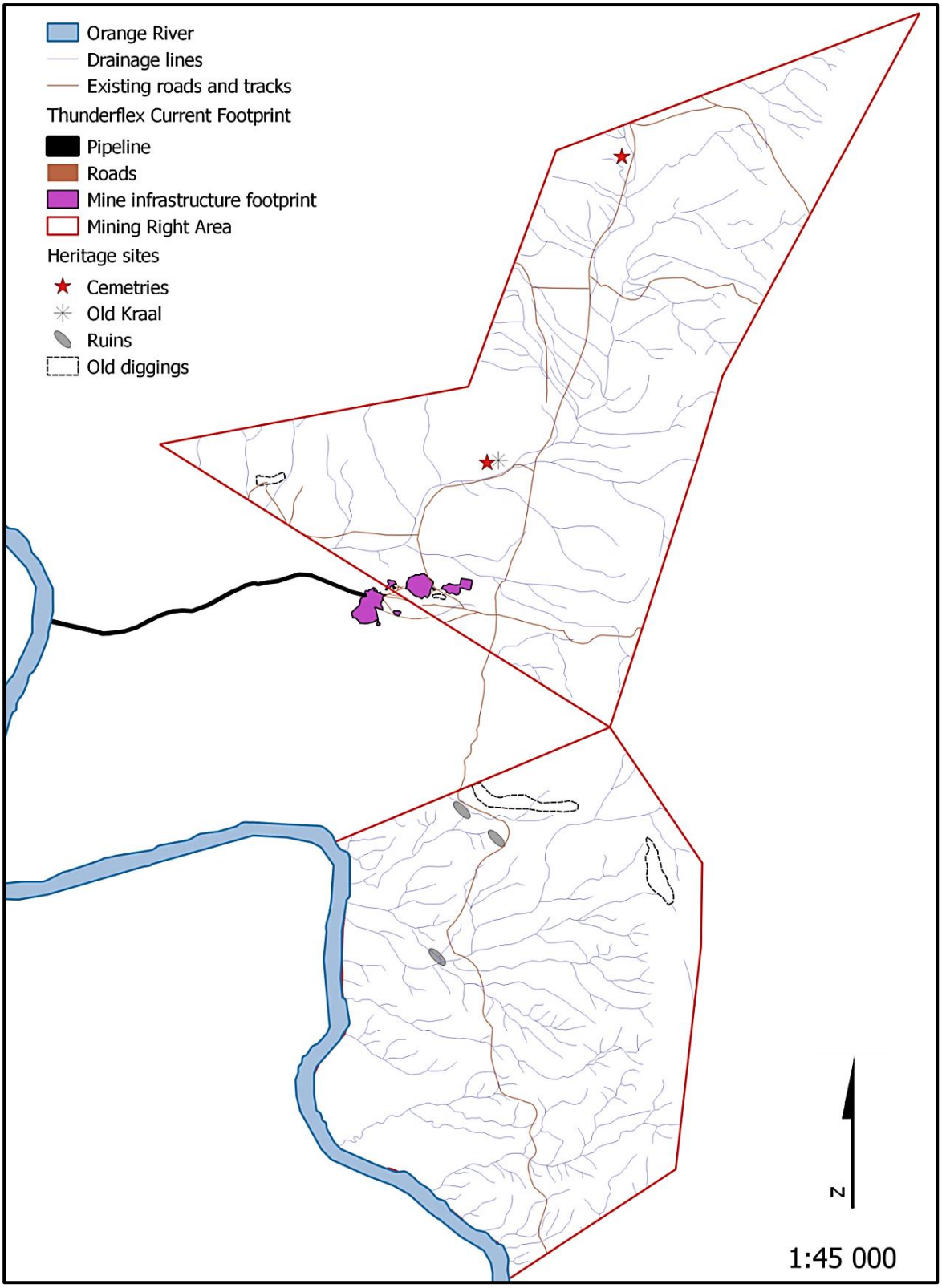
The only buffers that must be implemented is the 100 m away from any fixed infrastructure like the tar road and the farm house and out buildings in terms of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) Regulations relating to surveying, mapping and mine plans.

These regulations states that a mine must take reasonable measures to ensure that:

> *No mining operations are carried out within a horizontal distance of 100 (one hundred) metres from reserve land, buildings, roads, railways, dams, waste dumps, or any other structure whatsoever including such structures beyond the mining boundaries, or any surface, which it may be necessary to protect in order to prevent any significant risk, unless a lesser distance has been determined safe by risk assessment and all restrictions and conditions determined in terms of the risk assessment are complied with.*

The stone-walled ruins of two large historical terrains cover about 75 ha and 4.5 ha at Kliphuis 29 and Engeldewilgeboomfontein 22, respectively. The sites are associated with the asbestos mining industry that prevailed in the region more than a hundred years ago. A buffer of 100m should also be kept away from these sites.

Please see Final Site Map below.


Orange River
Drainage lines
Existing roads and tracks
Thunderflex Current Footprint
Pipeline
Roads
Mine infrastructure footprint
Mining Right Area
Heritage sites
Cemetries
Old Kraal
Ruins
Old diggings
N
1:45 000

d) Description of impact management objectives including management statements

i) Determination of closure objectives

The key aim decommissioning and closure is to ensure that all the significant impacts are ameliorated. All rehabilitated areas should be left in a stable, self-sustainable state. Proof of this should be submitted at closure. Specific objectives include:

Rehabilitation of infrastructure areas

The objectives for the removal of infrastructure and the subsequent rehabilitation of the areas they occupied include:

- To ensure that infrastructure identified for removal is successfully demolished and removed.
- To ensure that infrastructure identified to remain after mine closure is maintained until the issue of a closure certificate.

The removal, decommissioning and disposal of all mining infrastructure, will comply with all conditions contained in the MPRDA. To this end, decommissioning and rehabilitation of all infrastructure areas will follow the following principles:

- The plant and associated disused infrastructure will be dismantled or demolished. Any building foundations will be removed and land exposed to the demolition and dismantling of infrastructure and all other disturbed land will be rehabilitated.
- Rubble will be disposed of at a suitable site. The site will be selected in consultation with DENC.
- Any surface water management infrastructure will be maintained to ensure they are stable and functional.
- Just before closure, when disturbed land has been rehabilitated and erosion is controlled by vegetation cover, all disused surface water management facilities will be decommissioned.

Mine residue deposits

The mine residue deposits comprise of a slimes dam. The objectives pertaining to the effective management and rehabilitation of the slimes dam included:

- To ensure that the mine residue deposits are stable and that there is an acceptably low risk of failure of these deposits during the decommissioning phase and following mine closure;
- To establish self-sustainable vegetation cover on the slimes dam so that the visual impact of the slimes dam is improves and in order to prevent erosion.

Management principle pertaining to the slimes dam includes:

  - The slimes dam/s will continuously be inspected by a suitable qualified professional engineer to ensure their stability. If they are unstable, the appropriate remedial measures will be implemented.
  - Inspection and monitoring should continue until a suitable qualified profession engineer has confirmed the long-term stability of the slimes dam.
  - Any infrastructure or facilities that serve the slimes dam will be maintained to ensure that they are both stable and functional.

Maintenance

The necessary agreements and arrangement will be made by Thunderflex to ensure that all natural physical, chemical and biological processes for which a closure condition were specified are monitored until they reach a steady state or for three (3) years after closure or as long as deemed necessary at the time.

- Such processes include erosion of the slimes dams, rehabilitated surfaces, surface water drainage, air quality, surface water quality, ground water quality, vegetative re-growth, weed encroachment.
- The closure plan will be reviewed yearly.
- Rehabilitation of the land will be maintained until a closure certificate is granted or until the land use is regarded as sustainable.
- All rehabilitated areas will be monitored and maintained until such time as required to enable the mine to apply for closure of these different areas.

Performance assessments

As per the MPRDA and associated Regulations, this Environmental Management Programme will be continually assessed in terms of its appropriateness and adequacy. In order to achieve this, Thunderflex will undertake the following:

- Implement the necessary monitoring programmes, as discussed as part of this EMPR;
- Conduct performance assessments of this EMPR as required by the MPRDA and associated Regulations; and
- Compile and submit the afore-mentioned performance assessment reports to the DMR. The frequency of the performance assessments will occur every year. An independent and competent person will undertake all performance assessments.

Decommissioning and closure objectives

The key aim decommissioning and closure is to ensure that all the significant impacts are ameliorated. All rehabilitated areas will be left in a stable, self-sustainable state. Proof of this will be submitted at closure. Specific objectives include:

- To identify potential post-closure land uses in consultation with the surrounding land owners and land users. This should be done during the operational phase of the mine.
- Rehabilitate disturbed land to a state suitable for its post-closure uses;
- Rehabilitate disturbed land and mine residue deposits to a state that facilitates compliance with applicable environmental quality objectives.
- Limit the impact on staff whose positions become redundant at the time of mine closure, as addressed in the SLP.
- Keep relevant authorities informed of the progress of the decommissioning phase;
- Submit monitoring data to the relevant authorities;
- Maintain required pollution control facilities and rehabilitated land until closure;

Negative economic impacts

The objective is to alleviate the negative socio-economic impacts that will result from mine closure. Management principles to achieve this include:

- Thunderflex will undertake a carefully planned step-wise decommissioning process.
- Closure planning will form an integral part of mine planning.
- Strategies for sustainable development of surrounding towns have been and will continue to be developed by the project in collaboration with district and local authorities, local businesses and other interested parties. Early warning of impending closure will be given to IAPs.
- In conjunction with long-term closure planning, the mine will actively participate in regional and local planning to enhance the economic benefits of the project through development of alternative forms of income generation.
- Thunderflex will initiate and participate in regional planning exercises that will mitigate the impacts of closure of the mine, the local and regional economies and associated abandonment of community infrastructures surrounding the mine.
- The mine will fulfil the requirements for closure and the management of downscaling as contained in the SLP.

ii) The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity

These are contained in the EMPR.

iii) Potential risk of Acid Mine Drainage

There is no potential risk of acid mine drainage.

iv) Steps taken to investigate, assess, and evaluate the impact of acid mine drainage

Not applicable, there is no potential risk of acid mine drainage.

v) Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage

Not applicable, there is no potential risk of acid mine drainage.

vi) Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage

Not applicable, there is no potential risk of acid mine drainage.

vii) Volumes and rate of water use required for the mining, trenching or bulk sampling operation

The operation would require about 6 000 to 8 000 litres per day if a bourevestnic machine is going to be used. All water for the Thunderflex Mine is pumped from the Orange River under a temporary transfer from agricultural water from DWS. An estimated 105 000 L/hr is pumped using a 600 KvA pump, and transported via a 4.45km pipeline.

viii) Has a water use licence been applied for?

Yes, under reference number 27/2/1/11B94/11/2, the application is in its final stages for approval.

ix) Impact to be mitigated in their respective phases

Activity and phase	Potential Impact	Size and scale	Mitigation or Control Measure related to compliance with standards
ENVIRONMENTAL IMPACTS			
Construction Activities Control measures are to be applied during the implementation of respective activities.	**Geology** Sterilisation of mineral resources	Local	- No dumping of materials prior to approval by exploration geologist; - Proper planning of excavations
	Topography Changes to surface topography due to placement of infrastructure and development of residue deposits	Local	- Prominent natural features will not be disturbed such as EP 1 and grave sites; - All temporary infrastructure will be demolished during closure; - Waste will be disposed of at Municipal waste disposal site; - All disturbed areas will be rehabilitated
	Soils Loss of soils resources due to erosion Soil contamination due to hydrocarbon spillages	Local	- All temporary infrastructures will be demolished during closure; - Waste will be disposed of at Municipal waste disposal site; - Agreement to use this site will be sought from the municipality; - All disturbed areas will be cleaned and rehabilitated; - Topsoil will be stripped prior to placement of infrastructure, as well as excavating mine pits. - Topsoil will be stripped according the soil type and the available soil depth in the areas to be disturbed (up to 150mm) as per soil analysis of the area. - Soil will be stockpiled in windrows not higher than 2m with as little compaction as possible. - Stockpiling will be done as close as possible to areas where the soils will be replaced and single handling practiced. - Soil stockpiles will be kept in a weed-free condition. - Stockpiled soil will be used in ongoing rehabilitation of disturbed areas. - Rehabilitation will include: ✓ removing of all debris, ✓ replacement of soil with as little compaction as possible, ✓ reshaping, ploughing or ripping to break compaction, and ✓ introduction of organic matter as necessary; - Soil contamination will be prevented through: ✓ bunding of all above-ground storage facilities ✓ construction on impervious floors for hazardous substances such as diesel, oil and chemicals, and ✓ regular inspection of equipment and vehicles for leaks.

Activity and phase	Potential Impact	Size and scale	Mitigation or Control Measure related to compliance with standards
	Soils (continued)		- Spillages of oil, grease and hydraulic fluids will be reported. The spillages will be cleaned up by removing the soil and disposing such soil in a waste receptacle called soil farm. A dedicated engineer will be appointed to oversee the soil farm. - Contaminated soil will be removed taken to this soil farm, where it will be treated with decontaminant. The treated soil samples will be taken to the laboratory to determine if this soil is suitable for taking back to rehabilitation areas. - Contractors, staff and drivers will be trained on how to deal with spillage of hydrocarbons and other potential contaminants. - All domestic and industrial waste generated on site will be contained in skips and appropriate receptacles, collected and if required sorted by the approved contractor, and removed to approved waste disposal site. - Linear infrastructure such as roads and pipelines will be inspected at least monthly to check that the associated water management infrastructure is effective in controlling erosion. - All surface water management infrastructure constructed from soil (berms, canals and bunds) will be inspected at least monthly, with more frequent inspections during periods of high rainfall and after major rainfall events. - The disturbed areas will be rehabilitated to grazing potential and appropriate erosion control measures will be implemented. After the overburden have been placed back in the mined open pits, the topsoil/subsoil dumps will be replaced for rehabilitation and re-vegetation purposes. Clovely soils will be used for topsoiling. - Any excavation of topsoils will be done such that the cleared area is also ripped and allow to re-vegetate
	Land capability Loss of land capability	Local	- All construction activities to be restricted within the demarcated areas - Surface agreement to be signed with land owners - Check, service and maintain construction vehicles and equipment to minimise the risk of hydrocarbon and chemical leakages and spillages

Activity and phase	Potential Impact	Size and scale	Mitigation or Control Measure related to compliance with standards
	Land use Fragmentation of farm land	Local	- Restrict construction activities to demarcated areas and consider all other areas as no-go areas to minimise loss of grazing land - Do not disturb Pan - EP 1 - Do not disturb grave sites - Ensure that land which is not used during construction is made available for grazing and recreational activities.
	Fauna and Flora Loss of habitat	Local and regional	- Service and maintain construction vehicles in order to reduce noise emissions - Advise persons entering the site not to disturb or harm animals - Implement a biodiversity action plan that is available as part of the Biodiversity specialist report - Avoid sensitive areas, such as pans and streams banks-no infrastructure within 100 m of any road or water course
	Pans and wetlands Loss or disturbance of habitat through encroachment of mining related activities	Local	- Educate employees, contractors and visitors on biodiversity and land management principles - Planning & Surveying Department to be provided with relevant buffer areas to incorporate in future planning. - Applicable Water Use Licenses should be applied for disturbance of any pans.

Activity and phase	Potential Impact	Size and scale	Mitigation or Control Measure related to compliance with standards
	Alien Species Contamination by chemical control agents (users need to be registered and certified for use of dangerous products) Large areas denuded of vegetation. (Small-scale rehabilitation of denuded areas to be implemented)	Local and regional	- Mechanical and chemical methods will be implemented initially to bring about a quick reduction in these species that pose the greatest invasive threat to the area. - Mechanical (tree-felling) and chemical (stump treatment) methods to be implemented. Market for harvested wood to be investigated. - Mechanical methods (hand-pulling) of control to be implemented extensively in the early stages of establishment of the mine. - Annual follow-up operations to be implemented. - Control measures to be implemented on an opportunistic basis. - Landscaping and gardening to be based on the use of indigenous plants only. Alien plants are to be removed whenever possible.
	Biodiversity Loss of biodiversity	Local, regional and national	- Research and information gathering regarding the establishment of *B. albitrunca* trees. - Establish a nursery on site - Grow seedlings at the nursery - Monitor success rate for the establishment of seedlings - Conduct rehabilitation - Provide training in the identification of protected species - Re-vegetate using mix of indigenous locally occurring species - Re-establish tree species on the field away from the mining areas - Set up fixed point monitoring sites to check progress of rehabilitation - Fence off newly rehabilitated areas and protect from grazing until well established. - Apply for a licence for removal of *B. albitrunca* trees in terms of the National Forest Act.
	Ground water Contamination of ground water	Regional	- Implement waste management plan for handling hazardous waste b) Conduct ground water monitoring as per the monitoring plan

Activity and phase	Potential Impact	Size and scale	Mitigation or Control Measure related to compliance with standards
	Air quality Deterioration of air quality	Regional	- Rehabilitate and maintain disturbed surfaces that are not going to be utilised after construction; - Promote use of PPE such as dust masks
	Noise Increase in ambient noise level	Regional	- Restrict construction activities to daytime unless agreements are obtained from landowners to do 24 hr operation; - Service construction vehicles and equipment on a regular basis to ensure noise suppression mechanisms are functioning; - Construct enclosures/bunds and berms for pumps, generators and other noise generating equipment; - Equip vehicles with noise silencers; - Switch equipment off when not in use; - Demarcate and clearly mark noise zones; - Adhere to occupation health and safety noise limits; - Maintain occupational noise monitoring to determine noise levels from equipment as increased noise may indicate other issues. A noise monitoring programme and grievance procedure must be implemented;
	Visual Visual intrusion	Regional	- Use natural colour tones for structures, roofs of buildings will be angled so as to not reflect sunlight and night lighting will be minimised; - Carry adjustments to the siting and design of the project, the careful selection of finishes and colours, the use of earthworks (such as berms) and planting to provide visual screening, as well as dust control where required. Penalties for non-compliance should be considered; - Screen the site from the surrounding areas by planting fast growing indigenous trees; - Turn lights off using a timer or occupancy sensor or manually when not needed. - Both on-site and off-site landscape rehabilitation of areas affected by the project should be considered. This may include re-instating landforms and natural vegetation, provision of landscaped open space, or other agreed upon facilities.
	Sensitive areas Destruction of sensitive areas	Local	- Avoid all identified wetlands and ensure that no activities take place within wetland areas; - Construct catchment dams in areas that drain towards streams and wetlands, in order to contain dirty water and reduce impacts on wetlands; - Conduct monitoring programme for water, soil and biodiversity;

Activity and phase	Potential Impact	Size and scale	Mitigation or Control Measure related to compliance with standards
	Sensitive areas (continued)		- Introduce a hydrocarbon management system to ensure that hydrocarbon pollution is minimised; - Commence with construction during the low flow or during low rainfall in the - wet season; - Ensure that infrastructure is constructed outside the 100 year flood line and or within 100 m from streams and pans in order to minimise impacts on water courses; - Comply with Regulation 704 of the National Water Act of 1998 for all designs of mine residue disposal infrastructure; - Minimise the removal of vegetation during stripping.
	Traffic and safety	Local	- Allocate and adhere to speed limits; - To reduce negative impacts of increased traffic on and around the site; - Restrict traffic to demarcated areas; - Public to be given right of way on public roads and truck contractors shall make use of approved methods to control the movement of vehicles so as not to constitute a road hazard; - Erect safety signs in the local languages to warn people of the danger on roads; - Keep in constant liaison with the local Department of Roads who will need to be aware of any proposed road plans and who may be able to assist in terms of making recommendations and road maintenance; - Ensure that site access points are clearly visible from the main road; - Ensure that all drivers employed are certified with appropriate training levels for the required vehicle; - Ensure that all vehicles entering and leaving the site use demarcated routes.
	Surface Water Contamination of surface water resources	Regional	- Clean surface water or runoff will be prevented from entering dirty areas by diverting it around these areas; - The discharge positions might also require additional reinforcement in the form of a suitably designed gabion or similar structure to prevent erosion at the discharge positions.
	Fauna and flora Loss of natural vegetation and species of conservation value	Local, regional and national	- Ensure that vegetation is not unnecessarily removed; - Remove with care and relocate Red Data List species to avoid destruction; - Manage and control plant species declared as invasive and declared weeds.

Activity and phase	Potential Impact	Size and scale	Mitigation or Control Measure related to compliance with standards
Operational activities Control measures are to be applied during the implementation of respective activities	**Air quality** Deterioration in air quality	Local	- Minimise the removal of vegetation in order to reduce the possibility of dust pollution; - Vegetate topsoil stockpiles as soon as possible to reduce dust and particulate emissions; - Locate topsoil stockpiles in order to reduce its exposure to wind, thereby reducing the likelihood of particle entrainment. - Spray road surfaces with water and treat it with a dust binding agent to minimise emissions of fugitive dust. The type of dust-binding agent should determine the amount of watering.
	Topography Change in surface topography	Local	Engineer and environmental consultant should supervise vegetation and rehabilitation activities in accordance with post mining topographical plan.
	Land capability Loss of land capability	Local	- Plan all construction activities to prevent the incorrect stripping of topsoil which leads to the reduction in land capability; - Restrict all construction activities to demarcated areas.
	Soils Loss of soil fertility	Local	- Vegetate soil stockpiles and berms to minimise the risk of erosion; - Implement erosion control measures, such as contour banks in area prone to erosion, including slopes and uneven ground; c) Vegetate preferential flow paths of storm water runoff; - Remove soils in dryer months, due to their increased susceptibility to compaction and erosion during rains; - Separate topsoil (A horixon) and sub-soils (B horizon) where possible and stockpile separately; - Construct berms around soil stockpiles in order to divert water away from the stockpile to prevent erosion; - Restrict stockpile height to less than 3m and shape to reduce soil compaction; - Minimise the removal of topsoil in order to reduce dust and particulate emissions.
	Surface water Deterioration in water quality	Regional	- Ensure that construction activities are at least 100m from wetlands and floodlines; - Stabilise soil stockpiles with vegetation in order to reduce exposure to erosion and minimise the effects of silt loading of surface water running over exposed soil

Activity and phase	Potential Impact	Size and scale	Mitigation or Control Measure related to compliance with standards
	Surface water Deterioration of a water resource	Regional	- Measures to reduce the pressure on water resources include actions such as: ✓ Optimising the recycling and re-use of water, and ✓ Minimising losses - These can be accomplished in many ways, but with the following aspects being recommended for this site: ✓ Maximum re-use of water from the return water dam. - Dispose of domestic and hazardous waste originating form temporary and permanent offices and workshops at an authorised landfill facility to minimise the risk of surface water pollution; - Dispose of hazardous waste and effluent at an authorised landfill facility.
	Groundwater Contamination of ground water	Regional	- Check, service and maintain construction vehicles and equipment used during infrastructure construction to reduce the risk of hydrocarbon and chemical leakages and spillages; - Contain and remediate hydrocarbon or chemical leakages and spillages to prevent leaching into the groundwater; - Develop an emergency spill response plan and train all construction contractors in the emergency spill response procedure;
	Fauna and flora Loss of natural vegetation and species of conservation value	Local, regional and national	- Plan and construct strip areas carefully to minimise the impact on flora species; - Avoid the unnecessary removal of vegetation; - Set and enforce speed limits to prevent accidental injury or death to animals. - Restrict vehicles to road and demarcated areas to prevent damage to vegetation. - Prevent disposal of waste in non-designated areas and the reputable clearing and disposal of any such waste, as these can cause harm to animals, particularly poisonous wastes and plastics.
	Noise Noise disturbance	Local	- Restrict operational activities to normal working hours; - Service vehicles and equipment on a regular basis to ensure noise suppression mechanisms are functioning; - Limit the speed of vehicles to 40km/h; - Train workers in safety and the use of personal protective equipment to prevent damage to their hearing

Activity and phase	Potential Impact	Size and scale	Mitigation or Control Measure related to compliance with standards
SOCIO-ECONOMIC IMPACTS			
Construction, operational and decommissioning Control measures are to be applied during the implementation of respective activities	**Socio-Economic** Negative impacts on employment and loitering of people in the area resulting lack of security and safety	Local and regional	- Where possible local service providers and workers will be recruited from the local area to increase employment opportunities during the construction phase; - Ad-hoc, informal recruitment at the gate or through other unapproved channels by setting up recruitment stands in built up areas will be prohibited; - A skills audit should also be undertaken to determine local skills available; - HIV/AIDS awareness programmes/ Voluntary Counselling & Testing Program will be introduced; - Relationships with local government through LED programmes should be developed - Stakeholder database will be established to identify partners and develop collaborative networks; - Uncontrolled settlement of contractors outside of the site will be prevented; - The recruitment selection process to promote gender equality and the employment of women wherever possible - SLP commitments will be implemented - Reach agreement with the municipality regarding mandates and responsibility for issues relating to the upgrading of infrastructure and the allocation of land for housing.
	Interested and affected parties Lack of communication with stakeholders and loss of trust	Local and regional	- Implementation of EMP recommendations, involvement of communities in LED initiatives, ongoing communication to provide feedback and updates; - IAPs must be kept up to date on any changes to transport routes and increase in truck frequency or of alternative routes; - A complaints management system should be maintained by the mine to ensure that all issues raised by community members are followed up and addressed appropriately.

Activity and phase	Potential Impact	Size and scale	Mitigation or Control Measure related to compliance with standards
	Heritage resources Destruction of heritage resources	Local	- In the event that any major feature such as a burial or cache of ostrich eggshell flasks is uncovered during mining operation, an archaeologist should be called in to evaluate the finds. - A buffer zone from all graves and grave yards close to construction activities will be established. - The mine will not hinder easy and safe access for relatives to the grave yards. - In the event of an archaeological artefact being unearthed, an accredited archaeologist will inspect the site and make recommendations; - Promote archaeological awareness and investigate sustainable initiatives with communities to promote the local culture.
	Land Use Loss of land use Proliferation of alien invasive species	Local	- Incorporate an alien invasive eradication and control programme into the rehabilitation efforts. This programme should be formulated according to relevant legislation; - All temporary infrastructure will be demolished during closure
	Employment Loss of jobs and employment	Local and regional	- Opportunities for additional resources and redeployment, integration of employees and communities into sustainable LED projects, equip suppliers through mentorship and training; - Increased employment opportunities during decommissioning for local contractors; - Where short term employment opportunities exist during decommissioning, local contractors and jobs seekers will receive preference; - The workforce should undergo multiple skills training during the operation of the mine so that they can be productively absorbed into the local economy after mine closure; - Where retrenchments are unavoidable, they will be managed humanely according to legislative requirements;

Activity and phase	Potential Impact	Size and scale	Mitigation or Control Measure related to compliance with standards
	Employment (Continued)		- There should be adherence to the objectives and management measures stated with the Social and Labour Plan; - The workforce should be empowered to develop skills that will equip them to obtain employment in other sectors of the economy; - The LED plan should be implemented to assist local business development; - Local partners should be supported to diversify economy and decrease dependence on mining; - A strategy for saving jobs and management of downscaling and/or retrenchment should be implemented; - Assistance should be given for help with redeployment of retrenchees in other operations or assistance with alternative livelihood strategies; - Identify and implement training needs and training programmes for decommissioning and closure; - Consultation with communities and local government on future uses for the infrastructure and facilities should be implemented.

e) Impact Management Outcomes

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	MITIGATION TYPE	STANDARD TO BE ACHIEVED
Please refer to the above table in section ix					

f) Impact Management Actions

Table 54: Impact Management Actions

ACTIVITY	POTENTIAL IMPACT	MITIGATION TYPE	TIME PERIOD FOR IMPLEMENTATION	COMPLIANCE WITH STANDARDS
Please refer to the above table in section ix				

i) Financial Provision

(1) Determination of the amount of Financial Provision

(a) Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under Regulation 22(2)(d) as described in 2.4 herein.

The key aim decommissioning and closure is to ensure that all the significant impacts are ameliorated. All rehabilitated areas should be left in a stable, self-sustainable state. Proof of this should be submitted at closure. Specific objectives include:

Rehabilitation of infrastructure areas

The objectives for the removal of infrastructure and the subsequent rehabilitation of the areas they occupied include:

- To ensure that infrastructure identified for removal is successfully demolished and removed.
- To ensure that infrastructure identified to remain after mine closure is maintained until the issue of a closure certificate.

The removal, decommissioning and disposal of all mining infrastructure, will comply with all conditions contained in the MPRDA. To this end, decommissioning and rehabilitation of all infrastructure areas will follow the following principles:

- The plant and associated disused infrastructure will be dismantled or demolished. Any building foundations will be removed and land exposed to the demolition and dismantling of infrastructure and all other disturbed land will be rehabilitated.
- Rubble will be disposed of at a suitable site. The site will be selected in consultation with DENC.
- Any surface water management infrastructure will be maintained to ensure they are stable and functional.
- Just before closure, when disturbed land has been rehabilitated and erosion is controlled by vegetation cover, all disused surface water management facilities will be decommissioned.

Mine residue deposits

The mine residue deposits comprise of a slimes dam. The objectives pertaining to the effective management and rehabilitation of the slimes dam included:

- To ensure that the mine residue deposits are stable and that there is an acceptably low risk of failure of these deposits during the decommissioning phase and following mine closure;
- To establish self-sustainable vegetation cover on the slimes dam so that the visual impact of the slimes dam is improves and in order to prevent erosion.

Management principle pertaining to the slimes dam includes:

  - The slimes dam/s will continuously be inspected by a suitable qualified professional engineer to ensure their stability. If they are unstable, the appropriate remedial measures will be implemented.
  - Inspection and monitoring should continue until a suitable qualified profession engineer has confirmed the long-term stability of the slimes dam.
  - Any infrastructure or facilities that serve the slimes dam will be maintained to ensure that they are both stable and functional.

Maintenance

The necessary agreements and arrangement will be made by Thunderflex to ensure that all natural physical, chemical and biological processes for which a closure condition were specified are monitored until they reach a steady state or for three (3) years after closure or as long as deemed necessary at the time.

- Such processes include erosion of the slimes dams, rehabilitated surfaces, surface water drainage, air quality, surface water quality, ground water quality, vegetative re-growth, weed encroachment.
- The closure plan will be reviewed yearly.
- Rehabilitation of the land will be maintained until a closure certificate is granted or until the land use is regarded as sustainable.
- All rehabilitated areas will be monitored and maintained until such time as required to enable the mine to apply for closure of these different areas.

Performance assessments

As per the MPRDA and associated Regulations, this Environmental Management Programme will be continually assessed in terms of its appropriateness and adequacy. In order to achieve this, Thunderflex will undertake the following:

- Implement the necessary monitoring programmes, as discussed as part of this EMPR;
- Conduct performance assessments of this EMPR as required by the MPRDA and associated Regulations; and
- Compile and submit the afore-mentioned performance assessment reports to the DMR. The frequency of the performance assessments will occur every year. An independent and competent person will undertake all performance assessments.

Decommissioning and closure objectives

The key aim decommissioning and closure is to ensure that all the significant impacts are ameliorated. All rehabilitated areas will be left in a stable, self-sustainable state. Proof of this will be submitted at closure. Specific objectives include:

- To identify potential post-closure land uses in consultation with the surrounding land owners and land users. This should be done during the operational phase of the mine.
- Rehabilitate disturbed land to a state suitable for its post-closure uses;
- Rehabilitate disturbed land and mine residue deposits to a state that facilitates compliance with applicable environmental quality objectives.
- Limit the impact on staff whose positions become redundant at the time of mine closure, as addressed in the SLP.
- Keep relevant authorities informed of the progress of the decommissioning phase;
- Submit monitoring data to the relevant authorities;
- Maintain required pollution control facilities and rehabilitated land until closure;

Negative economic impacts

The objective is to alleviate the negative socio-economic impacts that will result from mine closure. Management principles to achieve this include:

- Thunderflex will undertake a carefully planned step-wise decommissioning process.
- Closure planning will form an integral part of mine planning.
- Strategies for sustainable development of surrounding towns have been and will continue to be developed by the project in collaboration with district and local authorities, local businesses and other interested parties. Early warning of impending closure will be given to IAPs.
- In conjunction with long-term closure planning, the mine will actively participate in regional and local planning to enhance the economic benefits of the project through development of alternative forms of income generation.
- Thunderflex will initiate and participate in regional planning exercises that will mitigate the impacts of closure of the mine, the local and regional economies and associated abandonment of community infrastructures surrounding the mine.
- The mine will fulfil the requirements for closure and the management of downscaling as contained in the SLP.

(b) Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties.

The consultation process with interested and affected parties (neighbouring farmers and land owners) was completed. Regular contact sessions are held with neighbouring farmers and land owners which are currently affected by the mining operations. Records are kept of the complaints and the mitigation measures have are being implemented. An advert in the DFA (Diamond Fields Advertiser) was also placed in order for other interested parties to come forward and register as interested parties in the project.

(c) Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure.

Infrastructure Areas

On completion of the prospecting operation, the various surfaces, including the access road, the office area, storage areas and the screening plant site, should finally be rehabilitated as follows:

- All remaining material on the surface should be removed to the original topsoil level. This material should then be backfilled into the depressions. Any compacted area should be ripped to a depth of 300 mm, where possible, the topsoil or growth medium returned and landscaped.
- All infrastructures, equipment, screening plant, and other items used during the operational period should be removed from the site.
- On completion of operations, all buildings, structures or objects on the office site should be dealt with in accordance with Regulation 44 of the Minerals and Petroleum Resources Development Act, 2002.

Topsoil and Stockpile Deposits:

Disposal Facilities: Waste material of all description inclusive of receptacles, scrap, rubble and tyres should be removed entirely from the mining area and disposed of at a recognized landfill facility. It should not be permitted to be buried or burned on the site.

Ongoing Seepage, Control of Rain Water: It is not foreseen that any monitoring of ground or surface water should take place after mine closure, except if so requested by the DWS – Kimberley.

Long Term Stability and Safety: It should be the objective of mine management to ensure the long term stability of all rehabilitated areas including the backfilled depressions. This should be done by the monitoring of all areas until a closure certificate has been issued.

Final rehabilitation in respect of erosion and dust control: Self-sustaining vegetation will result in the control of erosion and dust and no further rehabilitation is deemed necessary, unless vegetation growth is not returned to a desirable state by the time of mine closure.

Final Rehabilitation Roads:

- After rehabilitation has been completed, all roads should be ripped or ploughed, fertilized and seeded, providing the landowner does not want them

to remain that way and with written approval from the Director: Mineral Development of the Department of Mineral Resources.

Submission of Information:

- Reports on rehabilitation and monitoring should be submitted annually to the Department of Mineral Resources – Kimberley, as described in Regulation 55.

Maintenance (Aftercare):

- Maintenance after closure should include the regular inspection and monitoring and/or completion of the re-vegetation programme.
- The aim of the Environmental Management Programme is for rehabilitation to be stable and self-sufficient, so that the least possible aftercare is required.
- The aim with the closure of the mine should be to create an acceptable post-mine environment and land-use. Therefore all agreed commitments should be implemented by Mine Management.

After-effects Following Closure:

Acid Mine Drainage: No potential for bad quality leachate or acid mine drainage development is associated with alluvial diamond mine closure.

Long Term Impact on Ground Water: No after effect on the groundwater yield or quality is expected.

Long-term Stability of Rehabilitated Land: One of the main aims of any rehabilitated ground should be to obtain a self-sustaining and stable end result. The concurrent cleaning of all tailings material and replacement of topsoil where available should be ensured.

(d) Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives.

The ultimate rehabilitation of the mining site that involves the sloping, levelling, replacement of topsoil and the seeding of a grass seed mix in areas that does not recover acceptably as agreed to by the land owner will ensure that the site could be regarded as safe for humans and animals and will also ensure that the site is stable from an erosion point of view and also ensuring that the site could be used for grazing again.

- The removal of waste material of any description from the mining area and the disposal thereof at a recognised landfill facility.
- The removal of infrastructure, equipment, plant and other items from the site.
- The ripping of compacted areas to a level of 300mm and the levelling of such areas in order to re-establish a growth medium for plants (such areas will furthermore be seeded with a vegetation seed mix adapted to reflect the local indigenous flora that was present prior to the prospecting operation, if the re-establishment of vegetation is unacceptably slow.
- The backfilling of the final excavations with subsoil and the covering thereof with previously stored topsoil (where-after this area will also be seeded with a vegetation seed mix adapted to reflect the local indigenous flora that was present prior to the proposed operation, and seedlings protected for a period of one) if the re-establishment of vegetation is unacceptably slow.

(e) Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline.

The quantum of the financial provision required to manage and rehabilitate the environment is estimated at **R4 041 417.00**.

Please see calculations below:

(f) Confirm that the financial provision will be provided as determined.

It is hereby confirmed that the financial provision has already been submitted with bank guarantees to the DMR.

No.	Description	Unit	A Quantity	B Master Rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)
1	Dismantling of processing plant and related structures (including overland conveyors and powerlines)	m3	3904.2	**12.29**	1	1	47982.618
2 (A)	Demolition of steel buildings and structures	m2	562.49	**171.18**	1	1	96287.0382
2(B)	Demolition of reinforced concrete buildings and structures	m2	243.2	**252.26**	1	1	61349.632
3	**Rehabilitation of access roads**	**m2**	**15250.65**	**30.63**	**1**	**1**	**467127.4095**
4 (A)	Demolition and rehabilitation of electrified railway lines	m	0	**297.3**	1	1	0
4 (A)	Demolition and rehabilitation of non-electrified railway lines	m	0	**162.16**	1	1	0
5	Demolition of housing and/or administration facilities	m2	0	**342.34**	1	1	0
6	Opencast rehabilitation including final voids and ramps	ha	5	**174238**	0.52	1	453018.8
7	Sealing of shafts adits and inclines	m3	0	**91.89**	1	1	0
8 (A)	Rehabilitation of overburden and spoils	ha	2.4	**119642.23**	1	1	287141.352
8 (B)	Rehabilitation of processing waste deposits and evaporation ponds (non-polluting potential)	ha	6.5	**149012.22**	1	1	968579.43
8 (C)	Rehabilitation of processing waste deposits and evaporation ponds (polluting potential)	ha	0	**432802.15**	1	1	0
9	Rehabilitation of subsided areas	ha	0	**100182.35**	1	1	0
10	**General surface rehabilitation**	**ha**	**5**	**94776.82**	**1**	**1**	**473884.1**
11	River diversions	ha	0	**94776.82**	1	1	0
12	Fencing	m	0	**108.11**	1	1	0
13	Water management	ha	0.7	**36036.81**	1	1	25225.767
14	**2 to 3 years of maintenance and aftercare**	**ha**	**2**	**12612.88**	**1**	**1**	**25225.76**
15 (A)	Specialist study	Sum	0			1	0
15 (B)	Specialist study	Sum				1	0
					Sub Total 1		2905821.907
1	Preliminary and General		348698.6288		**weighting factor 2** 1		348698.6288
2	Contingencies		290582.1907				290582.1907
					Subtotal 2		3545102.73
					VAT (14%)		496314.38
					Grand Total		**4041417**

Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
Topography	To minimise the reduction of land capability.	To ensure that rehabilitation post-mining slopes are stable, free draining and no slopes have an angle in excess of 20º.	Site Manager/ Environmentalists	Monitoring will be done on an *annual basis* to ensure that the levels and the slopes are in order.
Soil	To prevent soil pollution; To limit soil compaction; To curb soil erosion; and To reinstate a growth medium able to sustain plant life.	Soil depth and chemical composition will be tested and possible erosion damage will be assisted and rectified.	Site Manager/ Environmentalists	Monitoring will be done on an *annual basis* or after a heavy rain event.
Air Quality	To control the incidence of unacceptable levels of dust pollution on site.	To ensure that the mine minimizes dust omissions, so that dust does not become a nuisance for affected parties and a health hazard.	Site Manager/Foreman appointed SHE Consultant	Visual inspections will be done and managed by dust suppression by a water tanker. Quarterly tests will also be conducted by a Safety Health and Environmental Consultant and submitted to Mine Health and Safety for monitoring purposes.
Fauna	To minimise vegetation destruction in drill, areas, and therefore a habitat for wildlife; and To eliminate poaching and the extermination of animal species within the boundaries of the study area as well as the surrounding areas.	To ensure that the species diversity and abundance is not significantly reduces.	Site Manager/ Environmentalists	Monitoring will be done at rehabilitated area on an *annually basis* to investigate species diversity and abundance.
Flora	To minimise the destruction of vegetation units; and To control invasion of exotic and invasive plant species.	To ensure that the rehabilitated areas become self-maintaining.	Site Manager/ Environmentalists	Monitoring will be done at the rehabilitated areas on a *twice a year basis* (mid-summer and mid-winter), where species diversity and vegetation cover will be investigated.
Noise	To control the incidence of unacceptable noise levels on site.	t The management objective will be to reduce any level of noise, shock and lighting that may have an effect on persons or animals, both inside the plant and that which may migrate outside the plant area.	Site Manager/Foreman appointed SHE Consultant.	Quarterly reports on fall-out noise monitoring will be conducted as required by legislation. If any complaints are received from the public or state department regarding noise levels the levels will be monitored at prescribed monitoring points.
Surface Water	To conserve water; and To eliminate the contamination of run-off and sources of surface water.	There are no sources in the vicinity of the mine.	Site Manager/Water Supply	No monitoring will be done to monitor the quality of the surface water.
Ground Water	To minimise and prevent as far as practically possible the contamination of ground water.	No ground water is used.	Site Manager/Water Supply	No monitoring will be done to monitor the levels and quality.

Monitoring plan for the Thunderflex operation

Action	Method
Monitoring the re-vegetation of: • Mined out and rehabilitated areas • Levelled and rehabilitated dumps • Old roads • Rehabilitation plots • *Boscia albitrunca* • Cleared areas	Foot inspection
Monitoring of erosion at: • Roads • Mine residue dam • Rehabilitated mined out areas • Dumps • Pumps and pipelines • Drainage lines • Any other area where erosion occurs	• Visual inspection • Walk over rehabilitated areas • Drive along roads • Check pipelines and pumps, mine residue dam and dumps • Photographic records
Monitoring of alien invasive plants	• Visual inspection on foot • Map presence of invasive plants • Plan removal and document area covered on a monthly basis • Photographic records
Monitoring of water quality from suggested points	• Chemical and bacteriological tests at identified points • Build up database and graph the results • Compare with limits and take action on non-conformance
Monitoring of all rehabilitated areas	Survey and map new rehabilitated areas
Evaluate compliance with gradients and variation in topography	Plot, map and calculate areas treated
Monitor the stability of the mine residue deposit and water storage facilities	Follow specifications in mandatory code of practise for slimes dams
Monitoring of disposal of metal scrap, old oil, oil filters, old oil drums, oily cloths, batteries, fluorescent tubes, tyres, and contaminated soil.	• Record each load sent off • Give used oils to oil recycling companies • Ensure safe disposal certificates are obtained from suppliers if the materials are given back to them
Monitoring of maintenance of general waste disposal	Running total of loads of waste taken to the Prieska waste disposal site
Monitoring of conditions of the septic tanks / sewage works	• Visual inspection • Record conditions
Monitoring of conditions of bunded areas around diesel fuel tanks, refuelling areas, old oil tanks, storm water facilities	Visual inspections
Monitoring of water use related activities in terms of Section 21 of the NWA	• Record total water use by recording flow meters • Ensure compliance with licences
Ground water monitoring	• Testing ground water quality of existing boreholes

l) Indicate the frequency of the submission of the performance assessment report

Annual Performance Assessment and Environmental Audit reports will also be conducted and submitted.

m) Environmental Awareness Plan

The objective of the environmental awareness plan is to ensure that:

- Training needs are identified and all personnel whose work may create a significant impact upon the environment have received appropriate training;
- All employees are aware of the impact of their activities
- Procedures are established and maintained to make appropriate employees aware of:
    - The significant environmental impacts (actual or potential) of their work activities and environmental benefits of improved personal performance,
    - Their roles and responsibilities in achieving conformance with environmental policies, procedures, and any implementation measures,
    - The potential consequences of departure from specified operating procedures.
- Personnel performing tasks, which can cause significant environmental impacts, are competent in terms of appropriate education, training and / or experience.

Environmental awareness will be part of the existing training and development plan. Key personnel with environmental responsibilities will be identified and the following principles will apply:

- Procedures will be developed to facilitate training of employees, on-site service providers and contractors;
- Environmental awareness will focus on means to enhance the ability of personnel and ensure compliance with the environmental requirements;

- Top management will build awareness and motivate and reward employees for achieve environmental objectives;
- Environmental policies will be availed to contractors;
- Environmental inductions will be conducted for employees, contractors and visitors;
- There will be an ongoing system of identifying training needs.

General environmental awareness training as part of the induction at Thunderflex should focus on the following:

- General environmental awareness
- The mine policies and vision concerning environmental management
- Legal requirements
- Mine activities and their potential impacts
- Different management measures to manage identified impacts
- Mine personnel's role in implementing environmental management objectives and targets

(1) Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work.

- An environmental, health and safety induction programme will be provided to all employees prior to commencing work, and they will sign acknowledgement of the induction.

- A daily "toolbox talk" will be held prior to commencing work, which will include discussions on health, safety and environmental considerations. The toolbox talks should be led by the Site Manager.

Environmental Awareness Training Programme Procedure

Natural resources are limited and not always renewable and it is the responsibility of management to ensure that all employees are trained to understand the impacts of their tasks on the environment and to reduce them wherever possible.

Environmental awareness training must be given to new employees on site and any contractors who may come onto site for a short period of time. Refresher training must be given to permanent employees on an annual basis.

The objective of this procedure is to ensure that all employees on the, including contractors, are competent to perform their duties, thereby eliminating negative impacts on their safety, health and environment.

The environmental topics to be covered in awareness training should include the following:-

- **RESOURCE MANAGEMENT**
  a. The importance of saving water:
     i. South Africa is a water scarce country and rivers are polluted.
     ii. Do not throw litter into river or water drains.
     iii. Do not dispose of oils in sewers.

b. Air pollution – climate change:
    i. The use of fossil fuels is increasing the amount of greenhouse gasses that are discharged to the atmosphere. Share transport or use public transport.
    ii. Don't burn any rubbish, the smoke pollutes the air.
    iii. Plant trees, they clean the air, provide us with oxygen and remove the greenhouse gas carbon dioxide from the air.
c. Soil conservation:
    i. Prevent overgrazing of farmlands, keep vegetation on the surface of the land to prevent soil erosion.
    ii. Plant trees.

- **HAZARDOUS SUBSTANCE USE AND STORAGE**

a. Solvent, petrol, diesel, insecticides, chlorine, detergents, chemical fertilisers are harmful to the environment and to your health. Use them sparingly and do not let them get into the water systems. Containers must be disposed of to a licensed hazardous waste disposal facility.
b. Hazardous substances must be stored and used correctly.
c. Ensure that 16 point Material Substances Safety Data Sheets (MSDS) are available at point of store.
d. Compressed gas storage requirements.
e. Flammable substances store requirements.

- **INCIDENT AND EMERGENCY REPORTING**

a. The company must have an emergency/incident reporting system whereby environmental incidents can be reported and actioned to mitigate and follow up on.

- **OIL / DIESEL / PETROL SPILL CLEAN UP**

a. All employees who work with machines and vehicles must be instructed how to prevent and clean up an oil or diesel spill appropriately. Spill kits must be available on site, drip trays must be used when servicing vehicles.

- **CONSERVATION OF WATER**
  a. Campaign to save water on site.
  b. Clean water is expensive and potable water must be used carefully.
  c. Prevent pollution of water by preventing spills and dispose of wastes properly.

- **CONSERVATION OF VEGETATION**

  Plants, grasses and trees are very important to our existence on the earth, they provide food, fuel, shelter, raw materials and they clean the air. Indigenous plants are especially important for muti and the whole ecology of life. Human activities are destroying the natural forests of the earth. The natural forests are the "lungs" of the planet and unfortunately they are being cleared faster than they can be regenerated.

  a. EIA's are to be done before virgin bush can be cleared.
  b. Vegetation cover reduces water and topsoil loss from the ground, do not clear vegetation unnecessarily.
  c. Indigenous trees provide shade, attract wild birds.
  d. Do not chop down indigenous trees without good reason.
  e. Implement a tree planting programme.
  f. Remove alien invasive trees in your area such as Prosopis, Syringa and Pepper trees, cactus plants.

- **WASTE MANAGEMENT**
  a. Employees must be instructed on how to tell the difference between hazardous waste and general waste.
  b. They must know how to separate hazardous and general waste and where to dispose of these wastes in the correct way.
  c. Examples of hazardous waste which must be recycled or sent to Waste Tech for disposal:
     i. Oil, diesel, batteries, acids, paint, thinners, electronic waste.
     ii. Pesticides, jik, Handy Andy.

iii. Old oil, old oil filters, old paint is hazardous and must not be disposed of to a general land fill. Oilkol of the Rose Foundation will collect old oil.

iv. Mercury in fluorescent light bulbs is hazardous, fluorescent lights must be handled with great care so as not to break the glass and release the mercury vapour into the air which you breathe.

d. Examples of general wastes which can go to the municipal landfill.

i. Wood, paper, plastic, glass, old PPE.

e. Recycle, Reuse, Reduce, Recover wherever possible.

- **CONCLUSION**

  The management of Thunderflex 78 (Pty) Ltd will utilize the Environmental Awareness Plan to assure that all employees and contractors are aware of the environment and know how to manage it correctly.

(2) Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment.

Air quality

Control the incidence of unacceptable levels of dust pollution on site.

Surface water

Conserve water and eliminate the contamination of run-off and sources of surface water.

Ground water

Minimise and prevent as far as practically possible the contamination of ground water.

Natural flora

Minimise the destruction of vegetation units and control invasion by exotic and invasive plant species.

Fauna

Minimise vegetation destruction in drill areas, and therefore a habitat for wildlife and eliminate poaching and the extermination of animal species within the boundaries of the study area, as well as in the surrounding reas.

Noise

Control the incidence of unacceptable noise levels on site.

Aesthetics

Minimise aesthetic disturbance and reduce the visual impact of the proposed prospecting operation through a process of on-going rehabilitation and reclamation.

Soils

Prevent soil pollution, limit soil compaction, curb soil erosion and reinstate a growth medium able to sustain plant life.

Land capability

Minimise the reduction of land capability.

Sensitive landscapes

Protect sensitive landscapes from potential negative impacts.

Surface environment - waste management

Ensure that the discarding of any waste material produced as a result of the proposed mining operation, including rubble, litter, garbage, rubbish or discards of any description, whether solid of liquid, takes place only at a site or sites demarcated for such purposes. Prevent waste material from being dumped within the borders or the vicinity of the prospecting area.

n) Specific information required by the Competent Authority

Section 41 of the MPRDA and regulations 53 and 54 promulgated in terms of the MPRDA deal with financial provision for mine rehabilitation and closure.

The holder of a right as described in the relevant sections of the MPRDA and its regulations must provide the Department of Mineral Resources (DMR) with sufficient financial provision. Officials in the DMR Regional Offices are required to assess, review and approve the quantum of financial provision submitted (that is, the monetary value of the financial provision that has been computed by the holder of a prospecting right, mining right or mining permit during the annual review) as being sufficient to cover the environmental liability at that time and for closure of the mine at that time.

The holder of a prospecting right, mining right or mining permit is required to annually assess the total quantum of environmental liability for the mining operation and ensure that financial provision are sufficient to cover the current liability (in the event of premature closure) as well as the end-of-mine liability.

It is hereby confirmed that the financial provision will be reviewed annually.

2) UNDERTAKING

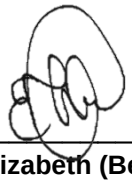
The EAP herewith confirms:

a) the correctness of the information provided in the reports;

b) the inclusion of comments and inputs from stakeholders and I&APs;

c) the inclusion of inputs and recommendations from the specialist reports where relevant; and

d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.



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Dr Elizabeth (Betsie) Milne

END