NAME OF APPLICANT: PPC LIME LIMITED

PROPOSED BOWDEN NORTH QUARRY EXTENSION SCOPING REPORT

FOR PUBLIC / STAKEHOLDER REVIEW

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SHANGONI
Management Services (Pty) Ltd

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

SCOPING REPORT

FOR LISTED ACTIVITIES ASSOCIATED WITH MINING RIGHT AND/OR BULK SAMPLING ACTIVITIES INCLUDING TRENCHING IN CASES OF ALLUVIAL DIAMOND PROSPECTING.

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

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PPC STRENGTH GUARANTEED
PPC LIME

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 furthermore 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 SCOPING PROCESS

The objective of the scoping process is to, through a consultative process—

(a) identify the relevant policies and legislation relevant to the activity;

(b) motivate 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 and confirm the preferred activity and technology alternative through an impact and risk assessment and ranking process;

(d) identify and confirm the preferred site, through a detailed site selection process, which includes an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment;

(e) identify the key issues to be addressed in the assessment phase;

(f) agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the activity will impose on the preferred site through the life of the activity, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site; and

(g) identify suitable measures to avoid, manage, or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

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Annexure H: **Alternatives Assessment Report**

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Scoping Report

1. Details and expertise of the EAP

1.1 Details of the EAP

Name of The Practitioner: Shangoni Management Services: Wilda Meyer
Tel No.: (012) 807 7036
Fax No.: (012) 807 1014
e-mail address: wilda@shangoni.co.za

1.2 Expertise of the EAP

Table 1: The qualification of the EAP

NAME	QUALIFICATIONS
Brian Hayes	Professional Engineer. M.Sc.: Environmental Engineering
Wilda Meyer	B.Sc. (Hons): Geography and Environmental Management

Table 2: Summary of the EAP's past experience

NAME	SUMMARY OF EXPERIENCE
Brian Hayes	Brian is a registered professional engineer (Chemical) with a master degree in Environmental Engineering from the University of Nottingham. Brian has 22 years' experience in environmental management and environmental engineering.
Wilda Meyer	Wilda obtained a B.Sc. Hons degree in Geography and Environmental Management through the University of Johannesburg. She has experience in conducting Environmental Management Programmes (EMPs), Basic Assessment Reports, Scoping Reports, Environmental Impact Assessments (EIAs), Waste Licence Applications, Integrated Water and Waste Management Plans (IWWMPs) and Integrated Water Use License Applications (IWULAs). Wilda also focusses on conducting environmental audits, such as EMP Performance Assessments and ISO14001 Internal Audits. She also has valuable experience in ISO14001 Environmental Management System (EMS) Implementation and has successfully implemented and obtained ISO14001 certification at various gold- and diamond mine sites.

Detailed CV's of the EAP are attached in Annexure B.

2. Description of the property

Table 3: Description of the property

Farm Name:	• Portion 24 of Carter Block 458 (Rosslyn) • Portion 63 of Carter Block 458 (Botha)
Application area (Ha)	149 hectares
Magisterial district:	• ZF Mgcawu (Siyanda) District Municipality • Kgatelopele Local Municipality
Distance and direction from nearest town	PPC Lime Limited's proposed Bowden North Quarry Extension is situated approximately 2 km to the East of Lime Acres Village and 25 km to the South-west of the town of Daniëlskuil, in the Northern Cape Province.
21 digit Surveyor General Code for each farm portion	Portion 24 of Carter Block 458 (Rosslyn): C03100000000045800024 Portion 63 of Carter Block 458 (Botha): C03100000000045800063

3. Locality map

(Show nearest town, scale not smaller than 1:250000).

The locality of the PPC Lime Limited Bowden North Quarry extension area is presented in Figure 1 below, and the regional locality in relation to the district and local municipalities is presented in Figure 2. The farm portions on which the proposed activity will take place as well as the adjacent farm portions are indicated in Figure 3.

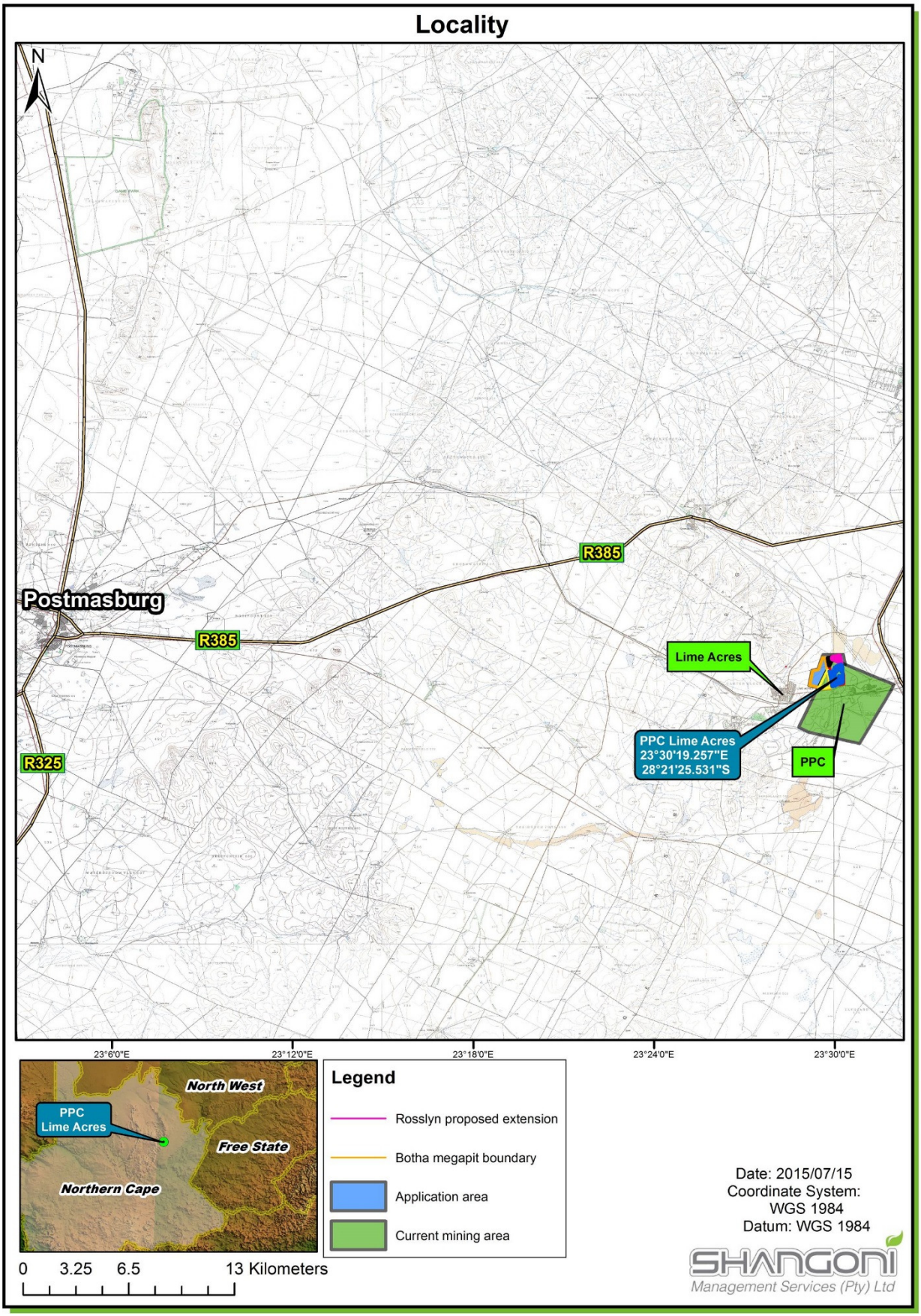


Figure 1: Locality of the PPC Lime Limited Quarry extension area (refer also to Annexure A)

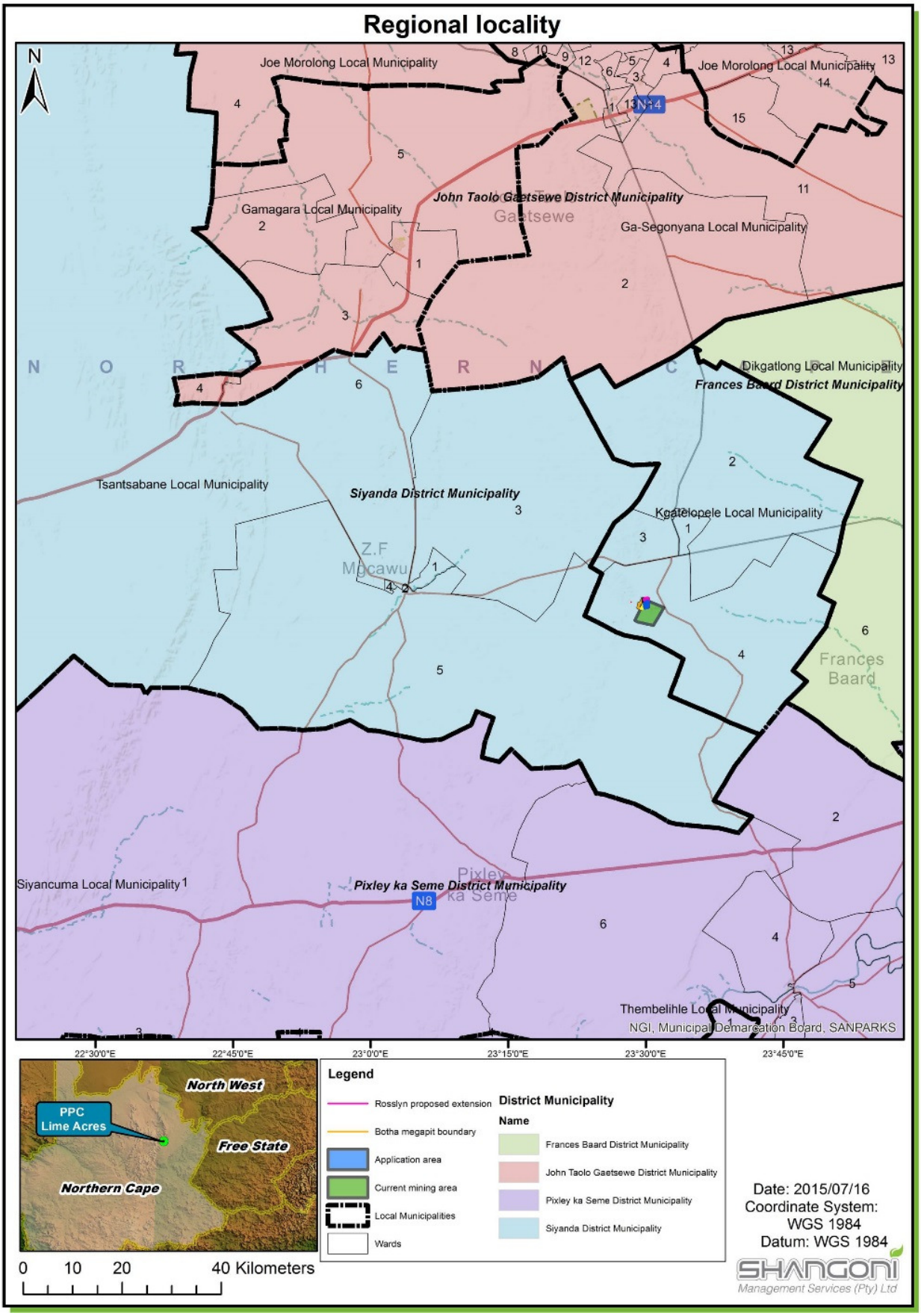


Figure 2: Regional locality of the PPC Lime Limited Quarry extension area in relation to district and local municipalities (refer also to Annexure A)

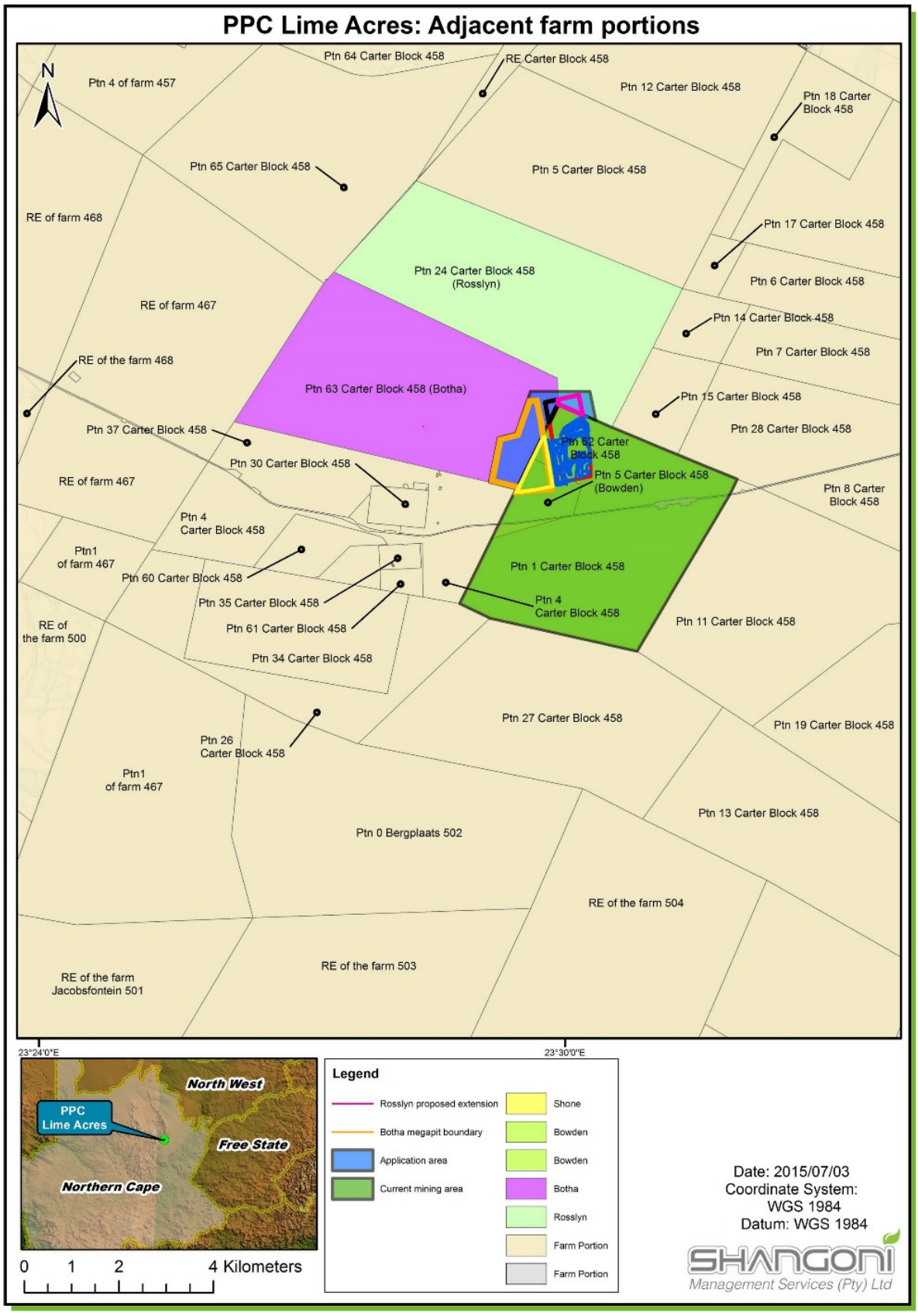


Figure 3: Farm portions and adjacent farm portions relevant to the PPC Lime proposed Quarry extension area

4. Description of the scope of the proposed overall activity

Pretoria Portland Cement Lime Limited (Lime Acres mine) (hereafter referred to as PPCL) is an existing quarry operation located in close proximity to the village of Lime Acres in the Northern Cape, and falls within the jurisdiction of the Kgatelopele Local Municipality.

PPCL was issued with a converted mining right (No (NC) 077 MRC) in terms of the Mineral Petroleum Resources Development Act (MPRDA), 2002 (Act No 28 of 2002) (refer to Annexure C), for its current mining activities on Portions 1, 5 and 52 of the farm Carter Block 458 (also known as farm Bowden) (refer to Figure 3 above).

PPCL kept its approved Environmental Management Programme Report (EMPr) updated on an annual basis, with the latest revised EMPr, dated February 2013 having been approved by the DMR in September 2013 (refer to Annexure I).

PPC Lime Limited proposes to extend its Bowden North Quarry towards the north and west, into the the following farm portions:

- Portion 24 of Carter Block 458 (also knowns as farm Rosslyn)
- Portion 63 of Carter Block 458 (also known as farm Botha)

PPCL compiled and submitted an Environmental Management Programme for prospecting to the Department of Mineral Resources (DMR) in terms of the Minerals and Petroleum Resources Development Act (MPRDA), 2002, and was subsequently issued with a Prospecting Right, which was signed on 10 November 2011 (refer to Annexure I). Following this, prospecting activities were undertaken on the mentioned farms, after which a decision was made to continue with the application for a mining right (Section 102 Amendment) and environmental authorisation for the proposed mining extension activities. This Scoping Report thus serves the purpose to provide the DMR with the necessary information, as required in the MPRDA, 2002 as well as the Environmental Impact Assessment (EIA) Regulations, dated December 2014 under the National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998) in support of a Section 102 Amendment Application.

A pre-application meeting (19 March 2015) and site visit with the DMR was held on 15 September 2015 to confirm the way forward and to obtain guidance from the DMR in terms of the process to follow. Refer to the minutes of the meeting and site visit, as well as the confirmation letter received from the DMR, in Annexure I.

The following outcome and way forward were reached from the mentioned meeting and site visit[1]:

- An application in terms of a Section 102 amendment needs to be made for the Environmental Authorisation to be obtained for the proposed PPC Lime Limited Bowden North quarry extension. The Environmental Authorisation application for the proposed project will be followed by a Scoping Report for the proposed quarry extension project (44 days after the application was submitted – as per the EIA Regulations, 2014), and lastly a combined (integrated) EIAR/EMPr (for the existing mining operations as well as the proposed extension project) (the latter included in this Scoping Report) may be submitted (106 days from acceptance of Scoping Report). It was indicated that no "new mining rights application" should be made. Refer to Annexure I for more detail.

4.1 Listed and specified activities

Table 4: Activities and listed activities associated with the proposed development

<table>
<tr><th>NAME OF ACTIVITY</th><th>ARIAL EXTENT OF ACTIVITY
Ha or m²</th><th>LISTED ACTIVITY
(mark with X)</th><th>APPLICABLE LISTING NOTICE (GNR 983, GNR 984 or GNR 985)/NOT LISTED</th></tr>
<tr><td>Clearance of vegetation.</td><td rowspan="3">• Combined area: 117.423 Ha.
• Phase 1 (northern quarries): 16.59 Ha
• Phase 2 (Mega Pit): 100.8 Ha</td><td>X</td><td>• Listed activity No. 15 of Listing Notice 2: GNR 984</td></tr>
<tr><td>Removal of topsoil and overburden from the quarry extension areas.</td><td rowspan="2">X</td><td rowspan="2">• Listed activity No. 17 of Listing Notice 2: GNR 984</td></tr>
<tr><td>Mining of limestone from the quarry extension areas.</td></tr>
<tr><td>The application area will extend into a section of a pan (depression wetland area) located to the north.[2]</td><td>26.3 Ha extended into pan (not all of which will be mined – refer to Figure 25).</td><td>X</td><td>• Listed activity No. 12 of Listing Notice 1: GNR 983
• Listed activity No. 19 of Listing Notice 1: GNR 983
• Listed activity No. 49 of Listing Notice 1: GNR 983</td></tr>
</table>

[1] Note that the outcome from the first pre-application meeting (March 2015) and the second pre-application meeting and site visit (September 2015) is different (i.e. during the first meeting DMR indicated that a new Mining Rights application is to be submitted and during the second meeting it was agreed that a Section 102 Amendment Application is the best way forward. It was indicated by the DMR attendees that a new mining rights application for the proposed project may not be the best option, as the nature of the project was explained as being an extension (continuation) of the existing operations to the north and west. He added that the DMR would prefer to amend the current mining right, rather than to issue another mining right to PPC, since it is for the same reserve (continuation of activities).

[2] A Water Use Licence will be required for the mining activities extending into a section of a pan (i.e. Section 21(c) Water Use in terms of the NWA, 1998). PPC Lime Limited will consult with the Department of Water and Sanitation (DWS) in this regard.

NAME OF ACTIVITY	ARIAL EXTENT OF ACTIVITY Ha or m²	LISTED ACTIVITY (mark with X)	APPLICABLE LISTING NOTICE (GNR 983, GNR 984 or GNR 985)/NOT LISTED
Placement of topsoil into stockpiles (located at the quarry areas) for transportation to rehabilitation areas. Topsoil is utilised as soon as possible for rehabilitation activities.	Forms part of proposed quarry extension area.	-	• Not listed
Loading of mined minerals.	-	-	• Not listed
Hauling of mined minerals to existing primary crusher or alternatively establishing an in-pit primary crusher during the later stages of mining (alternatives still being investigated). Should an in-pit primary crusher be established, crushed material may be transported to the existing processing plant via conveyor.	Current haul roads within the existing quarry will be extended to the mining face (Phase 1) and haul roads will be constructed for Phase 2. Note: Proposed haul roads will form part of and move along with the quarry extensions and will form part of the overall 117.423Ha quarry extension areas	X	• Listed activity No. 24 of Listing Notice 1: GNR 983 • Listed activity No. 56 of Listing Notice 1: GNR 983 • Listed activity No. 21 of Listing Notice 2: GNR 984
Placement of overburden material on the overburden dump (and on walls of evaporation pond area) for subsequent backfilling into the quarries as part of rehabilitation. DMR confirmed during a meeting and site visit held on 15 September 2015 that the backfilling of overburden into the quarries does not constitute a waste-related listed activity as per GNR 921, dated November 2013, since it forms part of the overall rehabilitation strategy. Therefore, this activity is not	Backfilling into existing and proposed (117.423 Ha) quarry areas. <u>Size of evaporation ponds (total area), containing overburden:</u> 72 Ha	-	• Not applicable.

NAME OF ACTIVITY	ARIAL EXTENT OF ACTIVITY Ha or m²	LISTED ACTIVITY (mark with X)	APPLICABLE LISTING NOTICE (GNR 983, GNR 984 or GNR 985)/NOT LISTED
applied for as a waste-related listed activities, as per GNR.921, dated November 2013.			
Disposal of slurry mix (lime and dolomite dust collected from processing facility and mixed with water) on existing evaporation ponds. The existing evaporation ponds (situated adjacent to the Bowden North Quarry) will continue to be used for disposal of the slurry mix (lime and dolomite dust mixed with water) from the Processing Facility (thus indirectly from the Quarry extension areas). The evaporation ponds were included in the approved EMP and are therefore considered to have an existing environmental authorisation and waste management licence. Therefore, this activity is not applied for as a waste-related listed activities, as per GNR.633, dated July 2015.	Size of evaporation ponds (total area): 72 Ha	-	• Included in approved EMP. Thus currently authorised.
Unless alternative uses are found, processing plant residue consisting of (amongst other) low grade lime will continue to be directed to the dedicated waste box and will then be collected and disposed of at the existing kiln waste dump situated adjacent to the existing dolomite quarry. The kiln waste dump is also comprised of dust screened from the screening plant. The kiln waste dump was included in the approved EMP and is therefore considered to have an existing environmental authorisation and waste management licence. Therefore, this	Size of Kiln Waste dump: 58 Ha	-	• Included in approved EMP. Thus currently authorised.

NAME OF ACTIVITY	ARIAL EXTENT OF ACTIVITY Ha or m²	LISTED ACTIVITY (mark with X)	APPLICABLE LISTING NOTICE (GNR 983, GNR 984 or GNR 985)/NOT LISTED
activity is not applied for as a waste-related listed activities, as per GNR 921, dated November 2013 or GNR.633, dated July 2015.			
Dewatering of water contained in the quarry extension pit areas and pumping of water to Quarry 5 for subsequent treatment and supply to the villages for domestic and industrial use (as per current practice).	Dewatering points will be located within the proposed quarry extension areas. Mining will proceed up until 30m to 40m before water will be reached and the need for dewatering will commence. Length of dewatering line expansion may be more than 1km (1000m) and the current dewatering rate is at 600m³/h (167 l/s) which is above the 120 l/s threshold of the relevant listed activity.	**X**	• Listed activity No. 46 of Listing Notice 1: GNR 983 • Listed activity No. 6 of Listing Notice 2: GNR 984[3]
Use and maintenance of chemical / portable toilets at quarry extension areas.	-	**-**	• Not listed.
Use of mobile transformer units. The mine currently makes use of 2x 6.6kV and 1x 3.3kV transformers in the Bowden North Quarry that will be moved as mining progresses.	-	**-**	• Does not exceed the specified threshold as per listed activities contained in Listing Notice 1: GNR 983.

[3] A Water Use Licence will be required for the dewatering activities (in terms of the NWA, 1998). PPC Lime Limited will consult with the Department of Water and Sanitation (DWS) in this regard.

NAME OF ACTIVITY	ARIAL EXTENT OF ACTIVITY Ha or m²	LISTED ACTIVITY (mark with X)	APPLICABLE LISTING NOTICE (GNR 983, GNR 984 or GNR 985)/NOT LISTED
All power lines supplying the mining area are 11kV (maximum). From this line the mine steps down to 3.3kV and 6.6kV to feed the shovels, depending on size. Any extension of the 11kV line in future will not exceed 33kV. For dewatering activities (pumping) the mine steps down to 380V for the motors driving the pumps.			
Rehabilitation of quarry areas (Backfilling with overburden; and subsequent topsoil placement). As mentioned above, DMR confirmed during a meeting and site visit held on 15 September 2015 that the backfilling of overburden into the quarries does not constitute a waste-related listed activity as per GNR 921, dated November 2013, since it forms part of the overall rehabilitation strategy.	Backfilling into existing and proposed (117.423 Ha) Bowden North quarry areas.	-	• Not applicable

Refer also to Figure 4 below for the site layout plan.

Provide a plan drawn to a scale acceptable to the competent authority but not less than 1: 10 000 that shows the location, and area (hectares) of all the aforesaid main and listed activities, and infrastructure to be placed on site

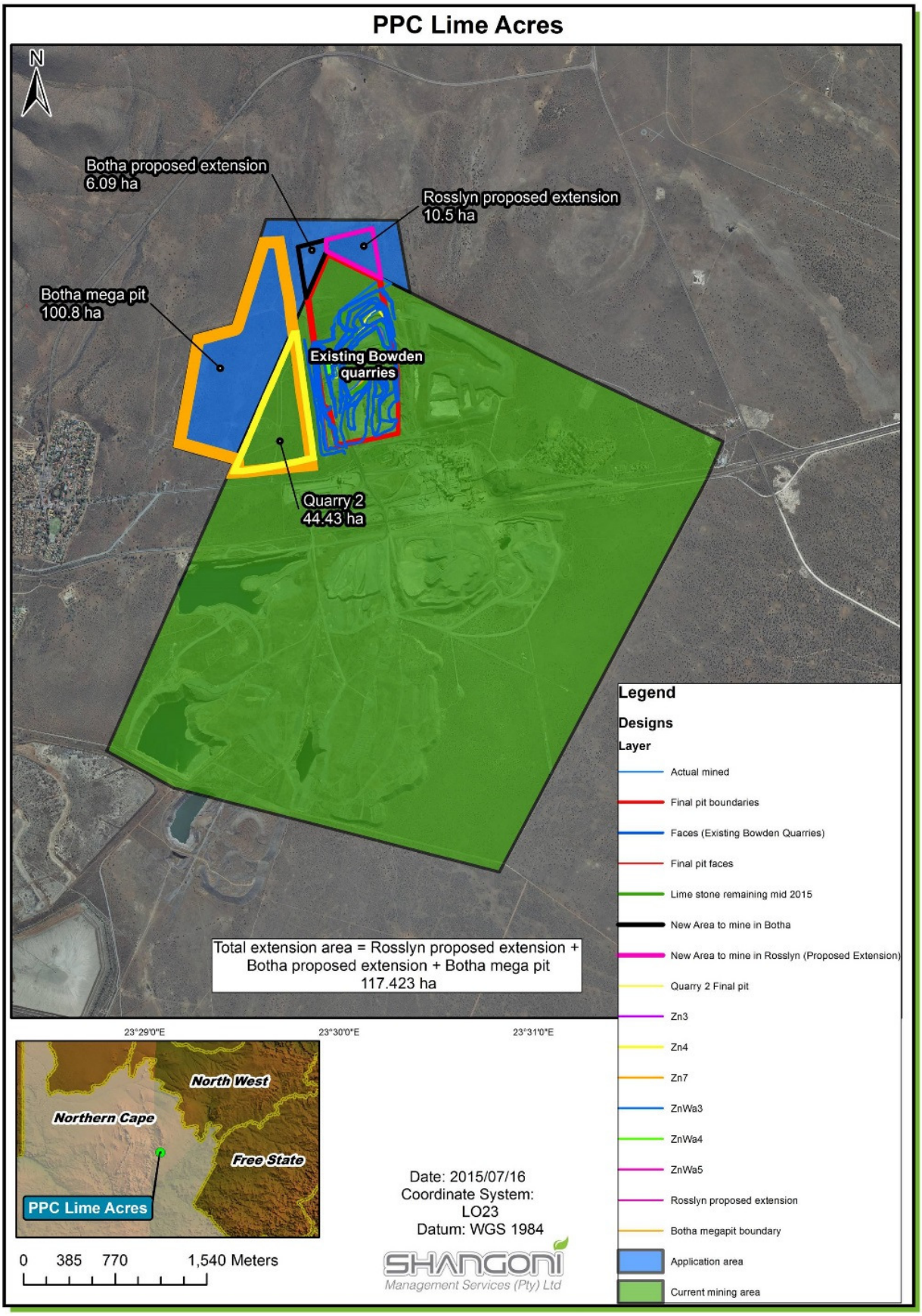


Figure 4: Site layout plan

4.2 Description of the activities to be undertaken

4.2.1 Mineral to be mined

The existing PPC Lime Limited quarries produce high-grade limestone and dolomite that is:

- Used to manufacture lime, burnt dolomite and related products at the existing Lime Acres based factory adjacent to the quarries, or
- Sold as high grade metallurgical limestone and dolomite.

The mining of limestone will be undertaken at the proposed quarry extension area. The quarry extension will be a continuation of the current Bowden North Quarry currently being mined by PPC Lime Limited.

4.2.2 Description of the main mining activities and processes

4.2.2.1 Mine plan and mining method

The quarry pit extension will be started by creating a cut and the removal of the topsoil and overburden. The quarrying process is conducted by means of diesel-electric haul trucks, hydraulic and electric rope shovels and other associated mining equipment, and involves:

- Clearance of vegetation;
- Removal of topsoil;
- The temporary stockpiling of topsoil for later transportation to rehabilitation area, with the aim of utilising such topsoil as soon as possible in order to prevent prolonged stockpiling of the soil and due to minimal availability of topsoil;
- Removal and disposal of overburden material on the existing overburden dump (located to the east of the Bowden North Quarry) (refer to Figure 6). As mining progresses and quarries reach their final depth, the overburden is backfilled into the quarries; and
- Drilling, blasting, mining, loading and hauling of the limestone to the existing primary crusher. An in-pit primary crusher may be established during the later stages of the quarry extension, from where crushed material will be transported via conveyor to the existing Secondary, and Tertiary crushers for further processing in the Plant.

PPC Lime Limited plans on mining the proposed quarry extension areas in two (2) phases:

- **Phase 1**: The continuation of the existing Bowden North Quarry in a northern direction into Portion 24 of the farm Carter Block 458 (also known as farm Rosslyn) and Portion 63 of the farm Carter Block (also known as farm Botha). Refer to Figures 4 and 5.
- **Phase 2:** The continuation of the existing Bowden North Quarry in a westerly / south-westerly direction into Quarry 2 (which still falls within the mine's current mine boundary area), followed by the extension of Quarry 2 into the proposed 'Mega-pit' (in a westerly / north-westerly direction into Portion 63 of the farm Carter Block (also known as farm Botha). Refer to Figures 4 and 5.

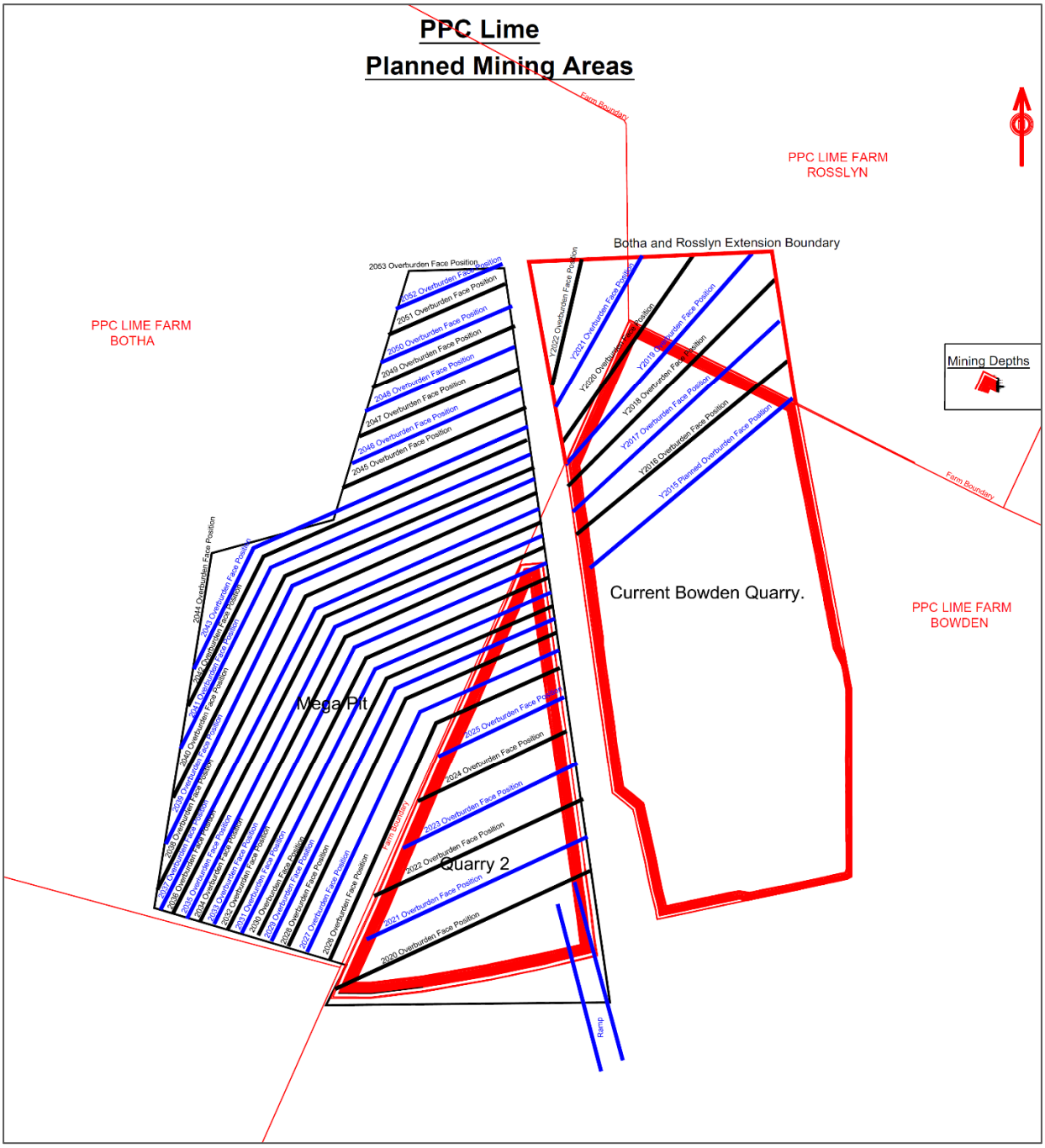


Figure 5: Mine plan

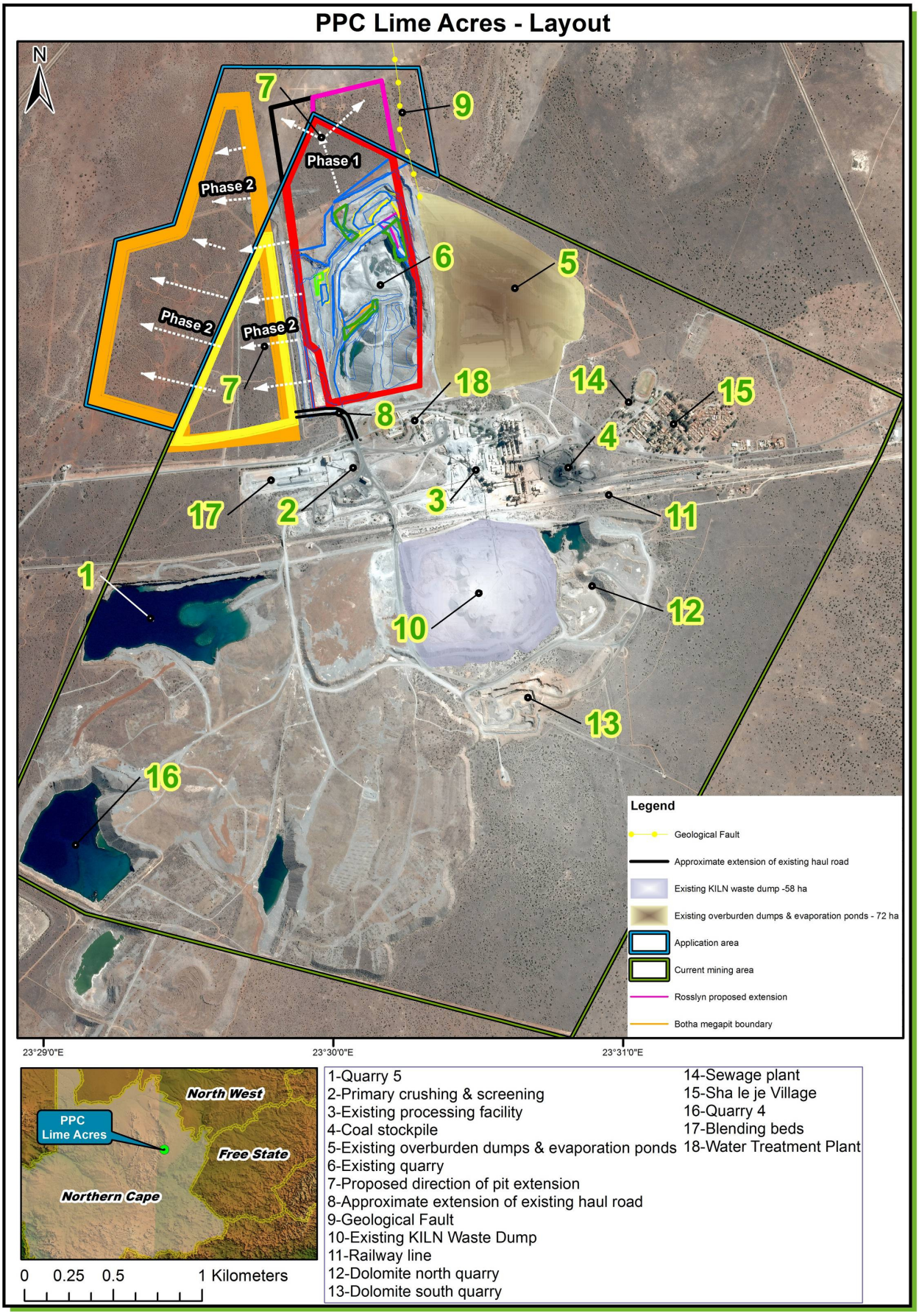


Figure 6: Master plan showing the proposed quarry extension in relation to existing facilities

4.2.2.2 Ore Processing

Material from the quarry areas are transported via haul trucks to the crusher/s (primary, secondary and tertiary), or will be crushed by means of an in-pit primary crusher (alternatives are still being investigated as part of the Scoping phase and will be assessed further during the EIA Phase), where after it will be processed at the existing processing plant (located within the existing mine boundary area).

The existing processing plant converts limestone into lime and by means of a calcination process. Limestone mined from the quarry is fed to the primary crusher where it is crushed down to minus 200mm. The material is then sent over a screen where the +90-125mm fraction is screened out as the first limestone product. The rest of the material goes through a secondary crusher where it is crushed down to minus 90mm. The material is stockpiled on one of two primary stockpiles or blending beds.

The material from the blending bed is then reclaimed by a drum reclaimer and transported to the tertiary crushing and screening plant via overland conveyors.

The minus 6mm fraction is screened out and the rest of the material is crushed down in the tertiary crusher to minus 50mm. It is screened and stockpiled into 5 product sizes, namely 6-10mm, 10-20 mm, 20-30 mm and 30-50 mm. The minus 6mm underflow generated in the tertiary crusher is further crushed down to minus 3.35mm and stockpiled.

From the major stockpiles, limestone is extracted and fed to the rotary kilns. A rotary kiln is a long steel cylinder about 122m long and 4m in diameter. This long steel cylinder is rotated on piers at about a 3° angle to the horizontal. Limestone is fed to the uphill side of the kiln, and due to the inclination and rotation of the kiln, the limestone works its way down to the discharge end of the kiln. At the front of the kiln is a burner where pulverized coal is burned to provide the energy.

Coal is pulverised and fed into the kiln where it ignites spontaneously. Additional oxygen is used to keep the flame going. Lime or dolomite is formed by heating limestone or to a temperature where dissociation into calcium oxide and carbon dioxide takes place. This process is referred to as calcination, and can be described with the following chemical formula:

$CaCO3$	+	Heat	→	$CaO + CO_2$
Limestone	+	Energy	→	Lime + Carbon dioxide

The reactions of calcining take place only above the threshold temperature of 825℃, below this temperature, no chemical reaction takes place.

Limestone that enters the kiln at the feed end is pre-heated by the kiln exit gas. As the limestone moves towards the discharge end, heat transfer to the stone takes place by radiation and convection

from the gas and flame, and to a lesser extent by radiation from the refractory lining. Agitation of the burden of the rotary kiln ensures that the stone is uniformly heated. Lime at ±1000℃ is discharged from the kiln and drops into the cooler where it is cooled by ambient air forced through the bed of lime. The exit gasses, which contain lime dust and CO_2 evolved during calcination, are drawn from the kiln by the induced draft fan which is situated behind the radiant cooler and electrostatic precipitator. The fan exhausts the filtered air to atmosphere.

The lime exiting the cooler is put into storage silos from where it is drawn by the dispatch Plant. The lime is screened into various sizes prior to loading and delivery to clients and customers.

At PPC Lime Limited a portion of the lime is also slaked in the Hydrator Plant to produce calcium hydroxide or hydrated lime. This is done by mixing the lime or calcium oxide with water to form calcium hydroxide.

CaO + H2O ➔ Ca(OH)2

This product can be despatched to the customers in bulk or in bagged form.

A simplified mining process flow chart is provided in Figure 7 below. The existing processing plant that will be used forms part of an existing environmental authorisation as it was covered in the approved EMP update, dated February 2013.

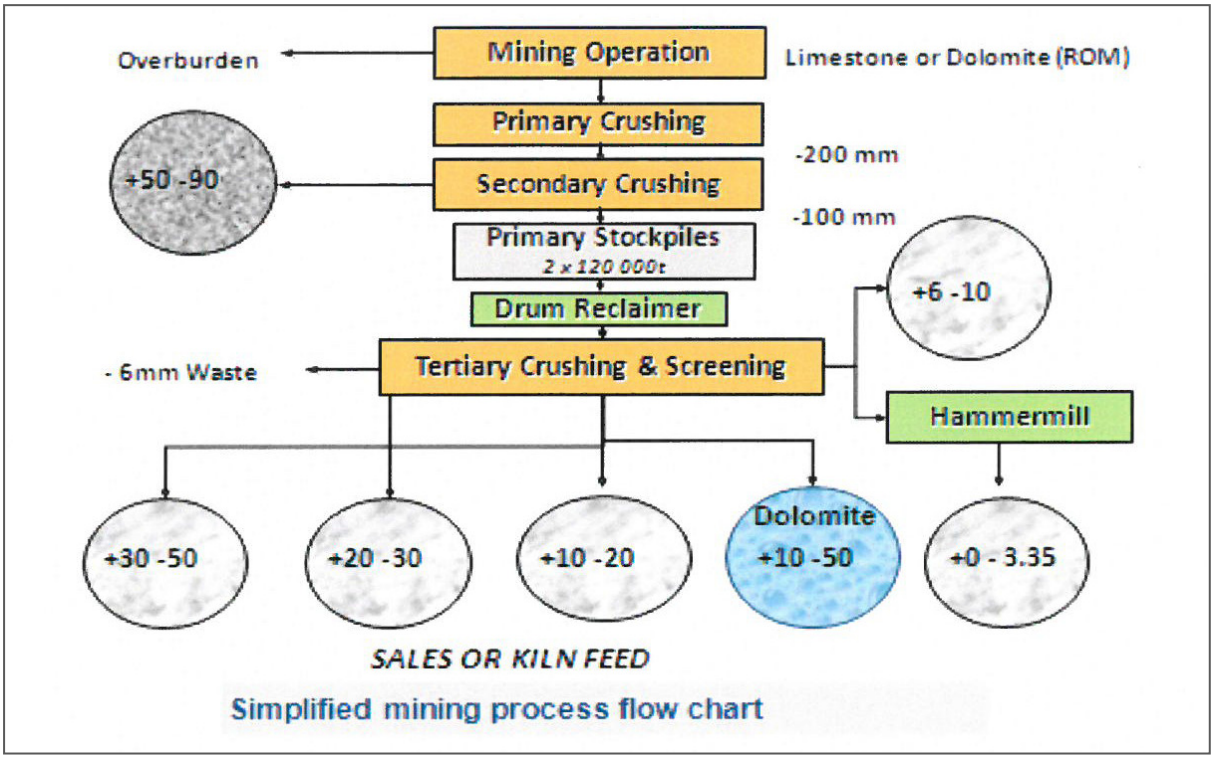


Figure 7: PPC Lime Limited simplified mining process flow chart

4.2.2.3 Mine and plant residue

Existing overburden dumps and evaporation ponds

Mine residue from the proposed quarry extension will consist of low grade limestone that will be placed on the overburden dumps situated to the east of the existing Bowden North quarry (refer to Figure 6). As mining progresses and quarries reach their final depth, the overburden will be backfilled into the quarries as part of the overall rehabilitation strategy.

The overburden dumps have been converted to accommodate for the evaporation ponds (Figure 6). Overburden is used to construct the walls of the facilities in order to accommodate the pumping of klin fines in a slurry form to the evaporation ponds from the processing plant.

The fine lime or dolomite dust particles collected from the kiln system via the moller pumps directed to the bins from where it is then mixed with water, slaked and pumped in a slurry form to the Bowden North area where paddocks were constructed with overburden waste and sealed with finer limestone to collect the fines. This hydrated lime/dolomite waste will stay in the evaporation ponds to dry. Once the paddocks are filled, the waste will be covered by run of mine overburden and rehabilitated.

PPC Lime Limited has an Integrated Water Use Licence (IWUL) in terms of Section 21(g) of the National Water Act, 1998, authorising the operation of the Overburden dumps and Evaporation Ponds.

Existing kiln waste dump

Currently, processing plant residue disposal consists of low grade lime, burnt dolomite and ash particles collected from the emission abatement equipment at the rotary kilns. The reject minerals are directed to the dedicated waste box. This is then collected and discarded at the historic kiln waste dump situated adjacent to the existing dolomite quarry. The kiln waste dump is also comprised of dust screened from the screening plant.

The portion of -6mm limestone or dolomite fines generated in the crushing and screening process are collected from a bin and transported back to the quarries to be used as resurfacing material of working areas, berms and for road making purposes. A fraction of these is recovered for the flue gas desulphurisation (FGD) as well as sinter material. The excess material is deposited on the kiln waste dump via overland conveyors.

4.2.2.4 Linear activities: Mineral transport on-site

Limestone will be hauled to the existing primary crusher (refer to Figure 6). An in-pit primary crusher may be established during the later stages of the quarry extension, from where crushed material will be transported to the existing processing plant via conveyor. Alternatives are discussed in Parts 8.1 of this Scoping Report and will further be assessed during the EIA/EMPr Phase. Refer also to Table 4 above for the list of activities associated with the proposed quarry extension.

4.2.2.5 Linear activities: Mineral transport off-site

Once the mineral has been processed at the on-site processing plant, it is transported via road or road to the clients and consumers.

4.2.2.6 Water management

Water used by PPC Lime is abstracted from water stored in the defunct quarries and ranges between 50 000m^3/month during the dry winter months and up to 135 500m^3/month during the wetter summer months; averaging approximately 104 000 m^3/month. The water is made up of collected surface water and some inflow of groundwater into the quarries. Two back-up boreholes were drilled and equipped to act as standby for water supply in case the quarries dry up during the drier months. No water has been abstracted from these boreholes to date (EMPR, 2011).

Active dewatering is currently taking place from the active mine quarry (Bowden North Quarry), which is pumped to Quarry 5 (one of the defunct quarries), from where it is abstracted and pumped to the chlorinators (Water Treatment Plant) and reticulated to the plant and villages (parts of Lime Acres and She-leje Villages, including some parts of Norfin Village). Some of the water from Quarry 5 is also used for dust suppression purposes.

PPC Lime Limited has an Integrated Water Use Licence (IWUL) that authorises them in terms of Section 21(a) and (j) to take a maximum quantity of 1 400 000 m^3 per annum from Quarry 5 for domestic and industrial processes. Furthermore, Quarry 5 is authorised in the IWUL in terms of Section 21(g) of the NWA, 1998 for a total volume of 1 400 000m^3 disposed per annum.

Water collected within the quarry extension areas will continue to be abstracted and pumped to Quarry 5, from where water will subsequently be pumped to the existing Water Treatment Plant. The water will be treated in the chlorinators before being distributed to the Plant and villages for domestic use.

4.2.2.7 Non-mineral Waste management

General waste generated at the proposed quarry extension area will be accumulated in waste bins made available on-site. General waste will be disposed offsite at a registered waste disposal facility. Should small amounts of hazardous waste be generated due to abnormal or infrequent activities within the quarry, the waste will be removed by a licenced hazardous waste transporter to a registered hazardous waste facility. Waste management will be implemented as per the requirements of the waste licence as well as the best practicable ways of the mine's existing Waste Management Work Instruction.

4.2.2.8 Sewage management

Chemical toilets will be made available at the proposed quarry extension areas. Such toilets will be serviced regularly by a suitably qualified contractor and sewage will be removed off-site to an appropriate facility dealing with such waste.

4.2.3 Resources and estimated reserves

Table 5: Resource Statement: Bowden North[4]

	Tonnage (Permitted)	Tonnage (not Permitted)	Tonnage (Internal waste)	$CaCO_3$	$MgCO_3$	SiO_2
Zone 3	10 841 220	-	-	95.55	2.75	1.22
Zone 3	-	851 760	2 640 300	95.34	2.83	0.95
Zone 4	5 682 300	-	-	96.21	2.21	1.21
Zone 4	-	642 460	786 500	94.2	5.1	1.39
Zone 5	6 564 220	-	-	94.65	3.32	1.23
Zone 5	-	1 042 860	1 183 780	94.91	3.18	0.83
Zone 6	5 253 300	-	-	94.64	3.74	0.62
Zone 6	-	717 340	1 977 820	97.1	1.87	0.36
Zone 7	18 876 000	-	-	96.37	2.17	0.6
Zone 7	-	4 814 680	-	96.12	2.87	0.55
Zone 8	3 371 160	-	-	94.22	2.06	1.21
Zone 8	-	1 178 580	-	95.69	2.2	0.94
Total	**50 588 200**	**8 069 100**	**6 588 400**	-	-	-

Table 6: Quarry 2 Measured reserves

	Tonnage	$CaCO_3$	$MgCO_3$	SiO_2
Zone 2	62 140	91.24	1.76	1.12
Zone 3	10 002 720	95.34	3.34	0.72
Zone 4	4 144 140	96.44	1.74	0.88
Zone 5	2 919 540	92.56	5.91	1.21

[4] The new Bowden Pit design was used for these values. The “Permitted” tonnage refers to what is within the existing mining permit; the “Not Permitted” refers to production limestone that lies on the extension block. There is some internal waste on the upper zones (zone 3, 4, 5 and 6). This internal waste is not included in the ‘Not Permitted” tonnage values as it is reported separately. Zone 8 can be referred to as “indicated reserves”. Therefore, more data will be collected as mining progresses. Bowden North Quarry has proven reserves (PPC Lime Mining Works Programme, 2015).

	Tonnage	$CaCO_3$	$MgCO_3$	SiO_2
Zone 6	3 168 880	94.7	4.19	0.68
Zone 7	10 449 920	94.08	4.68	0.55
Zone 8	1 758 380	94.12	4.25	0.67
Total	**32 505 720**			

Table 7: Mega Pit Tonnage

	Tonnage	Indicated reserve
Zone 1	17 997 980.00	20 937 020.00
Zone 2	40 260 220.00	46 026 240.00
Zone 3	41 538 120.00	59 015 580.00
Zone 4	15 343 900.00	21 647 080.00
Zone 5	11 346 400.00	18 205 720.00
Zone 6	13 712 920.00	21 178 040.00
Zone 7	50.297 260.00	68 272 620.00
Zone 8	10 068 760.00	17 474 600.00
Total	**200 565 560.00**	**272 756 900.00**

Table 8: Mega Pit Qualities (Measured)

	$CaCO_3$	$MgCO_3$	SiO_2
Zone 1	95.23	3.21	1.15
Zone 2	95.59	2.93	1.43
Zone 3	95.81	2.72	0.89
Zone 4	96.55	1.86	1.09
Zone 5	94.52	383	1.41
Zone 6	96.66	1.94	0.63
Zone 7	96.65	2.13	0.61
Zone 8	96.44	2.15	0.76

4.2.4 Production rate and Life of Mine

The production rate (not Life of Mine Calculation) is presented in Table 9 below. Refer also to Annexure D for a copy of the Mining Works Programme.

Since the mine plan (provided in Figure 5 above) indicates mining faces up to 2053, its is anticipated that the Life of Mine (LoM) will be extended up to atleast the year 2053. Further decommisioning will also be required after this date.

Table 9: Production rate (provided by PPC Lime Limited)

Production Plan	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Total
Limestone Budget	145,493	146,684	131,699	156,196	165,688	165,688	166,252	161,880	167,245	156,573	163,717	162,890	1,890,004
Overburden Budget	247,332	249,362	223,888	265,532	281,669	281,669	282,628	345,197	344,316	306,175	336,318	276,913	3,443,001
Dolomite Budget	26,304	26,304	19,370	24,157	26,304	26,304	26,304	20,867	19,869	21,793	22,617	24,042	284,234
WAD Budget	31,565	31,565	23,244	28,968	31,565	31,565	31,565	35,041	23,843	66,151	27,140	28,851	391,082
Total Stone Quarried	450,694	453,914	398,202	474,873	505,226	505,226	506,748	562,985	555,273	550,692	551,792	492,696	6,008,321

Production	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Total
Limestone Produced	183,507	168,370	160,286	161,752	152,483	202,107	229,201	250,408	179,711	176,967			1,864,790
Overburden Produced	196,450	238,950	144,750	210,600	406,800	270,150	236,550	266,500	293,700	119,550			2,374,000
Dolomite Produced	59,173	20,866	47,715	49,170	14,651	31,114	72,117	0	21,045	36,598			352,448
WAD Produced	34,500	31,500	25,200	10,050	9,750	108,750	21,150	70,850	64,650	117,450			493,850
Total Stone Quarried	473,629	459,686	377,951	431,572	583,683	612,121	559,018	577,758	559,106	450,565	0	0	5,085,088

Production Diff	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Total
Limestone Difference	38,014	21,686	28,587	5,556	-13,205	36,419	62,949	88,528	12,466	20,394			301,393
Overburden Difference	-50,882	-10,412	-79,138	-54,932	125,131	-11,519	-46,078	-88,697	-50,616	-186,625			-[illegible]
Dolomite Difference	32,869	-5,438	28,345	25,013	-11,653	4,810	45,813	-20,867	1,176	14,805			114,872
WAD Difference	2,935	-65	1,956	-18,938	-21,815	77,185	-10,415	35,809	40,807	51,299			158,758
Total Stone Diff	22,935	5,772	-20,251	-43,301	78,457	106,895	52,270	14,773	3,833	-100,127	0	0	121,255

5. Policy and Legislative Context

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT (A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process)	REFERENCE WHERE APPLIED (i.e. Where in this document has it been explained how the development complies with and responds to the legislation and policy context)
The Constitution of the Republic of South Africa, 1996 (Act 108 of 1996).	Throughout this Scoping Report.
The Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), as amended.	
The Mineral and Petroleum Resources Development Regulation GNR. 547 dated 2004	
Environmental Conservation Act, 1989 (Act 73 of 1989)	
The National Environmental Management Act, 1998 (Act No 107 of 1998), as amended.	
The Environmental Impact Assessment Regulation GNR. 982 dated 04 December 2014.	
Kgatelopele Local Municipality. Water Services By-law published under General Notice 81 in Northern Cape Province Gazette 1638 of 15 October 2012.	
The Environmental Impact Assessment Regulation. Listing Notice 1. GNR. 983 dated 04 December 2014.	Part 4.1 of this Scoping Report
The Environmental Impact Assessment Regulation. Listing Notice 2. GNR. 984 dated 04 December 2014.	
Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010. Government Notice 891 of 2014.	Part 6 of this Scoping Report.
Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector.	Chapters E, F and M of Part 8.4.1; and Part 8.4.4 of this Scoping Report.
The National Water Act, 1998 (Act No. 36 of 1998).	Part 4.2.2.6 and Chapter G of Part 8.4.1 of this Scoping Report.
Government Notice (GN) 704, dated 1999 under the NWA, 1998.	Part 4.2.2.6 and Part 9.9 and Chapter G of Part 8.4.1 of this Scoping Report.
The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	Chapter E, F and M of Part 8.4.1 of this Scoping Report as well as Annexures E1 and E2.
Northern Cape Nature Conservation Act, 2009 (Act No.9 of	Chapter E of Part 8.4.1 of this Scoping

2009).	Report.
National Forests Act, 1998 (Act No 84 of 1998)	
Alien and Invasive Species Regulations published in the Government Gazette No. 37886, dated 01 August 2014	
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)	
The National Environmental Management: Air Quality Act (Act No 39 of 2004).	Chapter J of Part 8.4.1 of this Scoping Report.
SABS Code of Practice 0103 of 2008: The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication. SABS Code of Practice 0328 of 2008: Environmental Noise Impact Assessments.	Chapter K of Part 8.4.1 of this Scoping Report and Annexure E5.
National Environmental Management: Waste Act (Act No 59 of 2008), as amended.	Part 4.2 and Part 9.9 of this Scoping Report.
National Heritage Resources Act (Act No. 25 of 1999), as amended.	Chapter N of Part 8.4.1 of this Scoping Report and Annexure E6.
DMR Guideline for Consultation with communities and Interested and Affected Parties. As required in terms of Sections 16(4)(b) or 27(5)(b) of the Mineral and Petroleum Resources Development Act (Act 28 of 2002), and in accordance with the standard directive for the compilation thereof as published on the official website of the Department of Mineral Resources.	Part 8.2; 8.2 and 9.7 of this Scoping Report and Annexure G.
Integrated Environmental Management Information Series. Criteria for determining alternatives in EIA.	Part 8.7 and Part 9.1 of this Scoping Report and Annexure H.

6. Need and desirability of the proposed activities

6.1 Need and Desirability in terms of the Guideline on Need and Desirability, dated 20 October 2014.

On the 20th of October 2014, the Department of Environmental Affairs published a Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010, in Government Notice 891 of 2014. The following table indicates on how the guideline requirement were considered in this Scoping Report.

Table 10: Need and Desirability of the Proposed Project

Requirement	Part where requirement is addressed/response
1. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?[5]	PPC Lime Limited (as well as the proposed Quarry extension area) is situated in the Savanna biome and in the Eastern Kalahari Bushveld bioregion. The majority of the study site is situated in the Olifantshoek Plains Thornveld vegetation type. To the north of the existing PPC Lime Acres site (within the proposed Quarry extension area) Azonal vegetation is present. Azonal vegetation is atypical of the surrounding biome (e.g. typically occur along watercourses, but also in other areas). Vegetation and fauna sensitivity, wetlands and protected areas and conservation planning are described in Chapters E; F; H and M of Part 8.4.1 of this Scoping Report. Refer also to Annexures E1; E2; and E3, attached to this Scoping Report for copies of the specialist studies conducted.
1.1 How were the following ecological integrity considerations taken into account?	
1.1.1 Threatened Ecosystems.[6]	
1.1.2 Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.[7]	
1.1.3 Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs").	Refer to Chapter M of Part 8.4.1 of this Scoping Report.
1.1.4 Conservation targets.	
1.1.5 Ecological drivers of the ecosystem.	
1.1.6 Environmental Management Framework.	There are no protected areas within the direct vicinity of the PPC Lime Limited proposed Quarry Extension. However, one depression wetland (a southern Kalahari salt pan) was delineated within the proposed Quarry extension area, as part of the Wetland Desktop Assessment (refer Annexure E3). The delineated wetland is part of a much larger pan system known as Rooipan (approximately 1 500 ha), of which 25.3 ha falls within the proposed Quarry Extension boundary application area. Refer to Chapter H of Part 8.4.1 for more detail.
1.1.7 Spatial Development Framework.	

[5] Section 24 of the Constitution and section 2(4)(a)(vi) of NEMA refer.

[6] Must consider the latest information including the notice published on 9 December 2011 (Government Notice No. 1002 in Government Gazette No. 34809 of 9 December 2011 refers) listing threatened ecosystems in terms of Section 52 of National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

[7] Section 2(4)(r) of NEMA refers.

Requirement	Part where requirement is addressed/response
	Priority vegetation types in the ZF Mgcawu District: In order to meet national biodiversity targets in the ZF Mgcawu District Municipality, the Siyanda (ZF Mgcawu) EMF, 2008 sets out the targets for priority vegetation types. It is based on finding areas where the sensitive vegetation types are grouped together. The conservation can be in the form of: • *Extensions to or the creation of new national parks or provincial reserves;* • *The establishment of private protected natural areas;* • *The establishment of conservancies; or* • *The stricter control of activities on identified area through the application of the EIA regulations.* The Olifantshoek Plains Thornveld, in which the proposed Quarry extension area of PPC Lime Limited falls, is identified in the EMF as a "medium" priority. Refer to Chapter M of Part 8.4.1 for more detail. The EMF, 2008 further states that due to the nature of the vast area with a low population there are no significant land use conflicts in the area that need to be addressed in the EMF with the exception of activities within the Orange River floodplain. **Environmental Control Zones** According to the Siyanda EMF, 2008, the PPC Lime Limited and proposed Quarry extension area falls within "Zone 1: Potential sensitive groundwater resources". A description of "Zone 1" is provided below. *Zone 1: Potential sensitive groundwater resources* *The karst aquifers that occur in the dolomite and lime stone rocks in the area represent a major strategic water resource. It is sensitive both in respect to the abstraction and potential pollution*

Requirement	Part where requirement is addressed/response
	of groundwater. Mining and quarrying forms part of the list of land uses and activities that may be compatible (depending on the specific nature of land use or activity) and that may be considered in the zone after an appropriate level of impact assessment (as required by law) has been conducted. As per the Siyanda EMF, 2008, Spatial Development Frameworks for the EMF area have not yet been developed. A service provider has been appointed to develop the SDF for the area.
1.1.8 Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.).[8]	Not applicable.
1.2 How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[9]	The preliminary potential impacts that have been identified and may occur as a result of the proposed activity has been discussed in Part 8.5 of this document. The impacts will be further discussed and assessed in greater detail as part of the EIR and EMPr.
1.3 How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[10]	
1.4 What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been	Processing plant residue material will be generated and will be disposed of on the existing Kiln Waste Dump. Mine residue from the proposed quarry extension

[8] Section 2(4)(n) of NEMA refers.

[9] Section 24 of the Constitution and Sections 2(4)(a)(i) and 2(4)(b) of NEMA refer.

[10] Section 24 of the Constitution and Sections 2(4)(a)(ii) and 2(4)(b) of NEMA refer.

Requirement	Part where requirement is addressed/response
explored to safely treat and/or dispose of unavoidable waste?[11]	will consist of low grade limestone that will be placed on the overburden dumps situated to the east of the existing Bowden North quarry (refer to Figure 6). As mining progresses and quarries reach their final depth, the overburden will be backfilled into the quarries as part of the overall rehabilitation strategy. The overburden dumps have been converted to accommodate the evaporation ponds (Figure 6). Overburden is used to construct the walls of the facilities in order to accommodate the pumping of kiln fines in a slurry form to the evaporation ponds from the processing plant. In terms of solid (non-mineral) waste generation, it is anticipated that mostly general waste will be generated from the proposed quarry extension areas. General waste will be disposed offsite at a registered waste disposal facility. Should small amounts of hazardous waste be generated due to abnormal or infrequent activities within the quarry, the waste will be removed by a licenced hazardous waste transporter to a registered hazardous waste facility. Waste management will be implemented as per the mine's Waste Management Work Instruction.
1.5 How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[12]	A Phase 1 Archaeological Impact Assessment (AIA) was conducted for the PPC Lime proposed quarry extension, which also again included a portion of the farm Rosslyn. The resultant report is attached hereto in Annexure E6. Refer also to Chapter N of Part 8.4.1 of this Scoping Report for a description of the baseline environment in terms of heritage resources. Midden 1 and Midden 2 were recorded during the AIA within the proposed Quarry extension area. The sites consist of industrial artefacts like metal, glass and fragments of clothing. It is assumed

[11] Section 24 of the Constitution and Sections 2(4)(a)(iv) and 2(4)(b) of NEMA refer.

[12] Section 24 of the Constitution and Sections 2(4)(a)(iii) and 2(4)(b) of NEMA refer.

Requirement	Part where requirement is addressed/response
	that the features are associated with 20th century farm or mine workers. According to the AIA, the middens are of contemporary nature and are not considered to be of any significance apart from noting their presence, which has been done so in the AIA report. The stone age artefacts have also been sufficiently recorded through the mentioned AIA report. Two cemeteries were also recorded, but fall outside the proposed Quarry extension area.
1.6 How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[13]	The mining and removal of minerals (non-renewable resources) at PPC Lime's proposed quarry extension area will result in the localised destruction of the geological strata, which is a consequence of mining. The proposed activity for the mining of limestone at the proposed quarry extension areas will be conducted in a phased approach. Mining will commence at the first quarry extension area (northern direction) with the removal of vegetation where after the topsoil and overburden will be stripped separately. This disturbance will occur progressively as the quarry progresses forward. Phase 2 of the proposed quarry extension relates to Quarry 2 being mined (Quarry 2 will be located within the current approved mining rights boundary), and subsequently moving into the proposed Mega Pit (mining to move in an western / north-western direction from Quarry 2 into the proposed Mega Pit. The reason the Phase 1 quarry and Phase 2 quarry extensions are not linked is due to the existence of a fault between the two quarry areas. Water collected within the quarry extension areas will continue to be abstracted and pumped to Quarry 5, from where water will subsequently be pumped to the existing Water Treatment Plant.
1.7 How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?[14]	

[13] Section 24 of the Constitution and Sections 2(4)(a)(v) and 2(4)(b) of NEMA refer.

[14] Section 24 of the Constitution and Sections 2(4)(a)(vi) and 2(4)(b) of NEMA refer.

Requirement	Part where requirement is addressed/response
	The water will be treated in the chlorinators before being distributed to the Plant and villages for domestic use. PPC Lime Limited has an IWUL that authorises them in terms of Section 21(a) and (j) to take a maximum quantity of 1 400 000 m3 per annum from Quarry 5 for domestic and industrial processes. Furthermore, Quarry 5 is authorised in the IWUL in terms of Section 21(g) of the NWA, 1998 for a total volume of 1 400 000m3 disposed per annum. The potential impacts that may be occur as a result of the proposed activity have been preliminarily identified and discussed in Part 8.5. The impacts will be described and assessed in detail as part of the EIR and EMPr.
1.7.1 Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)	The existing quarries produce high-grade limestone and dolomite that is: • Used to manufacture lime, burnt dolomite and related products at the existing Lime Acres based factory adjacent to the quarries, or • Sold as high grade metallurgical limestone and dolomite. Since the proposed Bowden North quarry extension will be a continuation of the mining of the limestone section of the operation, the dependency on the use of the resources will continue.
1.7.2 Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?)	
1.7.3 Do the proposed location, type and scale of development promote a reduced dependency on resources?	
1.8 How were a risk-averse and cautious approach applied in terms of ecological impacts?[15]	A risk-averse and cautious approach was applied by the undertaking of specialist studies, especially due to the existence of the pan to the north of the

[15] Section 24 of the Constitution and Section 2(4)(a)(vii) of NEMA refer.

Requirement	Part where requirement is addressed/response
	proposed extension area. A conservative approach will be followed in terms of the identification and assessing of environmental impacts associated with the proposed project during the EIA / EMPr phase.
1.8.1 What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	In the desktop Wetland study conducted, wetlands were delineated based on a desktop analysis of vegetation and topographical gradients visible from aerial imagery. As no ground-truthing was conducted in the field, the finer details of the wetlands may be lacking. A detailed Wetland delineation and functional assessment will thus be conducted during the EIA Phase. Refer also to Part 8.6.3 of this Scoping Report.
1.8.2 What is the level of risk associated with the limits of current knowledge?	Based on the above, and the fact that the project is still in the Scoping phase (i.e. a detailed Wetland Delineation Study will be conducted during the EIA Phase), the level of risk (currently) associated with the limits of current knowledge can be considered low to medium.
1.8.3 Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	
1.9 How will the ecological impacts resulting from this development impact on people's environmental right in terms following:[16]	
1.9.1 Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	All potential negative and positive impacts associated with the proposed activity have been preliminarily identified and discussed in Part 8.5 below. These impacts will be discussed, assessed and the significance determined in the EIA and EMP.
1.9.2 Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	
1.10 Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services	

[16] Section 24 of the Constitution and Sections 2(4)(a)(viii) and 2(4)(b) of NEMA refer.

Requirement	Part where requirement is addressed/response
applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	
1.11 Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?	
1.12 Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?[17]	Refer to Part 8.1 and Annexure H.
1.13 Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?[18]	A preliminary determination of the potential impacts associated with the proposed activity has been included in Part 8.5 of this document. These impacts (including the residual and cumulative impacts) will be described and assessed in detail and the significance determined as part of the EIA and EMP phase of the project.
2.1 What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?	
2.1.1 The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area,	Refer to Chapter O of Part 8.4.1 of this document. A preliminary determination of the potential impacts associated with the proposed activity has been included in Part 8.5 of this document. These impacts (including the residual and cumulative impacts) will be described and assessed in detail and the significance determined as part of the EIA and EMP phase of the project.
2.1.2 Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	
2.1.3 Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	
2.1.4 Municipal Economic Development Strategy ("LED Strategy").	
2.2 Considering the socio-economic context, what will the socio-economic impacts be of the development (and	

[17] Section 2(4)(b) of NEMA refer.

[18] Regulations 22(2)(i)(i), 28(1)(g) and 31(2)(1) in Government Notice No. R. 543 refer.

Requirement		Part where requirement is addressed/response
	its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	
2.2.1	*Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?*	
2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?[19]	Refer to Chapter O of Part 8.4.1 of this Scoping Report and the Social and Labour Plan attached hereto as Annexure F. Note: the proposed quarry extension will be a continuation of the current mining activities.
2.4	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term?[20] Will the impact be socially and economically sustainable in the short- and long-term?	The negative and positive impacts that have been preliminarily identified as part of the Scoping Phase have been described in Part 8.5 below. These impacts will be further described in detail, assessed and the significance determined during the EIA and EMP Phase. The development will be economically sustainable over the short and long-term as the mining operation is expected to continue for at least the next 35 years.
2.5	In terms of location, describe how the placement of the proposed development will:[21]	-
2.5.1	*result in the creation of residential and employment opportunities in close proximity to or integrated with each other,*	As the proposed activity is the extension of the current mining activities, residential opportunities will not be created. The mine will continue to provide work for employees during the operational phase. The proposed activity will not impact on the transportation of people.
2.5.2	*reduce the need for transport of people and goods,*	
2.5.3	*result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport),*	
2.5.4	*compliment other uses in the area,*	The current land use at PPC Lime Limited is that of 'mining'. This land use will be extended to adjacent farm portions that are owned by PPC Lime Limited.

[19] Section 2(2) of NEMA refers.

[20] Sections 2(2) and 2(4)(c) of NEMA refers.

[21] Section 3 of the Development Facilitation Act, 1995 (Act No. 67 of 1995) ("DFA") and the National Development Plan refer.

Requirement	Part where requirement is addressed/response
	Petra Diamonds: Finch Diamond Mine is also located in close proximity to PPC Lime Limited's site. Furthermore, guesthouses and local businesses and the existence of the town of Lime Acres is dependent on the operation of the mines in the area.
2.5.5 be in line with the planning for the area,	The EMF, 2008 states that due to the nature of the vast area with a low population there are no significant land use conflicts in the area that need to be addressed in the EMF with the exception of activities within the Orange River floodplain. **Environmental Control Zones** According to the Siyanda EMF, 2008, the PPC Lime Limited and proposed Quarry extension area falls within "Zone 1: Potential sensitive groundwater resources". A description of "Zone 1" is provided below. *Zone 1: Potential sensitive groundwater resources* *The karst aquifers that occur in the dolomite and lime stone rocks in the area represent a major strategic water resource. It is sensitive both in respect to the abstraction and potential pollution of groundwater.* Mining and quarrying forms part of the list of land uses and activities that may be compatible (depending on the specific nature of land use or activity) and that may be considered in the zone after an appropriate level of impact assessment (as required by law) has been conducted. As per the Siyanda EMF, 2008, Spatial Development Frameworks for the EMF area have not yet been developed. A service provider has been appointed to develop the SDF for the area.
2.5.6 for urban related development, make use of underutilised land available with the urban edge,	Not applicable.
2.5.7 optimise the use of existing resources and	PPC Lime Limited is an existing mine. A

Requirement	Part where requirement is addressed/response
infrastructure,	processing plant is also currently operated within the existing mining boundary area. As the proposed quarry extension will be a continuation of the current activities, existing infrastructure and resources will be used as far as possible.
2.5.8 *opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),*	
2.5.9 *discourage "urban sprawl" and contribute to compaction/densification,*	As mentioned above, PPC Lime Limited is an existing mine. A processing plant is also currently operated within the existing mining boundary area. As the proposed quarry extension will be a continuation of the current activities, it is not anticipated that the urban sprawl, the compaction / densification or impacts on spatial patterns will occur as a result of the proposed quarry extension. Existing resources and infrastructure will continue to be used as part of the proposed quarry extension as far as possible.
2.5.10 *contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,*	
2.5.11 *encourage environmentally sustainable land development practices and processes,*	Effective environmental management and mitigation of environmental impacts. Refer to Part 9.9. Detailed management and mitigation measures will be included in the EIAR and EMPr. As part of the rehabilitation strategy and as mining in the quarry areas progresses forward, backfilling will occur.
2.5.12 *take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),*	The proposed quarry locations were determined based on the location of the limestone mineral resources within the relevant farm portions.
2.5.13 *the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential),*	The current mining operation results in high socio-economic returns. Refer also to the SLP attached hereto as Annexure F.
2.5.14 *impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and*	It is not anticipated that the proposed activity will impact on any socio-cultural or heritages resources. The “sense of place” of the area has also already

Requirement	Part where requirement is addressed/response
	been impacted on as a result of current mining activities conducted on the property in question. Therefore regular passers-by of the area as well as local residents within the area are likely to be sensitised to the mining activities.
2.5.15 in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	It is not anticipated that the proposed activity will result in a more integrated settlement or in additional negative socio-economic impacts. Settlement patterns will most likely remain unchanged as the proposed quarry extension will be a continuation of the current mining activities. A conservative approach will be followed in terms of the identification and assessing of environmental impacts associated with the proposed project during the EIA / EMPr phase.
2.6 How were a risk-averse and cautious approach applied in terms of socio-economic impacts?[22]	
2.6.1 What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?[23]	It is believed that no socio-economic related knowledge gaps exist in terms of the proposed project. Also, no uncertainties have been identified. The following assumptions are made: • That all socio-economic information provided by the applicant regarding the proposed project is correct. • That the mitigation measures proposed in this report and the EMPr are implemented correctly and are effective. • All research/reference sources are accurate. • That there will be no significant changes to the proposed project that could affect the findings and recommendations of this report and the EMPr. Based on the above descriptions, it is our opinion that the level of risk associated with the limits of current knowledge (in terms of socio-economic aspects) is low.
2.6.2 What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	
2.6.3 Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	
2.7 How will the socio-economic impacts resulting from	-

[22] Section 2(4)(a)(vii) of NEMA refers.

[23] Section 24(4) of NEMA refers.

Requirement		Part where requirement is addressed/response
	this development impact on people's environmental right in terms following:	
2.7.1	*Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?*	PPC Lime Limited is an existing mine operating adjacent to the town of Lime Acres in the Northern Cape Province. The socio-economic impacts which have been preliminarily identified is that of impacts on the adjacent communities (Lime Acres Village and She-leje Village) in terms of continued dust and noise generation, and positively the continuation of job security. The impacts, both positive and negative, will be further described and assessed and the significance determined as part of the EIA and EMP phase of the project.
2.7.2	*Positive impacts. What measures were taken to enhance positive impacts?*	
2.8	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	The preliminarily identified impacts of the proposed activity are presented in Part 8.5 of this document.
2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?[24]	Refer to Annexure H for the Alternatives Assessment Report. The alternatives identified have taken the “best practicable environmental options” into account.
2.10	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)?[25] Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	
2.11	What measures were taken to pursue equitable	Refer to point 2.6 (of this table) above.

[24] Section 2(4)(b) of NEMA refers.

[25] Section 2(4)(c) of NEMA refers.

Requirement	Part where requirement is addressed/response
access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?[26]	
2.12 What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?[27]	The identification of the potential impacts has been presented in Part 8.5 below. The potential impacts will be further described and assessed in detail and the significance determined as part of the EIA and EMP phase of the project. Mitigation measures will also be provided for each potential impact that may occur, for the Life of Mine.
2.13 What measures were taken to:	-
2.13.1 ensure the participation of all interested and affected parties,	Refer to the Public Participation report attached hereto as Annexure G.
2.13.2 provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,[28]	
2.13.3 ensure participation by vulnerable and disadvantaged persons,[29]	
2.13.4 promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,[30]	
2.13.5 ensure openness and transparency, and access to information in terms of the process,[31]	
2.13.6 ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge[32], and	
2.13.7 ensure that the vital role of women and youth in environmental management and development were	Refer to the Public Participation report attached hereto as Annexure G. The Public Participation

[26] Section 2(4)(d) of NEMA refers.
[27] Section 2(4)(e) of NEMA refers.
[28] Section 2(4)(f) of NEMA refers.
[29] Section 2(4)(f) of NEMA refers.
[30] Section 2(4)(h) of NEMA refers.
[31] Section 2(4)(k) of NEMA refers.
[32] Section 2(4)(g) of NEMA refers.

Requirement	Part where requirement is addressed/response
recognised and their full participation therein were be promoted?[33]	report presents the details of all I&APs that were identified, how the I&APs were notified and involved in the process, any issues and concerns raised by the I&APs and the final results of the Public Participation Process.
2.14 Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?[34]	As mentioned previously, the proposed quarry extension is a continuation of an existing mining activity at PPC Lime Limited. It is not anticipated that additional opportunities will occur as a result of the proposed quarry extension. However, the proposed activity will contribute to the continued success of the mining activity and continued job security and socio-economic well-being of the area.
2.15 What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?[35]	All contractors, sub-contractors and workers will attend compulsory environmental awareness training and inductions. This training will highlight the dangers associated with the workplace. Procedures relating to environmental risks will also be put in place and will be regularly updated.
2.16 Describe how the development will impact on job creation in terms of, amongst other aspects:	-
2.16.1 the number of temporary versus permanent jobs that will be created,	PPC Lime Limited mine currently employs 466 employees (including contractors). Therefore, should the Section 102 Amendment and environmental authorisation be approved and granted, it would result in the increased job security of the current employees.
2.16.2 whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),	
2.16.3 the distance from where labourers will have to travel,	
2.16.4 the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and	
2.16.5 the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).	

[33] Section 2(4)(q) of NEMA refers.

[34] Section 2(4)(g) of NEMA refers.

[35] Section 2(4)(j) of NEMA refers.

Requirement	Part where requirement is addressed/response
2.17 What measures were taken to ensure:	-
2.17.1 that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and	Refer to the Public Participation report attached hereto as Annexure G. Other government departments are included on the list of I&APs and stakeholders and received the notifications of the proposed activity as well as notifications on the availability of the report for review. All applicable environmental legislation was considered during the Scoping process.
2.17.2 that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	
2.18 What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?[36]	During the initial Public Participation Process, all issue and concerns raised by the I&APs, stakeholders and the Organs of State were taken into account and responses provided.
2.19 Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?[37]	Mitigation measures for each of the identified impacts will be described in detail in the EIR and EMPr. The proposed mitigation measures will be realistic to protect both the bio-physical and socio-economic environment in both the short- and long-term.
2.20 What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?[38]	The applicant will be responsible for the costs of any remediation of pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects. The Financial Provisioning Report for PPC Lime Limited will be included and discussed in detail in the EIR and EMPr.
2.21 Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of	The alternatives for the proposed project are described in Part 8.1 below. The alternatives will be discussed in greater detail in the EIR and EMPr and will be assessed in terms of the following four categories:

[36] Section 2(4)(o) of NEMA refers.

[37] Section 240(1)(b)(iii) of NEMA and the National Development Plan refer.

[38] Section 2(4)(p) of NEMA refers.

Requirement		Part where requirement is addressed/response
	the best practicable environmental option in terms of socio-economic considerations?[39]	1. Environmental. 2. Technical/Engineering. 3. Economical. 4. Social. Refer to Annexure H for a detailed description of the method which will be utilised in assessing the alternatives for the proposed project.
2.22	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?[40]	The preliminarily identified impacts have been presented in Part 8.5 below. The impacts will be further described and assessed and the significance determined as part of the EIA and EMP phase of project. All residual and cumulative impacts will also be described and assessed in the EIR and EMPr.

7. Period for which environmental authorisation is required

Since the mine plan (provided in Figure 5 above) indicates mining faces up to 2053, its is anticipated that the Life of Mine (LoM) will be extended up to atleast the year 2053. Further decommisioning will also be required after this date. The environmental authorisation is thus required for the period relevant to the proposed extended Life of Mine, with additional years for decommisioing, which in total is in excess of 40 years.

8. Description of the process followed to reach the proposed preferred site.

8.1 Details of all alternatives considered

8.1.1 Proposed activity

The existing quarries produce high-grade limestone and dolomite that is:

- Used to manufacture lime, burnt dolomite and related products at the existing Lime Acres based factory adjacent to the quarries, or

[39] Section 2(4)(b) of NEMA refers.

[40] Regulations 22(2)(i)(i), 28(1)(g) and 31(2)(1) in Government Notice No. R. 543 refer.

- Sold as high grade metallurgical limestone and dolomite.

The mining of limestone will be undertaken at the proposed Quarry extension area. The Quarry Extension will be a continuation of the current Bowden North Quarry currently being mined by PPC Lime Limited.

The quarry pit extension will be started by creating a cut and the removal of the topsoil and overburden. The quarrying process is conducted by means of diesel-electric haul trucks, hydraulic and electric rope shovels and other associated mining equipment.

PPC Lime Limited plans on mining the proposed quarry extension areas in two (2) phases:

- **Phase 1**: The continuation of the existing Bowden North Quarry in a northern direction into Portion 24 of the farm Carter Block 458 (also knows as farm Rosslyn) and Portion 63 of the farm Carter Block (also known as farm Botha). Refer to Figures 4 and 5.
- **Phase 2:** The continuation of the existing Bowden North Quarry in a westerly / south-westerly direction into Quarry 2 (which still falls within the mine's current mine boundary area), followed by the extension of Quarry 2 into the proposed 'Mega-pit' (in a westerly / north-westerly direction into Portion 63 of the farm Carter Block (also known as farm Botha). Refer to Figures 4 and 5.

Once mining within each respective quarry is complete, backfilling with overburden, placement of topsoil and reshaping of the disturbed surface area will be conducted to be free draining.

8.1.2 Location Alternatives

As per the Prospecting EMP (Annexure C), the deposit is situated in the Lime Acres Member of the Ghaapplato Formation, Campbell Group, Griqualand West Sequence. It consists of high-grade strata bound limestone beds on the eastern flank of a large north/south striking syncline.

Therefore no alternative site locations could be considered due to the locality of the mineral deposit. However based on the Department of Environmental Affairs Integrated Environmental Management Series 11 "*Criteria for determining Alternatives in EIA*", dated 2004, alternatives in terms of activity, process, schedule, scale and the "No-go options" were identified (refer also to the Alternatives Assessment Report attached hereto as Annexure H).

8.1.3 Activity alternative

8.1.3.1 Mining method alternatives

Two alternatives in terms of mining method have been identified. These include:

- Alternative MM1: Opencast mining method (as is currently applied).
- Alternative MM2: Underground mining method.

The preferred alternative is that of opencast mining. This is due to the fact that underground mining is not feasible due to variation in Limestone zone thickness. Underground mining can not be considered due to the shallow nature of the Limestone deposit.

8.1.3.2 Primary crushing and transport alternatives

The following alternatives in terms of the primary crushing and transport of the mined mineral have been identified:

- Alternative PT1: The transportation of the mined mineral from the proposed quarry extension areas to the existing primary crusher via truck (haulage) from where it is transported to the remainder of the existing processing plant via conveyor.
- Alternative PT2: The transportation of the mined mineral from the proposed quarry extension areas to the existing primary crusher via conveyor (to be newly constructed) from where it is transported to the remainder of the existing processing plant via conveyor.
- Alternative PT3: The establishment of an in-pit primary crusher at the proposed quarry extension areas from where mined material is transported via conveyor to the remainder of the existing processing plant.
- Alternative PT4: A combination of Alternative 1 and Alternative 3. During Phase 1 and possibly the first section of Phase 2 of the proposed quarry extension, Alternative 1 is considered by PPC Lime as being the most practical (i.e. transporting the mine mineral to the existing primary crusher via haul truck). However, as mining progresses further to the west and to the north as part of the Mega-pit (during the later sections of Phase 2 of mining), the distance between the mining area and the existing primary crusher increases and from a cost and practical implementation perspective, an in-pit primary crusher (as per Alternative 3) may be established at the proposed quarry extension areas from where the crushed material will be transported via conveyor to the remainder of the existing Processing facility.

The current preferred option is thus Alternative PT4. The alternatives will however be further assessed during the EIA and EMP phase.

8.1.4 Process alternatives

Two alternatives have been identified for the processing of the mineral, and include:

- Alternative P1: Processing of the mined mineral at the existing processing plant.
- Alternative P2: Processing of the mined mineral at another processing plant.

The prefered alternative is the processing of the the mineral at the existing PPC Lime processing plant. The existing processing plant is located on the existing PPC Lime Limited mining area, adjacent to the proposed quarry extension area.

The other alternative would be to either construct a new processing plant or to transport the mined material to another processing plant for processing. This is however not preffered due to the high cost investment in constructing a new plant or the high cost investment in the transportation to another processing plant, when the PPC Lime Limited already has an operational processing plant in relative close proximity to the proposed quarry extension areas.

8.1.5 Scheduling alternatives

The following alternatives in terms of scheduling have been identified for the mining of of the mineral at PPC Lime Limited's proposed quarry extension areas:

- Alternative SCH1: Mining of the mineral from quarry areas utilising a phased approach (i.e. two phases) with an overlap between the Bowden North Quarry extension (north) and Quarry 2 (approximately in 2020).
- Alternative SCH2: Mining all of the proposed quarries simultaneously.

The mining of the proposed quarries utilising a phased approach is the current preferred option. This alternative allows for the Bowden North Quarry to be mined in a northerly direction (as part of Phase 1), followed by the mining of Quarry 2 (as part of the existing mining right) and the Mega-pit area in a western / north-western direction (as part of Phase 2). Refer to Figures 4 and 5. As mining progresses, overburden and topsoil is removed for later backfilling as part of the rehabilitation strategy. An overlap between Phase 1 and Phase 2 is however anticipated in approximately 2020 (as per Figure 5).

8.1.6 Scale alternatives

Two alternatives in terms of scale have been identified and include:

- Alternative SCA1: The mining of the mineral in the proposed quarries as per the site layout plans (Figures 4 and 5).
- Alternative SCA2: The mining of the mineral in larger or smaller quarries.

All quarries cannot be mined as one large quarry or in smaller quarries, due to mining-related reasons (i.e. it is preferred that mining is to be undertaken in the direction of the mining face for practical and

cost related reasons – refer to Figure 5). Furthermore, due to the existence of a fault located between the existing Bowden North quarry, including its northern extension (Phase 1) and the Quarry 2 and Mega-pit areas (Phase 2) (refer to Figure 6), mining all of the proposed quarries simultaneously as one large, will not be possible. Alternative SCA1 is thus the current preferred option.

8.1.7 Design or layout alternatives

Two alternatives in terms of the mine design / plan have been identified:

- Alternative DL1: Mine the whole reserve.
- Alternative DL2: Exclusion of the pan (of which a section is located within the proposed mining area) with a defined buffer zone surrounding the pan.

Note: A desktop wetland assessment has been conducted where the mentioned pan has been identified and delineated (on a desktop level). As per the resultant specialist report (Annexure E3), local government policies require that protective buffer zones be calculated from the outer edge of the temporary zone of a wetland (KZN DAEA, 2002; CoCT, 2008; GDACE, 2009). This report suggests that a generic 30m buffer zone be applied to the outer edge of the pan. Figure 24 shows the wetland (pan) area and its 30m buffer zone.

A detailed Wetland Assessment will be conducted as part of the EIA Phase in order to delineate the wetland / pan area based on a site visit by the specialist, as well as to confirm the necessary mitigation or management measures.

The two above-mentioned alternatives are thus still being investigated and will be further assessed during the EIA Phase based on the results of the detailed Wetland Assessment.

8.1.8 No-go option

If the reserves at the PPC Lime Limited proposed quarry extension areas are not mined, the *status quo* environmental conditions within the area will remain as is.

Physical and biophysical environment – The proposed project is expected to create a number of environmental impacts of which not all may necessarily be effectively mitigated and include impacts on water resources, fauna, flora, soil, wetlands, air quality and surrounding communities. Of special mention is the location of the proposed quarry extension area in relation to a pan (depression wetland) forming part of Rooipan. Refer to Figure 25.

Social – A number of social impacts have been provisionally identifed and include impacts on: sense of place and visual. It is however important to note that the PPC Lime Limited is an existing operation. Therefore the significance of negative social impacts that have been identified could be described as

being low as regular visitors to the area and the local community are likely to be desensitised to the mining operations.

Economic – Should the Section 102 Amendment and Environmental Authorisation not be granted, the Life of Mine will not be extended and several jobs may be lost. Skills development may cease and the ore body will remain *in situ* and unutilised. It is however important to note that should PPC Lime Limited not proceed with the proposed project, the mining of the reserves may not necessarily be avoided as another application can be made by another company unless the DMR sterilises these reserves.

Refer to the Alternatives Assessment Report in Annexure H for a description and comparison between the land use alternatives identified.

8.2 Details of the Public Participation Process Followed

A detailed public participation process was undertaken as part of the initial application. As required by the NEMA (1998), EIA Regulations, dated December 2014, the following has been conducted as part of the Section 102 Amendment and Environmental Authorisation application (proof hereof will be included in the final Public Participation Report to be submitted to the DMR along with the Final Scoping Report) (will be attached as Annexure G to this report):

- Advertisement.
  - A newspaper advertisement was placed in the Kathu Gazette.
- Site notices.
  - Site notices were placed around the PPC Lime Acres and She-leje Villages and proposed site(s).
- Written notices.
  - Written notices (including BIDs) were distributed to I&APs and Stakeholders.
- Availability of Scoping Report for public review
  - This Scoping Report is made available for public and stakeholder review for a period of 30 days.

8.3 Summary of issues raised by I&APs

Table 11 below provides a summary of the comments and issues raised and reaction to those responses. After this Scoping Report has been made available for public review for a period of thirty (30) days, any additional comments received will be included into the table below, where after the report will be finalised and submitted to the DMR.

Table 11: Summary of the issues raised by the I&APs (refer also to Annexure G)

This table will be completed once public participation (i.e. the Scoping Report public review period) has been completed and comments have been received from I&APs

Interested and Affected Parties		Date Comments Received	Issues raised	EAPs 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	Mark with an **X** where consulted				

8.4 The Environmental attributes associated with the sites. A baseline environment.

8.4.1 Type of environment affected by the proposed activity

A baseline description or "*status quo"* of the of the present environmental situation is provided in this part of the document. The following attributes / aspects have been described in detail, in the following respective chapters:

- Chapter A: Geology.
- Chapter B: Climate.
- Chapter C: Topography.
- Chapter D: Soil.
- Chapter E: Vegetation.
- Chapter F: Fauna.
- Chapter G: Surface water.
- Chapter H: Wetlands and other surface water features.
- Chapter I: Groundwater.
- Chapter J: Air Quality.
- Chapter K: Noise.
- Chapter L: Visual.
- Chapter M: Protected areas and conservation planning.
- Chapter N: Sites of Archaeological and cultural importance.
- Chapter O: Regional socio-economic structures.

Chapter A: Geology

The following information has been extracted from the following:

- The report titled: "*Environmental Management Programme Reports for prospecting and mining, PPC Lime*", Revision 5, dated February 2013 (hereafter referred to as EMP, Revision 5; dated February 2013);
- The report titled: "*PPC Lime Limited, Lime Acres, Hydrocensus*", dated February 2015 (refer to Annexure E4); and
- The report titled: PPC Lime, Environmental Management Programme for prospecting" (refer to Annexure C).

PPC Lime is directly underlain by dolomitic limestone with interbedded chert of the Ghaap Plateau Formation (Figure 8) and Campbell Group, forming part of the Griqualand West Sequence of rocks believed to be of a Vaalian era (2 200 Ma).

The deposit consists of high-grade strata bound limestone beds on the eastern flank of a large north/south striking syncline. The beds have a dip of about 3° to the west. The limestone is interbedded with low grade limestones, dolomite and chert being the main contaminants. The stone is well jointed, parallel and normal to the strike and several vertical N-S faults occur. It is overlain by stromatolitic dolomite grading upwards through the Passage Beds to the Banded Ironstone.

The limestone is subject to secondary dolomitisation caused by the percolation of magnesia rich solutions through the unconsolidated limestone beds and the replacement of calcite by dolomite. This has rendered some stone unsuitable for limestone production.

Owing to the dip of the deposit, the overburden increases from the east to the west. There is a very thin soil cover underlain by banded ironstone and chert rubble over the primary limestones. Beige and white secondary limestone has been derived from the limestone and contains much wind-blown Kalahari sand, recemented chert and banded ironstone fragments.

As Mentioned, various north-south striking faults occur in the area and have an influence on mining. It is believed that PPC Lime is bounded by dykes and fault lines of which the extent to the south are unknown. There may be more of these structures of which the existence or localities are not known. Each of these structures may act as preferred waterways or may act as groundwater boundaries, or may act as partial boundaries or partial waterways (Geo-Logic Trading Trust, 2009).

Banded ironstone of the Asbestos Hills Formation, which lies conformably on the dolomite, constitutes the Kuruman Hills along the western watershed or geological contact. This area to the west of Lime Acres was subjected to a number of tectonic events in the past. This caused considerable folding of the Asbestos Mountain Range. The impact of this folding, which originates from movement along the Namaqua-Natal mobile belt to the west, caused the formation of several large lineaments within the Ghaap Plateau. These lineaments are intruded with hypabyssal rocks of dolerite origin and display a dominating north-south angle with a minor east-west component. In the study area, these structures are represented by the Eastern, Daniëlskuil, Riversmoore, Beadle and Adams dykes. The latter two dykes are orientated strictly east-west, whilst the others vary between north 15° and north 150°. The transition from the Asbestos Hills banded ironstone to the Ghaap Plateau carbonates is characterized by a gradual change from pure carbonates to arenaceous ferruginated carbonates and finally into the banded ironstones (Botha and van Wyk, 1986).

The chemical composition of the carbonate rocks and the intruded rocks are completely different. The normal trend of weathering caused the doleritic intrusions to become partial groundwater barriers, while the other dolomitic features were leached to various degrees.

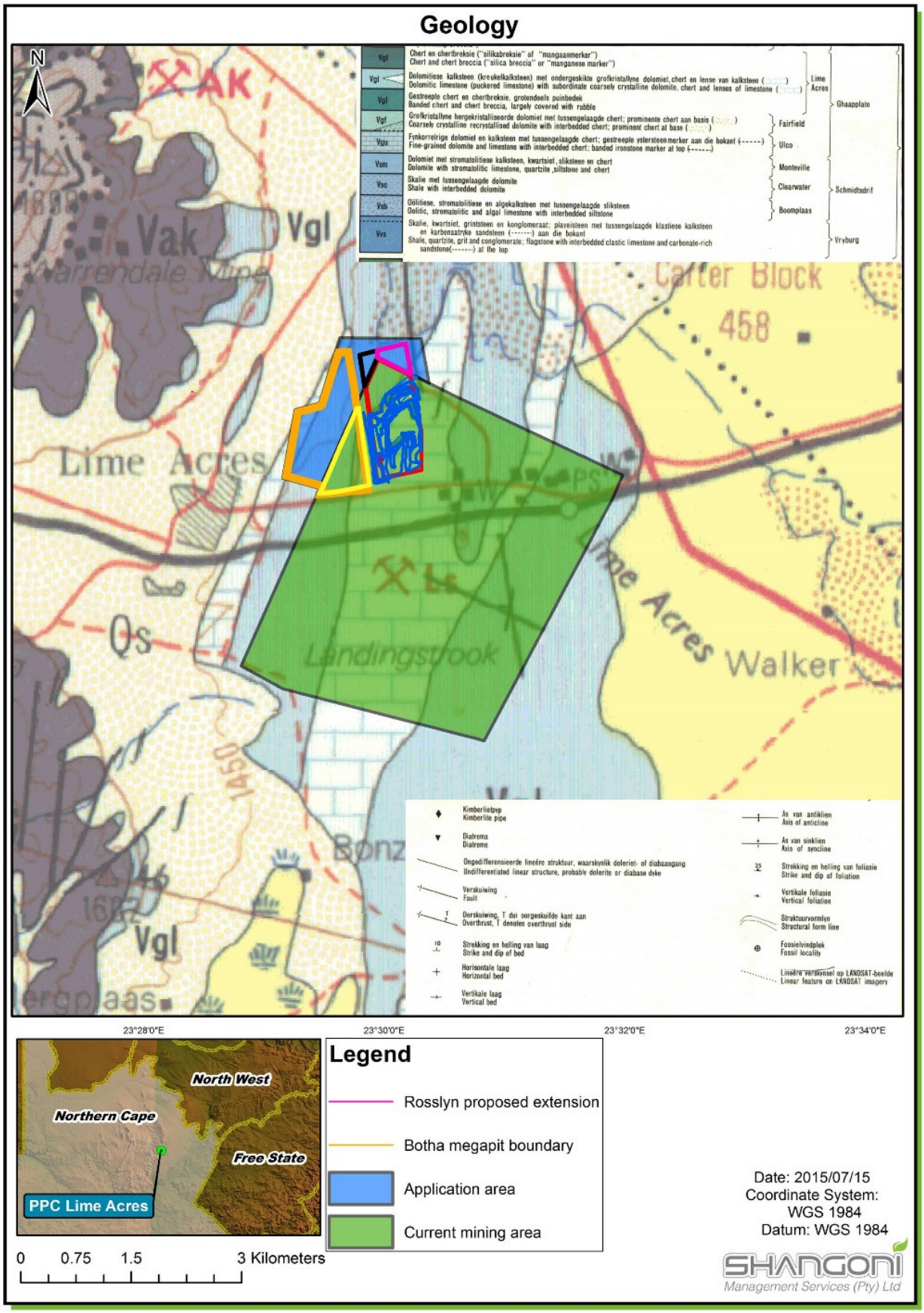


Figure 8: Regional Geology

Chapter B: Climate

Climate-related information was obtained from the following sources:

- World Weather Online (www.worldweatheronline.com);
- AGIS (www.agis.agric.za/agismap);
- Climate-Data.Org (http://en.climate-data.org);
- Wind data (www.windfinder.com/windstatistics);
- EMP, Revision 5; dated February 2013;
- PPC Lime Acres Hydrocensus Report, dated February 2015; and
- PPC Lime - Actual rainfall measurements.

1.1 Temperature

The climate of the area is typical continental with large seasonal variations in temperature. Figure 9 below provides the mean maximum and minimum temperatures for the Daniëlskuil area. The daily mean maximum temperature for the area varies between 24°C and 37°C, while the mean minimum temperature varies between -4°C and 11°C.

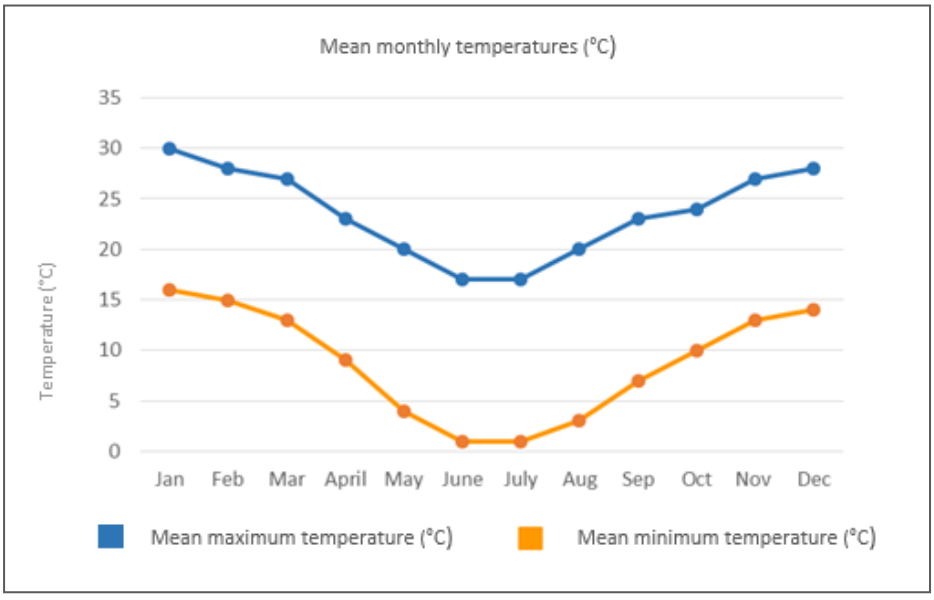


Figure 9: Mean monthly maximum and minimum temperatures for Daniëlskuil

1.2 Rainfall

PPC Lime Acres is located at the foothills of the Asbesberge in the Griqualand west area. The rainfall in this north-eastern part of the Northern Cape Province is fairly low (<400mm/annum) and could be described as semi-desert. The mean annual rainfall for Lime Acres and surroundings is very low at 335mm/annum. The rainfall regime is typically summer and the rainfall occurs most of the time as isolated thunderstorms. The driest month is July with most precipitation falling in February.

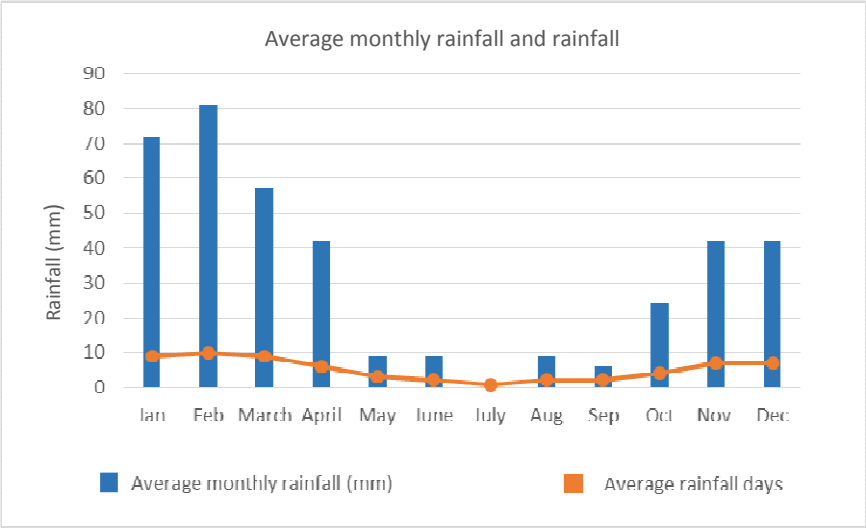


Figure 10: Average monthly rainfall and rainfall days for Daniëlskuil

Table 12: Actual rainfall measured at PPC Lime Limited (mm)

Year	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Total
2011	232.0	185.5	84.0	70.6	47.0		3.5	3.0			25.50	35.0	**686.1**
2012	15.5	62.6	118.0	37.0		33.0	7.0			40.0	5.0	116.0	**434.1**
2013	46.0	26.0	10.0	7.0	21.0		12.0			7.0	27.0	78.0	**213.0**
2014	62.0	148.0	38.0					36.0					**305.0**

1.3 Extreme weather conditions

Frost occurs during the period May to August and is moderate to locally severe in intensity. Cloud cover is associated with the mid-afternoon convectional activity and the resultant thunderstorms. Snow has a frequency of less than 1 day per year and mist is also rare. Fog will also occur only in extreme cases.

1.4 Mean monthly evaporation

Evaporation figures for this area due to its arid climate fluctuate between a minimum of 81.1mm in June and a maximum of 322.2mm per year in December. The mean annual evaporation rate varies between 2100mm/annum and 2600 mm/annum.

1.5 Mean monthly wind direction and speed

The prevailing wind direction is north-west to west during the dry and windy period of July to October. The average wind speed data for Postmasburg is provided in Table 13 below.

Table 13: Average wind speed (m/s) at Postmasburg

Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
3.6	3.1	4.6	4.1	2.6	3.1	3.6	4.6	n/a	3.6	8.2	4.1

(Source: http://www.windfinder.com/windstatistics/postmasburg)

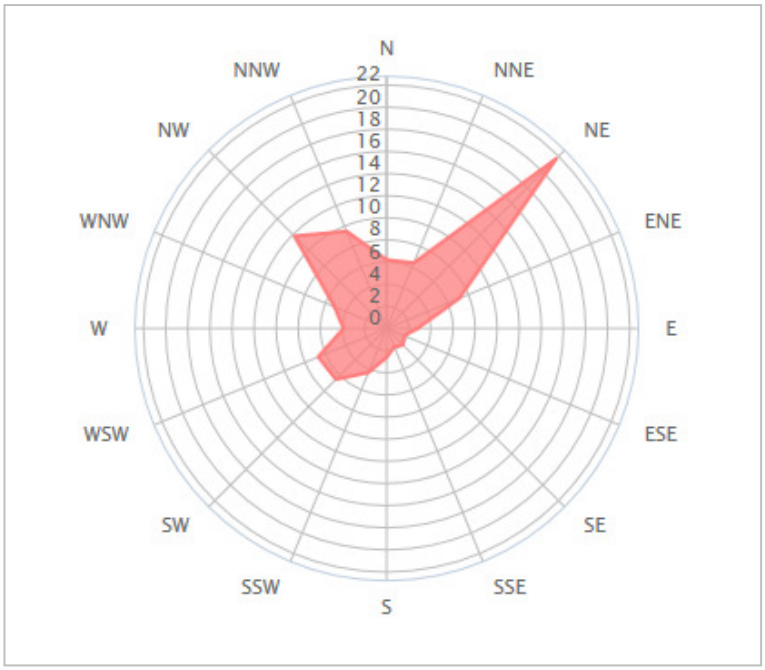


Figure 11: Wind direction distribution in percentage (%)
(Source: http://www.windfinder.com/windstatistics/postmasburg)

Chapter C: Topography

The area is bounded on its western side by a broken mountain range, known as the Asbestos Mountain belt (Figure 12). This mountain range forms the eastern flank of a regional north-south irregular highland. Elevations on the broken highland is around 1600 m above sea level. To the east of the Asbes Mountain, the topography is an almost flat landscape with topographical heights of 1400 m above sea level (Shangoni AquiScience, February 2015).

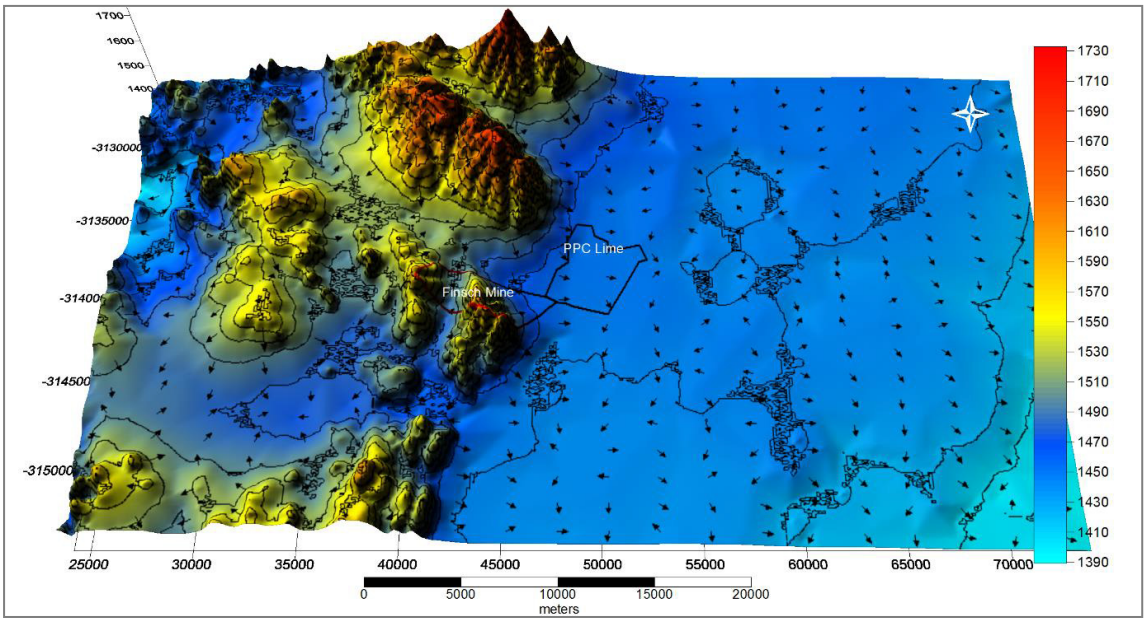


Figure 12: Topographical surface- and contour map

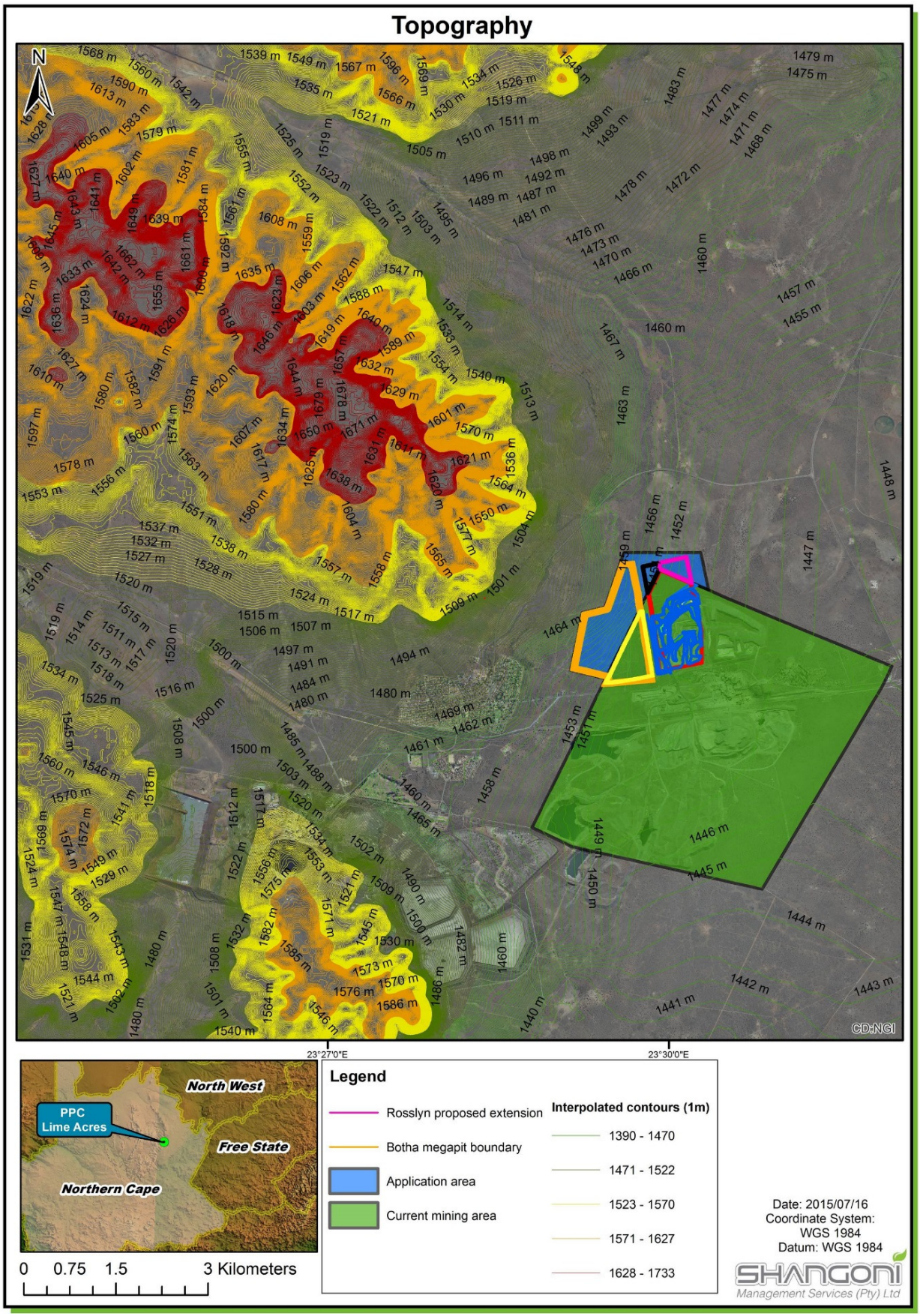


Figure 13: Map depicting the topography (contour lines) of the area associated with the PPC Lime Acres site

Chapter D: Soil

The following information was extracted from the following:

- Report titled: "*Soil survey of the land owned by PPC and neighbouring farms"), to identify, classify and map the undisturbed soil resources of the area associated with the PPC Lime Acres site"*, dated December 2003 and compiled by P.A.L le Roux from the University of the Orange Free State in Bloemfontein
- EMP, Revision 5; dated February 2013; and
- Dimela Eco Consulting. October 2014. *"PPC Lime Acres, Northern Cape Province, Vegetation Assessment" (Annexure E1).*

The PPC Lime Limited Quarry Extension site falls within the soil classification (S2) of freely drained, structureless soils and an area which may have restricted soil depth, excessive drainage, high erodibility and low natural fertility (refer Figure 14 below).

The dominant soil forms identified include Mispah soil, a loamy fine sand of the family Myhill. It covers the rocky, high lying areas. Associated with Mispah soil is rock outcrops, Hutton and Coega soils. Coega soil is situated on the lowest rim of the Mispah soils. Hutton soil interfingers the Mispah soil as depressions in the higher landscape. Brandvlei soil dominates in the low lying areas (pan or vlei areas). Addo soil is associated with it but present in small quantities (5%).

Due to the flat topography, none of these soils are prone to water erosion. The high lying soils are sensitive to wind erosion, if vegetation and coarse (rocky) layers are removed.

The high stone content (and thus low fine material content) of the soils hampers its suitability for re-use. Table 14 below provides a summary of the characteristics and interpretation of the soils on the farm Bowden.

Table 14: Characteristics of soils in the PPC Lime Acres area

Soil	Texture	Depth (mm)	Fertility	Erodability
Mispah	Loamy fine sand	1000	High	Low
Coega	Loamy fine sand	150	High	Low
Hutton	Loamy fine sand	400	High	Low
Brandvlei	Fine sandy clay loam	250	High	Low
Addo	Loamy fine sand	400	High	Low

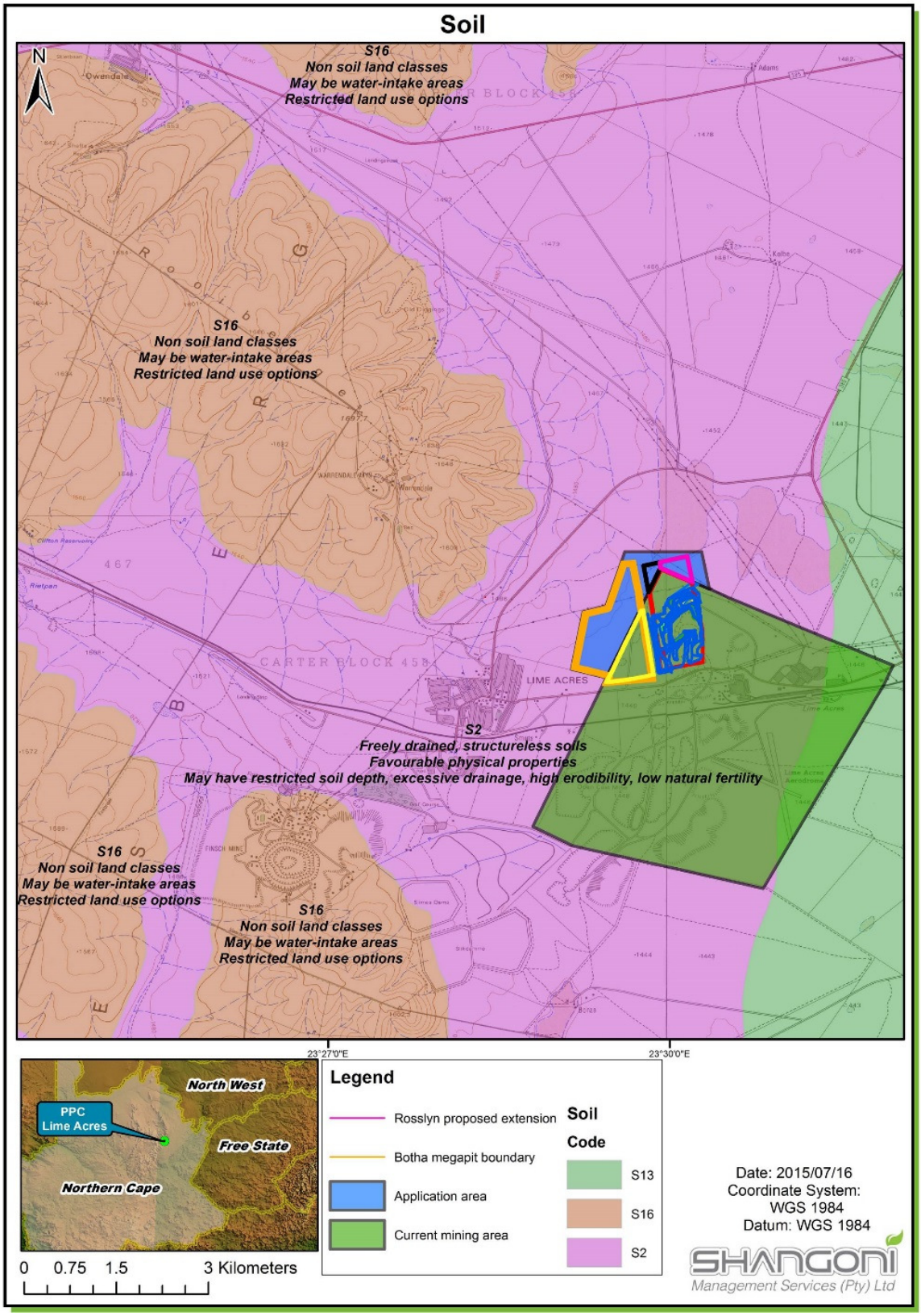


Figure 14: Map depicting the soil types of the area

Chapter E: Vegetation

Information in this section has been extracted from the following sources:

- Mucina L. and Rutherford. M.C. 2006. "*The Vegetation of South Africa, Lesotho and Swaziland*", and
- Dimela Eco Consulting. October 2014. *"PPC Lime Acres, Northern Cape Province, Vegetation Assessment"* (attached in Annexure E1).

1.1 National Vegetation Map

The proposed Quarry extension area is situated in the Savanna biome of South Africa and in the Eastern Kalahari Bushveld bioregion. The majority of the study site is situated in the Olifantshoek Plains Thornveld vegetation type (Mucina & Rutherford, 2006) (refer to Figure 15 below). This vegetation occurs on plains and consist of open tree and shrub layers with trees such as *Acacia luderitzii*, *Boscia albitrunca* (Shepherd's tree), *Searsia tenuinervis* and a usually sparse grass layer.

To the north of the existing PPC Lime Acres site (within the proposed Quarry extension area) Azonal vegetation is present. Azonal vegetation is atypical of the surrounding biome (e.g. typically occur along watercourses, but also in other areas). The azonal vegetation in this case grows in water-logged and salt-laden habitats that can only support specially adapted plants to survive in these habitats. Consequently the vegetation deviates from the typical surrounding zonal vegetation and are considered to be of azonal character. This vegetation on the study site consists of the Southern Kalahari Salt Pans which comprises low grassland on pan bottoms with some dwarf shrubs. These pans can also be devoid of vegetation (Mucina & Rutherford, 2006). In some cases, the pans can be linked to dry river beds, but are isolated from the river course by a raised calcareous sand formation. These pans rarely contain water.

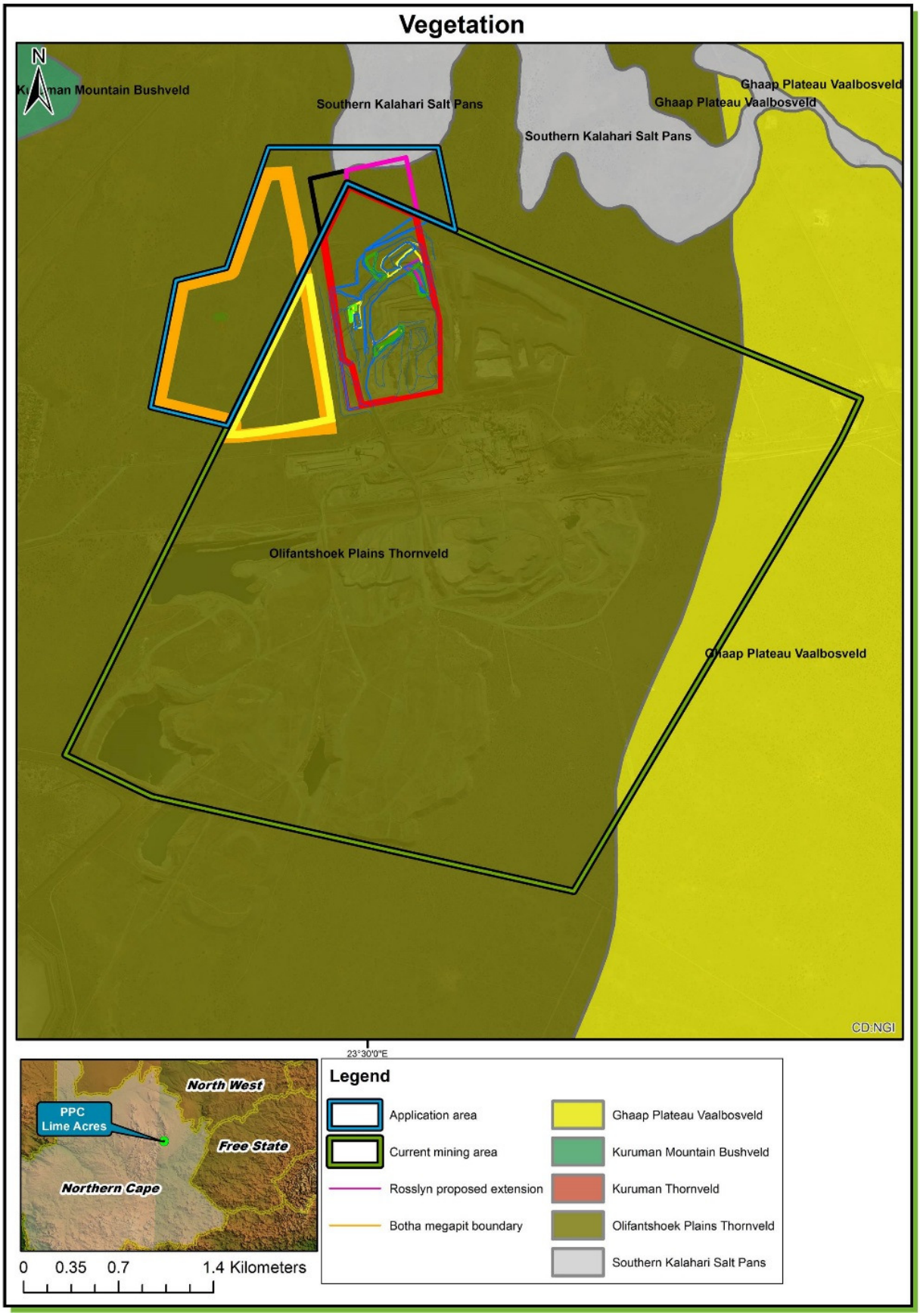


Figure 15: Map depicting the vegetation units associated with the PPC Lime Acres site

1.2 Listed Ecosystems

The National Environmental Management: Biodiversity Act (Act 10 of 2004) provides for listing threatened or protected ecosystems in one of four categories: critically endangered (CR), endangered (EN), Vulnerable (VU) or Protected (Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Government Gazette 34809, Government Notice 1002, 9 December 2011)). The ecosystem status is based on the percentage of original area remaining untransformed (by croplands, mining, urban development & roads) in relation to the biodiversity target and a threshold for ecosystem functioning. The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems.

Neither of the vegetation types form part of a listed ecosystem.

1.3 Provincial Conservation Plan

At the time of the assessment and the compilation of this Scoping Report, no Conservation Plan was available for the Northern Cape Province.

1.4 Results of the field assessment

Structure

The dominant vegetation structure range from open bushland to bushland (Willis, 2002). Open bushland occurs along the non-perennial drainage line on the north-western corner of the site, as well as through most of the eastern portion of the existing PPC Lime Limited mining site. The canopy cover range from 15-30% while the average height of the trees were 1, 5-2m. Although the bushland was characterised by a higher canopy cover (between 45% and 50%), the species composition was essentially the same**.**

The vegetation on the remainder of the existing PPC Lime Limited mining site ranged from a low woody canopy cover (15%), to bushland. Although some gravelly areas were noted, the soil were mostly sandy and deeper than in the proposed quarry extension area, likely promoting the grass layer.

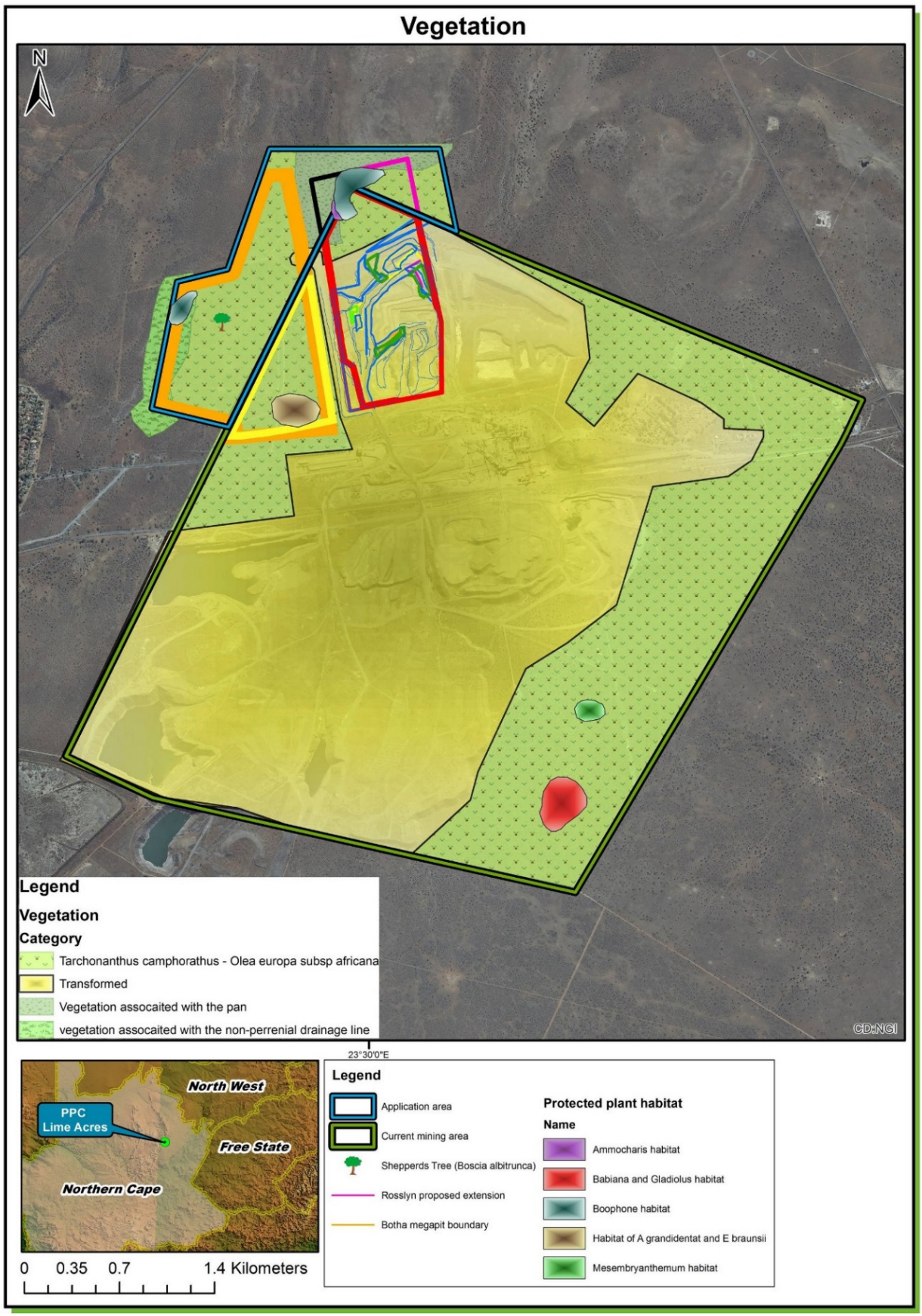


Figure 16: Broad vegetation grouping observed on the PPC Lime Acres site (adapted from: Dimela Eco Consulting. October 2014)

Composition

Data collected from sample plots and walked transects, indicates that the dominant tree and tall shrub species occurring are *Olea europea subsp africana* (wild olive tree), *Tarchonanthus camphoratus* (camphor bush / vaalbos), *Searsia tridactyla* (sour karee), *S. lancea* (karee) and *Grewia flava* (velvet raisin).

The occurrence of Acacia tree species was limited to *Acacia melifera* (black thorn) that occurred sporadically in the northern portion of the study site, but also formed a dense patch in the game camp, and a few individuals of *Acacia karoo* (sweet thorn). The low occurrence of thorny Acacia trees are not typical in the Olifantshoek Thornveld.

The south-central extent of Ghaap Plateau Vaalbosveld, has a remarkably low cover of Acacia species for an arid savanna and is dominated by *Tarchonanthus camphorathus*, *Olea europea subsp africana* and *Searsia lancea* (Mucina & Rutherford, 2006). Therefore, although much of the site was indicated to occur within the Olifantshoek Plains Thornveld, the assessment found that the diagnostic species and the species composition on the whole of the site were more representative of the south-central Ghaap Plateau Vaalbosveld, than the Olifantshoek Plains Thornveld. The dominant vegetation was classified as *Tarchonanthus camphorathus – Olea europea subsp* Africana vegetation. Although the vegetation was found to be homogenous, the assessment draws attention to small variations which include habitat for protected plant species and watercourses. The vegetation is discussed below and geographically represented in Figure 16 above: Broad vegetation groupings.

The northern portion proposed for the Quarry Extension showed the most variation in topography. The substrate varied from rocky and gravelly, to having exposed dolomite or deeper soils. Also, a non-perennial drainage line, as well as a dry pan were recorded and are described separately in this report. The vegetation on this portion of the site ranged from open bushland to bushland vegetation. In some areas the woody canopy cover was relatively low (15%), resembling grassland vegetation. Soil varied form shallow rocky soils to deeper red soils.

Figure 17: Open bushland and rocky, gravelly soils (left) and deeper red sands.

Vegetation within the area proposed for the quarry extension (north-western corner of the site)

Tarchonanthus camphorathus – Olea europea subsp africana vegetation

The vegetation was dominated by *Tarchonanthus camphoratus* (vaalbos) and *Olea europea* subsp *africana* (wild olive), with a number of shrub and herbaceous species (Table 1 and Appendix B of Annexure E1). The grass layer was grazed short or was dry but species such as *Themeda triandra* (red grass) and *Schmidtia pappophoroides* (sand quick) could be distinguished. Parts of the game camp area were found to show signs of past overgrazing with species such as *Chrysocoma ciliata* (bitterbos), *Pentzia globosa, Geigeria filifolia* (vermeerbos) and *Felicia muricata* proliferating in some areas. Also, a dense stand of *Acacia mellifera* was noted. This indigenous tree can densify following a disturbance to soil or to the grass-tree balance in savanna, likely from overgrazing. A nationally protected tree, *Boscia albitrunca* (shepherd's tree) was observed within a walked transect.

In the south-western corner of this area, two succulent species, not noted anywhere else on the site, were recorded. The soil was shallow, rocky and gravelly. *Aloe grandidentata* (bold aloe) was found growing in large patches, mostly under trees (Figure 18), while *Euphorbia braunsii* grew in areas with no canopy cover, in full sun (Figure 18). Both these species are provincially protected in the Northern Cape. In proximity to the pan the bulb *Ammocharis coranica* (groundlily) was recorded. This bulb, as well as the trees *Olea europea* subsp *africana* and *Gymnosporia buxifolia* are also protected by provincial legislation.

Figure 18: A patch of Aloe grandidentata (left) and Euphorbia braunsii (right)

Table 15: Summary of the dominant species recorded within the *Tarchonanthus camphorathus – Olea europea subsp africana* vegetation

Scientific name	Common name
Dominant Tree and Shrub Species	
Tarchonanthus camphoratus	Camphor bush / Vaalbos
Olea europea subsp *africana*	Wild olive tree
Searsia tridactyla	Sour karee)

Scientific name	Common name
Lycium cinereum	Kriedoring
Asparagus africanus	-
Other Common Species	
Trees and shrubs	
Ziziphus mucronata	Buffalo thorn
Searsia burchelii,	-
Grewia flava	Velvet raisin
Chrysocoma ciliata	Bitterbos
Gymnosporia buxifolia	Common spike thorn
Hertia pallens	Springbokbossie
Herbaceous plants	
Aptosimum procumbens	Carpet flower
Felicia muricata,	-
Pentzia globosa,	-
Salvia disermas	Blue sage
Kleinia longiflora	Sjambokbos
Blepharis mitrata	Klapperbossie
Microloma armatum	Ystervarkbossie
Small geophyte	
Ledebouria leptophylla	Spotted squil
Albuca species	-
Grasses	
Schmidtia pappophoroides	Sand quick
Themeda triandra	Red grass
Digitaria eriantha	Finger grass
Plants of Conservation Importance	
Provincially protected	**Nationally protected**
Succulents: Aloe gandidentata; Euphorbia braunsii *Geophyte: Ammocharis coranica*	Trees: *Boscia albitrunca*

Scientific name	Common name
Trees: Olea europea subsp Africana, Gymnosporia buxifolia	

Vegetation associated with the non-perennial drainage line

Vegetation around rivers and drainage lines usually exhibit a more lush growth which could include species specifically adapted to growing in seasonally inundated conditions. However, the vegetation associated with the dry non-perennial river along the western boundary of the proposed Quarry extension area did not differ significantly from the vegetation observed on the rest of the study site, although some species occurred more frequently along the drainage line (e.g. *Ziziphus mucronata* and *Lycium hirsuta*) than elsewhere on the study site (Figure 19).

The vegetation consisted of open bushland and dolomite was exposed on the surface along much of the drainage line. The succulents *Sansevieria aethiopica (bowstring hemp)*, *Kalanchoe rotundifolia* and *Sarcostemma verminale* (melktou) were recorded growing underneath an *Olea europea* subsp *africana* tree on exposed rock along the drainage line. These species were not recorded anywhere else on the site. The deeper sand also provided habitat to the provincially protected plant species *Boophone distichia* (see Section 3.3 of Annexure E1). This plant is nationally listed as Declining, indicating that although the plant species is not yet threatened, the numbers are declining.

Figure 19: Non-perennial drainage line with dolomite (right)

Table 16: Summary of the dominant species recorded within the *non-perennial drainage line vegetation in the proposed prospecting area*

Scientific name	Common name
Dominant Tree and Shrub Species	
Tarchonanthus camphoratus	Camphor bush / Vaalbos
Olea europea subsp *africana*	Wild olive tree
Ziziphus mucronata	-

Scientific name	Common name
Searsia tridactyla	Sour karee
Lycium hirsuta	River honey thorn
Other Common Species	
Trees and shrubs	
Acacia mellifera	*blackthorn*
Searsia burchelii	-
Grewia flava	velvet raisin
Gymnosporia buxifolia	*common spike thorn*
Herbaceous plants	
Kalanchoe rotundifolia	-
Sansevieria aethiopica	-
Pentzia globosa	-
Monechma divaricatum	wild lucern
Microloma armatum	ystervarkbossie
Grasses	
Fingerhuthia africana	thimble grass
Plants of Conservation Importance	
Provincially protected	
Geophyte: Boophone distichia *Trees: Olea europea* subsp *africana*	

Vegetation associated with the dry pan

The most northern portion of the study site (located within the proposed Quarry extension area) includes a dry pan. The vegetation observed is representative of the Southern Kalahari Salt Pans whereby shrubs such as *Lycium hirsuta* and *Rhigozum* species grow on the edge of the pan, while the dry pan supports a grass and dwarf shrub layer (Mucina & Rutherford, 2006). However, halophytes (plants adapted to high salt concentrations) were absent. The pan area was grazed by cattle, and grasses such as *Eragrostis bicolor* was recognised. Dwarf shrubs growing in the dry pan included *Eriocephalus ericiodes* (kapok bush) and *Chrysocoma ciliata* (bitterbos). The herbaceous *Pentzia globosa* as well as the succulent *Bulbine fructescens* (geelkatstert) were also noted. Around the edges of the pan, dolomite was exposed, while the tall shrub *Tarchonanthus camphorathus* and

tree *Olea europea* subsp *africana* dominated along with *Ziziphus mucronata* (buffalo thorn) and *Gymnoporia buxifolia* (common spike thorn).

Softer soils at the edge of the pan also supported the provincially protected *Boophone distichia* (poison bulb). Those encountered in walked transects were recorded. However, it is likely that the bulbs occur around the entire edge of the pan.

Figure 20: Pan area vegetated by grass and dwarf shrubs

Figure 21: Exposed dolomite around the edge of the pan

Table 17: Summary of the dominant species recorded within the *dry pan vegetation in the proposed Quarry extension area*

Scientific name	Common name
Dominant Tree and Shrub Species	
Tarchonanthus camphoratus	Camphor bush / Vaalbos
Olea europea subsp *africana*	Wild olive tree
Gymnosporia buxifolia	*common spike thorn*
Ziziphus mucronata	buffalo thorn

Scientific name	Common name
Grewia flava	velvet raisin
Zygophyllum pubescens	-
Microloma armatum	-
Herbaceous plants	
Gnidia polycephala	-
Felicia muricata	-
Bulbine fructescens	-
Species occurring in the pan	
Grasses: *Eragrostis bicolor, Enneapogon devauxii* Dwarf shrubs*: Eriocephalus ericiodes, Chrysocoma ciliata*	
Plants of Conservation Importance on the edge of the pan	
Provincially protected	
Geophyte: Boophone distichia *Trees: Olea europea* subsp *Africana, Gymnosporia buxifolia*	

Transformed vegetation

Vegetation within the existing mining area (located to the east and south-east of the proposed Quarry extension area) is considered to be transformed. The rehabilitated areas includes exotic plant species such as *Pennisetum setaceum* (fountain grass) and *Schinus molle* (pepper tree). However, some indigenous pioneer plants such as *Gomphocarpus fructesens* (milkweed) and *Acacia mellifera* (black thorn) were also present.

A number of *Eucaluptus* and other exotic tree species were noted, in particular at the residential village. These trees currently play a role in preventing soil erosion as well as suppressing dust. Although functional, the vegetation does not have conservation value and must be managed to prevent the spread of aliens and to ensure colonisation of disturbed areas by indigenous plant species. In addition, transformed areas should be managed with the closure land use in mind.

1.5 Review of vegetation conservation status

Threatened or protected plant species (ToPS)

Chapter 4, Part 2 of the National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA) provides for listing of plant and animal species as threatened or protected. If a species is listed as threatened, it must be further classified as Critically Endangered, Endangered or Vulnerable. These species are commonly referred to as TOPS listed. The Act defines these classes as follows:

- Critically endangered species: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- Endangered species: any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- Vulnerable species: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category will include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

In addition to the TOPS list, the Threatened Species Programme of the South African National Biodiversity Institute (SANBI) published the Red List of South African Plants (Raimondo et al, 2009). An online version provides up to date information on the national conservation status of South Africa's indigenous plants. The Red List includes the Threatened species as per the TOPS list and also makes provision for additional categories. These are referred to as Plants of Conservation Concern and are those plants that are important for South Africa's conservation decision making processes and include all plants that are Threatened, Extinct in the wild, Data deficient, Near-threatened, Critically rare, Rare and Declining. These plants are also referred to as Red Listed plants. Due to the ongoing assessment of these plants based on new information, the online Red List is likely more up-to date than the TOPS list.

A list of four (4) plants of conservation concern that could occur within the area that the study site is situated in was compiled using information from the South African National Biodiversity Institute's (SANBI) checklist (SANBI, 2009), Raimondo et al, (2009), and relevant literature pertaining to the area. The list is given in Table 18, as well as the plant species' likelihood of occurrence. No TOPS listed species were observed at the time of the field survey. Of the plants listed in Table 18, only *Boophone distichia*, a Declining species, was observed.

Table 18: Red data / plants of conservation concern that has historically been recorded within the area in which the study site is situated

Species	Conservation Status	Suitable habitat on-site
Rennera stellata	Vulnerable	Seasonally waterlogged pans, unweathered calcrete rocks, full sun. Known from only three locations. Potential habitat exists on the far northern portion of the site, within the dry pan area. However, the closet historic distribution for this plant to the study site is Koopmansfontein, about 50km north-east from the study site.
Acacia erioloba	Declining	Widespread in the drier areas of the northern provinces of South Africa, deep sandy soils and drainage lines. Not observed in transects walked on the study site, but does

Species	Conservation Status	Suitable habitat on-site
		occur in the vicinity of the site in deeper sandy soils.
Boophone disticha	Declining	Rocky areas or in deeper sand between rocky areas. Confirmed to occur in the northern portion of the study site
Hereroa wilmaniae	Data Deficient	Not enough is known about this species to assess its potential to occur on the study site.

Provincial protected plants

Provincially, a number of plants are protected by the Northern Cape Nature Conservation Act No.9 of 2009. Of the species listed by this Act, the species listed in the Table 19 below were observed on the site. These species are listed in Schedule 2 of the Act. Although not observed at the time of the field survey, *Harpagophytum* species could likely occur. *Harpagophytum* is specially protected by Schedule 1.

Table 19: Plant species protected as per Schedule 1 of the Northern Cape Nature Conservation Act (No 9 of 2009) which were observed at the of the field survey

Plant species occurring on-site	Provincial protection	Occurrence on-site (Figures 16 and 22)
Succulent plants		
Aloe grandidentata	The whole family *Asphodelaceae*, except those listed in Schedule 1 and *Aloe ferox*	Occurs to the north of the existing mining site.
Euphorbia braunsii	All species of the genus *Euphorbia*	Occurs to the north of the existing mining site.
Kalanchoe rotundifolia	All species in the family *Crassulaceae* are protected	Occurs west of the non-perennial drainage line (situated to the west of the existing mining site, within the proposed Quarry extension area)
Mesembryanthemum species (not in flower at time of field survey)	All species in this family are protected	Eastern portion of existing mining site, no direct threat by proposed Quarry Extension.
Trees		
Boscia albitrunca (also a national protected tree)	All species of *Boscia*	One individual recorded to the north-west of the existing mining site (within the proposed Quarry extension area)
Gymnosporia buxifolia	All species in the genus *Gymnosporia*	Occurs sporadically through most of the site.
Olea europea subsp *africana*	Only this species in the genus	Occurs sporadically through most of the site.
Geophytes		
Ammocharis coranica	All species in the family	Occurs in proximity to the pan

Plant species occurring on-site	Provincial protection	Occurrence on-site (Figures 16 and 22)
	Amaryllidaceae are protected	located to the north-west of the existing mining site (within the proposed Quarry extension area)
Boophone distichia	All species in the family *Amaryllidaceae* are protected	Confirmed to occur along the edge of the pan (located to the north-west of the existing mining site) and non-perennial drainage line (within the proposed Quarry extension area)
Babiana hypogaea	All species in the family *Iridaceae* are protected	Occur on the eastern portion of the Existing mining site

The localities of the plants identified on the study site at the time of the field survey are geographically represented in Figure 22. It is important to note that these localities represent only the plants identified within sample plots and along walked transects and that more of these plants are likely to occur. The removal or pruning of these plants will require a permit from the Northern Cape Department of Environment and Nature Conservation (refer to Appendix C of Annexure E1 for more detail).

Nationally protected trees

A number of trees indigenous to South Africa are nationally protected under the National Forests Act, 1998 (Act No 84 of 1998). The removal or pruning of these protected trees will require a permit from the Department of Agriculture Forestry and Fisheries. Only one individual of the protected *Boscia alibtrunca* was observed to the north-west of the existing mining site (situated outside of the existing mine boundary area). Refer to Figure 22.

Table 20: List of protected trees

Tree species	Common name	Locality
Boscia albitrunca	Shepherd's Tree	23°29'24.89"E; 28°21'4.99"S

Endemic plant species and Centre of plant endemism

Endemic plants are species that are naturally only found in a particular and usually restricted geographic area or region. These plants are therefore restricted in their distribution and vulnerable to habitat loss.

The study site is situated in the Griqualand West Centre of Endemism (GWC). A centre of plant endemism is an area with high concentrations of endemic plant species. Centres of endemism are important because it is these areas, which if conserved, would safeguard the greatest number of plant species. They are extremely vulnerable; relatively small disturbances in a centre of endemism could pose a serious threat to its many range-restricted species. The GWC is considered a priority in the

Northern Cape, as the number of threats to the area is increasing rapidly and it has been little researched and is poorly understood. Furthermore, this centre of endemism is extremely poorly conserved, and is a national conservation priority.

Table 21 lists the endemic plant species that occur within the two savanna national vegetation types that are indicated to occur on the site. None of these species were recorded at the time of the site visit.

Table 21: Endemic plant species with a likelihood of occurring on the site

Species	Vegetation types as per the National Vegetation Map (Mucina & Rutherford, 2006)	
	Olifantshoek Plains Thornveld	**Ghaap Plateau Vaalbosveld**
Acacia luderitzii var *luderitzii*	X	
Blepharis micrantha		X
Corchorus pinnatipartitus		X
Digitaria polyphylla		X
Euphorbia wilmaniae		X
Justicia puberula	X	
Lebeckia macrantha	X	X
Putterlickia saxatalis		X
Rennera stellata		X
Sutera griquensis	X	
Tarchonanthus obovatus	X	X

1.6 Alien invasive plant species

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems. Therefore, it is important that these plants are controlled and eradicated by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species (Henderson, 2001). The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to alien invasive plant species. In August 2014 the list of Alien Invasive Species was published in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 78 of 2014). The Alien and Invasive Species Regulations was published in the Government Gazette No. 37886, 1 August 2014. The legislation calls for the removal and / or control of alien invasive plant species (Category 1 species). In addition, unless authorised thereto in

terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within close proximity to a watercourse. Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) **(**NEMBA):

- **Category 1a**: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- **Category 1b**: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- **Category 2**: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
- **Category 3**: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

The alien plant species identified on the site are listed in Table 22 below. A total of 7 types of invasive species were identified on-site. Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

(a) Notify the competent authority in writing

(b) Take steps to manage the listed invasive species in compliance with:

(i) Section 75 of the Act;

(ii) The relevant invasive species management programme developed in terms of regulation 4; and

(iii) Any directive issued in terms of section 73(3) of the Act.

Table 22: Invader plant species identified on-site

Specie name	Common name	Relevant notes
Cordyline australis	-	Exotic tree
Eucalyptes species	Bluegums	Category 1b
Opuntia humifusa	Large-flowered Prickly Pear	Category 1b
Cylindropuntia imbricata (was *Opuntia imbricata)*	Imbricate prickly pear / kabeltruksvy	Category 1b
Pennisetum setaceum	Fountain Grass	Category 1b, except sterile cultivars

Specie name	Common name	Relevant notes
Prosopsis glandulosa	Honey Mesquite	Category 3
Schinus molle	Pepper Tree	Not listed

1.7 Vegetation sensitivity

In order to determine the sensitivity of the vegetation on the PPC Lime Acres site, weighting scores and criteria were applied (refer to Table 23). The results of the scoring places the vegetation in either of the sensitivity classifications as listed in Table 23 below. Vegetation with a low score are not considered to be sensitive.

Table 23: Vegetation sensitivity weighting scores

Scoring	13 - 18	12	7 - 11	6	0 - 5
Sensitivity	High	Medium – High	Medium	Low – Medium	Low

Vegetation of low sensitivity:

Vegetation with low sensitivity is generally degraded and disturbed vegetation with little ecological function and is usually species poor (most species are usually exotic or pioneers). This vegetation has little or no conservation potential (refer to Figure 22). However, the vegetation does have some ecological function in preventing soil erosion, as well as suppressing dust. Although functional, the vegetation does not have conservation value and must be managed to prevent the spread of aliens and to ensure colonisation of disturbed areas by indigenous plant species. In addition, transformed areas should be managed with the closure land use in mind.

Vegetation of medium sensitivity:

The *Tarchonanthus camphorathus – Olea europea subsp africana* vegetation was slightly modified with disturbances of low to medium intensity and a high degree of connectivity with other ecological systems (refer Table 24 below). It also encompass vegetation with intermediate levels of species diversity and the possible occurrence of threatened species. Provincially protected plant species occurred throughout this vegetation grouping.

As per Table 24 below, the result of the assessment indicates that the vegetation on site is in a near natural state, performing an ecological function and supporting provincially protected plant species.

Vegetation of high sensitivity:

Wetland and riparian vegetation is crucial to the functioning and health of watercourses. The vegetation subsequently plays a role on the hydrology and water quality of the catchment by:

- Flow regulation: vegetation slows the flow of water, both by physically blocking the passage of water, and by absorbing the water into its root systems. This moderates the impacts of flooding on downstream and surrounding areas.
- Water quality regulation: in the event of good rains, the vegetation acts as a buffer or filter between nutrients, sediments, contaminants, and bacteria from the surrounding land and air, and the river channel itself. The vegetation therefore prevents soil, pesticides, fertilizers and oil from entering the river and impacting on in-stream communities.
- Habitat provision: wetlands, pans and riparian areas provide important habitat for many plants and animals, because these are areas of transition between the land and the river.
- Corridor functions: along watercourses, vegetation serves as a corridor, connecting two or more habitats that may otherwise be isolated by land transformation of areas in between.

In addition, all watercourses are protected by national legislation (National Water Act, Act no of 36 of 1998), therefore the vegetation associated with riparian areas and wetlands should be regarded as sensitive.

Table 24: Scoring of vegetation that occur within the PPC Lime Acres site

Vegetation Group	Conservation status of regional vegetation unit	State of vegetation	Legislated protection	Plants of conservation concern	Ecological function	Conservation importance	Total score or of a max of 18
Transformed by mining activities and infrastructure in the existing mining area (located next to the proposed Quarry extension area)	0	0	0	0	1	0	1 Low
Tarchonanthus camphoratus-Olea europea vegetation	0	2	0	2	2	2	8 Medium
Vegetation associated with the non-operennial drainage line and Pan area	0	2	3	2	3	2	12 Medium-High

Figure 22: Vegetation sensitivity on the PPC Lime Acres site (adapted from: Dimela Eco Consulting. October 2014)

Chapter F: Fauna

Information in this section has been extracted from the following source:

- Rautenbach I.L, Kemp A.C, & van Wyk J.C.P. September 2014. An assessment of vertebrate species richness for the undeveloped portions of the PPC (Lime) Mine, Danielskuil District, Northern Cape. The resultant report is attached as Annexure E2.

The probability of occurrences of mammal, birds and herpetofauna species was based on their respective geographical distributional ranges and the suitability of on-site habitats. In other words:

- **High** probability would be applicable to a species with a distributional range overlying the study site as well as the presence of prime habitat occurring on the study site. Another consideration for inclusion in this category is the inclination of a species to be common, i.e. normally occurring at high population densities.
- **Medium** probability pertains to a species with its distributional range peripherally overlapping the study site, or required habitat on the site being sub-optimal. The size of the site as it relates to its likelihood to sustain a viable breeding population, as well as its geographical isolation is also taken into consideration. Species categorized as medium normally do not occur at high population numbers, but cannot be deemed as rare.
- **Low** probability of occurrence will mean that the species' distributional range is peripheral to the study site and habitat is sub-optimal. Furthermore, some mammals categorized as low are generally deemed to be rare.

1.1 Mammals

The local occurrences of mammals are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges.

Observed and expected mammal species

The occurrences of 21 species relevant to the PPC Lime Acres area, including the proposed Quarry extension area, were confirmed by the specialist (refer to Table 25). Fifty six (56) species of mammals are still part of the present-day mammal species assemblage, if not permanently, then as vagrants.

Most of the species of the resident diversity are common and widespread (e.g. scrub hares, dassies, multimammate mice, pygmy mice, Egyptian free-tailed bats, genets, mongooses and others). The majority of the species listed in Table 25 are robust (some with strong pioneering capabilities). The reason for their survival success is predominantly seated in their remarkable reproductive potential (viz. multimammate mice species capable of producing ca. 12 pups per litter at intervals of three weeks), and to a lesser extent their reticent and cryptic nature (scrub hares, genets and mongooses). It should, however, be emphasized that the species diversity (species richness, super-imposed on

population numbers) is low as a result of the poor conservation index of the ground cover, the end-seasonal nadir and the limiting effect of the unyielding compacted substrates.

Since no signs were encountered, it is uncertain whether aardvarks occur, but connectivity towards the northern and southern undeveloped properties could allow immigrations. The reason for the absence of aardvark is likely the absence of termitaria.

Brown hyenas, caracal and black-backed jackal most likely still occur in the district and can be expected to at least occasionally venture onto the site under the fence or through damaged portions. The small carnivores (mongooses and genets) are exceptionally reticent in habits, apart from having wide habitat tolerances and forgiving diets. As a result they can persist in areas in close association to human occupation, as long as prey densities remain on sustainable levels.

The Egyptian free-tailed bat and the Cape serotine bat showed remarkable adaptability by expanding their distributional ranges and population numbers, and by capitalising on the roosting opportunities offered by manmade structures; in this instance in the houses in the vicinity. Versper bats are more tolerant towards roost opportunities and it is more than likely that small colonies found roosting opportunities in the roofs of building near the study site. Free-tailed bats are likewise partial to narrow-entrance roosts provided by buildings; in some instances roost occupation could reach epidemic proportions. The study site offers no caves or suitable structures answering to the exacting roosting requirements of cave-dwelling bats (*Hipposideridae, Rhinolophidae, Nycteridae*), but it is likely that they have roosts elsewhere and at times commute to the site to hawk for invertebrates rising over the water in the quarries during summer sunsets. Dolomite is likely to form sinkholes and these could serve as roosting sites for cave-dwelling bats. The species richness is low for an area as extensive as the study site and adjoining properties. That is ascribed to the fact that the habitats under consideration are either overgrazed (terrestrial) and weakly developed (arboreal). The quality of conservation is largely ranked as average at best, and has resulted in the displacement of Red Data species (viz. leopard, spotted hyena and others).

Table 25: Mammal diversity. The species observed or deduced to occupy the site. *(Systematics and taxonomy as proposed by Bronner et.al [2003] and Skinner and Chimimba [2005])*

	Scientific Name	English Name
?[41]	*Macrocelides proboscideus*	Round-eared elephant shrew

[41] *√ Definitely there or have a high probability to occur;*
** Medium probability to occur based on ecological and distributional parameters;*
? Low probability to occur based on ecological and distributional parameters.

Red Data species rankings as defined in Friedmann and Daly's S.A. Red Data Book / IUCN (World Conservation Union) (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient. All other species are deemed of Least Concern.

	Scientific Name	English Name
	Procavia capensis	Rock hyrax
√	*Lepus capensis*	Cape hare
√	*Lepus saxatilis*	Scrub hare
√	*Cryptomys hottentotus*	African mole rat
√	*Hystrix africaeaustralis*	Cape porcupine
*	*Pedetes capensis*	Springhare
*	*Xerus inauris*	South African ground squirrel
*	*Rhabdomys pumilio*	Four-striped grass mouse
*	*Mus minutoides*	Pygmy mouse
*	*Mastomys coucha*	Southern multimammate mouse
?	*Micaelamys namaquensis*	Namaqua rock mouse
?	*Parotomys brantsii*	Brants' whistling rat
?	*Parotomys littledalei*	Littledale's whistling rat
*	*Desmodillus auricularis*	Cape short-tailed gerbil
*	*Gerbillurus paeba*	Hairy-footed gerbil
*DD	*Tatera leucogaster*	Bushveld gerbil
*	*Malacothrix typica*	Gerbil mouse
*	*Dendromus melanotis*	Grey climbing mouse
*	*Saccostomus campestris*	Pouched mouse
*DD	*Crocidura cyanea*	Reddish-grey musk shrew
?NT	*Atelerix frontalis*	Southern African hedgehog
√	*Tadarida aegyptiaca*	Egyptian free-tailed bat
√	*Neoromicia capensis*	Cape serotine bat
?NT	*Cistugo lesueri*	Lesueur's hairy bat
*	*Nycteris thebaica*	Egyptian slit-faced bat
?NT	*Rhinolophus clivosus*	Geoffroy's horseshoe bat
?	*Rhinolophus darlingi*	Darling horseshoe bat
?DD	*Rhinolophus denti*	Dent's horseshoe bat
?DD	*Hipposideros caffer*	Sundevall's roundleaf bat
?NT	*Manis temminckii*	Ground pangolin
?	*Proteles cristatus*	Aardwolf
?NT	*Parahyaena brunnea*	Brown hyena
?	*Caracal caracal*	Caracal
?	*Felis silvestris*	African wild cat
?Vu	*Felis nigripes*	Black-footed cat
	Felis silvestris	African wild cat
	Ictonyx striatus	Striped polecat
*	*Genetta genetta*	Small-spotted genet
√	*Suricata suricatta*	Suricate

	Scientific Name	English Name
√	*Cynictis penicillata*	Yellow mongoose
√	*Galerella pulverulenta*	Slender mongoose
√	*Otocyon megalotis*	Bat-eared fox
?	*Vulpes chama*	Cape fox
√	*Canis mesomelas*	Black-backed jackal
?NT	*Mellivora capensis*	Honey badger
*	*Ictonyx striatus*	Striped polecat
√	*Equus quagga*	Plains zebra
√	*Tragelaphus strepsiceros*	Kudu
√	*Alcelaphus buselaphus*	Red hartebeest
√	*Oryx gazella*	Gemsbok
*	*Sylvicapra grimmia*	Common duiker
√	*Kobus ellipsiprymnus*	Waterbuck
√	*Antidorcas marsupialis*	Springbok
√	*Raphicerus campestris*	Steenbok
√	*Aepyceros melampus*	Impala

Red Data listed mammal species

- **By the Scientific Community:**
  Crocidura cyanea, *Rhinolophus denti* and *Hipposideros caffer* cited as 'Data Deficient' ('DD') in Table 25 above are not necessarily endangered. These small mammals have not been adequately studied to provide quantitative field data to accurately assign a conservation ranking. As a precaution, they are thus considered as 'Data Deficient'. Shrews and insectivorous bats operate at the apex of the food pyramid, which means that their population numbers are inevitably significantly lower than that of similar-sized herbivorous mammals and especially of their smaller prey species. Because of the diet of these vociferous little insectivores they are furthermore not readily trapped with conventional bait or traps, which may mean that their actual numbers are under-estimated. Good results obtained with drift fences and pitfalls for terrestrial insectivorous small mammals and bat detectors for echo locating bats support the latter statement.

  Hedgehogs are 'Near Threatened' as a result of interference by humans and their pets. Under natural conditions, the passive defence mechanisms of these rather docile insectivores are sufficient to maintain breeding populations in a healthy condition. Considering the size of the district and connectivity towards the north and south it is considered possible that a small population of hedgehogs persists. Lesueur's hairy bat is 'Near Threatened'.

  The bushveld gerbil is afforded a Red Data ranking.

Geoffroys's horseshoe bats congregate in large numbers in deep caves. If disturbed by cavers during winter hibernation, these and other cave-dwelling bats are forced to wake up and in the process burn accumulated body fat. This may leave bats without essential reserves before the advent of summer and availability of prey, which causes them to starve; hence their "Near Threatened" conservation ranking.

Ground pangolins and brown hyenas both became 'Near Threatened' as result of prosecution, in the first case by stockists for the traditional medicine market and in the latter case by livestock farmers. It is not clear why honey badgers are deemed 'Near Threatened'.

Black-footed cats are considered as 'Vulnerable', but it is submitted that this ranking is more a guestimate than a considered opinion.

No other Red Data or sensitive species are deemed present on the site.

- **By the Biodiversity Act No 10 of 2004:**
  Nil (Van Schalkwyk, 2007).

- **By the Regulations of the Provincial Authority:**
  The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) Schedule 1: Specially Protected Species lists the following species that are considered present or at least vagrants to the PPC land:
  - Black-footed cat,
  - African wild cat,
  - Honey badger,
  - Striped polecat,
  - Bat-eared fox,
  - Cape fox,
  - Brown hyena,
  - Aardwolf, and
  - Hedgehog.

  Schedule 2: Protected Species lists all the other occupants of the PPC property.
  Schedule 4 recognizes the black-back jackal as a Damage Causing Species.

Formally invasive and prohibited species

No Invasive or Prohibited mammals listed in the Biodiversity Act No 10 of 2004 or in the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) Schedule 6, were recorded. Domestic dogs and cats are listed as undesirable in Schedule 5, and house rats (*Rattus rattus*) and House mice (*Mus musculus*) are listed as invasive species is Schedule 6. The former two should be eradicated as they

are likely to disturb the ecological balance (as it is) whereas the latter two are, however, unlikely to exist in the veld since they are entirely commensal with man.

1.2 Birds

Bird habitat assessment

The habitats at the site as identified for bird community distributions occur within the Grassy Karoo biome (Allan et al. in Harrison et al. 1997) and more specifically the sparsely wooded and grassy vegetation units of the Olifantshoek Plains Thornveld vegetation unit. The Southern Kalahari Salt Pans located to the north-west of the existing PPC Lime Acres site were dry at the time of the visit. Much of the study site and immediate surrounding area has been developed for residential and mining activities, but further afield most of the habitat remains in its natural state and is used for livestock and game farming.

The aerial mobility of birds also demands attention to the principal habitats surrounding the study site and their conservation status, not just those along the immediate borders but also more distant habitats that might provide sources for species visiting the site and sinks for those breeding on site. For water birds, various open areas formed by the seasonal salt pans extend to the north and east of the area, while the Harts-Vaal, Vaal-Riet and Vaal-Gariep River confluences are about 60 km to the southeast. For savanna birds, the Kuruman Hills to the northwest and the riparian habitat along the large river systems to the southeast are most relevant, the latter also embracing the Mokala National Park.

Three principal habitat types distinguished on and/or adjacent to the site, and considered most relevant to bird ecology and community structure, were distinguished.

1) Grassy karrooid savannah:

This is the original and still the predominant habitat around the site. The good tufted grass cover and sandy/pebbly ground cover provides habitat for grassland and ground-living avifauna, while the woody cover, ranging from bushes to small trees at varying densities, will attract bushveld and scrubland avifauna. Changes in grazing pressures and occasional fires are expected to be the most likely natural disturbances to such habitat, leading to reduced ground cover and/or shrub encroachment, but recovery and rehabilitation after removal is likely to be difficult, slow and only partly successful.

2) Transformed mining areas

These areas include not only the mine itself, where most of the topsoil has been removed and/or disturbed, and where mining has created deep quarries and rocky dumps, but also the buildings and the adjacent township, where abnormal availability of various structures and water provide for perch/nest sites and evergreen, wooded gardens to develop. The mine itself will be attractive to such species as favour rock faces and piles, unusual in this generally flat area, even attracting unexpected species such as Verreauxs' Eagle to prey on hyrax that have colonised the site.

3) Water bodies, permanent and temporary

Any open water in such an arid area is always an attraction for birds from the surrounding areas, as drinking sites for local species (e.g. doves, sandgrouse, finches) or as stopover points within a regional mosaic of natural aquatic habitats for nomadic and migrant species (e.g. waders, piscivores). While the water-filled quarries may appear sterile, they do ensure a permanent source of drinkable water and safe resting surfaces, while the temporary saltpans that stretch away to the north will be seasonally attractive as resting, feeding and sometimes even breeding sites for saline-adapted species. These habitats are expected to attract a high number of vagrant species, especially when the aquatic microfauna and flora have enough time to flourish, but these are not listed among the regional avifauna as the general expectation of their presence is unlikely.

Table 26: Rating of recognised on-site avian habitats (site + 500 m buffer) on and around the PPC proposed Quarry Extension

Avian Habitats	Conservation Priority					Sensitivity	
	High	Medium-high	Medium	Medium-low	Low	High	Low
1. Karrooid savanna				X			X
2. Mining developments					X		X
3. Water bodies		X				X	

Observed and expected bird species

The site falls within QDGC (28231AD LIME ACRES) and within pentad (2820_2325). Out of the maximum of 168 species expected for the site during 1987-1991 (SABAP 1), and including the 171 species so far reported since 2009 for the pentad within which the site fell (SABAP2), the specialist assessed that 221 bird species have a high, medium or low probability to occur on site, based on the habitats available. Of these, 14 species were confirmed and/or reported by others during the site visit (Table 27). The number would surely have been higher if the specialist had spent more days/seasons in search of species, if the surveys had started earlier and extended later in the day/night, and if the specialist had covered every sector in more detail.

The specialist assessed 116 species (52%) as having a high probability of occurrence, 74 species (33%) a medium probability and 32 species (14%) a low probability. The total number of species expected would be much larger if other unlikely species that are only recorded as rare vagrants to the area were not excluded from this analysis due to inadequate sustained availability of their preferred habitat(s).

The three different habitat types that were distinguished either support or are expected to support somewhat different species of birds (Table 27). Only 15 generalist species (7%) are expected to use all three habitat-types, excluding the 12 species (5%) classed as aerial feeders and expected to range

across all habitats when feeding. For the 209 non-aerial species, only 15 species (7%) preferred three habitats, 48 (22%) preferred two, and 146 (66%), the majority, only a single habitat type.

Based on a total of 331 assessments of predicted habitat preference, karrooid savannas are potentially the richest and most distinctive habitat, predicted to be used by 147 (44%) of the expected species' choices. Water bodies are preferred by an estimated 97 species (29%), with 87 species (26%) expected around the mining and associated developments. The 12 aerial-feeding species are included within the above analysis, not only for all the habitats they range across when feeding, but also if there are terrestrial habitats that some might use for breeding. Overall, savanna supported the highest diversity, with water bodies and the mine as less but almost similar preferences.

Table 27: Bird species diversity observed and expected on and around the PPC proposed Quarry extension area[42]

Common English Name	Scientific Name	Status Codes[43] (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Common Ostrich	*Struthio camelus*						L	1
Orange River francolin	*Scleroptila levaillantoides*						L	1
Common Quail	*Coturnix coturnix*		**NBM**			M		1
Helmeted Guineafowl	***Numida meleagris***				**H**			**1,2**
White-faced Duck	*Dendrocygna viduata*					M		**3**
Egyptian Goose	***Alopochen aegyptiaca***				**H**			**3**
South African Shelduck	*Tadorna cana*				H			3
Cape Teal	*Anas capensis*				H			3
Yellow-billed Duck	*Anas undulate*				H			3
Cape Shoveller	*Anas smithii*					M		3
Red-billed Teal	*Anas erythrorhyncha*					M		3
Southern Pochard	*Netta erythrophthalma*						L	3
Maccoa Duck	*Oxyura maccoa*					M		3
Greater Honeyguide	*Indicator indicator*						L	1
Lesser Honeyguide	*Indicator minor*						L	1
Golden-tailed Woodpecker	*Campethera abingoni*						L	2
Cardinal Woodpecker	*Dendropicos fuscescens*				H			1,2
Acacia Pied Barbet	*Tricholaema leucomelas*				H			1

[42] *Based on the national list and annotations of Birdlife South Africa (2014), sorted in the order of 'Roberts VII' (Hockey et al. 2005), with probability of occurrence and habitat preferences assessed after a site visit on 16-17 September 2014 and comparison with lists from SABAP 1 & 2 (Harrison et al., 1997; www.sabap2.org). Species in bold font were detected on the site visit.*

Common English Name	Scientific Name	Status Codes[43] (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Black-collared Barbet	*Lybius torquatus*					M		1,2
Crested Barbet	*Trachyphonus vaillantii*				H			1,2
Southern Yellow-billed Hornbill	*Tockus leucomelas*					M		1
African Grey Hornbill	*Tockus nasutus*					M		1,2
African Hoopoe	*Upupa africana*				H			1,2
Green Wood-hoopoe	*Phoeniculus purpureus*					M		1,2
Lilac-breasted Roller	*Coracias caudatus*					M		1
Purple Roller	*Coracias naevius*					M		1
Pied Kingfisher	*Ceryle rudis*					M		3
White-fronted Bee-eater	*Merops bullockoides*					M		1,2
Swallow-tailed Bee-eater	*Merops hirundineus*				H			1
European Bee-eater	*Merops apiaster*		**B/NBM**			M		1,2,3
White-backed Mousebird	*Colius colius*				H			1,2
Red-faced Mousebird	*Urocolius indicus*				H			1,2
Diderick Cuckoo	*Chrysococcyx caprius*		**BM**		H			1,2,3
Burchell's Coucal	*Centropus burchellii*						L	3
African Palm-Swift	*Cypsiurus parvus*					M		Aerial,2
Alpine Swift	*Tachymarptis melba*		**BM**		H			Aerial
Common Swift	*Apus apus*		**NBM**			M		Aerial
Bradfield's Swift	*Apus bradfieldi*				H			Aerial
Little Swift	*Apus affinis*				H			Aerial,2
White-rumped Swift	*Apus caffer*		**BM**		H			Aerial,2
Barn Owl	***Tyto alba***				**H**			**1,2**
Spotted Eagle-Owl	*Bubo africanus*				H			1,2

Common English Name	Scientific Name	Status Codes[43] (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Pearl-spotted Owlet	*Glaucidium perlatum*					M		1
Rufous-cheeked Nightjar	***Caprimulgus rufigena***		**BM**		**H**			**1,2,3**
European Nightjar	*Caprimulgus europaeus*					M		1,2
Rock Dove	*Columba livia*					M		2
Speckled Pigeon	***Columba guinea***					**M**		**2**
Laughing Dove	*Streptopelia senegalensis*				H			1,2,3
Cape Turtle-Dove	***Streptopelia capicola***				**H**			**1,2,3**
Red-eyed Dove	*Streptopelia semitorquata*					**M**		**1,2,3**
Namaqua Dove	*Oena capensis*				H			1,2
Kori Bustard	***Ardeotis kori***	**NT,NT**				**M**		**1**
Red-crested Korhaan	*Lophotis ruficrista*				H			1
Northern Black Korhaan	*Afrotis afraoides*				H			1
Blue Crane	*Anthropoides paradiseus*	**NT,VU**					L	1,3
Common Moorhen	*Gallinula chloropus*					M		3
Red-knobbed coot	*Fulica cristata*					M		3
Namaqua Sandgrouse	***Pterocles namaqua***				**H**			**1,3**
Marsh Sandpiper	*Tringa stagnatilis*		**NBM**		H			3
Common Greenshank	*Tringa nebularia*		**NBM**		H			3
Wood Sandpiper	*Tringa glareola*		**NBM**		H			3
Common Sandpiper	*Actitis hypoleucos*		**NBM**		H			3
Little Stint	*Calidris minuta*		**NB**			M		3
Curlew Sandpiper	*Calidris ferruginea*		**NBM**				L	3
Ruff	*Philomachus pugnax*		**NBM**			M		3
Greater Painted-snipe	*Rostratula benghalensis*	**VU,NT**					L	3

Common English Name	Scientific Name	Status Codes[43] (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Spotted Thick-knee	*Burhinus capensis*				H			1,2
Black-winged Stilt	*Himantopus himantopus*				H			3
Pied Avocet	*Recurvirostra avosetta*				H			3
Kittlitz's Plover	*Charadrius pecuarius*				H			3
Three-banded Plover	*Charadrius tricollaris*				H			3
Chestnut-banded Plover	*Charadrius pallidus*	**NT,NT**				M		3
Blacksmith Lapwing	***Vanellus armatus***				**H**			**2,3**
Crowned Lapwing	*Vanellus coronatus*				H			1
Double-banded Courser	*Rhinoptilus africanus*	**NT,LC**			H			1
Burchell's Courser	*Cursorius rufus*	**VU,LC**			H			1
Grey-headed Gull	*Chroicocephalus cirrocephalus*						L	3
Whiskered Tern	*Chlidonius hybrida*						L	3
White-winged Tern	*Chlidonias leucopterus*		**NBM**			M		3
Black-shouldered Kite	*Elanus caeruleus*				H			1,2,3
Black Kite	*Milvus migrans*		**NBM**			M		1,2
African Fish-Eagle	*Haliaeetus vocifer*						L	3
White-backed Vulture	*Gyps africanus*	**EN,EN**					L	1
Black-chested Snake-Eagle	*Circaetus pectoralis*				H			1
Black Harrier	*Circus maurus*	**EN,VU**				M		1
Southern Pale Chanting Goshawk	*Melierax canorus*				H			1
Gabar Goshawk	*Melierax gabar*				H			1
Steppe Buzzard	*Buteo buteo*		**NBM**		H			1,3
Tawny Eagle	*Aquila rapax*	**EN,LC**				M		1,3
Verreaux's Eagle	***Aquila verreauxii***	**VU,LC**				**M**		**1,2**

Common English Name	Scientific Name	Status Codes[43] (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Booted Eagle	*Hieraaetus pennatus*		NBM				L	1,3
Martial Eagle	*Polemaetus bellicosus*	EN,VU					L	1,3
Secretarybird	***Sagittarius serpentarius***	VU,VU			**H**			**1,3**
Lesser Kestrel	*Falco naumanni*		NBM		H			1
Rock Kestrel	*Falco rupicolus*					M		1,2
Greater Kestrel	*Falco rupicoloides*				H			1
Lanner Falcon	*Falco biarmicus*	VU,LC			H			1,2,3
Great-crested Grebe	*Podiceps cristatus*						L	3
Little Grebe	*Tachybaptus ruficollis*				H			3
Black-necked Grebe	*Podiceps nigricollis*					M		3
African Darter	*Anhinga rufa*					M		3
Reed Cormorant	*Phalacrocorax africanus*					M		3
White-breasted Cormorant	*Phalacrocorax lucidus*						L	3
Great Egret	*Egretta alba*					M		3
Little Egret	*Egretta garzetta*				H			3
Yellow-billed Egret	*Egretta intermedia*					M		3
Grey Heron	*Ardea cinerea*				H			3
Black-headed Heron	*Ardea melanocephala*				H			1,3
Cattle Egret	*Bubulcus ibis*				H			1
Black-crowned Night-Heron	*Nycticorax nycticorax*						L	3
Hamerkop	*Scopus umbretta*					M		2,3
Greater Flamingo	*Phoenicopterus roseus*	NT,LC					L	3
Lesser Flamingo	*Phoeniconaias minor*	NT,NT					L	3
Glossy Ibis	*Plegadis falcinellus*						L	3

Common English Name	Scientific Name	Status Codes[43] (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Hadeda Ibis	***Bostrychia hagedash***				**H**			**2,3**
African Sacred Ibis	*Threskiornis aethiopicus*					M		3
African Spoonbill	*Platalea alba*				H			3
Black Stork	*Ciconia nigra*	**VU,LC**					L	3
White Stork	*Ciconia ciconia*						L	1,3
Brubru	*Nilaus afer*				H			1
Brown-crowned Tchagra	*Tchagra australis*					M		1
Crimson-breasted Shrike	*Laniarius atrococcineus*				H			1
Bokmakierie	*Telophorus zeylonus*				H			1
Pririt Batis	*Batis pririt*				H			1
Cape Crow	*Corvus capensis*				H			1
Pied crow	*Corvus albus*				H			1
Red-backed Shrike	*Lanius collurio*		**NBM**		H			1
Lesser Grey Shrike	*Lanius minor*		**NBM**			M		1
Common Fiscal	*Lanius collaris*				H			1,2
Cape Penduline-Tit	*Anthoscopus minutus*				H			1
Ashy Tit	*Parus cinerascens*			**(*)**		M		1
Brown-throated Martin	*Riparia paludicola*					M		Aerial,3
Banded Martin	*Riparia cincta*						L	Aerial,1
Barn Swallow	*Hirundo rustica*		**NBM**		H			Aerial
White-throated Swallow	*Hirundo albigularis*		**BM**		H			Aerial,2
Greater Striped Swallow	*Cecropis cucullata*		**BM**		H			Aerial,2
Rock Martin	*Hirundo fuligula*				H			Aerial,2
African Red-eyed Bulbul	*Pycnonotus nigricans*				H			1,2

Common English Name	Scientific Name	Status Codes[43] (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Fairy Flycatcher	*Stenostira scita*			(*)		M		1
Long-billed crombec	*Sylvietta rufescens*				H			1
Yellow-bellied Eremomela	*Eremomela icteropygialis*				H			1
Little Rush-Warbler	*Bradypterus baboecala*						L	3
African Reed-Warbler	*Acrocephalus baeticatus*		**BM**				L	3
Lesser Swamp-Warbler	*Acrocephalus gracilirostris*						L	3
Icterine Warbler	*Hippolais icterina*		**NBM**			M		2
Willow Warbler	*Phylloscopus trochilus*		**NBM**			M		2
Layard's Tit-Babbler	*Sylvia layardi*			(*)	H			1
Chestnut-vented Tit-Babbler	*Sylvia subcaerulea*				H			1
Garden Warbler	*Sylvia borin*		**NBM**			M		2
Cape White-eye	*Zosterops capensis*			(*)	H			1,2
Orange River White-eye	*Zosterops pallidus*					M		2,3
Grey-backed Cisticola	*Cisticola subruficapilla*					M		1
Levaillant's Cisticola	*Cisticola tinniens*						L	3
Neddicky	*Cisticola fulvicapilla*				H			1
Zitting Cisticola	*Cisticola juncidis*				H			1,3
Desert Cisticola	*Cisticola aridulus*				H			1
Black-chested Prinia	*Prinia flavicans*				H			1,3
Rufous-eared Warbler	*Malcorus pectoralis*				H			1
Rufous-naped Lark	*Mirafra africana*				H			1
Eastern Clapper Lark	*Mirafra fasciolatus*				H			1
Sabota Lark	*Calendulauda sabota*				H			1
Fawn-coloured Lark	*Calendulauda africanoides*					M		1

Common English Name	Scientific Name	Status Codes[43] (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Spike-heeled Lark	*Chersomanes albofasciata*				H			1
Karoo Long-billed Lark	*Certhilauda subcoronata*					M		2
Grey-backed Sparrowlark	*Eremopterix verticalis*				H			1,2
Red-capped Lark	*Calandrella cinerea*				H			1
Sclater's Lark	*Spizocorys sclateri*	**NT,NT**		**(*)**			L	1
Short-toed Rock-Thrush	*Monticola brevipes*						L	2
Groundscraper Thrush	*Psophocichla litsitsirupa*					M		2
Karoo Thrush	*Turdus smithi*			**(*)**		M		2
Chat Flycatcher	*Bradornis infuscatus*				H			1
Marico flycatcher	*Bradornis mariquensis*				H			1
Fiscal Flycatcher	*Sigelus silens*			**(*)**		M		1,2
Spotted flycatcher	*Muscicapa striata*		**NBM**		H			1,2
Cape Robin-Chat	*Cossypha caffra*					M		2
Kalahari Scrub-Robin	*Erythropygia paena*				H			1
Karoo Scrub-Robin	*Erythropygia coryphoeus*					M		1
African StoneChat	*Saxicola torquatus*					M		3
Mountain Wheatear	*Oenanthe monticola*					M		2
Capped Wheatear	*Oenanthe pileata*				H			1
Familiar Chat	*Cercomela familiaris*				H			1,2
Ant-eating Chat	*Myrmecocichla formicivora*					M		1
Pale-winged Starling	*Onychognathus nabouroup*					M		1,2
Cape Glossy Starling	***Lamprotornis nitens***				**H**			**1,2,3**
Pied Starling	*Lamprotornis bicolor*			**(*)**		M		2
Wattled Starling	*Creatophora cinerea*				H			1,2,3

Common English Name	Scientific Name	Status Codes[43] (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Common Myna	*Acridotheres tristis*		I			M		2
White-bellied Sunbird	*Cinnyris talatala*				H			1,2
Dusky Sunbird	*Cinnyris fuscus*				H			1
Marico Sunbird	*Cinnyris mariquensis*				H			1,2
Scaly-feathered Finch	*Sporopipes squamifrons*				H			1
White-browed Sparrow-Weaver	*Plocepasser mahali*				H			1,2
Sociable Weaver	*Philetairus socius*					M		1
Southern Masked-Weaver	*Ploceus velatus*				H			1,2,3
Red-billed Quelea	*Quelea quelea*					M		1
Southern Red Bishop	*Euplectes orix*					M		3
African Quailfinch	*Ortygospiza fuscocrissa*				H			1
Red-headed Finch	*Amadina erythrocephala*				H			1
Black-faced Waxbill	*Estrilda erythronotos*					M		1
Common Waxbill	*Estrilda astrild*					M		3
Violet-eared Waxbill	*Uraeginthus granatinus*				H			1
Red-billed Firefinch	*Lagonosticta senegala*				H			1
Pin-tailed Whydah	*Vidua macroura*				H			1,2,3
Shaft-tailed Whydah	*Vidua regia*					M		1
House Sparrow	*Passer domesticus*		I		H			2
Great Sparrow	*Passer motitensis*					M		1
Cape Sparrow	*Passer melanurus*				H			1,2
Southern Grey-headed Sparrow	*Passer diffusus*				H			1,2
Cape Wagtail	***Motacilla capensis***				**H**			**1,2,3**
African Pipit	*Anthus cinnamomeus*				H			1,2,3

Common English Name	Scientific Name	Status Codes[43] (see below)			Probability of occurrence (see 5.4 above)			Preferred Habitats (see 6.2 above)
		RD	S	E	High	Medium	Low	
Plain-backed Pipit	*Anthus leucophrys*						L	1
Buffy Pipit	*Anthus vaalensis*					M		1,2
Black-throated Canary	*Crithagra atrogularis*					M		1,2,3
Yellow Canary	*Crithagra flaviventris*				H			1,2,3
White-throated Canary	*Crithagra albogularis*				H			1
Lark-like Bunting	*Emberiza impetuani*				H			1
Cape Bunting	*Emberiza capensis*					M		2
Cinnamon-breasted Bunting	*Emberiza tahapisi*				H			1,2
Golden-breasted Bunting	*Emberiza flaviventris*					M		1

Table 28: Description of status codes used in Table 27 above

Red Status	Status in south Africa (S)	Endemism in South Africa (E)
NA = Not Assessed	BM = breeding migrant	Endemism in South Africa (E) (not southern Africa as in field guides)
LC = Least Concern	NBM = non-breeding migrant	
NT = Near-Threatened	V = vagrant	* = endemic
VU = Vulnerable	I = introduced	
EN = Endangered	R = rare	(*) = near endemic (i.e. ~70% or more of population in RSA)
CR = Critically Endangered	PRB = probable rare breeder	B* = breeding endemic
EX = Extinct Regionally	RB = rare breeder	B(*) = breeding near endemic
NR = Not Recognised	RV = rare visitor	W* = winter endemic
Red Status is from *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland,* Taylor (2014)		

Red Data listed bird species

- **By the Scientific Community:**

  Based on the most recent assessment of the threatened status of South Africa's avifauna (Taylor 2014), a total of 17 Red Data avifaunal species are expected to use the site and its surroundings given the habitats available. However, only eight of these species have already been reported for the 2820_2325 pentad within which the site falls, during the period of the ongoing Southern African bird atlas project started in 2009 (SABAP2).

Table 29: List of threatened species that will possibly make use of the habitats on and around the PPC proposed Quarry Extension[44]

Threatened Status	Species	Preferred Habitat Type(s)		
		Savanna	Mining developments	Water bodies
Near Threatened	Kori Bustard	X		
	Blue Crane	X		X
	Chestnut-banded Plover			X
	Double-banded Courser	X	X	
	Greater Flamingo*			X
	Lesser Flamingo*			X
	Sclater's Lark	X		
Vulnerable	Secretarybird*	X		
	Greater Painted-Snipe*			X
	Burchell's Courser	X		
	Verreauxs' Eagle*		X	
	Lanner Falcon*	X	X	X
	Black Stork			X
Endangered	White-backed Vulture	X		
	Black Harrier	X		
	Tawny Eagle*	X		
	Martial Eagle	X		X
TOTALS	**17**	**10**	**3**	**8**

The specialist's analyses indicate that by far the most important habitats to conserve for nationally threatened bird species are the karrooid savanna and the water bodies. The various forms of savanna on-site could provide habitat for various threatened species, although the failure to record so many species during SABAP2, even for previously regular species under SABAP1 with ≥5% frequency (Blue Crane, Double-banded Courser, Burchell's Courser, Black Stork, White-backed Vulture), suggests that they have declined regionally. The principal water bodies from a conservation

[44] *Note one species may have more than one habitat preference. * indicates species recorded for the site's pentad since 2009 (sabap2.org.za).*

perspective are the salt pans, which when they are full and productive can provide food and breeding opportunities for some species (Chestnut-banded Plover, Greater Painted-Snipe), but the perennial 'lakes' within the mining quarries can add stopover sites and temporary support for any other aquatic species (Blue Crane, Greater Flamingo, Lesser Flamingo, Black Stork).

Only the Secretarybird, recorded during the site visit, is expected to be a regular breeding resident, but two other predatory species are expected as frequent visitors (Verreauxs' Eagle to feed on the hyrax that have colonised the site, and Lanner Falcon attracted to birds concentrated at the water) and probably breed in the wider area. The remainder are expected as erratic visitors (6), at such times as the habitats on site most resemble their preferred conditions, or as infrequent vagrants (8 species) since although patches of their preferred habitat occur in the general area, they are not necessarily on site, and they may just move in transit through the site. All 17 are species resident in southern Africa.

While the habitats on-site are generally suitable for these threatened species to pass through, their generally mediocre to poor quality on site for supplying sustained food and roost sites, especially on the saltpans, makes them of mediocre productivity and reduced structure, and therefore of mediocre to poor support value over the longer term (refer to Table 7.2.3.3 in Annexure E2). This also means that the probability of any of these species nesting on-site is even more unlikely, with only Secretarybird, Double-banded and Burchell's Coursers and Greater Painted-Snipe out of 15 potential breeding species assessed as possibly nesting somewhere and sometime on-site.

Under the previous listings (Barnes 2000), 11 threatened Red Data species were reported for the 2430CC grid cell under SABAP 1, with six additional species recently reported for the pentad under SABAP 2. In addition to the species already listed as possible to occur on site above, Lesser Kestrel has been omitted because they are no longer classified nationally as threatened.

- **By the Biodiversity Act No 10 of 2004:**
  Two expected species are classified as Endangered (Blue Cane, White-backed Vulture) and five as Vulnerable (Kori Bustard, Black Stork, Tawny Eagle, Martial Eagle, Lesser Kestrel; Van Schalkwyk, 2007). Several of these species listed as threatened, and others unlisted, now differ in their status versus the recently revised national Red Data book for birds (Taylor 2014).

- **By the Regulations of the Provincial Authority:**
  The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) Schedule 1: Specially Protected Species lists the following species that are expected on the PPC property:
  - Chestnut-banded Plover,
  - Greater Painted-Snipe,
  - Black Stork,
  - Lesser Flamingo,

- Greater Flamingo,
- Booted Eagle,
- Tawny Eagle,
- Verreauxs' Eagle,
- Steppe Buzzard,
- Black-chested Snake-Eagle,
- Black Harrier,
- Black-shouldered Kite,
- Lanner Falcon,
- Lesser Kestrel,
- Greater Kestrel,
- Rock Kestrel,
- White-backed Vulture,
- African Fish-Eagle,
- Southern Pale Chanting Goshawk,
- Gabar Goshawk,
- Black Kite,
- Martial Eagle,
- Secretarybird,
- Sclater's Lark,
- Spotted Eagle-Owl,
- Pearl-spotted Owl and
- Rufous-cheeked Nightjar.

Schedule 2: Protected Species lists all the other indigenous species expected on the PPC property (Table 27), with the exception of the few listed as common or invasive.

Formally invasive and prohibited species

Schedule 5: Invasive Species recognizes the Common Myna as an invasive species, and they are expected if not already there.

1.3 Herpetofauna

Herpetofauna Habitat Assessment

The local occurrences of reptiles and amphibians are, like their warm-blooded mammal cousins, closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupicolous (rock-dwelling) and wetland-associated vegetation cover. Irrespective of season and the fact that herpetofauna are poikilothermic, it is thus possible to deduce the presence or absence of reptile and amphibian species by evaluating the habitat types within the context of global distribution ranges.

The topography of the site and of surrounding areas consists mostly of monotonous plains. From a herpetological perspective the site and adjoining properties offer mainly a terrestrial habitat and elements of an arboreal habitat type. There are fundamentals of man-made rupicolous habitat in the form of rock accumulations on the mine dumps. Other than accumulations of discarded rocks on the mine dumps, rupicolous habitat in the form of randjies, mountain ridges and rock protrusions are absent. However, it should be pointed out that the mine residue deposits attracted immigrants in the form of dassies.

During the spring site visit, grass cover was dry, high and relatively dense, as such providing abundant refuge for terrestrial herpetofauna. Moribund termitaria, that provide ideal retreats for small reptiles and amphibians, are absent. In some places scattered rocks were found in the veld that potentially provides excellent shelter for herpetofauna. The terrestrial habitat is relatively disturbed.

Scrub clusters comprised of wild camphor bush (Tarchonanthus camphorates), buffalo-thorn (Ziziphus mucronata), blue guarri (Euclea crispa), black thorn (Acacia mellifera), wild olive (Olea europaea) and others occur on the study site, and these scrub associations provide arboreal habitat. A few dead logs that provide habitat for smaller reptiles also occur on the study site.

Electrical fencing makes it difficult for large herpetofauna to migrate in and out of the study site.

The conservation ranking of the site is defined as “average”, and connectivity for smaller reptiles are considered as “fair” but, as a result of the electrical fence, as “poor” for larger reptiles.

Observed and expected herpetofauna species

Of the 47 reptile species and 19 amphibian species were concluded to occur on the study site (Table 30). Sixty-six herpetofauna species are thus recorded as potential occupants of the study site. Most of these are robust generalists with the ability to capitalise on disturbed environments. It should be pointed out that potential occurrences are interpreted as being possible over a period of time, as a result of expansions and contractions of population densities and ranges that stimulate migrations.

The species assemblage is typical of what can be expected in extensive natural areas with sufficient habitat to sustain populations. Most of the species of the resident diversity are fairly common and widespread (viz. brown house snake, mole snake, common egg eater, rinkhals, eastern striped skink, common platanna, common river frog, Boettger’s caco, bubbling kassina, guttural toad and raucous toad). The relatively high species richness is due to the fair size of the study site and the three different habitat types occurring on the study site.

Table 30: Reptile and Amphibian diversity. The species observed or deduced to occupy the site. Systematic arrangement and nomenclature according to Branch (1998), Alexander and Marais (2007), Minter, et.al (2004) & Du Preez and Carruthers (2009)

[45]	Scientific Name	English Name
	CLASS: REPTILIA	**Reptiles**
	Order: TESTUDINES	**Tortoises & Terrapins**
	Family Testudinae	Land tortoises
√	*Stigmochelis pardalis*	Leopard tortoise
√	*Psammobates oculifer*	Serrated or Kalahari Tented Tortoise
	Family: Pelomedusidae	Side-necked Terrapins
*	*Pelomedusa subrufa*	Marsh or Helmeted Terrapin
	Order: SQUAMATA	SCALE-BEARING REPTILES
	Suborder: LACERTILIA	**Lizards**
	Family: Gekkonidae	Geckos
*	*Pachydactylus affinis*	Transvaal Thick-toed or Transvaal Gecko
?	*Pachydactylus capensis*	Cape Thick-toed or Cape Gecko
√	*Pachydactylus vansoni*	Van Son's Thick-toed Gecko
	Family: Agamidae	Agamas
√	*Agama aculeata*	Ground Agama
?	*Agama atra*	Southern Rock Agama
	Family: Scincidae	Skinks
√	*Trachylepis capensis*	Cape Skink
√	*Trachylepis striata*	Eastern Striped Skink
√	*Trachylepis varia*	Variable Skink
?	*Panaspis wahlbergii*	Wahlberg's Snake-eyed Skink
?	*Acontias gracilicauda*	Thin-tailed Leggless Skink
	Family:Lacertidae	Old World Lizards or Lacertids
√	*Pedioplanis lineoocellata*	Spotted Sand Lizard
*	*Nucras lalandii*	Delalande's Sandveld Lizard
	Family: Gerrhosauridae	Plated Lizards
*	*Gerhosaurus flavigularis*	Yellow-throated Plated Lizard
	Family: Cordyidae	

[45] √ *Definitely there or have a high probability of occurring;*

** Medium probability of occurring based on ecological and distributional parameters;*

? Low probability of occurring based on ecological and distributional parameters.

Red Data species rankings as defined in Branch, The Conservation Status of South Africa's threatened Reptiles': 89 – 103..In:- G.H.Verdoorn & J. le Roux (editors), 'The State of Southern Africa's Species (2002) and Minter, et.al, Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, NT = Near Threatened, DD = Data Deficient. All other species are deemed of Least Concern.

[45]	Scientific Name	English Name
?	*Chamaesaura aenea*	Coppery Grass Lizard
*	*Cordylus vittifer*	Transvaal Girdled Lizard
	Family: Varanidae	**Monitors**
*	*Varanus albigularis*	Rock Monitor
√	*Varanus niloticus*	Water Monitor
	Suborder: SERPENTES	**Snakes**
	Family: Typhlopidae	Blind Snakes
?	*Typhlops bibronii*	Bibron's Blind Snake
	Family: Leptotyphlopidae	Thread Snakes
*	*Leptotyphlops conjunctus*	Cape Thread or Worm Snake
*	*Leptotyphlops scutifrons*	Peter's Thread or Worm Snake
	Family: Atractaspididae	African burrowing Snakes
*	*Aparallactus capensis*	Cape or Black-headed Centipede Eater
?	*Homoroselaps lacteus*	Spotted Harlequin Snake
NT?	*Homoroselaps dorsalis*	Striped Harlequin Snake
?	*Amblyodipsas concolor*	Natal Purple-glossed Snake
	Family: Colubridae	Typical Snakes
√	*Lycodonomorphus rufulus*	Common Brown Water Snake
√	*Boaedon capensis*	Brown House Snake
*	*Lamprophis inornatus*	Olive House Snake
?	*Lamprophis guttatus*	Spotted House or Rock Snake
?	*Lamprophis aurora*	Aurora House Snake
?	*Lycophidion capense*	Cape or Common Wolf Snake
?	*Duberria lutrix*	Common Slug Eater
√	*Pseudaspis cana*	Mole Snake
?	*Amplorhinus mutimaculatus*	Many-spotted Snake
√	*Psammophylax rhombeatus*	Spotted Skaapsteker
?	*Psammophis brevirostris*	Short-snouted Grass or Sand Snake
√	*Psammophis crucifer*	Crossed Whip Snake
?	*Philothamnus natalensis*	Eastern Green Snake
?	*Philothamnus hoplogaster*	Green Water Snake
√	*Dasypeltis scabra*	Common or Rhombic Egg Eater
*	*Crotaphopeltis hotamboeia*	Herald Snake
	Family: Elapidae	Cobras, Mambas and Others
?	*Elapsoidea sunderwallii*	Sundevall's Garter Snake
√	*Hemachatus haemachatus*	Rinkhals
	Family: Viperidae	Adders

45	Scientific Name	English Name
√	*Causus rhombeatus*	Rhombic Night Adder
√	*Brits arietans*	Puff Adder
	CLASS: AMPHIBIA	**Amphibians**
	Order: ANURA	**Frogs**
	Family: Pipidae	Clawed Frogs
√	*Xenopus laevis*	Common Platanna
	Family: Bufonidae	Toads
√	*Amietaophrynus gutturalis*	Guttural Toad
√	*Amietaophrynus rangeri*	Raucous Toad
	Family: Hyperoliidae	Reed Frogs
?	*Hyperolius marmoratus*	Painted Reed Frog
√	*Kassina senegalesis*	Bubbling Kassina
√	*Semnodactylus wealii*	Rattling Frog
	Family Breviceptidae	Rain Frogs
?	*Breviceps mossambicus*	Mozambique Rain Frog
	Family Phrynobatrachidae	Puddle Frog
*	*Phrynobatrachus natalensis*	Snoring Puddle Frog
	Family Ptychadenidae	Grass Frogs
*	*Ptychadena porosissima*	Striped Grass Frog
	Family: Pyxicephalidae	
√	*Amietia angolensis*	Common River Frog
*	*Amietia fuscigula*	Cape River Frog
√	*Strongylopus fasciatus*	Striped Stream Frog
*	*Strongylopus grayii*	Clicking Stream Frog
√	*Cocosternum boettgeri*	Boettger's Caco or Common Caco
*	*Cocosternum nanum*	Bronze Caco
NT?	*Pyxicephalus adspersus*	Giant Bullfrog
*	*Tomopterna cryptotis*	Tremolo Sand Frog
√	*Tomopterna natalensis*	Natal Sand Frog
?	*Tomopterna tandy*	Tandy's Sand Frog

Red data listed herpatofauna

- **By the Scientific Community:**

  The striped harlequin snake has not been recorded in the quarter degree square grids overlying the PPC Lime Limited site. The site furthermore does not contain moribund termitaria, where this species is most likely to be found. It is very difficult to confirm whether this cryptic snake is

present on any study site, but a small possibility exists that the striped harlequin snake occurs on this particular study site. It is important to note that in the latest literature (Measey (ed.) 2011 and Carruthers & Du Preez, 2011); the giant bullfrog's status has changed officially from Near Threatened (Minter et al, 2004) to Least Concern in South Africa.

- **By the Biodiversity Act No 10 of 2004:**
  The Giant bullfrog is listed by Van Schalkwyk (2004) as a 'Protected species'.

- **By the Regulations of the Provincial Authority:**
  The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) Schedule 1: Specially Protected Species lists the African bullfrog, which is deemed a probable inhabitant, as a Specially Protected species. Schedule 2: Protected Species lists all the other occupants of the PPC property (Table 30).

Formally invasive and prohibited species

No Invasive or Prohibited reptile or amphibian listed in the Biodiversity Act No 10 of 2004 or in the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) Schedule 6, were recorded.

Chapter G: Surface Water

Information on surface water has been sourced from the following:

- PPC Lime Acres EMP, Revision 5; dated February 2013;
- Petra Diamonds: Finsch Diamond Mine: Environmental Management Programme, dated April 2012;
- PPC Lime Acres Hydrocensus Report, dated February 2015; and
- PPC Lime Limited's surface water monitoring programme.

1.1 Catchment area and management area

PPC Lime Acres is situated in the C92A and C92C quaternary catchments (Figure 23) within the Lower Vaal- and Lower Orange River Water Management Area.

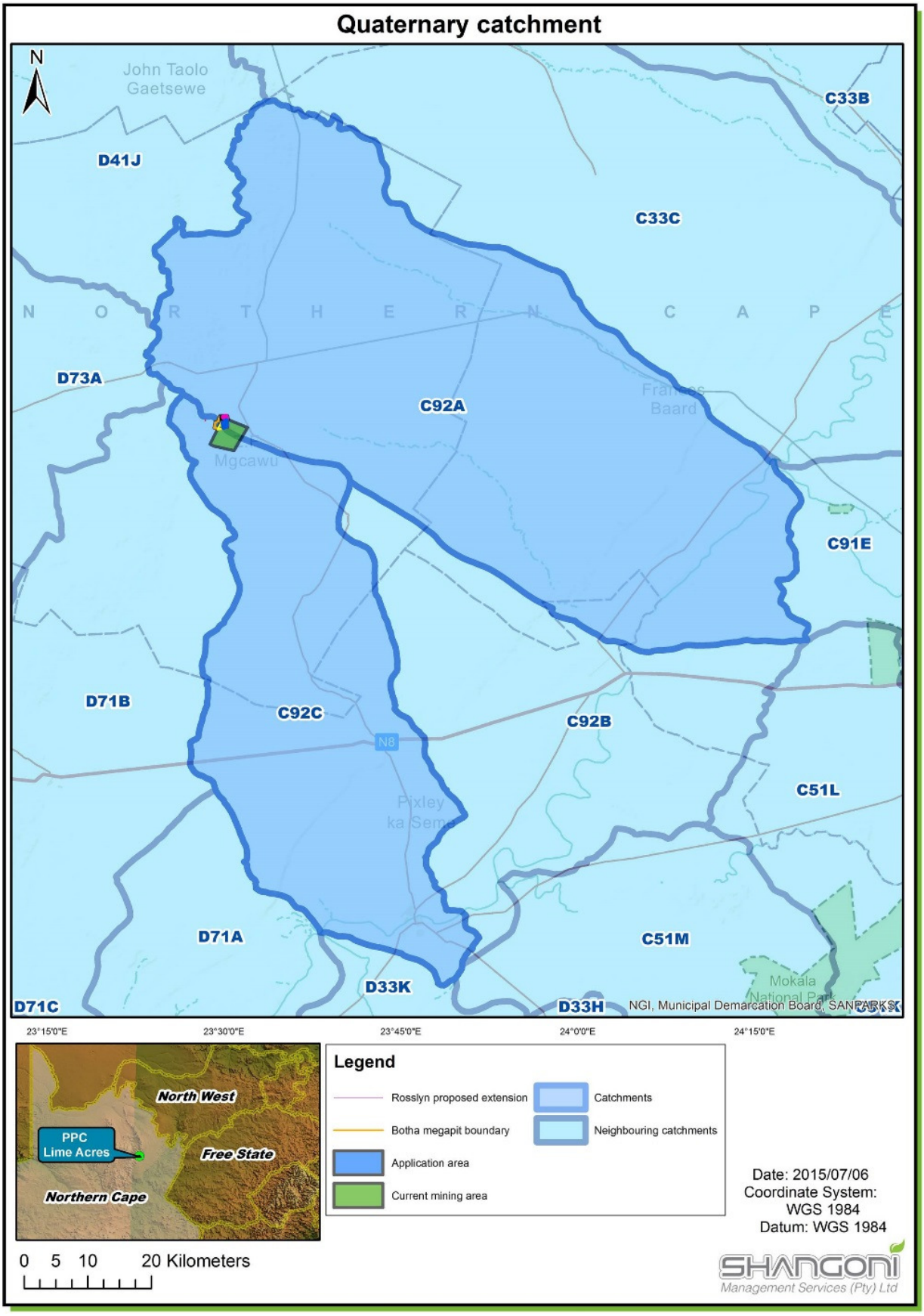


Figure 23: Map depicting the catchments relevant to the PPC Lime Acres Quarry extension area

1.2 Drainage

The only significant surface water drainage system in the vicinity of PPC Lime Limited is the Klein Riet River that drains in a south-eastern direction towards the Vaal River.

Surface gradients for the eastern highland range between 0.1 and 0.3 while the flat landscape in the east has a relatively constant gradient of approximately 0.02 dipping towards the Vaal River in the south-east. The only two prominent depressions, the Great Pan and Rooi Pan, occur further east of the mining area. These depressions are in the order of 5 to 10 m lower than the surrounding area. Due to the arid nature of the area, little visible surface water is present. The only flowing or standing water would be found in the drainage lines directly after an intense thunderstorm.

Drainage systems in the Asbestos Mountain range are mostly directed towards the Gamagara and Kuruman systems. Surface drainage from the eastern flank of the mountain range towards the Ghaap Plateau is controlled by a number of geological features, which are not always prominent. Some of these systems end in surface depressions like the Great and Rooi Pans (Botha and van Wyk, 1986).

1.3 Flood peaks and volumes

A 1:50 year flood line study was conducted by Steffen, Robertson & Kirsten. The resultant report (Report 203339/1 on file) is available from PPC Lime Acres upon request.

Based on a Mean Annual Precipitation (MAP) of approximately 390mm, the 24 hour storm rainfall depth was determined via the "Op ten Noort Formulae". The following rainfall depth was obtained:

1: 50 year - 135 mm

1: 100 year - 160 mm

The 1:50 year flow rates were then determined for the above catchment and meteorological conditions, using computer models and empirical methods. Two models were used, namely the HDYP01 model based on the unit hydrograph technique and the SCS model using the soil conservation services (curve number) technique. As a further verification of the results, an empirical method based on the KOVACS method was used.

The results for the 1:50 year flow are summarised in Table 31 below.

Table 31: 1:50 Year flow rates

Method	1 : 50 Year Flow (m^3/s)
HDYP01	233
SCS	200
KOVACS	158
Weighted Average	180

The 1:50 year flood line is indicated on the Figure attached hereto in Annexure A.

The 1: 50 year flood line along the watercourse was computed using the FLOOD computer model. This model makes use of a standard backwater technique and computes a high water level (HWL) for various peak flows, taking into account the existing watercourse condition and any obstructions such as road and rail crossings.

This 1:50 year high water level in the pan area to the west of the Bowden North Quarry is expected to be 1447.50m. This is approximately 0.5m below the lowest quarry level of about 1448.0m at perimeter.

Under present conditions the two access road crossings within the watercourse and the railway line crossing would be flooded during a 1:50 year storm event. The overflow depth is expected to be 0.3 to 0.4m. This is a fairly good correlation that was obtained between the predicted and previously observed HWL at the main access road during a storm event measuring some 165 mm in 24 hours during February 1988 (± 1:100 year event). The 1:50 year, 24-hour storm rainfall of 135 mm will give a slightly lower HWL at the main plant access road crossing.

Certain areas in and around the Sha-leje Village are also within the boundaries of the 1:50 flood line.

1.4 Drainage density

The only main dry watercourse (Klein Riet River) that drains the catchment area runs from the northwest to the southeast into the Rooi Pan. The total length of this drainage path is 22.5km, excluding the various small sub arteries. The drainage pattern can be classified as dendritic. The 22.5km long watercourse drains the entire catchment area of 190 km^2.

1.5 Surface water quality

Surface water quality results as monitored by PPC Lime Limited at Quarry 5 for the period July 2014 to June / July 2015 is presented in Tables 32 and 33 below.

Table 32: PPC Lime Limited surface water quality results (chemical analysis) for Quarry 5[46]

Description	Aluminium (Al)	Arsenic (As)	Cadmium (Cd)	Cobalt (Co)	Copper (Cu)	Cyanide (free) (CN^-)	Fluoride (F)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Mercury (Hg)	Nickel (Ni)	Nitrates (N)	Phenols	Selenium (Se)	Sulphate (SO_4)	Chromium (Cr)	Total Trihalomethanes	Vanadium	Alkalinity	Calcium (Ca)	Chloride (Cl)	Colour	Electrical Conductivity 9EC)	Magnesium (Mg)	Hardness Ca	Hardness (Mg)	Hardness Total	pH	Potassium (K)	Sodium (Na)	TDS	Turbidity	Zinc (Zn)
Max Class 1	300	10	3	500	2000	70	2	2000	10	500	6	70	11	10	10	500	50	0.3	200		150	300	15	170							200	1200	1	5
MHS		300	20		100	300	1.5	1000	100	1000	10		10	10	50	600						600		300	100			650			400			5
Unit	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l	mg/l	mg/l	mg/l	mS/m	mg/l	mg/l	mg/l	mg/l	25^0C	mg/l	mg/l	mg/l	NTU	mg/l
QUARRY 5																																		
July 2014						<50	<0.5						8.7			257	<2.0			121	117	107		111.2	41	292	142	434	8			700		
Aug 2014						<50	<0.5	<100					9.2			269	2.9			116	112	109		111.5	41	280	142	422	8.1			714		
Sep 2014	<100	<10	<3.0			<50	<0.5		<4.0	<100	<1		9.4			260				110	127	111	3	113.5	43	317	149	466	8			726	0.3	<0.10
Oct 2014																																		
Nov 2014							<0.5						12			268	<2.0			110	117	112		112.7	43	292	149	441	8.2			706		
Dec 2014	<100		<3.0	<2.0	<100	<50	<0.5	<100	<4.0	<100			8.6			285	<2.0		<4.0			123	1	113.5		0	0	0	8.3		58	708	0.4	<0.1
Jan 2015													9.6			255				104	110			112.8	40	275	139	413	8			724		
Feb 2015													8.6			252				105	141			112.3	49	352	170	522	8.1			708		
Mar 2015						<50	<0.5						6.5			265	<2.0			119	115	112		113.9	41	287	142	429	8.2			706		
Apr 2015													9.7			266				177	115			112.6	41	287	142	429	8			718		
May 2015													6.9			268				112	115			113.3	42	287	146	433	8.1			712		
Jun 2015						<50	<0.5						8.7			273				112	115	111		113.9	42	287	146	433	8			728		

[46] Monitoring done by PPC Lime Limited, based on SANS 241, 2006

Table 33: PPC Lime Limited surface water quality results (bacteriological analysis) for Quarry

Description	Faecal coliform (E-coli)	Total Coliform	Heterotrophic
Max Class 1	0	10	5000
MHS	0	5	Not specified
Unit	Count/100ml	Count/100ml	Count/1ml
QUARRY 5			
July 2014	0	95	183
Aug 2014	0	62	149
Sep 2014	0	14	118
Oct 2014	0	101	312
Nov 2014	1	15	65
Dec 2014	0	31	124
Jan 2015	0	56	139
Feb 2015	0	83	161
Mar 2015	0	41	138
Apr 2015	0	201	330
May 2015	0	>201	410
June 2015	*June Bacterial samples were sent to Sedibeng but the 24hr rule had elapsed and thus the samples could not be analysed.*		
Jul 2015	0	15	83

1.6 Surrounding surface water use

Due to the low mean annual precipitation (MAP) and the flat surroundings of the area, little or no run-off water exist. The only stream draining the area is constantly dry and some run-off water will only occur after heavy downpours. The run-off water will collect in the local depressions or low lying areas and will not reach the receiving body, the Rooi Pan. There are no major drainage systems from the local pans to the Vaal River. It is more likely that these pans form a series of interior drainage basins which overflow occasionally during very high rainfall seasons (EMPr, 2011). Given the flat topography, the major fraction of precipitation most probably evaporates while the remaining fractions are recharged into the groundwater system (4.3% of MAP; sourced from Geo-Logic Trading Trust, 2009).

The water accumulated in the existing Bowden South Quarry 5 is primarily used as drinking water for the villages and the processing plant. The water from the existing quarry reports to chlorination plant where it is disinfected prior to distribution.

The monthly water consumption from Bowden South Quarry (Quarry 5) is listed in Table 34 below.

Table 34: Monthly water consumption from Bowden South quarry

Month (past 4 years)	Consumption (m^3)
January	125 770
February	113 040
March	81 425
April	81 890
May	73 330
June	50 345
July	68 375
August	115 605
September	125 890
October	141 400
November	132 390
December	135 500
Average	**103 746**

(Source: EMP, Revision 5; dated February 2013))

Chapter H: Wetlands and other surface water features

Information on wetlands has been sourced from the following report:

- PPC Lime Acres prospecting area, Northern Cape. Desktop Wetland Delineation Report, dated March 2015, compiled by Limosella Consulting (attached in Annexure E3).

1.1 Wetland classification and delineation

The classification system developed for the National Wetlands Inventory is based on the principles of the hydro-geomorphic (HGM) approach to wetland classification (SANBI, 2009). The desktop wetland study followed the same approach by classifying wetlands in terms of a functional unit in line with a level three category recognised in the classification system proposed in SANBI (2009). HGM units take into consideration factors that determine the nature of water movement into, through and out of the wetland system. In general HGM units encompass three key elements (Kotze *et al,* 2005):

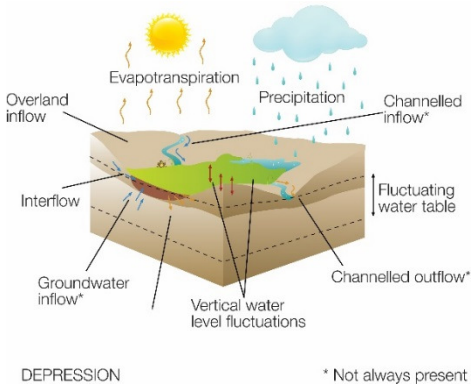
» Geomorphic setting - This refers to the landform, its position in the landscape and how it evolved (e.g. through the deposition of river borne sediment);

» Water source - There are usually several sources, although their relative contributions will vary amongst wetlands, including precipitation, groundwater flow, stream flow, etc.; and

» Hydrodynamics - This refers to how water moves through the wetland.

The wetland HGM type relevant to the study area is discussed in Table 35 below.

Table 35: Description of hydro-geomorphic wetland type relevant to the study area

Hydro-geomorphic types (Ollis *et al,* 2013)	Description (Kotze *et al,* 2005)
Depression Wetlands 	Depression wetlands are associated with closed or near-closed elevation contours which increase in depth towards the centres where the water accumulates. In semi-arid conditions depressions form when the insufficient water inputs prevents water accumulations from connecting with an open drainage network. Depressions that are flat bottomed are often referred to as pans.

One depression wetland (a southern Kalahari salt pan) was delineated within the proposed Quarry extension area, as part of the Desktop Assessment. The delineated wetland is part of a much larger pan system known as Rooi Pan (approximately 1 500 ha), of which 25.3 ha falls within the proposed Quarry Extension boundary application area. The pan is one of several large pans in the region. Figure 24 shows the delineated pan together with the 30m wetland buffer in relation to the proposed Quarry extension area. A drainage-way along the western boundary of the study site has not been delineated as a wetland but would require further investigation as part of a more detailed wetland assessment.

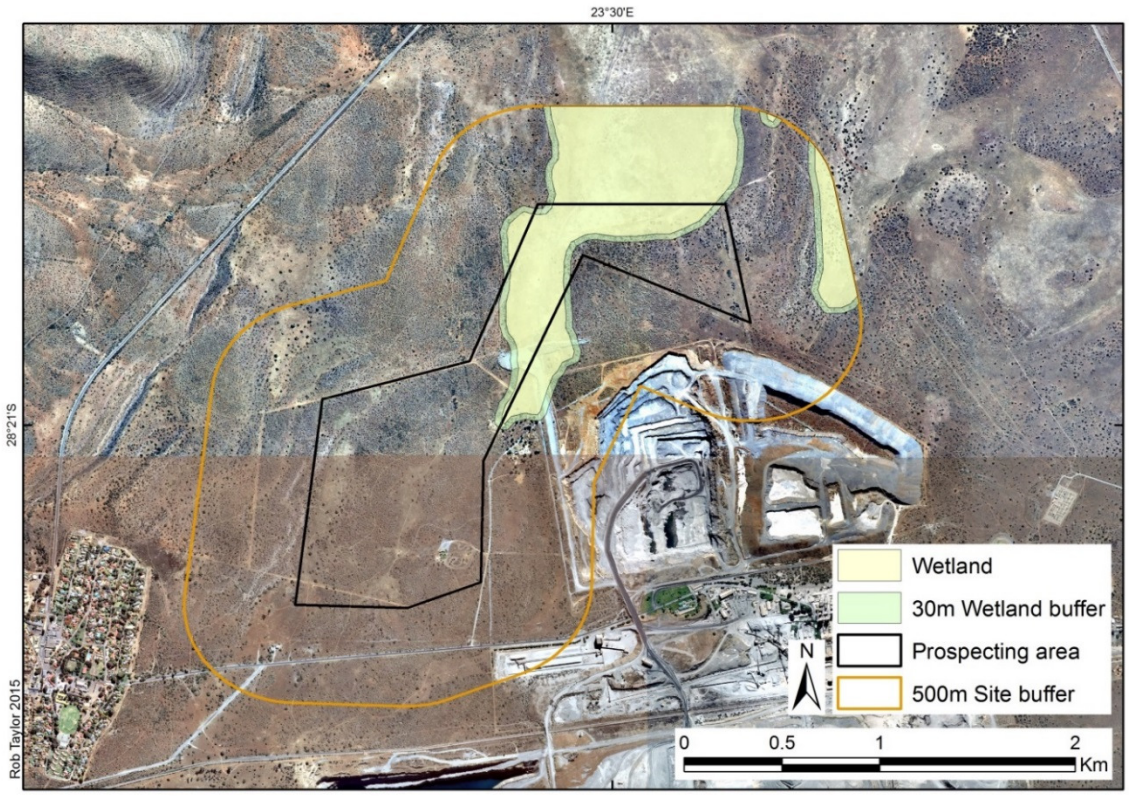


Figure 24: The wetland and wetland buffer on the study site. All wetlands within a 500m buffer of the prospecting area are prescribed by the DWA as relevant to the Water Use Licence application process.

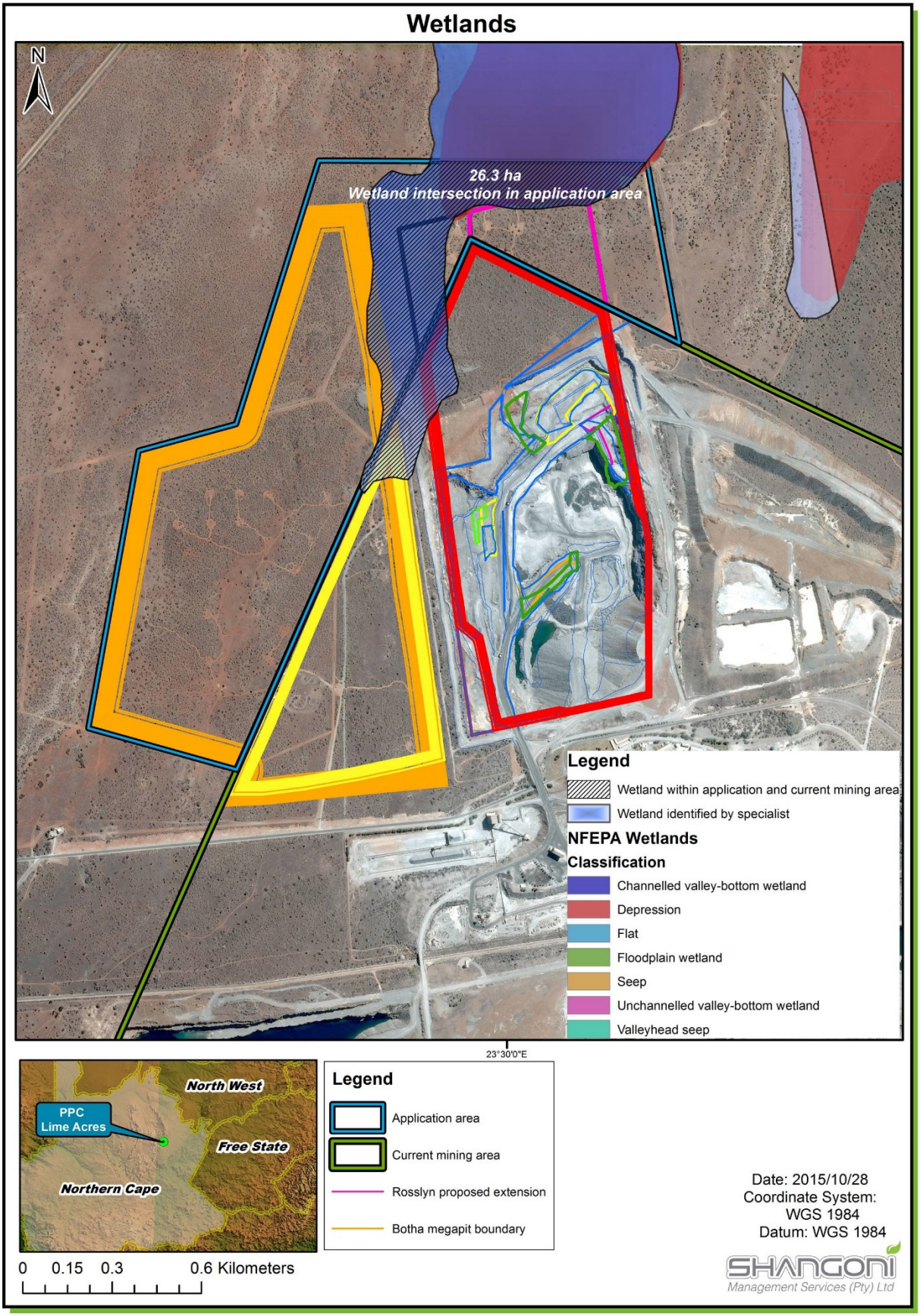


Figure 25: NFEPA wetlands and delineated wetlands (as per Desktop Wetland Assessment – Limosella Consulting, March 2015) within and around the proposed PPC Lime Limited Quarry extension area

1.2 Wetland functionality

Present Ecological Status

The wetland in the study site appears largely unmodified. A large sand barrier constructed across the pan does impede some flow to-and-from the south-western extent of the pan, but the majority of the flow would be towards the north-east and into the main body of the pan. Several dirt roads cut across the pan but are unlikely to impact on flows.

Ecological Importance and Sensitivity

Several locally and regionally important plant species are known to occur in the pans, including *Boophone distichia* on the margins of the pan. It is unknown what important diatoms and invertebrates occur in the pan and further investigation would be required.

As the wetland delineated on the study site forms the upper reaches of the much larger Rooi Pan it is expected that any contaminants entering the system from the mine will flow into and accumulate there.

Refer to Part 9.3 of this Scoping Report regarding further studies to be conducted and included as part of the Plan of Study for EIA.

Chapter I: Groundwater

Available groundwater information as provided below have been sourced from the report titled: "*PPC Lime Limited; Lime Acres. Hydrocensus*", dated February 2015 and prepared by Shangoni AquiScience. The resultant report is attached in Annexure E4.

1.1 Aquifer characteristics

The main aquifer in the Lime Acres area is a secondary dolomite aquifer with moderate karst development. The dolomite aquifer is divided into compartments by dolerite and/or kimberlite dykes. PPC Lime seems to be situated in a compartment where the northern and southern boundaries are not clearly defined (EMPr, 2011). The majority of groundwater recharge occurs to the south-west in the Asbestos Mountain Range although active recharge also occurs in vicinity of the mine (Botha and van Wyk, 1986).

The primary rocks of the dolomite aquifer consist of a succession of alternating layers of limestone, dolomite, chert and carbonaceous shale. The dolomite has moderate karst development, large solution channels and cavities are present. The ground-water is held and transmitted along fissures, joints, solution channels and bedding planes within the dolomite and limestone (Botha and van Wyk, 1986).

1.2 Depth of water tables

The depth to the water table in the Lime Acres area is highly variable and fluctuates between 3 m and 50 m below surface depending on quarry dewatering including the prevailing rainfall and borehole location. During periods of high rainfall the groundwater table rises rapidly and then declines gradually until the next period of high rainfall.

1.3 Borehole yield

Borehole yields are highly variable from 1 l/s to 12 l/s. Borehole yield is dependent on the proximity of boreholes to fissures and storage compartments in the dolomite aquifer.

Three boreholes were submitted to borehole yield tests during the groundwater study conducted by Botha and van Wyk (1986). During this study transmissivity and storativity values for the three main aquifer systems, namely the Middle Dolomite, Black Blob Chert (BBC) and the Leached karst zone, were calculated from the pump test data. The aquifer hydraulic values are shown in Table 36.

Table 36: Hydraulic parameters for boreholes in the Lime Acres region obtained from pump tests (van Wyk and Botha, 1986)

Borehole ID	T (M2/d)	S	Formation
PPC003	71	5.0E-8	Middle Dolomite
PPC016	47	2.7E-3	BBC
PPCW7/1	690	5.2E-2	Leached karst

These main aquifer zones tend to form cavities interconnected by fractures. Leached cavities can reach depths of 68 mbgl (Middle Dolomite) but significantly decrease in size or vanishes completely 100 mbgl. The cavities at shallower depths are usually larger and more effectively connected and therefore hydraulic parameters of the aquifer/s in the Lime Acres region decrease with depth. This phenomenon will lower the regional recharge as well as water levels (Botha and van Wyk, 1986).

1.3 Aquifer recharge

Aquifer recharge is the addition of any water to the saturated zone. It is dependent on a number of different recharge mechanisms and factors namely the amount of rain, evaporation figures, type of soil cover, type of grass cover and the ability of the geology to absorb and store the water. Several mechanisms or calculations exist to estimate recharge for an area, some of which include qualified guesses. The groundwater recharge programme from Gerrit van Tonder and Yongzin Xu (van Tonder and Xu, 2000) are frequently used to estimate groundwater recharge and a mean groundwater recharge figure. The mean value of the chloride, soil, geology, Vegter, Acru, Harvest Potential and Base Flow methods are used together with a weighting ratio to estimate the groundwater recharge figure for the specific site. The geohydrological study conducted by Geo-Logic Trading Trust (2009) used this programme to estimate an average recharge value based on the various mechanisms and qualified guesses. The recharge figures obtained was highly variable and ranged between 0.9% (of

MAP) and 18.4% with an average value of 4.3%. Vegter (1995), in his groundwater recharge maps for South Africa estimated recharge for Ghaap Plateau to range between 10 mm and 15 mm per annum which equates to 3%-4.5% of MAP while Smit (1978) used springflow and the Thornthwaite method to estimate recharge for the Ghaap Plateau with recharge fractions of 3.39% and 2.47% calculated, respectively. However, the general flat topography and lack of significant surface drainage features all point to recharge being relatively high (% of MAP) on the dolomites and therefore the recharge estimates given in this report should be viewed as underestimations.

Table 37 summarises the different recharge values obtain by various researchers which ranges between 2.5% and 4.3% of the MAP with an average of 3.3725% or 11.30 mm/a.

Table 37: Average recharge values estimated for the study area

Recharge method	Average recharge % of MAP	Annual recharge (mm)[a]	Reference
RECHARGE programme	4.3	14.405	Geo-Logic Trading Trust, 2009
Vegter	3.75	12.563	Vegter, 1995
Springflow & groundwater balance	2.5	8.375	Smit, 1978
Thornthwaite	2.94	9.849	Smit, 1978
Average	**3.3725**	**11.30**	

a Annual recharge calculated using MAP of 335 mm

1.4 Water abstraction and use

Water used by PPC is abstracted from water stored in the abandoned quarries and ranges between 50 000 m^3/month during the dry winter months and up to 135 500 m^3/month during the wetter summer months; averaging approximately 104 000 m^3/month. The water is made up of collected surface water and some inflow of groundwater into the quarries. Two back-up boreholes were drilled and equipped to act as standby for water supply in case the quarries dry up during the drier months. No water has been abstracted from these boreholes to date. The abstracted water is disinfected at the chlorine plant and distributed to the villages and plant.

1.5 Hydrocensus

A hydrocensus was performed on and around the mine in a 10 km radius from the mine to identify interested and affected parties (IAPs) and groundwater users. The data gathered was also used to construct groundwater flow contours for the vicinity. The water level information gained from this census is also required for future numeric groundwater modelling for the mine.

A total of 73 boreholes were recorded during the survey which took place from the 2nd of February to the 7th of February 2015. This included 20 PPC owned monitoring boreholes and 53 privately owned farm boreholes. Additional borehole information for use in constructing the groundwater contours was

received from Finsch Mine and Golder Associates; the former a Petra Diamonds owned diamond mine adjacent to PPC Lime Limited, and the latter an environmental consulting firm that is currently investigating the possibility of supplementing the Gamagara pipeline with groundwater from the region. Golder Associates supplied information on 17 boreholes. A list of the surveyed boreholes can be viewed in Table 38 while more detailed descriptions of the hydrocensus localities are featured in Appendix A of Annexure E4. A layout map of the surveyed boreholes are displayed in Figure 26.

Table 38: PPC Lime hydrocensus information

Sample ID	Owner	Latitude	Longitude	Elevation (mamsl)	Water level (m)	Equipped (Y/N)	Stat/dyn	Est. Yield (l/h)	Collar (m)	Sampled (Y/N)	Water use		
											Domestic	Livestock	Irrigation
PPC Lime monitoring boreholes													
SL West	PPC	-28.35467	23.50540	1451	40.34	N	S	-	0.20	Y	na		
LLO		-28.36234	23.51252	1452	14.36	N	S	-	0.15	Y			
Airstrip		-28.37442	23.51818	1450	26.6	N	S	-	0.20	Y			
PPC15		-28.38257	23.48507	1450	41.85	N	S	-	0.30	Y			
PPC03		-28.38007	23.47987	1452	Dry	N	S	-	0.00	Y			
PPC16		-28.37694	23.48138	1454	48.68	N	S	-	0.40	Y			
PPC14		-28.37685	23.48150	1454	47.57	N	S	-	0.20	Y			
PPC02.1		-28.37667	23.48158	1454	48.48	N	S	-	0.05	Y			
PPC01		-28.37240	23.48366	1453	31.22	N	S	-	0.50	Y			
PPC02		-28.37097	23.48554	1452	30.69	N	S	-	0.65	Y			
Oil tanks		-28.35935	23.51142	1458	22.9	N	S	-	0.15	Y			
SL South		-28.35694	23.50836	1455	22.06	N	S	-	0.40	Y			
SL East1		-28.35509	23.51408	1454	23.83	N	S	-	0.65	Y			
SL East		-28.35375	23.51412	1455	27.64	N	S	-	0.40	Y			
Papkuil		-28.35627	23.53225	1453	25.36	N	S	-	0.25	Y			
Brickworks		-28.35837	23.53216	1454	28.74	N	S	-	0.30	Y			
East substation		-28.36182	23.48544	1455	26.27	N	S	-	1.00	Y			
West substation		-28.36199	23.48077	1461	29.6	N	S	-	0.75	Y			
Boom1		-28.35016	23.48750	1469	38.32	N	S	-	0.10	Y			
Boom2		-28.35416	23.49071	1459	29.52	N	S	-	0.25	Y			
Farm boreholes													
BE3	Hennie van Zyl (Beadle)	-28.32472	23.56472	1451	11.33	N	S	100	0	N	Not used		
BE1		-28.32041	23.56593	1446	10.33	N	S	100	0.40	N			
BE2		-28.32155	23.56477	1449	10.25	N	S	4500	0.60	N			
BE4		-28.32152	23.55542	1452	Dry	N	-	-	-	N	Borehole dry		
BE8		-28.31803	23.54645	1453	18.4	N	S	20 000	0.25	N	Not used		
BE7		-28.31833	23.54611	1453	17.6	N	S	100 000	0.30	N	Hole collapsed		

Sample ID	Owner	Latitude	Longitude	Elevation (mamsl)	Water level (m)	Equipped (Y/N)	Stat/dyn	Est. Yield (l/h)	Collar (m)	Sampled (Y/N)	Water use		
BE13		-28.31852	23.54590	1453	17.78	N	S	50 000	0.1	N	Not used		
BE10		-28.32384	23.54546	1452	20.25	Y	D	100 000	0.70	Y	✓	✓	
BE9		-28.31943	23.54576	1453	17.8	N	S	30 000	0.40	N	Not used		
BE6		-28.31892	23.54590	1453	17.64	N	S	11 000	0.30	N			
BE5		-28.31896	23.54612	1453	Dry	N	-	-	-	-	Borehole dry		
BE11		-28.31833	23.53944	1451	16.27	Y	D	10 000	0.30	Y	✓	✓	
L2	Small Farmers Association (Laughing Waters)	-28.31157	23.54767	1454	Dry	N	-	-	-	-	Borehole dry		
L3		-28.31118	23.54790	1454	18	Y	D	-	0.20	Y	✓	✓	
L4		-28.31111	23.54792	1454	17.27	N	S	-	0.25	N	Not used		
L5		-28.30613	23.57087	1446	Dry	N	-	-	-	N	Borehole dry		
L6		-28.30241	23.57496	1450	14.6	Y	D	-	0.30	N	✓	✓	
L7		-28.30136	23.57526	1450	NAWL	Y	-	-	-	N	✓	✓	
TY1	Kokkie York (Rooipan)	-28.36870	23.65723	1438	8.45	Y	S	26 000	0.25	Y	✓	✓	✓
TY2		-28.36866	23.65719	1438	7.62	N	S	-	0.45	N	Not used		
TY3		-28.38534	23.64474	1442	15.35	N	S	-	0.50	N			
TY4		-28.38534	23.64481	1442	15.45	Y	D	6000	0.50	N		✓	
TY5		-28.38747	23.64324	1441	14.2	Y	S	-	0.45	N		✓	
TY6	Killian Trust (Grootpan)	-28.37831	23.61034	1446	16.4	Y	S	-	0.40	N		✓	
TY7		-28.40949	23.59910	1446	14.48	Y	S	-	0.40	N		✓	
TY8		-28.35373	23.59062	1445	10.8	Y	S	-	0.45	N	✓	✓	
TY9		-28.35962	23.60181	1445	NAWL	Y	S	-	0.40	N	Not used		
TY10		-28.36881	23.62926	1444	15.56	N	S	>30 000	0.50	N			
TV1	Theuns Vermeulen (England)	-28.34429	23.62025	1447	NAWL	Y	D	-	1.0	Y	✓	✓	
TV2		-28.34552	23.62036	1445	7.06	Y	S	-	0.35	N	✓	✓	
TV3		-28.34727	23.62107	1444	NAWL	Y	-	-	-	N	Not used currently		
F1	Suzette Faihste (Silver Streams)	-28.35389	23.58111	1445	10.95	Y	S	-	0.45	Y	✓	✓	
F2		-28.35361	23.58083	1446	12.65	Y	D	-	0.30	N		✓	
F6		-28.35367	23.58088	1446	12.11	N	S	-	0.15	N	Not used		
F5		-28.35271	23.58345	1445	7.5	N	S	-	0.30	N			
F4		-28.35290	23.58217	1445	Dry	N	-	-	0.15	N	Borehole dry		

Sample ID	Owner	Latitude	Longitude	Elevation (mamsl)	Water level (m)	Equipped (Y/N)	Stat/dyn	Est. Yield (l/h)	Collar (m)	Sampled (Y/N)	Water use		
DS1	Deon Stander (Selfhelp)	-28.41392	23.62564	1443	16.87	Y	D	-	0.70	Y		✓	
DS2		-28.41388	23.62561	1443	DRY	Y	-	-	0.70	N	Borehole dry		
DS3		-28.42650	23.60635	1442	10.58	Y	S	-	0.35	Y	✓	✓	
DS4		-28.42725	23.60638	1443	NAWL	Y	-	-	0.45	N		✓	
A2	Wynand de Jager	-28.38110	23.58044	1445	14.77	Y	D	-	0.27	Y	✓	✓	
A3		-28.37307	23.58971	1445	DRY	N	-	-	0.30	N	Borehole dry		
O1	Vickters	-28.34494	23.56979	1452	15.44	Y	S	-	0.45	Y	✓	✓	
L1		-28.34259	23.55375	1453	DRY	N	-	-	0.35	N	Borehole dry		
DB1	Johan Visser (Walker)	-28.37620	23.56142	1447	DRY	N	-	-	0.35	N			
DB2		-28.37633	23.56236	1445	DRY	N	-	-	0.10	N			
DB3		-28.37982	23.52667	1452	22.33	N	S	-	0.45	Y		✓	
R2	Thinus vd Spuy	-28.47431	23.56874	1437	11.3	Y	S	-	0.10	Y	✓		
R3	(Rocklands	-28.47250	23.57095	1438	NAWL	N	-	-	0.15	Y	Borehole blocked		
JM1	Johan Meyer (Rolpan)	-28.44467	23.56175	1439	11.26	Y	D	150	0.30	Y	✓	✓	
JM2		-28.44439	23.56151	1439	11.17	Y	D	150	0.40	Y	✓		
HS1	Gideon du Plessis	-28.35764	23.63796	1443	9.88	Y	S	-	0.75	Y	✓	✓	
HS2	(Langverwaht	-28.35760	23.63795	1443	9.12	N	S	-	0.30	N	Not used		

D Dynamic/pumping water level

S Static/rest water level

Na Not applicable

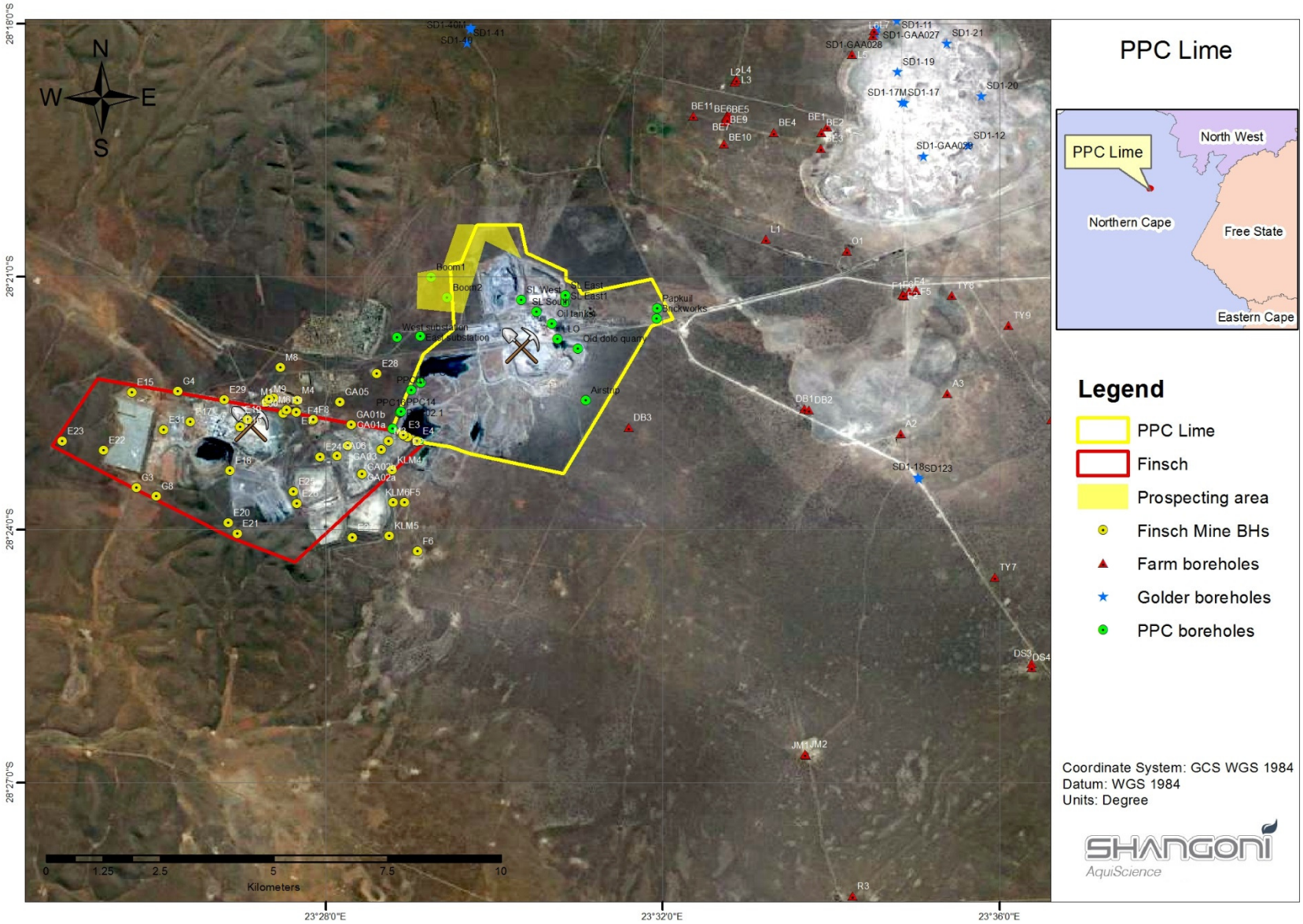


Figure 26: PPC Lime Hydrocensus map (extracted from the Hydrocensus Report, compiled by Shangoni AquiScience. February 2015)

The above figure shows that the majority of boreholes surveyed are located to the north-east and south-west of the PPC Lime Limited site while some were surveyed to the north and south of the mine. Borehole data received from Finsch Mine are located to the west of PPC Lime. Borehole data towards the immediate north and south are relatively sparse and according to the farm owners no additional boreholes are located in these regions.

Of the 73 surveyed boreholes 25 are equipped and in use, 2 are equipped and not currently in use while 26 are not equipped and not intended for use. Most of the equipped and in use boreholes are used for domestic or livestock watering use or both. Twenty (20) of the surveyed boreholes are used as PPC monitoring boreholes and are unequipped.

Water levels were recorded from 56 boreholes while Golder supplied information on 17 unequipped boreholes. Water levels from the surveyed boreholes ranged between 2.27 mbs to 53.37 mbs (Figure 27); eight of these represent dynamic water levels and 65 static water levels. The dynamic water levels ranged between 12.65 mbs and 20.25 mbs with an average of 16.11 mbs while the static water levels ranged between 2.27 mbs and 53.37 mbs with an average of 19.13 mbs (cone of depression not taken into account in distinguishing between static and dynamic levels, only present abstraction or not).

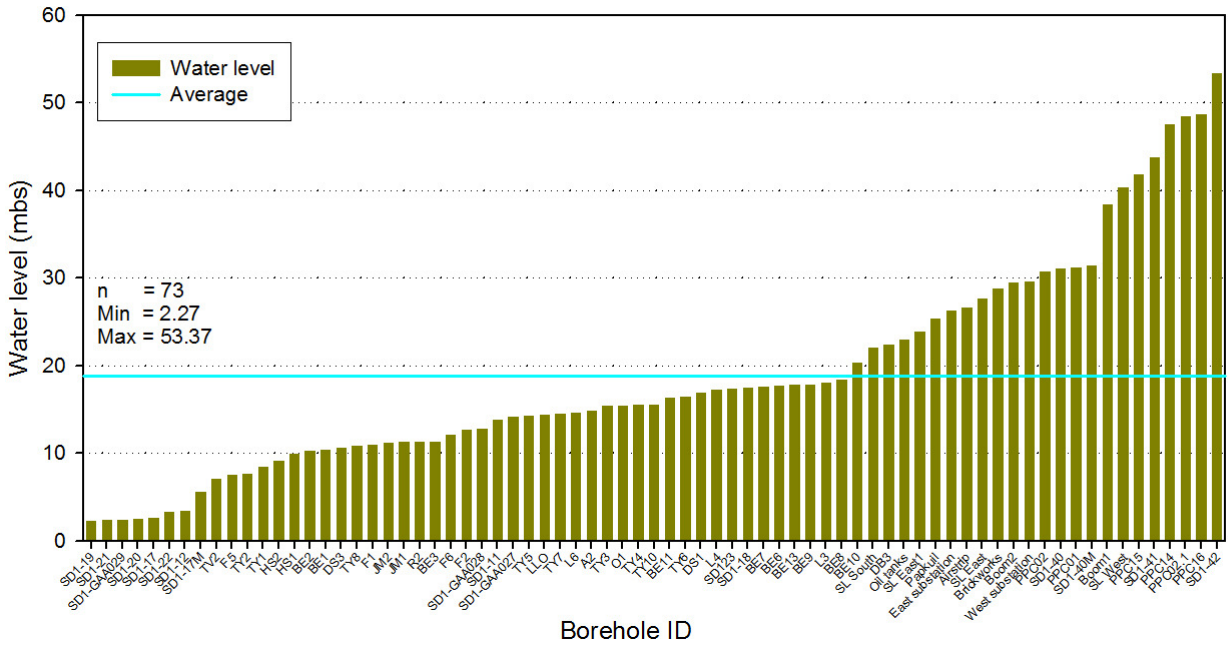


Figure 27: Water levels recorded during the hydrocensus for PPC Lime during February 2015 (extracted from the Hydrocensus Report, compiled by Shangoni AquiScience. February 2015)

1.6 Hydraulic head contours and gradients

A hydraulic head contour map was constructed with data sourced from the surveyed boreholes and borehole data received from Finsch and Golder (Figure 28). The contours illustrate that PPC Lime is

bounded by groundwater divides (most probably dolerite and/ or kimberlite dykes) on its eastern and western perimeters while a constant head boundary might possibly exist towards the north (possibly subsurface flow within the Klein Riet River). Groundwater flow mimicking itself as a cone of depression can be seen extending towards the south-west and towards the east from either Quarry 4 or Quarry 5 and also towards the north with the Bowden North Quarry as source. A mounding of groundwater can be seen immediate south-west from Bowden North Pit in the vicinity of the ponds and also within the vicinity of the old dolomite quarry. Flow gradients are shown in Figure 28.

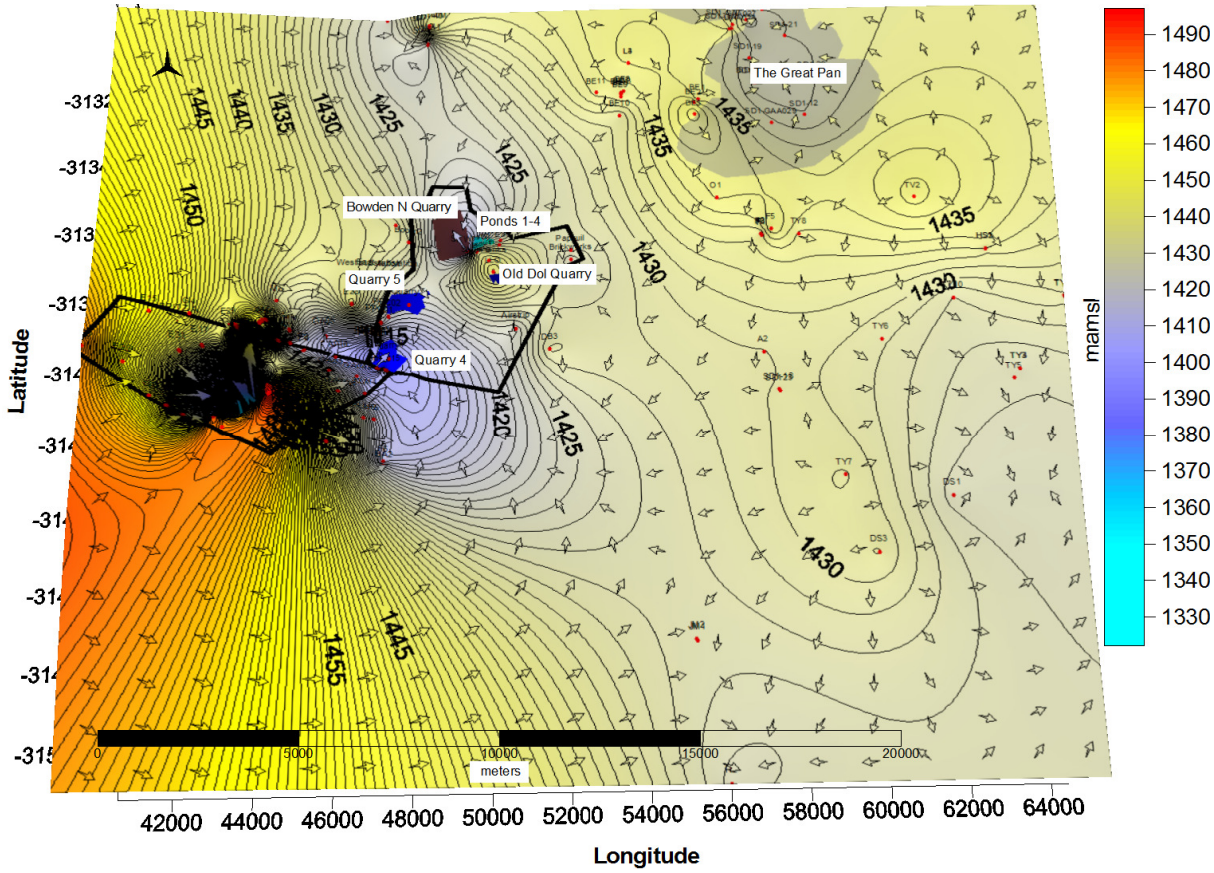


Figure 28: Interpolated hydraulic head contours and groundwater flow directions (extracted from the Hydrocensus Report, compiled by Shangoni AquiScience. February 2015)

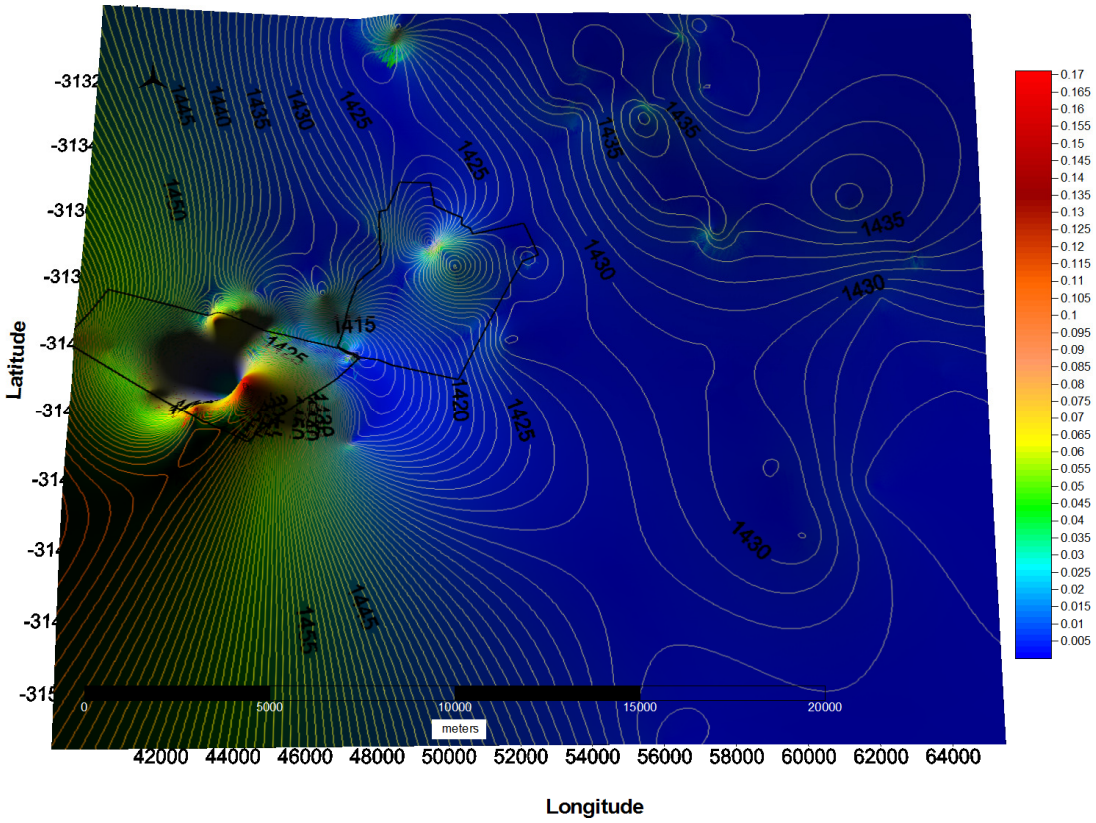


Figure 29: Groundwater gradients and hydraulic head contours (extracted from the Hydrocensus Report, compiled by Shangoni AquiScience. February 2015)

From the interpolated hydraulic head contours, it can be inferred that two distinct depression cones are formed. One extending from the from existing Bowden Quarry North approximately 7 km towards the north and, 1 km towards the east and west and 1 km towards the south. The other cone extends almost radially from quarries 4 and 5 approximately 2 km towards west, 3.3 km towards the east and extending for about 8 km towards the south and south-east (Figure 30). However, borehole data is lacking towards the immediate north and south of PPC Lime which makes the delineation of the zone of influence in Figure 30 questionable.[47]

[47] *It must be stressed that the cone extensions are estimations only based on interpolated borehole water levels only in one event in time and should not be a substitute for a groundwater flow model which will take into account parameters such as actual abstraction and sources, geology, lineaments, aquifer hydraulic parameters, recharge etc. Boreholes are lacking towards the north and south for a more accurate contouring of hydraulic heads. It is recommended that more boreholes be located or drilled towards the north and south nearer to PPC Lime to be included in an active and ongoing monitoring programme.*

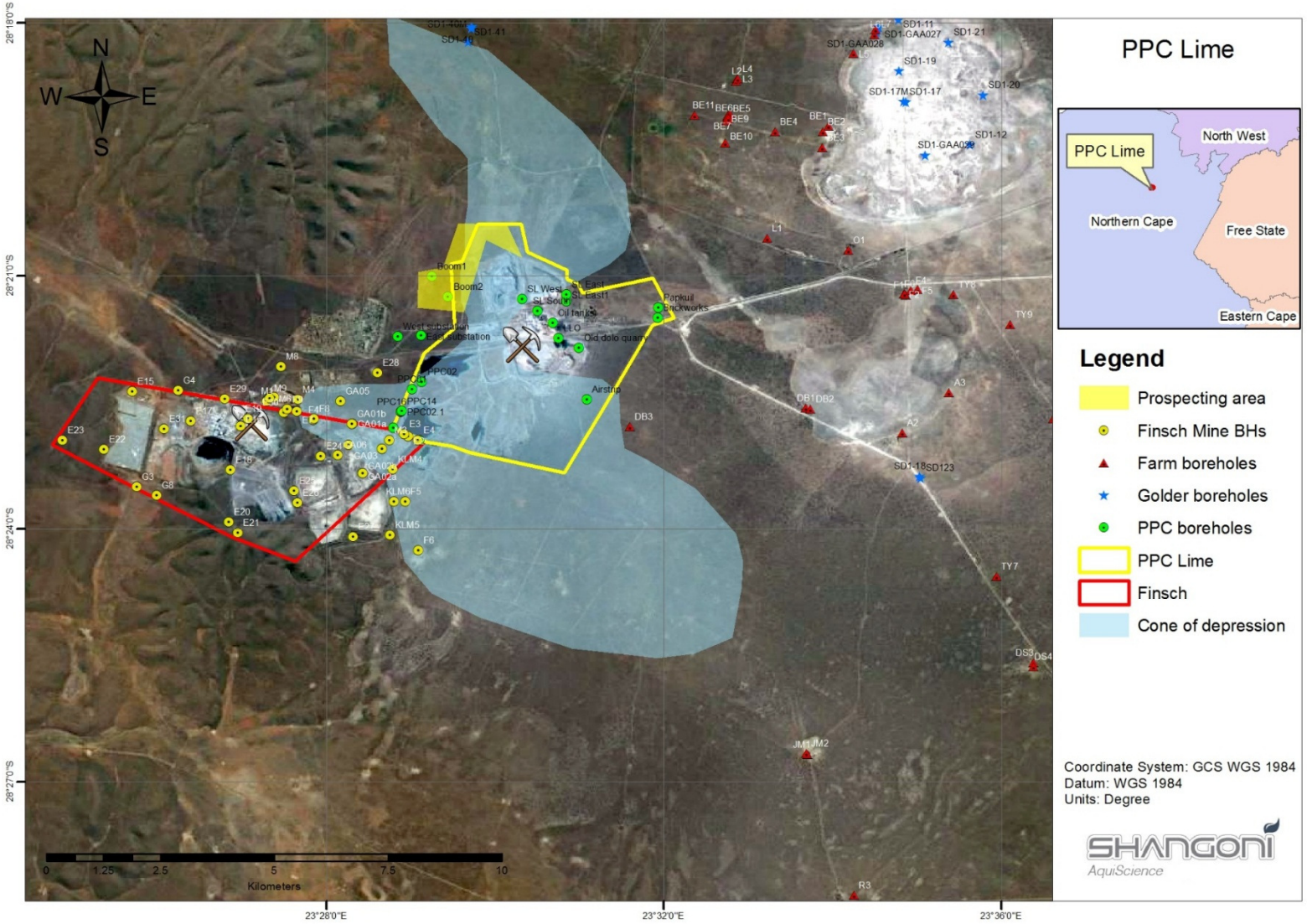


Figure 30: First estimation of PPC Lime's zone of influence (extracted from the Hydrocensus Report, compiled by Shangoni AquiScience. February 201

1.7 Groundwater quality

Groundwater samples were collected for chemical analysis during the hydrocensus from all of the PPC monitoring boreholes including selected samples from the privately owned boreholes. A total of 34 samples were taken from the above-mentioned boreholes during the survey.

The water samples were kept cool until it were submitted to Aquatico Laboratories, a SANAS accredited water laboratory (T0374) situated in Pretoria, Gauteng. The samples were analysed for major cation/anion analysis, nutrients as well as selected trace metals. Where available, historical chemistry data captured on PPC Lime's database was incorporated into the characterisation of the groundwater chemistry. An overview of the groundwater quality will be given in the following paragraphs at the hand of tabulated data and the conventional Durov, Piper and Stiff diagrams. The analytical results were subjected to the South African Nation Standard drinking water standards (SANS 241:2011) and DWA standards (WRC, 1998).

1.7.1 PPC monitoring boreholes

The boreholes currently included in PPC Lime's monitoring programme were sampled to infer any problem source areas as well as risk parameters. The data was interpreted based on the domestic colour coded classification system including the SANS for drinking water. The SANS 241: 2011 drinking water standards were used as objective whilst the WRC guidelines were used to classify a specific set of water quality data. The groundwater quality of PPCs monitoring boreholes as sampled during February 2015 are shown in Table 39.

The general hydrochemistry can be described as neutral to slightly alkaline, relatively non-saline but hard to extremely hard given the dolomitic geological setting. The electrical conductivity (EC) ranged between 17.1 mS/m and 180 mS/m, the former recorded for Substation West and the latter for borehole LLO, situated to the north of the Old dolomite Quarry, which could be related to seepage from the quarry and/or other source/s. Other parameters that recorded high to elevated concentrations include inorganic nitrogen especially in the form of total ammonia (NH_4 + NH_3) but also nitrate (NO_3) and manganese (Mn). The former may be attributed to the use of ammonia-nitrogen explosives and the latter due to fluctuating redox conditions in the groundwater caused by the percolation of magnesia rich solutions through the unconsolidated limestone beds.

The groundwater classification diagrams illustrated in Figures 15 – 17 in Annexure E4 show a general fresh recently recharged water with a typical dolomite character with a CaMg-HCO_3^- facies. However, boreholes LLO, SL South, SL West and PPC03 have Ca-$HCO_3^-SO_4$ character which is typical of mine affected water.

Table 39: Hydrochemistry of PPC Lime's monitoring boreholes

SITE ID		West subst.	East subst.	PPC02	PPC14	PPC15	LLO	SL East	Brickworks	Airstrip
pH	5 – 9.7	8.01	7.66	7.46	7.63	7.7	7.66	7.95	7.46	7.63
EC mS/m	≤170	17.1	**160**	113	94.5	75.6		95.5	93.3	95.4
TDS mg/l	≤1200	111	1040	735	614	491	1170	621	606	620
Ca mg/l	-	11.9	**254**	119	**161**	62.4	**355**	150	149	109
Mg mg/l	-	2.31	27.9	27.5	54.6	44.3	51.3	34.4	48.8	55.9
Na mg/l	≤200	9.4	24.9	52	13.2	23.4	49	37.4	16.1	25.6
K mg/l	-	5.36	13.5	8.16	5.82	6.02	1.68	2.79	2.78	19.5
MALK mg/l	-	42.6	699	295	492	282	296	294	466	525
Cl mg/l	≤300	34.4	88.7	67.3	25.5	60.1	98.5	68	35.3	51.8
SO_4 mg/l	≤500	2.07	58.3	165	75	18.2		148	48.4	3.28
NO_3 mg N/l	≤11	<0.017	<0.017	<0.017	<0.017	<0.017	5.16	2.27	5.75	0.059
NH_4 mg N/l	≤1.5						**0.686**			
Inorganic N mg/l	-	**6.87**	**37.5**	**17.8**	**1.7**	**4.61**	**5.85**	**3.85**	**13.36**	**8.21**
PO_4 mg P/l	-	<0.008	<0.008	**1.18**	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
F mg/l	≤1.5	0.259	0.246	0.331	0.27	0.319	0.193	0.329	0.516	0.34
Al mg/l	≤0.3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.036	<0.003	<0.003
Fe mg/l	≤2.0	<0.003		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Mn mg/l	≤0.5	<0.001					<0.001	<0.001	<0.001	
Hardness mg/l	-	39	749	410	627	338	1098	516	573	502
Classification*		**Class 3 Poor**			**Class 2 Marginal**	**Class 3 Poor**	**Class 3 Poor**	**Class 2 Marginal**	**Class 3 Poor**	**Class 3 Poor**
Worst parameter		**NH_4**			**Ca, NH_4 (Mn)**	**NH_4 (Mn)**	**Ca, SO_4**	**NH_4**	**NH_4**	**NH_4 (Mn)**

Shaded values exceed SANS 241: 2011 drinking water requirements

* Classification according to DWA domestic standards is based upon chemical constituents only

Table 39 continued

SITE ID		SL East1	PPC01	SL West	Oil Tank	Papkuil	Boom1	Boom2	PPC16	SL South
pH	5 – 9.7	8.01	7.32	7.81	7.5	7.37	7.88	7.6	7.57	7.68
EC mS/m	≤170	72.3	102	**116**	88.2	81.8	111	82.6	76.2	**121**
TDS mg/l	≤1200	470	663	754	573	532	722	537	495	**787**
Ca mg/l	-	92.8	**163**	**168**	132	**160**	**164**	146	92.5	**176**
Mg mg/l	-	47.9	23.6	24.9	52.6	11.9	33.3	33.2	40.4	38.9
Na mg/l	≤200	16.1	22.2	54.8	10	5.04	38.6	18.1	13.7	45.5
K mg/l	-	3.2	6.24	9.65	2.21	3.98	3.29	7.55	8.81	2.22
MALK mg/l	-	323	468	281	437	463	238	365	406	286
Cl mg/l	≤300	36.6	46.8	67.7	25.1	24.2	95.4	30.9	24.6	57.5
SO_4 mg/l	≤500	49.4	69.4	**190**	55.7	2.99	**190**	91.9	42.5	**246**
NO_3 mg N/l	≤11	5.87	<0.017	**8.39**	2.66	0.38	2	0.168	0.053	**7.73**
NH_4 mg N/l	≤1.5	0.297	1.45	0.257	0.146		0.102	**1.4**		0.027
Inorganic N mg/l	-	**6.17**	**1.45**	**8.65**	**2.81**	**2.22**	**2.10**	**1.57**	**1.63**	**7.76**
PO_4 mg P/l	-	<0.008	<0.008	<0.008	<0.008	**0.634**	<0.008	<0.008	**0.695**	<0.008
F mg/l	≤1.5	0.294	0.276	0.265	0.403	0.371	0.229	0.362	0.308	0.199
Al mg/l	≤0.3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Fe mg/l	≤2.0	<0.003	<0.003	<0.003	<0.003	0.246	<0.003	<0.003	0.238	<0.003
Mn mg/l	≤0.5	<0.001		<0.001	<0.001	0.175	<0.001	0.187		<0.001
Hardness mg/l	-	429	504	522	546	449	547	501	397	600
Classification*		**Class 1 Good**	**Class 2 Marginal**	**Class 2 Marginal**	**Class 1 Good**	**Class 2 Marginal**	**Class 2 Marginal**	**Class 2 Marginal**	**Class 2 Marginal**	**Class 1 Good**
Worst parameter		**EC/TDS, Ca**	**Ca, Mn, NH_4**	**Ca (SO_4)**	**Ca**	**Ca, NH_4**	**Ca (SO_4)**	**NH_4**	**Mn, NH_4**	**EC/TDS, SO_4**

Shaded values exceed SANS 241: 2011 drinking water requirements

* Classification according to DWA domestic standards is based upon chemical constituents only

1.7.2 Farm boreholes

The hydrochemical results for the farm boreholes as sampled during the PPC hydrocensus (February 2015) are tabulated in Table 40. *Note that not all surveyed boreholes were sampled; one borehole from each farm used for domestic purposes was sampled for chemical analyses.*

In general, the data indicates relatively good water quality in terms of major cations and anions except for the extreme hardness in most cases, which is mostly related to the Ca cation given the dolomitic geology. However, three boreholes, O1 (Suzette Vickters), A2 (Wynand de Jager) and DS3 (Thinus vd Spuy/Deon Stander) recorded high Cl (>300 mg/l) and relatively high SO_4 (139 mg/l-205 mg/l) and Na (115 mg/l-140 mg/l), displaying similar ion ratios with no significant dominating cations or anions as displayed in the relevant Stiff diagrams and Piper diagram in figures 19 and 20, respectively. These outliers are indicative of an intrusive body signature, most probably a dolerite dyke which may be evident in Figures 12-14 in Annexure E4.

High to very high inorganic nitrogen were also recorded for the majority of farm boreholes, albeit it mostly as NO_3. An elevated NO_3 concentration was recorded for borehole **DS3** (Thinus vd Spuy/Deon Stander) with a value of 50.1 mg N/l and a subsequent *Unacceptable* classification *(Class 4)*in terms of domestic use due to the hazard it poses to infants (methemoglobinemia/blue-baby-syndrome).

The Stiff diagrams (Figure 19 in Annexure E4) and Piper diagram (Figure 20 in Annexure E4) displays mostly CaMg-HCO_3^- waters except for boreholes O1, A2 and DS3 that have no distinct dominating cations or anions and is most probably related to an igneous intrusive body while the former indicates fresh relatively recent recharged groundwater.

It must be noted that due to mine abstractions and the subsequent formation of the cone of depression, polluting substances generated due to the mining processes cannot migrate in a pollution plume away from PPC since all polluting substances will move with groundwater (through advection) which are drawn inwards towards the areas of abstraction. This, together with the flow of groundwater being either towards PPC Lime or towards the east from the probable igneous intruded body acting as a flow boundary, imply that PPC Lime cannot be responsible for substandard water quality recorded for the farm boreholes.

Table 40: Hydrochemistry of farm boreholes

SITE ID		F1	R2	R3	JM1	JM2	BE11	DS1	DS3
pH	5 – 9.7	7.94	7.76	8.09	7.57	7.76	7.68	7.63	7.71
EC mS/m	≤170	100	102	74.1	136	136	71.5	73.3	
TDS mg/l	≤1200	650	663	482	884	884	464.75	476.45	
Ca mg/l	-	121	**164**	86.7	**159**	**164**	134	125	**246**
Mg mg/l	-	49	55.7	42.5	69.7	70.8	24.6	32.7	94.5
Na mg/l	≤200	38.9	14.9	13.2	44.2	44.3	8.34	6.67	129
K mg/l	-	6.85	2.5	10.2	9.62	9.6	1.21	1.14	97.6
MALK mg/l	-	328	459	378	400	420	337	395	494
Cl mg/l	≤300	85	66.9	29.4	126	129	25.4	20.5	
SO_4 mg/l	≤500	66.4	36.2	25.4	77.1	77.5	23.4	10.7	139
NO_3 mg N/l	≤11	**7.15**	**8.55**	1.12			4.31	1.27	
NH_4 mg N/l	≤1.5	0.741		0.13	0.046	0.048	0.05	0.037	0.039
Inorganic N mg/l	-	**7.89**	**10.57**	**1.25**	**18.05**	**18.15**	**4.36**	**1.31**	**50.14**
PO_4 mg P/l	-	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
F mg/l	≤1.5	0.328	0.337	0.329	0.394	0.41	0.235	0.274	0.313
Al mg/l	≤0.3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Fe mg/l	≤2.0	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Mn mg/l	≤0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hardness mg/l	-	504	639	392	684	701	436	447	1003
Classification*		**Class 1 Good**	**Class 2 Marginal**	**Class 1 Good**	**Class 2 Marginal**		**Class 1 Good**	**Class 1 Good**	
Worst parameter		**NO_3**	**Ca NH_4 (NO_3)**	**EC/TDS**	**NO_3, Ca**		**EC/TDS**	**EC/TDS**	

Shaded values exceed SANS 241: 2011 drinking water requirements

* Classification according to DWA domestic standards is based upon chemical constituents only

Table 40 continued

SITE ID		TY1	A2	TV1	L3	O1	DB3	HS1	BE10
pH	5 – 9.7	7.74	8.23	8.19	7.63	7.78	7.54	7.94	8.09
EC mS/m	≤170	103		**112**	80.3		103	90.4	72.9
TDS mg/l	≤1200	669	1118	728	522	1196	670	588	474
Ca mg/l	-	135	103	101	137	**189**	**165**	118	133
Mg mg/l	-	49.8	76.7	62.6	31.7	68.7	31.5	44	25.6
Na mg/l	≤200	38.8	140	34.8	15.2	115	26.6	30.7	12.2
K mg/l	-	6.07	26.5	6.61	1.73	15.5	2.68	4.44	1.75
MALK mg/l	-	420	283	314	322	245	454	368	292
Cl mg/l	≤300	75.6		89.2	52.2		44.2	73.9	45.7
SO_4 mg/l	≤500	59.5	**163**	46.4	69.7	**205**	36.1	52.5	57.9
NO_3 mg N/l	≤11	1.51	4.63		3.54		2.07	2.61	3.23
NH_4 mg N/l	≤1.5	0.036	0.037		0.382	0.215	0.063		0.14
Inorganic N mg/l	-	1.55	4.67	20.65	3.92	**15.82**	2.13	4.36	3.37
PO_4 mg P/l	-	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
F mg/l	≤1.5	0.261	0.263	0.311	0.233	0.231	0.301	0.329	0.239
Al mg/l	≤0.3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Fe mg/l	≤2.0	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Mn mg/l	≤0.5	<0.001	<0.001	<0.001	<0.001	<0.001	0.019	<0.001	<0.001
Hardness mg/l	-	542	573	510	473	755	542	476	438
Classification*		**Class 1 Good**	**Class 2 Marginal**	**Class 2 Marginal**	**Class 1 Good**	**Class 2 Marginal**	**Class 2 Marginal**	**Class 1 Good**	
Worst parameter		**EC**	**EC, Cl**	**NO_3, NH_4**	**EC/ TDS, Ca**	**NO_3, Cl, Ca**	**Ca (EC/TDS)**	**EC/TDS**	

Shaded values exceed SANS 241: 2011 drinking water requirements

* Classification according to DWA domestic standards is based upon chemical constituents only

Chapter J: Air Quality

Information contained in this section has been sourced from the following:

- PPC Lime Limited's dust monitoring programme;
- PPC Lime Acres EMP, Revision 5; dated February 2013;
- PPC Lime Limited's stack emission data.

Different air quality impact sources at PPC Lime Limited's site are identified. These include fugitive dust from drilling, blasting, hauling, crushing and transfer of materials in different points. Point source emissions are also identified at the existing processing plant which include the rotary kilns stacks (refer to Figure 32).

PPC Lime converts limestone into lime. This process, known as calcination, can be described by the following formula :

$CaCO_3 + Heat \rightarrow CaO + CO_2$

Limestone + Energy ➔ Lime + Carbon Dioxide

In the calcination process, the calcium carbonate molecule loses a molecule of carbon dioxide. The energy used for calcination is pulverized duff coal with an ash content of 18%. The carbon dioxide released from the limestone and generated from the burning of coal is then released into the atmosphere after the fine lime dust and coal ash have been removed by an electrostatic precipitator. Dust levels in the stacks are monitored on a continuous basis, trends are plotted and recorded on a graph.

1. Fall-out dust monitoring

PPC Lime implements an existing fall-out dust monitoring programme. A total of thirteen (13) dust buckets are located throughout the existing mining site. Table 41 below provides the coordinates of each dust bucket location. Figure 31 below provides a map showing the locations of the dust buckets. No PM10 and PM2.5 monitoring is currently conducted.

Table 41: Current dust bucket locations at PPC Lime Limited

Name	Latitude - S	Longitude E	Altitude (m)	type
LA Station	28°21'46.25"S	23°31'17.76"E	1495	Single
AEL	28°23'1.32"S	23°30'57.80"E	1407	Single
Die Boom North	28°20'55.12"S	23°29'22.04"E	1470	Single
Police Station	28° 21´ 31" 83	23° 31´ 27" 52	1448	Single
Reclaimer (Raw Stone)	28° 21´ 43" 60	23° 29´ 41" 04	1478	Single
Weather Station	28°21'31.41"S	23°30'8.02"E	1455	Single
Coal Reclaimer (Coal Yard)	28°21'36.07"S	23°30'57.54"E	1451	Single
Sewer Plant (STP)	28°21'25.25"S	23°31'0.53"E	1451	Single
Die Boom	28°21'18.83"S	23°29'32.14"E	1451	Twin
Eskom	28°21'8.94"S	23°31'15.04"E	1450	Twin
Airstrip	28°22'35.52"S	23°31'15.25"E	1449	Twin
Quarry	28°22'48.06"S	23°28'47.53"E	1454	Twin

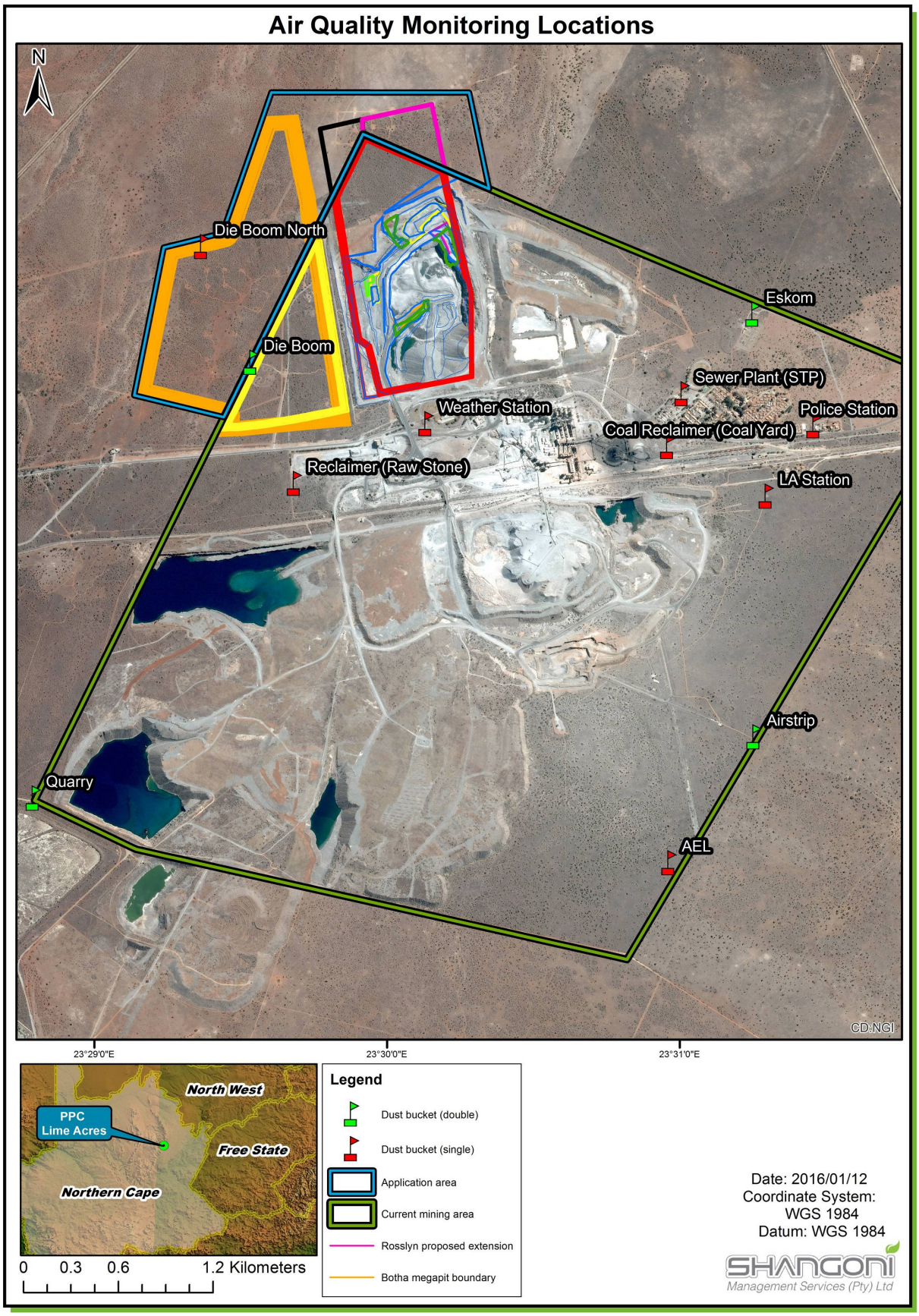


Figure 31: Map showing the dust bucket locations at the existing PPC Lime Limited site

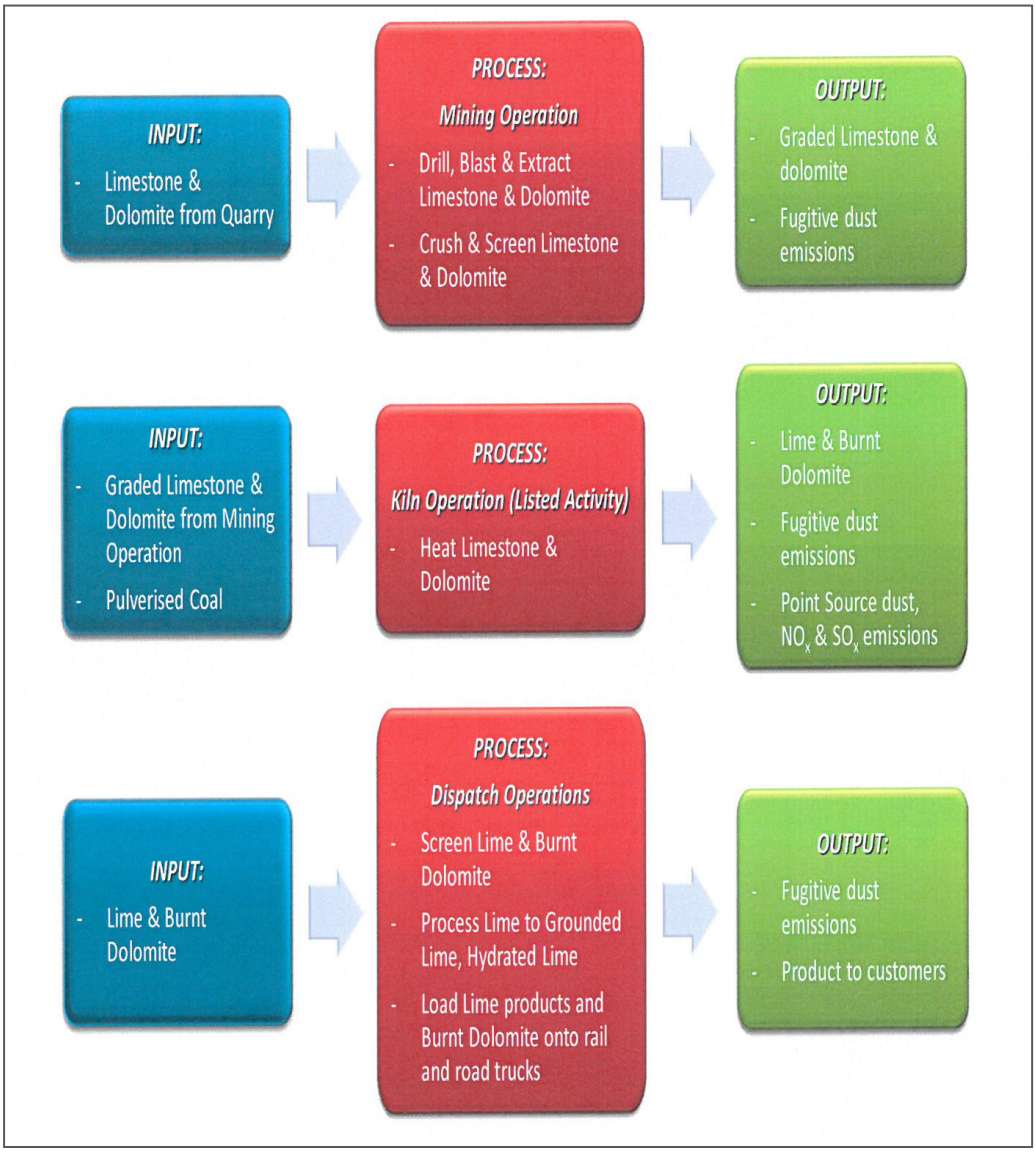


Figure 32:: Inputs, processes and outputs related to fugitive dust and point source emissions at PPC Lime

Tables 42, 43 and 44 below provides the fall-out dust monitoring results as measured by PPC Lime Limited for the period August 2014 to August 2015.

Table 42: Fall-out dust monitoring results – Dust from PPC

	Die Boom	Eskom	Airstrip	Quarry	Limit (1200mg/m^2/d)	Target (300mg/m^2/d)
Aug-14	669.000	726.000	449.000	697.000	1200.0	300.00
Sep-14	686.000	752.000	1398.000	739.000	1200.0	300.00
Oct-14	973.000	1222.000	1379.000	1049.000	1200.0	300.00
Nov-14	883.000	883.000	638.000	1116.000	1200.0	300.00
Dec-14	698.000	687.000	1003.000	708.000	1200.0	300.00
Jan-15	1130.000	987.000	905.000	1087.000	1200.0	300.00
Feb-15	1001.000	1356.000	1297.000	1152.000	1200.0	300.00
Mar-15	1310.000	2263.000	1287.000	1268.000	1200.0	300.00
Apr-15	636.000	911.000	755.000	472.000	1200.0	300.00
May-15	682.000	1114.000	1091.000	772.000	1200.0	300.00
Jun-15	798.000	882.000	941.000	766.000	1200.0	300.00
Jul-15	651	913	1147	1117	1200.0	300.00
Aug-15	631	663	996	625	1200.0	300.00

Table 43: Fall-out dust monitoring results – Dust to PPC

	Die Boom	Eskom	Airstrip	Quarry	Limit (1200mg/m^2/d)	Limit (300mg/m^2/d)
Aug-14	348.000	754.000	1025.000	742.000	1200	300
Sep-14	371.000	715.000	1103.000	881.000	1200	300
Oct-14	371.000	1202.000	1133.000	1003.000	1200	300
Nov-14	395.000	876.000	1158.000	843.000	1200	300
Dec-14	201.000	691.000	324.000	668.000	1200	300
Jan-15	553.000	1052.000	1296.000	947.000	1200	300
Feb-15	721.000	1252.000	1197.000	967.000	1200	300
Mar-15	846.000	1632.000	1579.000	1238.000	1200	300
Apr-15	596.000	553.000	727.000	533.000	1200	300
May-15	524.000	849.000	1268.000	738.000	1200	300
Jun-15	591.000	547.000	944.000	795.000	1200	300
Jul-15	776.000	881.000	1117.000	779.000	1200	300
Aug-15	467.000	719.000	1011.000	625.000	1200	300

Table 44: Fall-out dust monitoring results for the existing PPC Lime Limited site

Single buckets	LA Railway Station	AEL	Die Boom North	Police Station	Reclaimer	Weather Station	Coal yard Reclaimer	Sewer Plant (STP)	Limit (1200mg/m^2/d)	Target (300mg/m^2/d)
Aug-14	347.00	1285.00	492.00	515.00	648.00	1333.00	922.00	798.00	1200.0	300.00
Sep-14	1185.00	966.00	537.00	646.00	604.00	1246.00	1185.00	859.00	1200.0	300.00
Oct-14	1141.00	797.00	674.00	886.00	730.00	1797.00	1612.00	1329.00	1200.0	300.00
Nov-14	712.00	1433.00	437.00	733.00	634.00	1284.00	1451.00	1248.00	1200.0	300.00
Dec-14	445.00	416.00	476.00	659.00	469.00	977.00	1210.00	848.00	1200.0	300.00
Jan-15	498.00	459.00	1051.00	821.00	583.00	1487.00	1528.00	885.00	1200.0	300.00
Feb-15	1735.00	875.00	883.00	876.00	957.00	1597.00	1410.00	1299.00	1200.0	300.00
Mar-15	1182.00	863.00	913.00	954.00	1344.00	1831.00	1589.00	1155.00	1200.0	300.00
Apr-15	805.00	536.00	488.00	362.00	927.00	1140.00	1371.00	615.00	1200.0	300.00
May-15	888.00	633.00	508.00	685.00	521.00	1240.00	1550.00	994.00	1200.0	300.00
Jun-15	546.00	568.00	667.00	609.00	482.00	1056.00	1063.00	667.00	1200.0	300.00
Jul-15	471.00	641.00	807.00	465.00	491.00	1102.00	964.00	644.00	1200.0	300.00
Aug-15	674.00	583.00	556.00	543.00	527.00	831.00	783.00	667.00	1200.0	300.00

2. Stack emission monitoring

PPC Lime Limited has an Atmospheric Emission Licence (AEL) (Licence No. NC/AEL/ZFM/PPC01/2013) as contemplated in Section 40(1)(a) of the National Environmental Management: Air quality Act, 2004 (Act No. 39 of 2004), in respect of listed activity No. 5: Mineral Processing, Storage and Handling sub-category 5.7 – Lime production (using alternative fuels and/or resources). The AEL was issued in April 2015 and is valid until 31 March 2020.

The latest available stack emission monitoring results, as provided by PPC Lime Limited, are presented in Table 45 below.

Table 45: Stack emission monitoring results for the existing PPC Lime Limited site

Month	LK6	LK7	LK8	LK9	Average	Limit	Total
Sep-14	1.26	8.73	0.00	5.98	3.99	50	**15.98**
Oct-14	0.00	7.96	0.00	19.71	6.92	50	**27.67**
Nov-14	1.79	6.61	0.00	19.15	6.89	50	**27.54**
Dec-14	1.59	1.20	0.00	8.49	2.82	50	**11.28**
Jan-15	2.29	1.38	0.00	10.39	3.51	50	**14.06**
Feb-15	1.61	1.24	0.00	9.37	3.06	50	**12.23**
Mar-15	1.42	1.58	0.00	24.28	6.82	50	**27.28**
Apr-15	1.94	1.66	0.00	40.61	11.05	80	**44.22**
May-15	3.00	1.88	0.00	60.99	16.47	80	**65.87**
Jun-15	4.73	14.51	0.00	23.32	10.64	80	**42.56**
Jul-15	4.40	23.90	0.00	73.38	25.42	80	**101.68**
Aug-15	4.53	33.86	0.00	62.01	25.10	80	**100.41**
Sep-15	4.37	0.00	0.00	61.14	16.38	80	**65.50**

Chapter K: Noise

An environmental noise survey was conducted for the mine (including the proposed Quarry extension area) by Varicon cc in April 2015. The resultant report is attached as Annexure E5.

The sound levels were evaluated against the standards as specified in the SABS Code of Practice 0103 of 2008 (“the measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication”) with reference to Code SABS 0328 of 2008 (“Environmental Noise Impact Assessments”).

Table 46 below provides the typical rating levels for ambient noise in districts.

Table 46: Typical rating level for ambient noise

Type of district	Equivalent Continuous Rating Level ($L_{Req.T}$) for Ambient Noise					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
a) Rural Districts	45	45	35	35	35	25
b) Suburban with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with some workshops, business premises and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	65	55	55	45
f) Industrial districts	70	70	60	60	60	50

Note: *The values given are A-weighted sound pressure levels and include corrections for tonal character and impulsiveness of the noise*

The following environmental conditions were present during the survey periods.

Table 47: Environmental conditions present during the survey periods

Time	Weather conditions	Wind direction	Humidity	Ambient air Temperature
10:00 – 14:00 (Day time)	Strong wind blowing, partly cloudy to cloudy conditions.	North-Westerly Direction	75%	19,5 ^{0}C – 26,0 ^{0}C
20:00 – 22:00 (Night time with no mining activities)	Mild wind blowing, with cloudy skies.	North-Westerly Direction	60%	12,0 ^{0}C – 21,0 ^{0}C
22:00 – 24:00 (Night time with mining activities)	Mild wind blowing, with clear skies.	North-Westerly Direction	35%	14,5 ^{0}C – 22,0 ^{0}C

The test results were compared to the typical rating levels (Category E) (assumed to be best fit) as provided in Table 47 shown above.

The results of the environmental noise surveys at the 6 positions around the proposed quarry extension area are tabulated below in Table 48. Measurement results are representative of both daytime and night time conditions (refer to the Google image that display the sampling positions, shown as Figure 2 in Annexure E5).

Due to the fact that mining activities only commence at 22:00, two sets of night time levels were recorded. During the first round of measurements only the process plant was operational and some noise levels were recorded outside of the mining area during no mining activities. During the second round of night measurements, sampling was done after the mining activities commenced. This was done as a “before” and “after” evaluation in terms of noise levels that could be disturbing for residents close to the operation.

In Table 48 below the two sets of measurements recorded during the night shift period, are displayed as (A) and (B) for identification purposes.

(A) = Noise levels before mining commenced

(B) = Noise levels after mining commenced

The reflected values in the table below represent the noise levels of the relevant sampling positions as described. All measurements recorded were below the statutory levels as stipulated in Table 48 under the category “E” that was chosen as the best fit for the current situations.

Table 48: Noise measurement results

TABLE 2: ENVIRONMENTAL NOISE LEVELS MEASURED AROUND THE PERIMETER OF THE OPERATION AT VARIOUS SAMPLING LOCATIONS.								
Measuring Positions	**Approximate Google Co-ordinates**	**AMBIENT NOISE (dB(A))**						**Remarks**
		Day-time Levels *(outdoors)*			**Night-time Levels *(outdoors)***			
		Average Results	**1.1 Typical 1.2 Rating (SABS 0103) (Category E)**	**Excess $\Delta L_{Req,T}$ (dBA)**	**Average Results**	**1.3 Typical Rating (SABS 0103) (Category E)**	**Excess $\Delta L_{Req,T}$ (dBA)**	
Position A: Eastern boundary of the Lime Acres Village.	28^{0}21'40.77"S 23^{0}28'38.48"E	39.4	65	+25.6	40.9 (A) 42.6 (B)	55	+14.1 +12.4	**Day-time:** - On the eastern boundary of the village which is fairly remote from the mine operations. Normal town and human activities contributed to the levels measured. No significant contribution from the mines or plant could be recorded. **Night-time (A):** – On the eastern boundary of the village and the sounds from the road traffic and normal town activities during early evening were more eminent than the sounds from the plant operation. **Night-time (B):** - Late evening and the mining operations have started. The village is quiet and the sound from the plant and mining operations are clearly audible. The levels recorded are still below the allowable limits.
Position B: Entrance gate to the private game farm. Directly next to the main road leading to	28^{0}21'35.75"S 23^{0}29'36.70"E	44.5	65	+20.5	36.6 (A) 39.7 (B)	55	+18.4 +39.7	**Day-time:** - Plant noise more evident at this point, but the road traffic on the main road proved to be more significant. **Night-time (A):** – Less road traffic and the sound from the process plant is the highest contributor during the

the mine and plant. Also representing the southern corner of the proposed extension portion.								early evening. **Night-time (B):** - Late evening and the mining operations are ongoing. The noise levels recorded show an increase due to the mining activities in combination with the plant.
Position C: Northern corner of the private game farm – close to the western corner of the limestone quarry. Also representing the western corner of the proposed extension portion.	28^{0}20'51.55"S 23^{0}29'28.41"E	37.9	65	+27.1	35.6 (A) 38.3 (B)	55	+19.4 +16.7	**Day-time:** - Noise from the trucks inside the lime stone quarry. The truck's reverse hooters were the main contributors. The wind acted as an attenuation factor due to the wind direction being north-westerly at this sampling point, taking the noise away from the sampling position. **Night-time (A):** – Early evening and the only noise that could be recorded, was traffic on the main roads and the normal veld noises. North-western wind tends to move the sound away from the point of sampling **Night-time (B):** - Late evening and the mining activities contributes to the recorded sound levels at this point. Reverse hooters, engine noises and tipping of raw material are the main contributors. North-western wind tends to move the sound away from the point of sampling.
Position D: North-western corner of the proposed mining extension portion.	28^{0}20'26.59"S 23^{0}29'49.27"E	32.8	65		46.7 (B)	55	+8.3	**Day-time:** - Some noise contribution from the open pit area, but the main contributing factor was road traffic noise from the main road leading into the village. **Night-time (B):** – Late evening after the mining process has started. Remote from the lime stone open pit, but with no wind at this stage, the sounds from the haul trucks were very prominent.

Position E: Northern corner of the proposed mining extension portion.	28^{0}20'24.25"S 23^{0}30'12.99"E	30.9	65		49.4 (B)	55	+5.6	**Day-time:** - Noise from the distant main road leading into the village. No significant contribution from the mine or plant activities **Night-time (B):** – Late evening after the mining process has started. Remote from the lime stone quarry, but with no wind at this stage, the sounds from the haul trucks were very prominent.
Position F: North-eastern corner of the limestone quarry. Also representing the north-eastern corner of the proposed mining extension portion	28^{0}20'40.62"S 23^{0}30'14.03"E	43.8	65		54.7 (B)	55	+0.3	**Day-time:** - Sound from the mining activities in the limestone quarry very evident. **Night-time (B):** – Close to the existing lime stone quarry and the noise levels are dominated by the mining activities. This is to be expected. Fortunately the high walls deflects the sounds away from any possible sensitive areas that could result in complains of noise disturbance.

Ambient Noise: The totally encompassing sound in a given situation at a given time and usually composed of sound from many sources both near and far.

Chapter L: Visual

The area is bounded on its western side by a broken mountain range, known as the Asbestos Mountain belt (as previously indicated in Figure 13). To the east of the Asbes Mountain, the topography is an almost flat landscape with topographical heights of 1400 m above sea level.

The Lime Acres area is populated by residents and employees of the mines and certain inter town travelling does occur. Tourism traffic, if any, generally passes 15km north of Lime Acres.

The operation, in terms of visual aspect, can be divided into : (a) Plant buildings, offices, stacks and structures, (b) Overburden dumps and evaporation ponds and (c) the Kiln Waste Dump.

From the residential area these aspects remain more or less hidden with occasional glimpses of all three elements depending on the elevation of the viewpoint. For the resident returning to Lime Acres the operation is visible along certain lengths of road from about a 10km distance.

For the traveller on the tarmac roads connecting other towns in the vicinity there is little visual impact with the exception of a higher viewpoint some 30 km away which provides a fleeting glimpse of the plant buildings and residue dumps.

Other dirt roads with minimal vehicle and pedestrian density also provide aspects of the operation; again one is conscious of the plant and the residue dump with more visibility of the overburden dump from the eastern view. These dumps will also continue to be rehabilitated as the operation progresses thus improving their visual impact.

Chapter M: Protected areas and conservation planning

At the time of compilation of this Scoping Report, no alone-standing Conservation Plan was available for the Northern Cape Province.

There are no protected areas within the direct vicinity of the PPC Lime Limited proposed Quarry Extension area. However, one depression wetland (a southern Kalahari salt pan) was delineated within the proposed Quarry extension area, as part of the Wetland Desktop Assessment (refer Annexure E3). The delineated wetland is part of a much larger pan system known as Rooi pan (approximately 1 500 ha), of which 25.3 ha falls within the proposed Quarry Extension boundary application area. The pan is one of several large pans in the region. Figure 24 shows the delineated pan together with the 30m wetland buffer in relation to the proposed Quarry extension area.

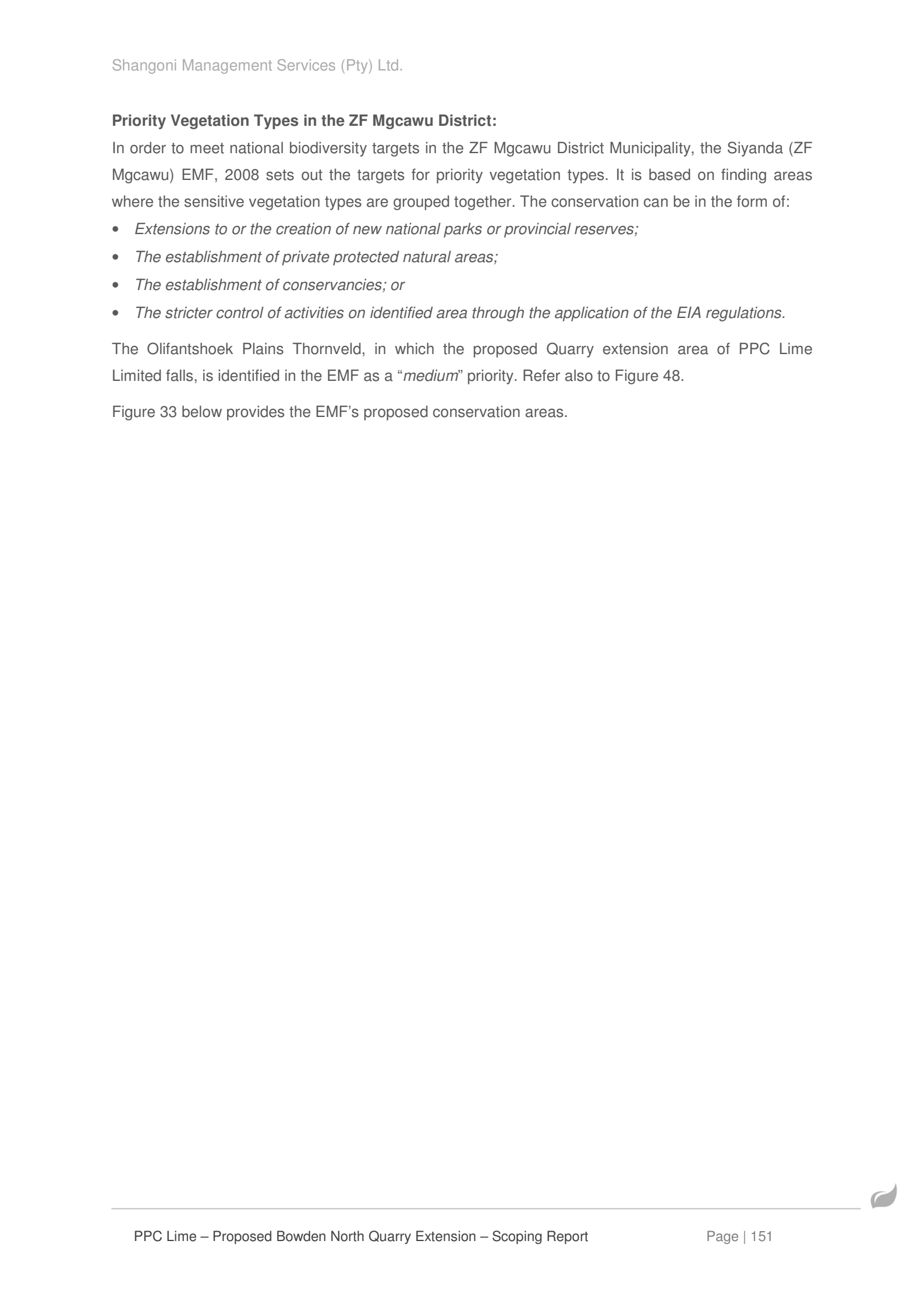
Priority Vegetation Types in the ZF Mgcawu District:

In order to meet national biodiversity targets in the ZF Mgcawu District Municipality, the Siyanda (ZF Mgcawu) EMF, 2008 sets out the targets for priority vegetation types. It is based on finding areas where the sensitive vegetation types are grouped together. The conservation can be in the form of:

- *Extensions to or the creation of new national parks or provincial reserves;*
- *The establishment of private protected natural areas;*
- *The establishment of conservancies; or*
- *The stricter control of activities on identified area through the application of the EIA regulations.*

The Olifantshoek Plains Thornveld, in which the proposed Quarry extension area of PPC Lime Limited falls, is identified in the EMF as a "*medium*" priority. Refer also to Figure 48.

Figure 33 below provides the EMF's proposed conservation areas.



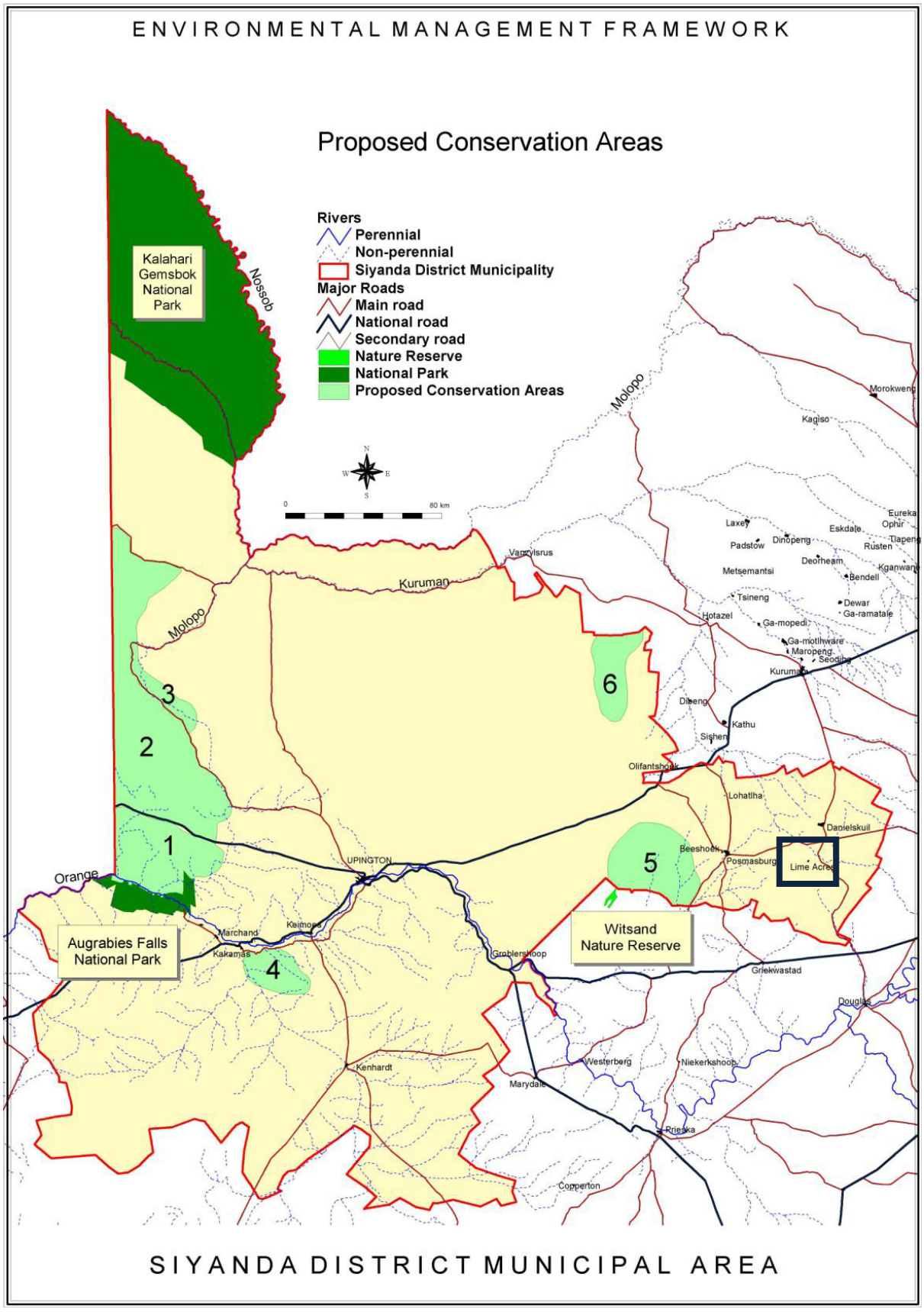


Figure 33: Proposed Conservation Areas Map (source: Siyanda ZF Mgcawu EMF, 2008)

Environmental Sensitivity Index:

The main factors that were used to compile the index as contained in the Siyanda (ZF Mgcawu) EMF, 2008, include the following:

- The erosion potential of soil where soils with a high erosion potential were awarded a sensitivity of 1;
- The conservation priority of veld types for veld types with a medium conservation priority were awarded a sensitivity count of 1 those with a high conservation priority were awarded a count of 2 and those with a very high conservation priority were awarded a count of 3;
- Topographical areas with a high variance in shape and form were awarded a sensitivity count of 1;
- All watercourses, drainage lines and pans (including a 32m buffer on either side) were awarded a sensitivity count of 2; and
- All transformed areas were awarded a sensitivity count of -1.

Refer to Figure 34 below for an extract of the Environmental Sensitivity Index Map, as taken from the Siyanda EMF, 2008.

The EMF, 2008 further states that due to the nature of the vast area with a low population there are no significant landuse conflicts in the area that need to be addressed in the EMF with the exception of activities within the Orange River floodplain.

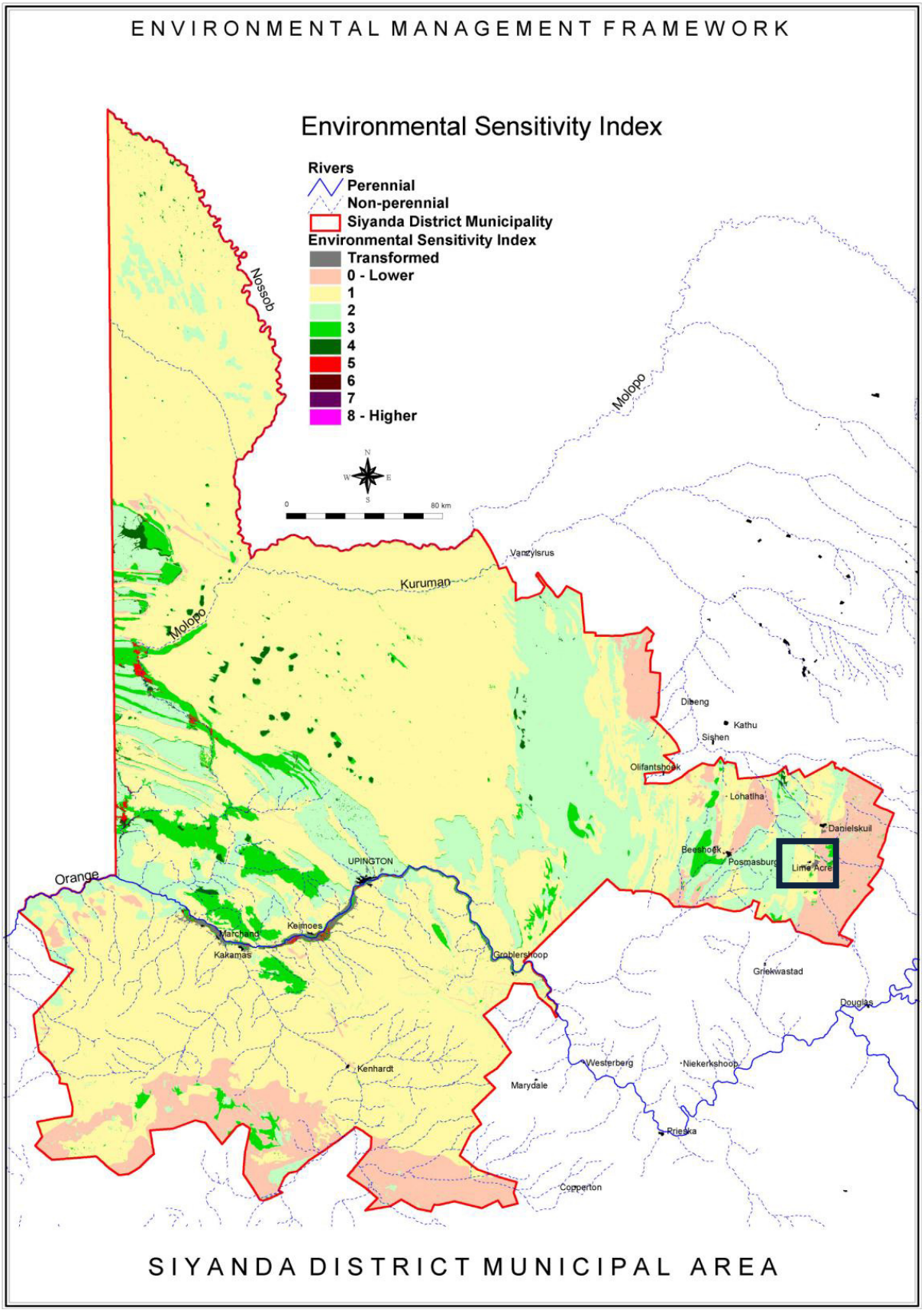


Figure 34: Environmental Sensitivity Index (source: Siyanda (ZF Mgcawu) EMF, 2008)

Environmental Control Zones

The purpose of environmental control zones is to indicate areas that require a specific type or regime of control due to unique environmental elements that occur in these areas. It may or may not be linked to the application of Environmental Impact Assessment (EIA) legislation and should be dealt with at a more strategic level where it should serve as a guide for decision-making and planning.

In respect to the Siyanda (ZF Mgcawu) district as a whole the following specific environmental control areas have been identified:

- Zone 1: Potential sensitive groundwater resources (4.2% of the total area);
- Zone 2: Potential wind erosion areas (47.1% of the total area);
- Zone 3: Potential high to very high vegetation conservation areas (8.0% of the total area);
- Zone 4: Potential sensitive groundwater resources and potential wind erosion areas 0.04% of the total area);
- Zone 5: Potential sensitive groundwater resources and potential high to very high vegetation conservation areas (0.1% of the total area);
- Zone 6: Potential wind erosion areas and potential high to very high vegetation conservation areas (3.0% of the total area); and
- Zone 7: Low control zone (37.0% of the total area).

According to the Siyanda (ZF Mgcawu) EMF, 2008, the PPC Lime Limited and proposed Quarry extension area falls within "*Zone 1: Potential sensitive groundwater resources*". Refer to Figure 35 below. A description of "Zone 1" is provided below.

Zone 1: Potential sensitive groundwater resources

The karst aquifers that occur in the dolomite and lime stone rocks in the area represent a major strategic water resource. It is sensitive both in respect to the abstraction and potential pollution of groundwater.

The following management parameters are suggested for the zone:

- Land uses and activities that are compatible with the zone and may be allowed without further assessment:
  - Nature conservation.
  - Stock farming that does not exceed the carrying capacity of the veld.
  - Game farming that does not exceed the carrying capacity of the veld.
- Land uses and activities that may be compatible (depending on the specific nature of land use or activity) and that may be considered in the zone after an appropriate level of impact assessment (as required by law) has been conducted:
  - Irrigated agriculture;
  - Establishment of towns or settlements (including components thereof) and related infrastructure;

- Extraction of groundwater;
- Mining and quarrying;
- Decanting of water from mines;
- Bulk sewer and storm water infrastructure; and
- New roads, railways, pipelines and cables.

- Land uses and activities that are not appropriate for this zone:
  - The bulk storage of hazardous substances; and
  - Unrehabilitated spoil heaps and mine dumps.
- General parameters for the zone:
  - Relatively small facilities that store hazardous materials such as filling stations should be limited to the minimum necessary in the area in order keep the risk of polluting the aquifers in the area to the minimum possible; and
  - Geohydrological investigations should be a standard requirement for all impact assessments of activities that relates to the storage of hazardous materials and the abstraction of groundwater.

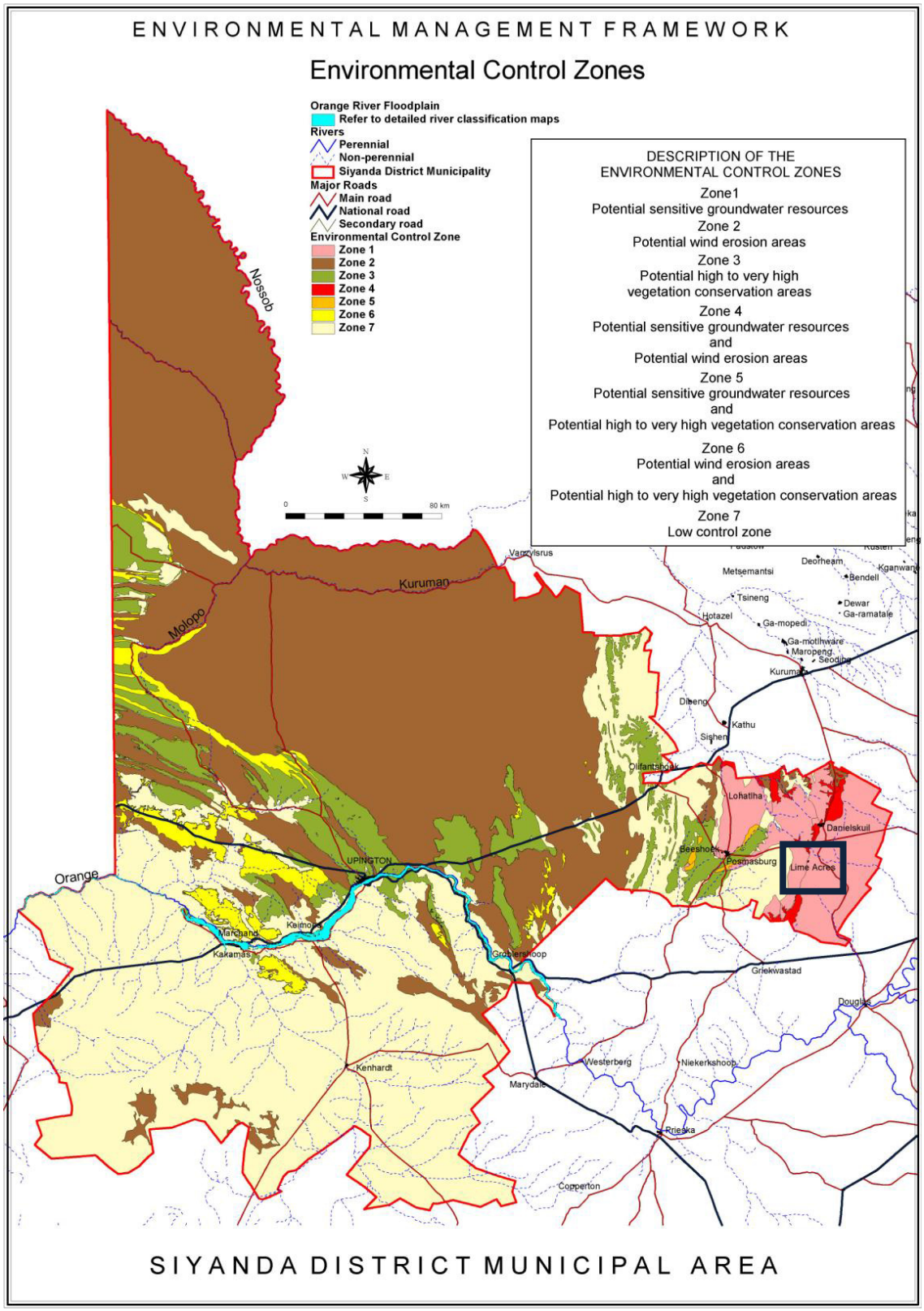


Figure 35: Environmental Control Zones (source: Siyanda (ZF Mgcawu) EMF, 2008)

Chapter N: Sites of archaeological and cultural importance

1. Archaeological aspects

Information on sites of archaeological and cultural importance as contained under this section has been obtained from the following sources:

- Report titled: "Archaeological and historical investigation of the proposed mining activities at the farm Rosslyn, Lime Acres, Northern Cape:, dated November 2007 and compiled by Cobus Dreyer; and
- Report titled: "*Archaeological impact assessment for the proposed PPC Lime Opencast Extension, PPC Lime Acres, Northern Cape Province*", dated August 2015 and compiled by Heritage Contracts and Archaeoligical Consulting CC, attached in Annexure E6.

1.1 Historical and archaeological background of the area

Numerous projects were completed in the greater study area e.g. Henderson 2005, Morris 2008, Webley 2010 & Fourie 2011 and Hutton 2014. An assessment of Rock Art close to Danielskuil was also conducted (Morris & Beaumont 1994). Henderson conducted a study to the west of the current area under investigation for Finch mine and recorded historic structures and middens, cemeteries and a range of Stone Age manifestations. Morris conducted a study approximately 1.5 km to the south on Carter Block 458 and recorded twentieth century debris relating to mine workers but no archaeological remains. The Webley and Fourie surveys were conducted approximately 17 km to the North West and recorded historical structures, cemeteries and Stone Age material. Closer to the current area under investigation, Dreyer (2007) conducted a CRM project on Carter Block and concluded that no heritage artefacts were present in the study area.

Google Earth and 1:50 000 maps of the area were utilised to identify possible places where archaeological and historical sites might be located. The database of the Genealogical Society of South Africa indicated no known grave sites within the study area.

The archaeological record for the greater study area consists of the Stone Age and Iron Age.

1.1.1 Stone Age

South Africa has a long and complex Stone Age sequence of more than 2 million years. The broad sequence includes the Later Stone Age, the Middle Stone Age and the Earlier Stone Age. Each of these phases contains sub-phases or industrial complexes, and within these we can expect regional variation regarding characteristics and time ranges. For Cultural Resources Management (CRM) purposes it is often only expected/ possible to identify the presence of the three main phases. Yet sometimes the recognition of cultural groups, affinities or trends in technology and/or subsistence practices, as represented by the sub-phases or industrial complexes, is achievable (Lombard 2011). The three main phases can be divided as follows;

- Later Stone Age; associated with Khoi and San societies and their immediate predecessors. Recently to ~30 thousand years ago.

- Middle Stone Age; associated with Homo sapiens and archaic modern humans. 30-300 thousand years ago.
- Earlier Stone Age; associated with early Homo groups such as Homo habilis and Homo erectus. 400 000-> 2 million years ago.

The larger study area has a wealth of pre-colonial archaeological sites (Beaumont & Morris 1990; Morris & Beaumont 2004). Famous sites in the region include the world renowned Wonderwerk Cave to the north of the study area. Closer to Kuruman two shelters on the northern and southern faces of GaMohaan (in the Kuruman Hills north west of the town) contain Later Stone Age remains and rock paintings. Rock art is known to occur at Danielskuil to the north and on Carter Block itself (Morris 2008). Middle Stone Age material is on record around the study area.

Archaeological surveys have shown rocky outcrops and hills, drainage lines, riverbanks and confluences to be prime localities for archaeological finds and specifically Stone Age sites, as these areas where utilized for settlement of base camps close to water and hunting ranges. Studies in close proximity to the study area collaborates this e.g. Henderson 2005, Webley 2010, Fourie 2011.

1.1.2 Iron Age

Iron Age expansion southwards past Kuruman into the Ghaap plato and towards Postmasburg is dated to the 1600's (Humphreys, 1976 and Thackeray, 1983). Definite dates for Tswana presence in the Postmasburg area are around 1805 when Lichtenstein visited the area and noted the mining activities of the Tswana (probably the Thlaping) tribes in the area. The area of Danielskuil was named by the Thlaro as Thlaka la tlou (reeds of the elephant) and with the Thlaping they settled the area from Campbell in the east to Postmasburg and towards the Langeberg close to Olifantshoek in the north west before 1770 (Snyman, 1988).

The Korana expansion after 1770 started to drive the Thlaro and Thlaping further north towards Kuruman (Shillington, 1985).

1.2 Proposed Quarry extension area and surrounds (including existing PPC Lime site)

A Phase 1 Archaeological Impact Assessment is a pre-requisite for development in South Africa as prescribed by the South African Heritage Resources Agency (SAHRA) and stipulated by legislation. The overall purpose of a heritage specialist input is to:

- Identify any heritage resources, which may be affected;
- Assess the nature and degree of significance of such resources;
- Establish heritage informants/constraints to guide the development process through establishing thresholds of impact significance;
- Assess the negative and positive impact of the development on these resources;
- Make recommendations for the appropriate heritage management of these impacts.

An Archeaological and historical investigation of the proposed mining activities at the farm Rosslyn, Lime Acres, was conducted in November 2007, by Cobus Dreyer. The following finds were recorded for the area:

- Two graveyards. Grave Site 1 and Grave Site 2 (refer also to latest assessment information below); and
- Arachaeological material appearing in the form of a small scatter of stone flakes on the surface.

A Phase 1 Archaeological Impact Assessment was conducted for the PPC Lime proposed quarry extension, which also again included a portion of the farm Rosslyn. The report titled: "*Archaeological impact assessment for the proposed PPC Lime Opencast Extension, PPC Lime Acres, Northern Cape Province*", dated August 2015 and compiled by Heritage Contracts and Archaeoligical Consulting CC, is attached hereto in Annexure E6.

A field survey of the study area was conducted; focusing on drainage lines, outcrops, high lying areas and disturbances in the topography. The study area was surveyed by means of vehicle and extensive surveys on foot by a professional archaeologist on the 6th and 7th March 2015.

All sites discovered inside the proposed development area was plotted on 1:50 000 maps and their GPS co-ordinates noted. Digital photographs were taken at all the sites.

1.3 Baseline description of study area

The north and north eastern portion of the property is currently fallow and is characterised by a undulating landscape with the low-lying areas covered in grass veld. The southern portion of the study area is used as a game reserve by PPC and is characterised by rising rocky ridges covered with shrubs and trees.

In terms of the built environment (Section 34 of the NHRA), no standing buildings of significance were recorded. In terms of the archaeological component of Section 35 within the study area isolated Middle Stone Age (MSA) artefacts were recorded scattered over the study area. Two contemporary middens associated with mine workers/farm labourers were also recorded. Outside of the proposed quarry area two cemeteries were recorded that will not be impacted on (refer to Figures 36 and 37).

Cemetery 1 (also identified as Grave Site 2 in 2007) is located approximately 1 km to the south of the proposed quarry and no impact is foreseen on the site. The cemetery is overgrown and consists of approximately 16 graves with calcrete dressings (Figure 36).

Heritage Significance: Generally Protected A (GP.A)

Figure 36: Cemetery 1 viewed from the east

Cemetery 2 (also identified as Grave Site 1 in 2007) is located to the east of the current mining operations 1.8km from the new proposed quarry and no impact is foreseen on the site. It is a large cemetery that is fenced off with at least 80 graves. Grave dressings consist mostly of calcrete with two granite headstones (Figure 37). This site is also recorded by Dreyer 2007.

Heritage Significance: Generally Protected A (GP.A)

Figure 37: Cemetery 2 viewed from the south

Midden 1 is located within the south eastern portion of the proposed quarry. Material remains consist of industrial artefacts like metal, glass and fragments of clothing. It is assumed that the feature is associated with 20th century farm or mine workers. It is also possible that a demolished mud dwelling used to be at this location (Figure 38).

Heritage Significance: Generally Protected C (GP.C)

Figure 38: Artefacts from Midden 1

Midden 2 consists of two middens located approximately 20 meters apart. These are large middens (10 meter in diameter) and might be the result of a dumping site. Material remains consist of industrial artefacts like metal, glass and fragments of clothing (Figure 39). It is assumed that the features are associated with 20th century farm or mine workers debris.

Heritage Significance: Generally Protected C (GP.C)

Figure 39: Artefacts from Midden 2

Isolated Middle Stone Age artefacts are scattered over the eastern portion and to a lesser extent in the western portion of the study area in very low density's (less than 2 artefacts per 6m²). These artefacts are scattered too sparsely to be of any significance apart from noting their presence, which has been done so in this report. These low density scatters are of low significance and corroborates findings in the area where these isolated artefacts has been given a low significance rating (Henderson 2005, Dreyer 2007, Fourie 2014). Artefacts consist mostly of miscellaneous flakes and

broken pointed flakes with faceted striking platforms (Figure 40). Raw material consists of igneous and metamorphic rocks.

Heritage Significance: Generally Protected C (GP.C)

Figure 40: Ventral and dorsal of artefacts found in the study area

Stone Age material found in the larger study area spans the Earlier, Middle and Later Stone Ages through Pleistocene and Holocene times although only isolated MSA artefacts were recorded in the study area similar to the study by Dreyer (2007) and the study by Morris (2008). Higher concentrations were recorded by Henderson (2005) and Fourie (2015) probably attributed to the location of these sites closer to higher lying areas and water resources that is absent within the current study area.

Carter Block is known to contain engravings on dolomite surfaces (Morris 2008). The exact location of these engravings are not clear from the Morris report but are indicated to occur outside and to the south of the proposed quarry area (red dotted area in Figure 41). Very few dolomite surfaces were noted during the survey and none of these had any engravings on them.

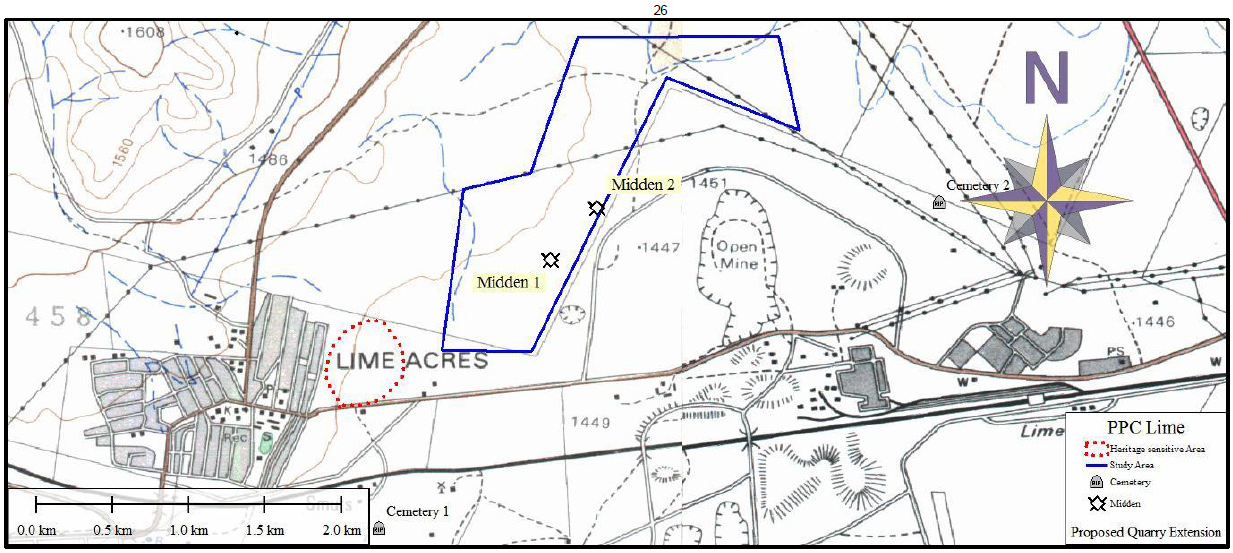


Figure 41: Map showing the identified features on-site (refer also to Figure 48).

2. Palaeontological aspects

A desktop Palaeontological Assessment was conducted for the proposed Quarry Extension. The resultant report is attached in Annexure E7. Information contained in this section has been sourced from the mentioned report, titled: "*Desktop Palaeontological Heritage Impact Assessment report on the site of a prospecting area proposed to become an extension of the existing PPC Lime Acres Quarry, to be located to the immediate west and north-west of the existing PPC Lime Acres Quarry on the farm Carter Block 458, Postmasburg Magisterial District, Northern Cape Province"*, dated April 2015 and compiled by Millsteed, B.D.

Section 38 of the of the National Heritage Resources Act (Act No. 25 of 1999), stipulates that any person who intends to undertake an activity that falls within the following:

- The construction of a linear development (road, wall, power line, canal etc.) exceeding 300 m in length,
- The construction of a bridge or similar structure exceeding 50 m in length,
- Any development or other activity that will change the character of a site and exceed 5 000 m^2 or involve three or more existing erven or subdivisions thereof,
- Re-zoning of a site exceeding 10 000 m^2,
- Any other category provided for in the regulations of SAHRA or a provincial heritage authority,

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development. If there is reason to believe that heritage resources will be affected by such development, the developer may be notified to submit an impact assessment report. A Palaeontological Impact Assessment (PIA) only looks at the potential impact of the development palaeontological resources of the proposed area to be affected.

Section 2 of the Act defines "palaeontological" material as "any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains".

As per the Desktop Palaeontological Assessment Report, the project area is completely underlain by rocks of the Neoachaean Campbell Rand Subgroup, Transvaal Supergroup. A summary of the characteristics of the Campbell Rand Subgroup and its fossiliferous potential follows.

The Campbell Rand-Subgroup forms part of the Transvaal Supergroup within the Griqualand West Basin. Together with the correlative Malmani Subgroup, which occurs in the Transvaal Basin, the two units cover approximately 190,000 km^2 and probably originally covered the entire Kaapvaal Craton with an aerial extent exceeding 600,000 km^2 (Beukes, 1987). A single zircon obtained from tuff near the top of the Monteville Formation (the basal unit of the subgroup) has provided an age of 2555 Ma (Altermann and Nelson, 1998). Similarly, the Campbell Rand Subgroup has been dated as being approximately 2521 Ma in age by Sumner and Bowring (1996).

Significant amounts of the Campbell Rand Subgroup consist of carbonate rocks (Beukes, 1987). The Monteville, Reivelo Fairfield, Klipfontein, Papkuil, Klippankogelbeen, Gramohaan and Tsineng Formations collectively constitute the Campbell Rand Subgroup and are all predominantly comprised of grey, shallow marine dolomites, many of which are stromatolitic or contain algal mats. Indeed, the Monteville and Reivelo Formations in particular contain giant stromatolitic domes (Eriksson et al., 2006). It is pertinent to note that and metallurgical dolomite is mined near Lime Acres (Altemann and Wotherspoon, 1995) and, thus, such dolomites may well be expected to underlie the proposed quarry extension area.

2.1 Palaeontological potential

The Monteville, Reivelo Fairfield, Klipfontein, Papkuil, Klippankogelbeen, Gramohaan and the Tsineng Formations collectively constitute the Campbell Rand Subgroup and all contain stromatolites and algal mats. The Monteville and Reivelo Formations in particular contain giant stromatolitic domes (Eriksson et al., 2006). The stromatolite assemblages within the carbonates in the Transvaal Supergroup tend to be abundant where they occur and can dominate the lithology. The palaeontological potential of the Campbell Rand Subgroup is, accordingly, high. No other fossil macrofossils are known in any rocks of comparable age within South Africa.

Chapter O: Regional socio-economic structures

The information provided under this section has been sourced from the following:

- PPC Lime Limited's Social and Labour Plan (SLP) for the period 2014 to 2018 (attached hereto as Annexure F);
- The Integrated Development Plan (IDP) titled: "*Kgatelopele Local Municipality IDP Review 2013/14 Formal Final Draft*", (IDP, 2013/14); and
- Siyanda (ZF Mgcawu) District Municipality's Environmental Management Framework (EMF), 2008.

1 Demographic profile

1.1 Population

The PPC Lime Limited operation as well as the proposed quarry extension area is located in in Ward 4 of the Kgatelopele Local Municipality, which forms part of the ZF Mgcawu District Municipality in the Northern Cape Province. Lime Acres is situated approximately 150 km from Kimberley and 23 km from Danielskuil. The mining operation, which extracts limestone and dolomite, is located 3 km from the Lime Acres village.

The Kgatelopele Local Municipality has a total population of 18 687. 50.7% of the population being male, while 49.3% are female. The population growth rate has been 2.37% between 2001 and 2011.

The municipality has 5381 households, with 29.7% of households being female-headed (Stats SA, 2011). The average household size is 3.4.

The majority of people residing in the municipal area are black africans, followed by coloured people. The two least represented racial groups are whites and indian/asians. The most commonly spoken language is Afrikaans at 58%, followed by Setswana at 33%. The population groups are presented in **Error! Reference source not found.**42 below.

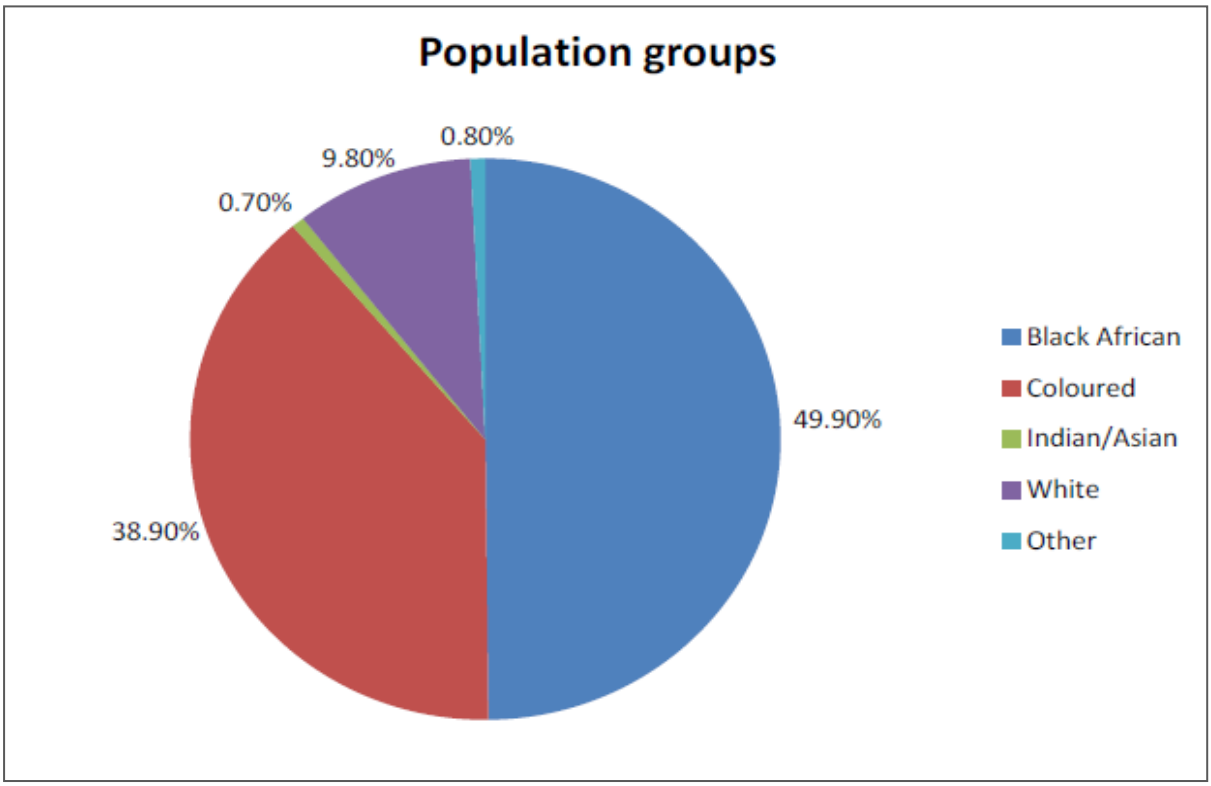


Figure 42: Population Groups – Kgatelopele Local Municipality (sourced from IDP, 2013/14)

1.2 Age groups

The majority of people residing in the Kgatelopele Local Municipality are children of 0 – 4 years old, followed by those in the 20 – 24 years old group. This indicated that more programmes or projects need to be more responsive to the needs of children and young people. The population of the municipality resembles that of most developing nations, where there are high birth rates, slow growth rates and a population with a short life expectancy.

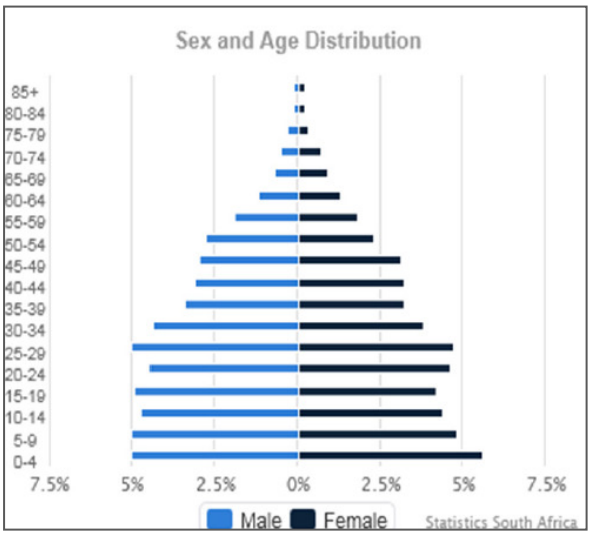


Figure 43: Population Pyramid – Kgatelopele Local Municipality (sourced from IDP, 2013/14).

1.3 Education levels

According to the IDP, the majority of people in the municipal area have some secondary education and have completed their secondary schooling. There are those that have no schooling, some primary and others completed primary schooling and this means that these people did not receive their senior certificate, which limits their chances of getting a decent job or employment opportunities. The numbers of those who completed secondary school and got a higher education is high, so there is a large capacitated workforce to contribute to the economy of the municipality or the region.

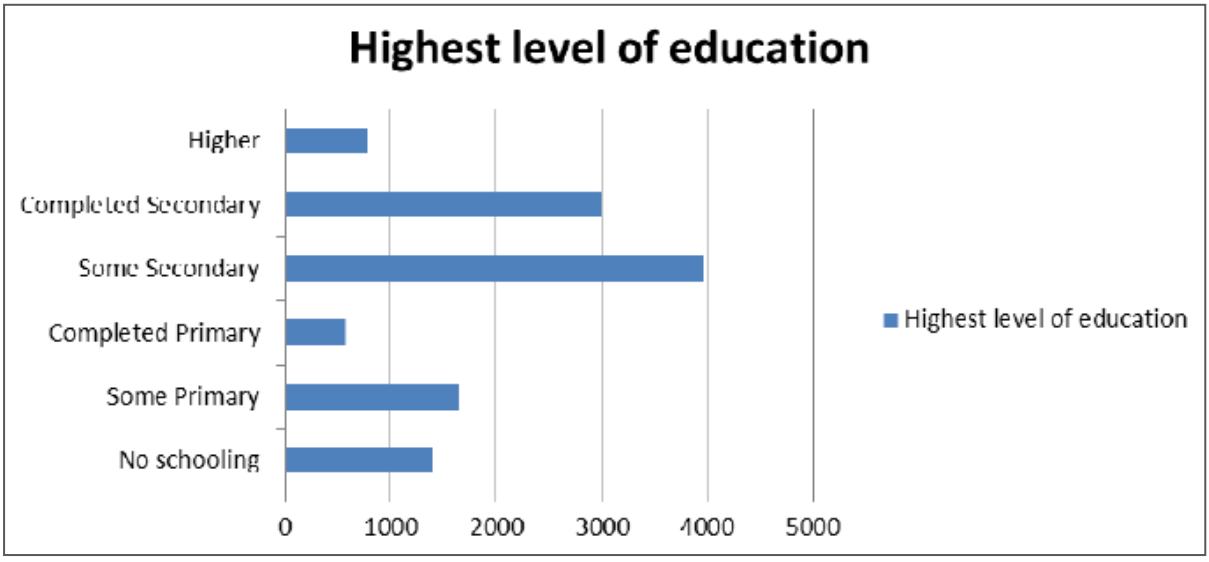


Figure 43: Highest level of education – Kgatelopele Local Municipality (sourced from IDP, 2013/14).

1.4 Employment levels

The number of those economically active is slightly greater than those not economically active, hence the dependency ratio of 50.6% which is very high. Stats SA (2011) indicates that the unemployment

rate is at 22.3% while 29.1% of the total unemployed people are young people. The IDP states that there is need to address the challenges of those not employed particularly the youth.

1.5 Income distribution

A large number of people in the municipal area receive income above the poverty line (large capacitated workforce). The IDP states that it is of great concern from a municipal perspective for those who have no income at all. This income group may most likely be highly depended on government grants and are thus not able to spend money in the municipal area or pay their rates.

Figure 44: Employment status – Kgatelopele Local Municipality (sourced from IDP, 2013/14).

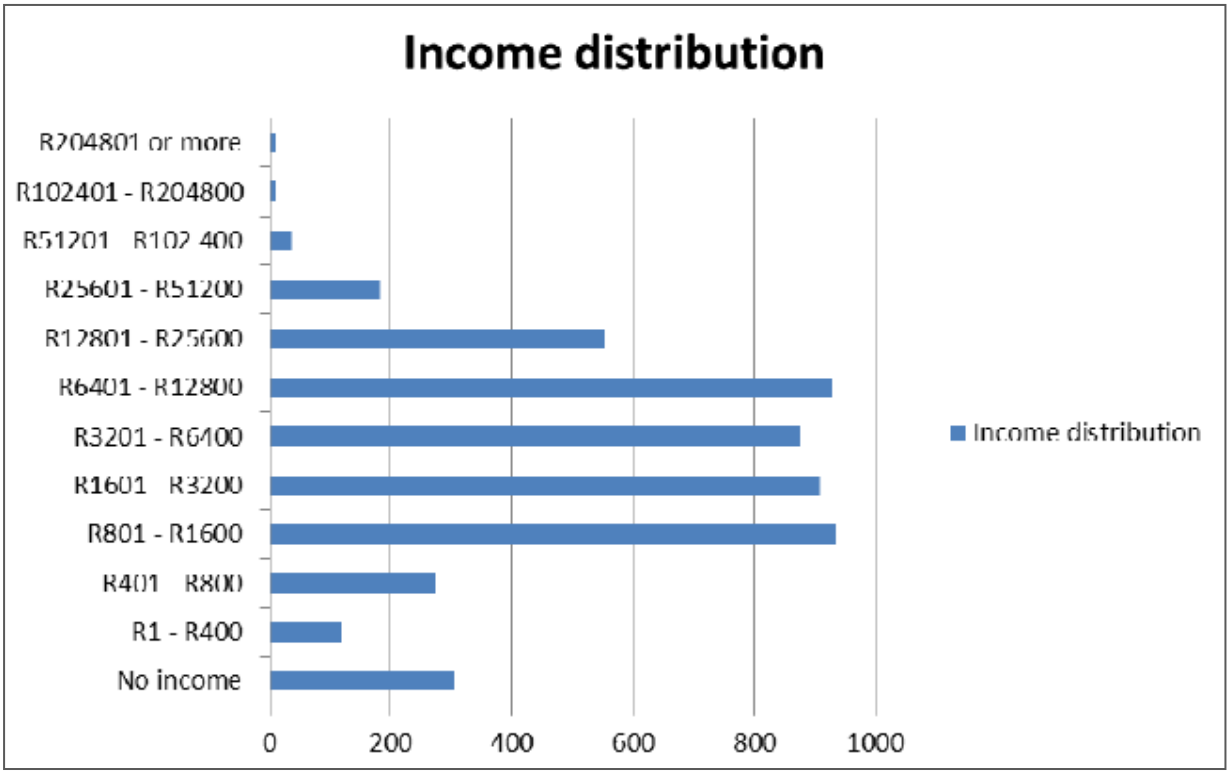


Figure 45: Income distribution – Kgatelopele Local Municipality (sourced from IDP, 2013/14).

1.6 Social infrastructure

The residents within the local municipality have access to the following facilities:

Table 49: Available facilities (adapted from IDP, 2013/14)

Ward	Education	Health service	Recreational / community facility	Safety
1	Primary school	-	-	-
2	High school	-	-	-
3	Primary- and High school	Clinic	Club, Swimming pool	Police station
4	3 Primary schools	Clinic	Recreational club, Swimming pool	Police station

1.7 Basic Services

1.7.1 Housing

The dwelling type with percentages for the province, district- and local municipality is provided in Table 50 below.

Table 50: Type of dwelling Northern Cape Province, Siyanda District and Kgatelopele local municipality (adapted from IDP, 2013/14)

Type of dwelling	Province: Northern Cape	District: Siyanda	Municipality: Kgatelopele
Traditional	3.19%	1.24%	0.52%
Formal	83.30%	80.53%	89.97%

Type of dwelling	Province: Northern Cape	District: Siyanda	Municipality: Kgatelopele
Informal	13.51%	18.23%	9.51%

In most areas where there are mines and mining related operations squatting often becomes a huge problem and added burden on the municipalities. In contrary, the Northern Cape is dominated by formal house or brick/concrete block structure dwellings. The majority of these dwellings enjoy access to piped water, flush toilets and electricity as depicted below.

1.7.2 Water

The statistics for percentage of the dwellings / institutions that have access to water are presented in Table 51 below.

Table 51: Access to water - Northern Cape Province, Siyanda District and Kgatelopele local municipality (sourced from SLP, 2014-2018)

Access to water	Province: Northern Cape	District: Siyanda	Municipality: Kgatelopele
Piped (tap) water inside dwelling / institution	45.76%	48.47%	74.43%
Piped (tap) water inside yard	32.27%	37.71%	24.08%
Piped (tap) water on community stand; distance less than 200m from dwelling / institution	12.75%	6.35%	0.45%
Piped (tap) water on community stand; distance between 200m and 500m from dwelling / institution	4.13%	1.42%	0.19%
Piped (tap) water on community stand; distance between 500m and 1000m from dwelling / institution	1.64%	1.33%	0.09%
Piped (tap) water on community stand; distance greater than 1000m from dwelling / institution	0.81%	0.38%	0.11%
No access to piped (tap) water	2.64%	4.34%	0.66%

1.7.3 Electricity

Electricity usage for the province, local- and district municipality is presented in Table 52 below.

Table 52: Electricity usage - Northern Cape Province, Siyanda District and Kgatelopele local municipality (sourced from SLP, 2014-2018)

Electricity usage		Province: Northern Cape	District: Siyanda	Municipality: Kgatelopele
Cooking		78.37%	82.26%	82.26%
Lighting		85.63%	86.95%	92.03%
Heating		69.50%	77.06%	82.18%

1.7.4 Sanitation

Stats SA indicates that 4799 households have access to flush toilets (connected to sewerage system), while 217 households use flush toilets with septic tank. The concern is for those (187 households) that are still using bucket toilets, as that is supposed to have been eradicated. Ward 2 seems to be the ward with the greatest challenge when it comes to sanitation, as 50 households are using bucket system and 107 households have no toilet facilities.

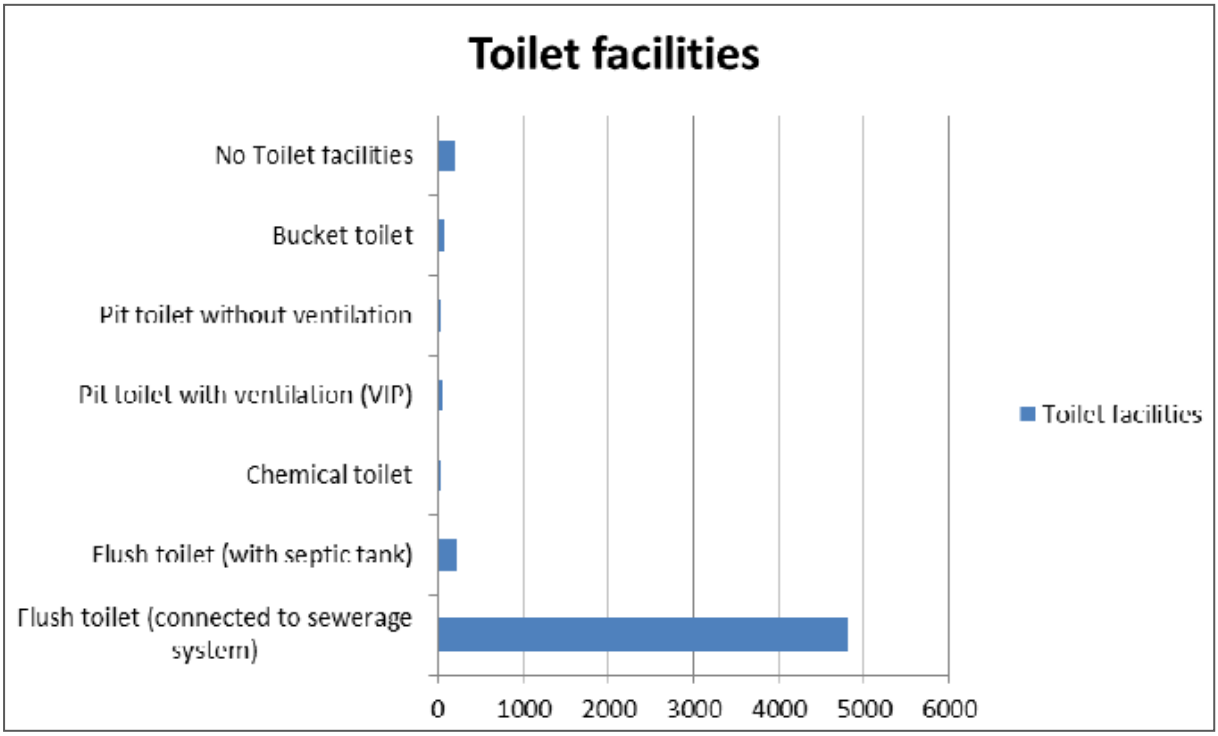


Figure 46: Toilet facilities – Kgatelopele Local Municipality (sourced from IDP, 2013/14).

1.7.5 Refuse removal

According to the IDP (2013/14) weekly refuse removal is at 91.7%. The municipality acknowledges that areas using their own refuse dump and those that have no rubbish disposal need more attention, as they might be disposing waste in a manner that is not in line with sustainable development.

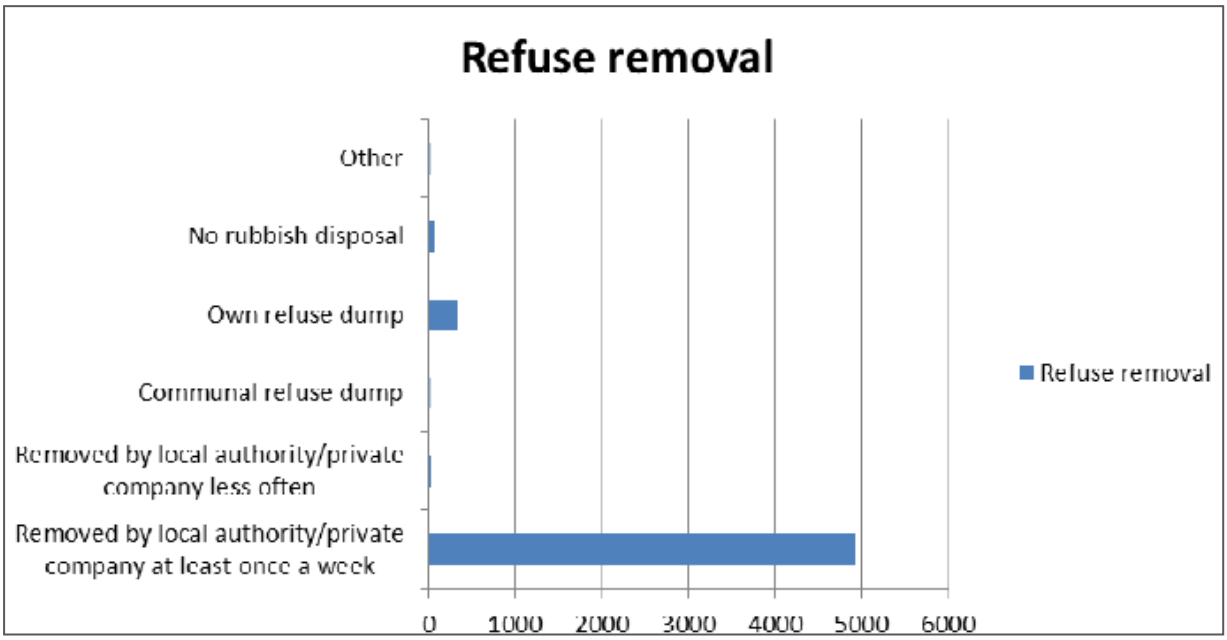


Figure 47: Refuse removal – Kgatelopele Local Municipality (sourced from IDP, 2013/14).

According to the Siyanda (ZF Mgcawu) District Municipality EMF, 2008, the Kgatelopele Local Municipality waste is removed by a private contractor. A new landfill site has been in operation since November 2006. In the Siyanda District Municipal Area (SDMA), the individual landowners organize their own refuse removal.

The IDPs indicates that there is currently a need across all the local municipalities to develop and upgrade landfill sites in the ZF Mgcawu District in order to prevent environmental degradation and meet the needs of the community. The following objectives have been set in the local municipalities in order to improve the status quo of waste management in the area:

- Upgrading of existing landfill sites;
- Provision of new landfill sites;
- Upgrading and improvement of current waste management services rendered by the municipalities;
- Initiate recycling projects; and
- Extent services in un-serviced areas.

1.7.6 Roads and transport network

According to the IDP (2013/14) access to transport service is at the heart of settlements that performs well, as residents are able to travel to other places to get goods and services that are not found in the area they reside in.

The main movement routes through the municipality are the:

- R385 running in an east west direction linking with Postmasburg in the west with Daniëlskuil;

- R31 running in a north south direction linking Daniëlskuil with Kuruman in the north and with Kimberly in the east;
- R385 linking Daniëlskuil with Lime Acres to the south and further to Prieska and Hopetown (Siyanda (ZF Mgcawu) DM SDF, 2012).

The challenge is the municipal roads that are not adequately maintained due to financial constraints reasons. As mobility is absolutely essential for everyday living, the residents use taxis to commute to Kuruman, Postmasburg, Kimberley and Upington. There are no buses services in the municipal area and there is also the challenge of not having a taxi rank in the municipal area.

2 Local Economic Development

The Kgatelopele LED Strategy defines LED as "an approach to sustainable economic development that encourages residents of local communities to work together to stimulate local economic activity that will result in, inter alia, an improvement in the quality of life for all in the local community". The municipality has a Local Economic Development Strategy, which was developed in 2012. The LED Strategy provides a strategic direction in terms of creating the necessary environment for local economic growth. Various economic indicators contribute to how the local economy is performing.

2.1 Economic Sectors

Below is an indication of the sectors operating in the district municipality and how they have changed between 2001 and 2010.

Table 53: Economic sectors (sourced from Siyanda DM SDF, 2012)

Industries	2001	2010	% Change
Agriculture	16 419	11	-3.56
Mining	5789	854	6.19
Manufacturing	1899	9941	-0.39
Electricity	328	1833	-1.61
Construction	1618	284	2.87
Trade	6345	2087	0.57
Transport	1737	6677	-1.08
Finance	2194	1576	2.29
Community services	8737	2650	3.83
Households	4284	12 253	1.39

2.2 Tourism and SMME's

The IDP recognizes that more works is needed in making the municipal area an area where those travelling to their destination can stop and contribute to the local economy. There is a need to capacitate SMMEs, on operating viable businesses as well as how processes of spheres of government unfold.

2.3 Job creation initiatives

The Expanded Public Works Programme (EPWP) aims to provide poverty and income relief through temporary work for the unemployed. The aim of EPWP is:

- To bring the unemployed into a temporary working environment;
- The unemployed will obtain skills and gain work experience;
- The unemployed will receive a stipend (allowance); and
- To enhance their chances of future employment and/or trigger their "entrepreneurial spirit".

Various EPWP projects were implemented, which contributed to the creation of job opportunities. Below is a list of the projects that were implemented in order to create job opportunities:

- Paving of roads;
- Cleaning of dump site;
- Cleaning of sidewalks; and
- Repair of pot holes.

2.4 Regional economic advantage

The municipality is a gateway to those travelling to Kuruman and those travelling to Kimberley. According to the IDP (2013 /14), the municipality tries by all means to take decisions related to the release of land within the time allocated for such applications. The development of the new Spatial Development Framework (SDF) would assist greatly in indicating strategies for spatial restructuring. Thus making sure that adequate consideration of spatial issues that are relevant to economic development can be addressed.

2.5 Conducive environment

Most of the LED programmes and projects are financed by the mines. This assists towards creating a conducive environment for local economic growth.

3. Environmental Management Framework

The Department of Environmental Affairs and Tourism (DEAT), the Northern Cape Department of Tourism, Environment & Conservation (NCDTEC) and the Siyanda District Municipality (SDM) decided to jointly establish an Environmental Management Framework (EMF) for the Siyanda District municipal area to ensure that future development in the area occurs in a manner that is appropriate to the unique features and character of the area. The EMF document refers to the following opportunities, constraints and desired states within the area:

Geology and topography:

- *"The varied landscape of the Siyanda District provides a unique and special character to the area that has the potential to contribute to a variety of local and international tourism opportunities, especially if scenic routes are developed that take these landscapes into account.*

- *There are significant undeveloped mineral resources left in the area that can contribute to future economic growth in the area depending on the future viability of exploiting the minerals.*

Surface water:

- *The further development of activities that require the use of surface water should be limited to the extent that it is sustainable given the limited remaining potential of the resource.*

Groundwater:

- *The allocation of groundwater should be based on the sustainable availability of groundwater;*
- *Water extraction should be limited to amounts that equals the natural recharge of groundwater;*
- *Additional groundwater extraction of water out of the karst systems should be investigated and strictly controlled before it is allowed to prevent the resource from being over utilised; and*
- *Potentially polluting activites should not be allowed on the karst aquifer systems.*

Climate change:

The following strategies have been identified as to accommodate the effects of future climate change:

- *Supply management:*
  - *Reduction of leaks programmes*
  - *Regional water resource planning*
  - *Local municipalities water resource management and monitoring*
  - *Conjunctive use of surface and groundwater*
  - *Rainwater harvesting*
- *Demand management:*
  - *Dry sanitation systems*
  - *Education programmes*
  - *Tariff structures*
  - *Water restrictions*

Vegetation:

In order to meet national biodiversity targets in the Siyanda District Municipality, the EMF sets out the targets for priority vegetation types. It is based on finding areas where the sensitive vegetation types are grouped together. The conservation can be in the form of:

- *Extensions to or the creation of new national parks or provincial reserves;*
- *The establishment of private protected natural areas;*
- *The establishment of conservancies; or*
- *The stricter control of activities on identified area through the application of the EIA regulations.*

The Olifantshoek Plains Thornveld, in which the proposed Quarry extension area of PPC Lime Limited falls, is identified in the EMF as a "*medium*" priority. Refer also to Figure 48 below.

Economic drivers:

Economic drivers are the influences and activities that underpin economic growth and development. There are two kinds of drivers, namely external drivers (legislation and policy) and internal drivers

(economic activities). In respect to external drivers it is important that government (at all levels) create a legislative and policy environment that is conducive to quality sustainable economic growth in the area. Potential internal drivers include:

- *The expansion, diversification and refinement of irrigated agricultural crops as well as associated agro-industrial processing, with an emphasis on high value crops and especially those that serve the export market.*
- *The marketing and use of the transportation infrastructure, especially Upington Airport and the major road, to create a regional and even international hub for imports, exports and cargo handling/distribution.*
- *The development of niche tourism markets that capture full value out of the special attributes of the area.*
- *The exploitation of the climate of the area for energy generation (sunshine).*
- *Increased mineral beneficiation that unlocks manufacturing opportunities.*

4. Spatial Development Framework (SDF's)

As per the latest EMF for the Siyanda (ZF Mgcawu) District (Siyande EMF, 2008), Spatial Development Frameworks for the EMF area have not yet been developed.

5. PPC Lime Limited's Social and Labour Plan

PPC Lime Limited has a Social and Labour Plan (SLP), titled: "PPC Limited Lime Acres Mine, Social and Labour Plan, 2014 – 2018, Office Reference: NC 5/3/2/149". The SLP is attached hereto as Annexure F.

The aim of this SLPis to align with the requirements of the DMR in terms of the Social and Labour Plan components. Consequently, specific and focused research was undertaken to identify the issues pertinent to the host municipality area and formulate specific interventions for the purposes of:

- Formulating clear and practical human resource and socio-economic development strategies
- Identifying projects that will translate into the development of the "latent potential" of the host municipality
- Illustrating the identified projects

The SLP encompasses all the pillars of the mining charter and brings into effect the Mineral and Petroleum Resource Development Act. A central aspect that is emphasized is the need to ensure that the designed (external) interventions align and integrate with the Local Municipality as well as the local integrated development plans (IDPs).

The objectives of the Social and Labour Plan include:

- To undertake the required research in the area to establish baseline information that will inform the socio-economic and economic benchmark profiles

- To identify the possible areas where synergies can be developed between the activities of the mine, and the government structures
- To ensure that PPC Lime Acres's efforts and expenditure in social investments are effectively co-ordinated and managed to the best advantage of the relevant stakeholders
- To address the objectives of the Mining Charter and requirements of the MPRDA
- To provide clear areas where the requirements of the DME regarding the SLP are addressed
- To design implementation guidelines that can be utilized to incorporate the development programmes of the host municipality as well as the major labour sending areas into the SLP

To provide a clear indication of the various mitigation strategies required as per DME guidelines.

8.4.2 Description of the current land uses

The information contained in this section was extracted from the following:

- Report titled: "*Soil survey of the land owned by PPC and neighbouring farms"), to identify, classify and map the undisturbed soil resources of the area associated with the PPC Lime Acres site"*, dated December 2003 and compiled by P.A.L le Roux from the University of the Orange Free State in Bloemfontein
- EMP, Revision 5; dated February 2013; and
- PPC Lime Acres prospecting area, Northern Cape. Desktop Wetland Delineation Report, dated March 2015, compiled by Limosella Consulting (attached in Annexure E3).
-

General

The land surrounding the existing PPC Lime Acres operation is used mostly for livestock grazing. Pre-mining land use was restricted to cattle and sheep farming prior to the commencement of the PPC Lime Acres mining operation in 1952.

The soils observed within the area are not capable of being used for crop production due to the lack of topsoil in the area. The high lying soils have a high stone content and the low lying Brandvlei soils lack natural drainage. Crop farming is localised to small areas where some topsoil exists and to areas where water is available for irrigation. The value of the soil in the area in terms of reclamation varies from low to very low.

Site specific

As per the Wetland Desktop Study conducted by Limosella Consulting in March 2015 (Annexure E3), the proposed quarry extension area is bordered by the existing PPC Lime Limited mine in the south and east and unmodified veldt on the slopes of the Rooiberge to the north and east. The site has been used as a game camp and grazing for cattle up to present. The veld consists of dry open woodland on the slopes and grassland associated with the wetland depressions.

A large sand barrier constructed across some of the site, possibly to divert water flowing in to the mine working area, was a notable disturbance visible in desktop study conducted. As per the fauna

study conducted by Rautenbach I.L, Kemp A.C, & van Wyk J.C.P, dated September 2014 (Annexure E2), the game camp has been heavily grazed, which has resulted in a measure of bush encroachment by *Acacia mellifera*. The undeveloped area southeast of the mining activities is grazed by cattle.

8.4.3 Description of specific environmental features and infrastructure on the site

The area is bounded on its western side by a broken mountain range, known as the Asbestos Mountain belt (Figure 13). This mountain range forms the eastern flank of a regional north-south irregular highland. Elevations on the broken highland is around 1600 m above sea level. To the east of the Asbes Mountain, the topography is an almost flat landscape with topographical heights of 1400 m above sea level (Shangoni AquiScience, February 2015).

As described above, the land use of the area is that of cattle grazing and game farming, as well as the existing PPC Lime Limited mine and factory (processing plant) to the east and south-east of the proposed quarry extension site. The veld consists of dry open woodland on the slopes and grassland associated with the wetland depressions. More detail on vegetation sensitivity and wetlands are provided in Chapters E and H above.

8.4.4 Environmental and current land use map

Figure 48 below presents the specific environmental features and the current land uses in relation to the infrastructure on site and the proposed mine plan.

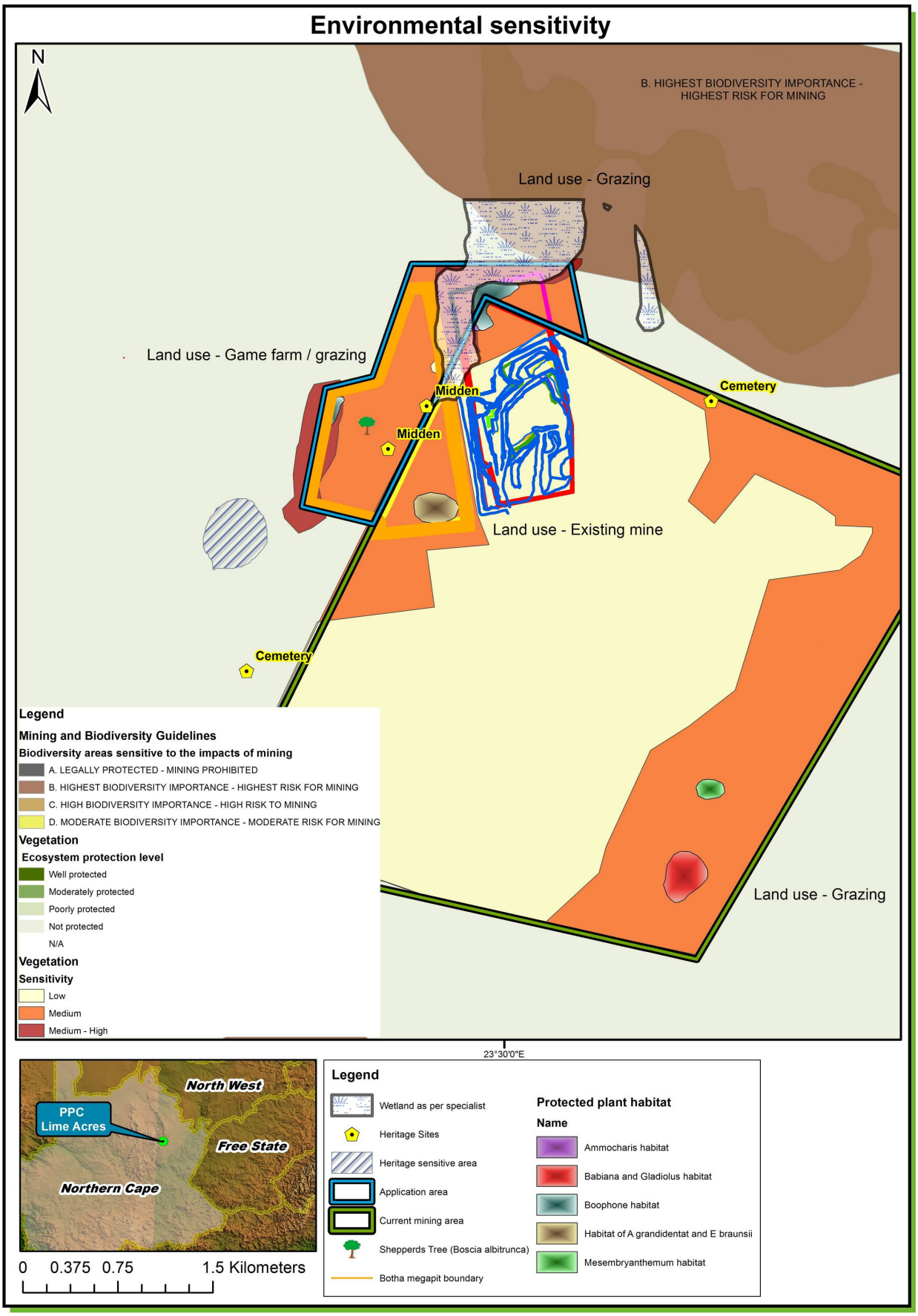


Figure 48: Environmental features and current land use map

8.5 Impacts identified

Table 54 below contains preliminary potential impacts which have been identified for the activities described in the site layout plan. A detailed risk assessment will be undertaken as part of the EIA and EMP Phase, in which the duration, probability, magnitude and reversibility of the impacts will be determined and the significance of the impact calculated. Potential cumulative impacts have also been determined and are presented in Table 54 below.

Table 54: Preliminary determination of potential impacts

Environmental component (Aspects affected)	Activity	Potential Impact description
Geology	• Mining of limestone from the quarry extension areas.	A permanent impact on the localised geology of the areas associated with the proposed quarry extension areas will result from the mining and removal of limestone.
Topography	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries.*	The construction and progressive development of the quarries will temporarily alter the topography.
	• Placement of overburden material on the overburden dump (and on walls of evaporation pond area). • Disposal of slurry mix (lime and dolomite dust collected from processing facility and mixed with water) on existing evaporation ponds. • Unless alternative uses for processing plant residue are found, it will continue to be disposed of at the existing kiln waste dump situated adjacent to the existing dolomite quarry.	The continuation of placement of overburden material on the overburden dumps, slurry on the evaporation ponds and plant processing residue on the Kiln Waste Dump, will continue to influence the flat nature of the topography that is typical of the surrounding area. Although all dumps will be landscaped as part of the decommissioning phase, the topography will differ from the original.
	• Rehabilitation of quarry areas (Backfilling with overburden; and subsequent topsoil placement).	During rehabilitation the quarry will be backfilled and the disturbed area reshaped to be free draining and to as close as possible to pre-mining conditions. The topography of the localised area will however most likely be permanently altered.

Environmental component (Aspects affected)	Activity	Potential Impact description
Soil, land use and land capability	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries.*	The original (pre-mining) and current land use in the area is restricted to livestock grazing, as crop farming is not possible because of the lack of soil and the harsh climatic conditions in the area. A section where the proposed Quarry Extension Mega-pit is proposed to be located, is currently utilised for game farming. The disturbed terrain (associated with the proposed quarry extension) will therefore be unavailable for grazing or game farming during the operational phase of the mine.
	• Removal of topsoil and overburden from the quarry extension areas. • Placement of topsoil into stockpiles (located at the quarry areas) for transportation to rehabilitation areas. Topsoil is utilised as soon as possible for rehabilitation activities.	The removal of topsoil may result in the mixing of the horizons of the soil which will have an impact on the fertility and production potential of the soil.
		The temporary stockpiling of topsoil may result in a decrease in the fertility of the soil and the leaching of minerals due to exposure of the soil to elements.
		A loss of microbes and viable seed may occur as a result of the temporary stockpiling of topsoil.
		Soil compaction and topsoil loss through erosion may occur as a result of the mining and mining related activities (including the temporary stockpiling). This will further lead to a loss of soil fertility.
	• Use and maintenance of chemical / portable toilets at quarry extension areas.	The ineffective control and management of the proposed chemical toilets, to be placed at the quarry locations, may lead to the contamination of soil, surface water and ground water resources.
	• Use of mobile transformer units.	The ineffective handling of hydrocarbon spillages may lead to the contamination of soil, surface water and ground water resources.
	• Hauling of mined minerals to existing primary crusher.	Ineffective erosion control along haul roads towards the quarries may lead to siltation of downstream water resources and scouring of soil.
Surface water	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries.* • Placement of overburden material on the overburden	Due to the proximity of the proposed quarries to the delineated pan (depression wetland) and the drainage-way along the western boundary of the study site, surface water quality of such resources may be impacted upon.
		In the event of chemical or hydrocarbon spillages on soil, surface water runoff which comes into contact with the soil may become contaminated and enter the receiving environment and / or water resources. This will have an

Environmental component (Aspects affected)	Activity	Potential Impact description
	dump (and on walls of evaporation pond area) for subsequent backfilling into the quarries as part of rehabilitation.	impact on, not only the surface water quality, but the aquatic vegetation, animal life and any other downstream water users.
		Surface water contamination may occur should the separation of clean- and dirty water management areas not be effectively implemented.
		A reduction in the catchment yield may result from the ingress of surface water runoff into the quarries, which may have an impact on the downstream surface water users.
Groundwater	• Dewatering of water contained in the quarry extension pit areas and pumping of water to Quarry 5 for subsequent treatment and supply to the villages for domestic use (as per current practice).	Potential aquifer depletion due to quarry dewatering.
	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*. • Placement of overburden material on the overburden dump (and on walls of evaporation pond area). • Disposal of slurry mix (lime and dolomite dust collected from processing facility and mixed with water) on existing evaporation ponds. • processing plant residue will continue to be disposed of at the existing kiln waste dump situated adjacent to the existing dolomite quarry.	Potential seepage of water from the quarry areas and dumps to the groundwater regime may contaminate groundwater resources. Parameters that recorded high to elevated concentrations in monitoring boreholes during the Geohydrological Assessment: Hydrocensus conducted for PPC Lime Limited (Annexure E4) include: Electrical Conductivity (EC); inorganic nitrogen (in the form of total ammonia (NH4 + NH3) but also nitrate (NO3)); and Manganese (Mn). A pollution risk towards groundwater remain but only within the immediate vicinity of the mining area due to the cone of depression and groundwater flow patterns. This may only hold true for operational phases of mining when active dewatering takes place. As mentioned in the Geohydrological Assessment: Hydrocensus report (Annexure E4), it must be noted that due to mine abstractions and the subsequent formation of the cone of depression, polluting substances generated due to the mining processes cannot migrate in a pollution plume away from PPC since all polluting substances will move with groundwater (through advection) which are drawn inwards

Environmental component (Aspects affected)	Activity	Potential Impact description
		towards the areas of abstraction. This, together with the flow groundwater being either towards PPC Lime or towards the east from the probable igneous intruded body acting as a flow boundary, imply that PPC Lime cannot be responsible for substandard water quality recorded for the some of the farm boreholes.
		Groundwater quality may be impacted in the event of a spillage of chemicals or hydrocarbon materials (e.g. oil spill from vehicles and machinery).
Vegetation	• Clearance of vegetation. • Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*.	The indigenous and natural vegetation will be impacted upon within the proposed Quarry extension areas as a result of clearance of vegetation and mining. Other than for the area transformed by the current mining extent, the site was dominated by the *Tarchonanthus camphoratus-Olea europea subsp africana* vegetation. Variation in soil depth, the presence of gravelly, shallow soils or watercourses resulted in smaller habitats within the dominant *Tarchonanthus camphoratus-Olea europea subsp africana* vegetation. No nationally Threatened or Protected Species (TOPS) were recorded. However, a number of plants protected by the Northern Cape Nature Conservation Act, 2009 (No.9 of 2009) were recorded on the site, as well as one individual of the national protected tree *Boscia albitrunca*.
		Declared alien and invasive plant species may establish in disturbed areas, if not controlled properly.
Fauna	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*.	Noise generated by the mining and mining related activities may frighten animals which may lead to injuries, deaths as well as the animals migrating away from the site.
		Animal life may move to and from the mining areas and the adjacent properties, should the mining areas not be demarcated and fenced in, animals may be injured, deaths may result and the animals may damage infrastructure on site.
		Any poaching, killing or snaring of animals will have a negative impact on animal life. It will result in migration of these species but the lack of suitable habitat in the surrounding areas may further contribute to loss of animal life.

Environmental component (Aspects affected)	Activity	Potential Impact description
		Veld fires can be a risk to fauna and flora as well as the community (including adjacent landowners and employees).
	• Hauling of mined minerals to existing primary crusher.	Animal deaths may occur should they be struck by haul vehicles, due to the hauling of the mined material between the quarries and the primary crusher and Processing plant.
Sensitive landscapes (including wetlands)	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*. • Mining activities will extend into a section of a pan (depression wetland area) located to the north.	A pan (depression wetland) has been identified. The mentioned pan forms part of the larger Rooi Pan, and a section thereof is located within the proposed quarry extension area. As mentioned in the Desktop Wetland Assessment (Annexure E3), several locally and regionally important plant species are known to occur in the pans, including *Boophone distichia* on the margins of the pan. It is unknown what important diatoms and invertebrates occur in the pan and further investigation would be required. As the wetland delineated on the study site forms the upper reaches of the much larger Rooipan it is expected that any contaminants entering the system from the mine will flow into and accumulate there. Potential impacts to be taken into account include: • Loss and disturbance of wetland habitat (including possible diatom and invertebrate communities) and fringe vegetation. • Introduction and spread of alien invasive vegetation. • Changes in the amount of sediment entering the system. • Changes in water quality due to toxic contaminants and increased nutrient levels entering the system. • Changes in water flow regime due to the alteration of surface characteristics. Further investigations on the wetland (pan) system have been identified as part of the Scoping process and a detailed Wetland Assessment will be conducted as part of the EIA Phase.
Sites of archaeological and cultural	• Mining of limestone from the quarry extension areas:	As mentioned in the Archaeological Impact Assessment report (Annexure E6), in terms of the archaeological component of Section 35 of the NHRA isolated Middle

Environmental component (Aspects affected)	Activity	Potential Impact description
importance	*Construction and progressive development of the quarries*.	Stone Age (MSA) artefacts were recorded scattered over the study area. The artefacts are scattered too sparsely to be of any significance apart from noting their presence, which has been done so in this report. Two contemporary middens associated with mine workers/farm labourers were recorded within the proposed Quarry extension area. These sites are of low significance as they are not older than 60 years and in the case of Midden 2 probably represent secondary dumping of household refuge amongst other things. Outside of the proposed quarry area two cemeteries were recorded that will not be impacted on.
		As per the Desktop Palaeontological Assessment report (Annexure E7), the palaeontological potential of the Campbell Rand Subgroup is, accordingly, high. The probability and significance of any negative impact occurring in the rocks of the Campbell Rand Subgroup is assessed as being high, but the impact will be low.
Protected areas and conservation planning	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*.	There are no protected areas within the direct vicinity of the PPC Lime Limited proposed Quarry Extension. However, one depression wetland (a southern Kalahari salt pan) was delineated within the proposed Quarry extension area, as part of the Wetland Desktop Assessment (refer Annexure E3). The Olifantshoek Plains Thornveld, in which the proposed Quarry extension area of PPC Lime Limited falls, is identified in the EMF and Mining and Biodiversity Guidelines from SANBI as a “medium” priority. The EMF, 2008 further states that due to the nature of the vast area with a low population there are no significant land use conflicts in the area that need to be addressed in the EMF with the exception of activities within the Orange River floodplain. PPC Lime Limited and proposed Quarry extension area falls within “Zone 1: Potential sensitive groundwater resources”. Refer to Figure 35 below. A description of “Zone 1” as follows: “The karst aquifers that occur in the dolomite and lime stone rocks in the area represent a major strategic

Environmental component (Aspects affected)	Activity	Potential Impact description
		water resource. It is sensitive both in respect to the abstraction and potential pollution of groundwater."
Air quality	• Mining (including blasting) of limestone from the quarry extension areas: *Construction and progressive development of the quarries*. • Loading of mined minerals. • Hauling of mined minerals to existing primary crusher or alternatively establishing an in-pit primary crusher during the later stages of mining (alternatives still being investigated). • Rehabilitation of quarry areas (Backfilling with overburden; and subsequent topsoil placement).	During the construction of the quarries, mining of the ore body, transport of the mined material to the primary crusher, and rehabilitation activities, dust (particulate matter, PM10 and PM2.5) may be generated which may have an impact on the ambient air quality of the area.
		All vehicles and mining machinery may have an impact on the air quality of the surrounding area as a result of the emissions released by the vehicles and machinery.
Noise	• Mining of limestone (including drilling and blasting) from the quarry extension areas: *Construction and progressive development of the quarries*. • Hauling of mined minerals to existing primary crusher or alternatively establishing an in-pit primary crusher during the later stages of mining (alternatives still being investigated).	The removal of vegetation, topsoil, overburden and the mining of the limestone will be conducted where after the mined material will be transported to the primary crusher via haul truck, or alternatively an in-pit primary crusher may be operated during the later stages of mining. These activities, as well as rehabilitation (backfilling) activities will produce noise which may impact on the surrounding landowners.
Visual	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*.	The proposed mining activities may be intrusive, in terms of visual aspects, which may result in a change of sense of place to the local community and tourist passing through the area. It is however important to note that mining activities (including the processing activities) are currently taking

Environmental component (Aspects affected)	Activity	Potential Impact description
	• Hauling of mined minerals to existing primary crusher or alternatively establishing an in-pit primary crusher during the later stages of mining (alternatives still being investigated).	place. Therefore it is likely that regular passers-by and the local residents are desensitised to the mining and proposed mining activities.
Socio-economic	• Mining and mining related activities	Job security of the mine's current employees will continue, along with other benefits arising from the Social and Labour Plan.
		The excavation of material will hinder the opportunity to utilise the proposed sites for grazing or game farming activities for the duration of the operational phase, until such a time as the land has been rehabilitated.
	• Mine Closure	During mine closure, a loss of jobs will occur which may not only impact on the employees but on the socio-economic status of the local community and economy.

Table 55: Preliminary identification of potential cumulative impacts

Environmental component (Aspects affected)	Activity	Potential Impact description
Geology	Mining activities conducted within the area	The proposed mining activities as well as the surrounding present mining activities may cumulatively have an impact on the regional geological strata.
Topography	Mining activities conducted within the area	The proposed mining activities and the current mining activities at PPC Lime Limited's site, along with the other mining activities in the area (e.g. Finsch Mine) may cumulatively alter the topography of the area.
Soil, land use and land capability	Mining activities as well as grazing and game farming activities conducted within the area.	Erosion may occur as a result of mining and related activities. Should erosion also occur as a result of overgrazing or inadequate capacity management at the game farm, this could cumulatively lead to large disturbed areas which subsequently results in dust generation, increased runoff and silt content in surface water as well as the ineffective establishment of vegetation. This could ultimately effect the land capability for the area to be continually used for grazing and game farming purposes.

Environmental component (Aspects affected)	Activity	Potential Impact description
Surface water and groundwater	Mining activities as well as grazing and game farming activities conducted within the area.	Surface and groundwater resources may become contaminated in the event that contaminated surface water runoff from the mining areas enter the receiving environment.
Vegetation	Mining activities as well as grazing and game farming activities conducted within the area.	The establishment and spreading of alien invasive plant species could impact cumulatively in terms of the loss of natural vegetation in the area.
Fauna		The potential destruction of the natural vegetation as well as habitat loss for fauna species, may occur on a cumulative scale, should other activities in the area have a similar impact on the biodiversity of the area.
Sensitive landscapes (including wetlands)	Mining activities as well as grazing and game farming activities conducted within the area.	The current and proposed mining activities conducted on-site as well as any past impacts caused on the wetland (pan) and drainage system as a result of grazing in the within the pan (wetland) areas, may cumulatively have an impact on the wetland drainage system.
Sites of archaeological and cultural importance	Mining activities as well as grazing and game farming activities conducted within the area.	A cumulative impact will occur should the surrounding land uses (grazing and game farming) impact on any sites of cultural and archaeological importance (midden – artefacts).
Air quality	Mining and related activities conducted within the area	The ambient air quality, community and neighbouring residents may be impacted upon as a result of dust generation originating from both the proposed mining activities as well the current mining activities (along with the other mining activities in the area (e.g. Finsch Mine)).
Noise	Noise generation from mining and agricultural activities.	Nuisance to community and neighbouring residents could result due to the generation of environmental noise at the proposed mining area as well as the existing mining areas along with the other mining activities in the area (e.g. Finsch Mine).
Visual	Positive impact as a result of rehabilitation activities and agricultural activities.	Visual impacts may be cumulative in nature as a result of the proposed mining activities as well as the current mining and related activities along with the other mining activities in the area (e.g. Finsch Mine). Rehabilitation of the quarry will contribute to the restoration of the

Environmental component (Aspects affected)	Activity	Potential Impact description
		'sense of place' associated with the agricultural areas in the region. A restoration in terms of the visual aesthetics for the surrounding area will also take place, along with other rehabilitation activities undertaken in the area.
Socio-economic	Mining activities conducted within the area	The proposed mining activities (along with the current mining activities and other mining activities in the area (e.g. Finsch Mine) will result in the increased job security of the current employees but may result in the loss of jobs of in the grazing and game farming sectors.

8.6 Methodology used in determining the significance of environmental impacts

8.6.1 Methodology to be applied during the EIA and EMP phase

The environmental risk of any aspect is determined by a combination of parameters associated with the impact. Each parameter connects the physical characteristics of an impact to a quantifiable value to rate the environmental risk.

Impact assessments should be conducted based on a methodology that includes the following:

- Clear processes for impact identification, predication and evaluation;
- Specification of the impact identification techniques;
- Criteria to evaluate the significance of impacts;
- Design of mitigation measures to lessen impacts;
- Definition of the different types of impacts (indirect, direct or cumulative); and
- Specification of uncertainties.

After all impacts have been identified, the nature and scale of each impact can be predicted. The impact prediction will take into account physical, biological, socio-economic and cultural information and will then estimate the likely parameters and characteristics of the impacts. The impact prediction will aim to provide a basis from which the significance of each impact can be determined and appropriate mitigation measures can be developed.

The risk assessment methodology is based on defining and understanding the three basic components of the risk, i.e. the source of the risk, the pathway and the target that experiences the risk (receptor). Refer to
Figure 49 below for a model representing the above principle (as contained in the DWA's Best Practice Guideline: G4 – Impact Prediction.

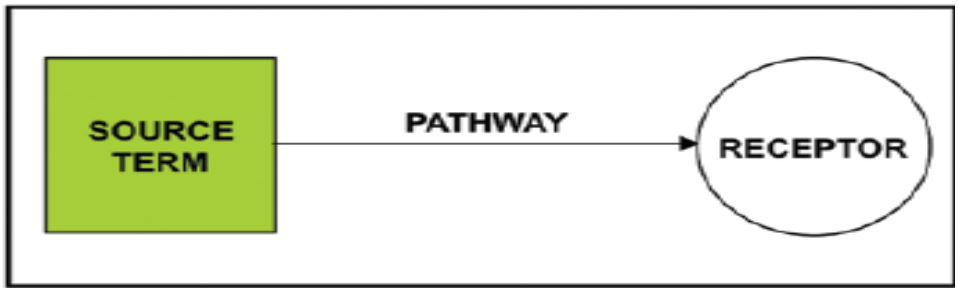


Figure 49: Impact prediction model

Table 56 and Table 57 below indicate the methodology to be used in order to assess the Probability and Magnitude of the impact, respectively, and Table 58 provides the Risk Matrix that will be used to plot the Probability against the Magnitude in order to determine the Severity of the impact.

Table 56: Determination of Probability of impact

SCORE	FREQUENCY OF ASPECT / UNWANTED EVENT	AVAILABILITY OF PATHWAY FROM THE SOURCE TO THE RECEPTOR	AVAILABILITY OF RECEPTOR
1	Never known to have happened, but may happen	A pathway to allow for the impact to occur is never available	The receptor is never available
2	Known to happen in industry	A pathway to allow for the impact to occur is almost never available	The receptor is almost never available
3	< once a year	A pathway to allow for the impact to occur is sometimes available	The receptor is sometimes available
4	Once per year to up to once per month	A pathway to allow for the impact to occur is almost always available	The receptor is almost always available
5	Once a month - Continuous	A pathway to allow for the impact to occur is always available	The receptor is always available

Step 1*: Determine the* ***PROBABILITY*** *of the impact by calculating the average between the Frequency of the Aspect, the Availability of a pathway to the receptor and the availability of the receptor.*

Table 57: Determination of Magnitude of impact

Score	SOURCE				RECEPTOR	
	Duration of impact	**Extent**	**Volume / Quantity / Intensity**	**Toxicity / Destruction Effect**	**Reversibility**	**Sensitivity of environmental component**
1	Lasting days to a month	Effect limited to the site. (metres);	Very small quantities / volumes / intensity (e.g. < 50L or < 1Ha)	Non-toxic (e.g. water) / Very low potential to create damage or destruction to the environment	Bio-physical and/or social functions and/or processes will remain unaltered.	Current environmental component(s) are largely disturbed from the natural state. Receptor of low significance / sensitivity
2	Lasting 1 month to 1 year	Effect limited to the activity and its immediate surroundings. (tens of metres)	Small quantities / volumes / intensity (e.g. 50L to 210L or 1Ha to 5Ha)	Slightly toxic / Harmful (e.g. diluted brine) / Low potential to create damage or destruction to the environment	Bio-physical and/or social functions and/or processes might be negligibly altered or enhanced / Still reversible	Current environmental component(s) are moderately disturbed from the natural state. No environmentally sensitive components.
3	Lasting 1 – 5 years	Impacts on extended area beyond site boundary (hundreds of metres)	Moderate quantities / volumes / intensity (e.g. > 210 L < 5000L or 5 – 8Ha)	Moderately toxic (e.g. slimes) Potential to create damage or destruction to the environment	Bio-physical and/or social functions and/or processes might be notably altered or enhanced / Partially reversible	Current environmental component(s) are a mix of disturbed and undisturbed areas. Area with some environmental sensitivity (scarce / valuable environment etc.).
4	Lasting 5 years to Life of Organisation	Impact on local scale / adjacent sites (km's)	Very large quantities / volumes / intensity (e.g. 5000 L – 10 000L or 8Ha– 12Ha)	Toxic (e.g. diesel & Sodium Hydroxide)	Bio-physical and/or social functions and/or processes might be considerably altered or enhanced / potentially irreversible	Current environmental component(s) are in a natural state. Environmentally sensitive environment / receptor (endangered species / habitats etc.).
5	Beyond life of Organisation / Permanent impacts	Extends widely (nationally or globally)	Very large quantities / volumes / intensity (e.g. > 10 000 L or > 12Ha)	Highly toxic (e.g. arsenic or TCE)	Bio-physical and/or social functions and/or processes might be severely/substantially altered or enhanced / Irreversible	Current environmental component(s) are in a pristine natural state. Highly Sensitive area (endangered species, protected habitats etc.)

Step 2: *Determine the* ***MAGNITUDE*** *of the impact by calculating the average of the factors above.*

Table 58: Determination of Severity of impact

ENVIRONMENTAL IMPACT RATING / PRIORITY					
	MAGNITUDE				
PROBABILITY	**1 Minor**	**2 Low**	**3 Medium**	**4 High**	**5 Major**
5 Almost Certain	Low	Medium	High	High	High
4 Likely	Low	Medium	High	High	High
3 Possible	Low	Medium	Medium	High	High
2 Unlikely	Low	Low	Medium	Medium	High
1 Rare	Low	Low	Low	Medium	Medium

***Step 3**: Determine the **SEVERITY** of the impact by plotting the averages that were obtained above for Probability and Magnitude.*

8.6.2 Methodology to be applied by the specialists

8.6.2.1 Vegetation (Flora) Assessment

The methodology applied by Dimela Eco Consulting to determine the significance of the impacts is described below and in Table 59 (refer also to Annexure E1).

The possible impacts are assessed based on the Significance Rating Matrix below.
The Significance of the impact is calculated as follows:

Significance = Consequence (Magnitude+ Duration+ Extent + Reversibility) **X Probability**

Table 59: Methodology applied in determining the significance of impacts as utilised for the Vegetation Assessment

Ranking	Magnitude	Reversibility	Extent	Duration	Probability
5	Very high/ don't know	Irreversible	International	Permanent	Certain/inevitable
4	High		National	Long term (impact ceases after operational life of asset)	Almost certain
3	Moderate	Reversibility with human intervention	Provincial	Medium term	Can occur
2	Low		Local	Short term	Unusual but possible
1	Minor	Completely	Site bound	Immediate	Extremely remote

Ranking	Magnitude	Reversibility	Extent	Duration	Probability
		reversible			
0	None		None		None

RANKING	65-100	64-36	35-16	15-5	1-4
SIGNIFICANCE	Very High	High	Moderate	Low	Minor

8.6.2.2 Fauna Assessment

The methodology applied by the Fauna specialist(s) to determine the significance of the impacts is described in Table 60 below (refer also to Annexure E2).

Table 60: Methodology applied in determining the significance of impacts as utilised for the Fauna Assessment

Significance of impact	Degree to which the impact can be reversed	Degree to which the impact may cause irreplaceable loss	Mitigation possibility
Considering the nature, extend and duration of impact and the probability of the impact occurring, provide a statement on the significance of the impact (for each relevant impact).	Provide a statement on the degree to which the impact can be reversed (for each relevant impact).	Provide a statement on the degree to which the impact may cause irreplaceable loss of resources (for each relevant impact)	Provide a statement on the degree to which the impact can be mitigated. Also provide suitable recommendations for mitigation.

8.6.2.3 Wetland Assessment

As the Wetland Assessment conducted during the Scoping Phase was a desktop study, a qualitative approach was followed in terms of the description of potential impacts. Note that a detailed Wetland Delineation and Functional Assessment has been identified as part of the Plan of Study for EIA, and will thus be conducted during the EIA Phase, for inclusion into the EIAR and EMPr. The risk rating matrix as per Tables 56 to 58 above will be used for the detailed Wetland delineation and functional assessment.

8.6.2.4 Environmental Noise Assessment

The basic methodology applied by Varicon cc to determine the significance of the impacts is described in Table 60 above (similar table as provided under Section 8.6.2.2 above) (refer also to Annexure E5). Furthermore, the risk rating conducted as part of the Noise Assessment is the same as the impact assessment methodlogy applied by the EAP (refer to Tables 56 to 58 above).

8.6.2.5 Archaeological Assessment

The methodology applied by Heritage Contracts and Archaeological Consulting to determine the significance of the impacts is described is the same as the impact assessment methodlogy applied by the EAP (refer to Tables 56 to 58 above).

8.6.2.6 Palaeontological Assessment

As the Palaeontological Assessment conducted during the Scoping Phase was a desktop study, a qualitative approach was followed in terms of the description of potential impacts. This included the consideration of the following:

- Nature of impact;
- Extent of impact;
- Duration of impact;
- Probability of impact;
- Significance of impact;
- Severity / Benefit scale;
- Status;
- Reversal of damage; and
- Degree of irreversable loss.

8.6.3 Knowledge gaps, assumptions and limitations

The knowledge gaps, assumptions and limitation that were identified are described below:

- **Vegetation (Flora) Assessment:**
  - In the absence of a guideline document for biodiversity assessment in the Northern Cape, the Gauteng Requirements for Biodiversity Assessments Version 2 (GDARD, 2012) was used as best practise.
  - Vegetation studies should be conducted during the growing season of all plant species that may potentially occur. This may require more than one season's survey with two visits undertaken preferably during November and February. However, this report relied on a single site visit undertaken in September 2014. As the study area had not received significant summer rainfall, the vegetation was dry. Although some herbaceous plants were in flower, other species might have been dormant. Therefore, the species list compiled for this report is not complete but representative of the species identified at the time of the September survey. Additional studies during late summer (depending on seasonal rainfall) would likely produce a more extensive list.

- **Fauna Assessment:**
  - The vertebrate team has sufficient experience and ample access to information sources to confidently compile lists of biota such as presented herein, and to support conclusions and

suggested mitigation measures based on site visits. In instances where doubt exists, a species is assumed to be a possible occupant (viz. *Suncus* species, pythons and bull frogs) - this approach renders the conclusions robust. In instances where the possible occurrence has significant ecological implications, an intensive survey is recommended. In view of the latter, it is highly unlikely that an intensive survey to augment this site visit will add significantly to the data base, and the additional costs are unlikely to warrant the effort. However, a third investigation phase is recommended, namely a 'walk-through' of the finalized preferred site.

- **Geohydrological Assessment: Hydrocensus:**
  - It must be stressed that the cone extensions are estimations based on interpolated borehole water levels only in one event in time and should not be a substitute for a groundwater flow model which will take parameters such as actual abstraction and sources, geology, lineaments, aquifer hydraulic parameters, recharge etc. into account. Boreholes are lacking towards the extensions of the inferred cone of depression for a more accurate contouring of groundwater levels. These areas are towards the immediate north in vicinity of the prospecting area, towards the north-east and also towards the south.

- **Wetland Assessment:**
  - In this study, wetlands were delineated based on a desktop analysis of vegetation and topographical gradients visible from aerial imagery. As no ground-truthing was conducted in the field, the finer details of the wetlands may be lacking.[48]
  - Flood line calculation, groundwater and hydrological processes fall outside the scope of wetland and riparian delineation and functional assessments discussed in the Wetland report.
  - Inaccuracies may arise during the course of converting spatial data to final drawings. The scale at which maps and drawings are presented in the current report may become distorted should they be reproduced by for example photocopying and printing.

A detailed Wetland delineation and functional assessment will be conducted during the EIA Phase.

- **Archaeological Assessment:**
  - Due to the fact that most cultural remains may occur below surface, the possibility exists that some features or artefacts may not have been discovered/ recorded during the survey. Low ground visibility of parts of the study area is due to high vegetation cover, and the possible occurrence of unmarked graves and other cultural material cannot be excluded. Only the surface infrastructure footprint areas were surveyed as indicated in the location map, and not the entire farm. This study did not assess the impact on the palaeontological component of the project. Although Heritage Contracts and Archaeological Consulting CC surveyed the

[48] *A detailed Wetland delineation and functional assessment will be conducted for the EIA Phase.*

area as thoroughly as possible, it is incumbent upon the developer to stop operations and inform the relevant heritage agency should further cultural remains, such as stone tool scatters, artefacts, bones or fossils, be exposed during the process of development.

- **Palaeontological Assessment:**
  - The information provided within this report was derived from a desktop study of available maps and scientific literature; no direct observation was made of the area as result of a site visit. The activities required to undertake this project and any infrastructure that may be required were not available to the author at the time of preparation of this report. In order to assess the potential impacts of the project upon the palaeontological heritage of the area assumptions were made concerning both the necessary activities and infrastructure by comparison to normal practice in other comparable exploration and mining projects in South Africa.

8.7 Positive and negatives that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and community affected.

A full description on the positive and negative implications of both the proposed activity and the alternatives has been provided as part of the Alternative Assessment Report attached hereto as Annexure H. The positive and negative implication of the proposed activity and the alternatives identified have however also been provided below. Refer also to Part 8.1 of this Scoping Report.

Table 61: Advantage and disadvantages of the proposed activity and alternatives

Alternative		Advantages	Disadvantages
Activity alternatives (mining method alternatives)	**Alternative MM1:** Opencast mining methods (as is currently applied)	• Shallow nature of limestone deposit can easily be mined by means of opencast mining.	• Opencast mining methods may result in direct and indirect impacts on several aspects of the environment including: Soil (compaction), flora (clearance and dust), fauna (habitat destruction, noise), air quality (dust, vehicle emissions), noise (animal life and surrounding communities), and surface- and groundwater (spillages, inadequate separation of clean and dirty water, potential leaching of water into the groundwater regime).
	Alternative MM2: Underground mining method	• If underground mining would have been feasible, less surface-related environmental impacts would have resulted from mining (when compared to opencast mining).	• Underground mining is not feasible due to shallow nature of limestone deposit.[49] • Larger safety risk.
Activity alternatives (primary crushing and transport alternatives)	**Alternative PT1**: The transportation of the mined mineral from the proposed quarry extension areas to the existing primary crusher via truck (haulage) from where it is transported to the remainder of the existing processing plant via conveyor.	• The haul trucks can haul a large amount of mined material at once. • More financially viable for the initial stages of mining and the current Bowden North Quarry mineral deposit is currently also transported to the existing	• The utilisation of haul trucks may result in direct and indirect impacts on several aspects of the environment including: Soil (compaction), flora (dust), fauna (road collisions, noise), air quality (dust, vehicle emissions), visual, and noise

[49] Alternatives that are not feasible (such as underground mining) will not be included as part of the impact (risk) assessment section in the EIAR and EMPr that will be compiled for the proposed project (as well as the existing mining area) and submitted to the DMR.

Alternative		Advantages	Disadvantages
		primary crusher.	(animal life and I&APs). • During the later stages of Phase 2, the distance between the Mega-pit and the existing primary crusher may become too great for the material to be hauled (taking fuel costs and price increases into account).
Activity alternatives (primary crushing and transport alternatives)	**Alternative PT2**: The transportation of the mined mineral from the proposed quarry extension areas to the existing primary crusher via conveyor (to be newly constructed) from where it is transported to the remainder of the existing processing plant via conveyor	• The utilisation of a conveyor would eliminate the use of haul trucks thereby minimising the potential impacts on soil, noise, air quality, fauna and flora.	• High cost investment (especially taking the distance into account during the later stages of Phase 2).
	Alternative PT3: The establishment of an in-pit primary crusher at the proposed quarry extension areas from where mined material is transported via conveyor to the remainder of the existing processing plant.	• Ease of being able to crush material in-pit before it being transported to the remainder of the existing Processing plant. • May have a lower cost associated over the longer term as with hauling of the material during the later stages of Phase 2. • The utilisation of a conveyor (along with the in-pit Primary crusher) would eliminate the use of haul trucks thereby minimising the potential impacts on fauna and flora.	• Cost associated with establishing an in-pit primary crusher. • Will most likely still result in impacts in terms of dust and noise generation.
	Alternative PT4: A combination of Alternative 1	• The haul trucks can haul a large amount	• The utilisation of haul trucks during the

Alternative		Advantages	Disadvantages
	and Alternative 3. During Phase 1 and possibly the first section of Phase 2 of the proposed quarry extension, Alternative 1 is considered by PPC Lime as being the most practical (i.e. transporting the mine mineral to the existing primary crusher via haul truck). However, as mining progresses further to the west and to the north as part of the Mega-pit (during the later sections of Phase 2 of mining), the distance between the mining area and the existing primary crusher increases and from a cost and practical implementation perspective, an in-pit primary crusher (as per Alternative 3) may be established at the proposed quarry extension areas from where the crushed material will be transported via conveyor to the remainder of the existing Processing facility.	of mined material at once. • The use of haul trucks is more financially viable for the initial stages of mining and the current Bowden North Quarry mineral deposit is currently also transported to the existing primary crusher. • Ease of being able to crush material in-pit before it being transported to the remainder of the existing Processing plant during the later stages of mining. • May have a lower cost associated over the longer term as with hauling of the material during the later stages of Phase 2. • The utilisation of a conveyor (along with the in-pit Primary crusher) during the later stages of mining, would eliminate the use of haul trucks thereby minimising the potential impacts on fauna and flora.	initial stages of mining may result in direct and indirect impacts on several aspects of the environment including: Soil (compaction), flora (dust), fauna (road collisions, noise), air quality (dust, vehicle emissions), visual, and noise (animal life and I&APs). • Cost associated with establishing an in-pit primary crusher. • An in-pit Primary crusher will most likely still result in impacts in terms of dust and noise generation.
Process alternatives	**Alternative P1:** Processing of the mined mineral at the existing processing plant.	• PPC Lime Limited operates an existing Processing plant on the farm Bowden on which the current mining activities occur. Therefore no further infrastructure would be required and no additional costs would be incurred.	• The transportation of the mined material to the existing Processing plant may result in negative impacts on the bio-physical environment.

Alternative		Advantages	Disadvantages
	Alternative P2: Processing of the mined mineral at another processing plant.	• Environmental impacts associated with emissions, storm water management, waste management etc. at the Plant will be eliminated / minimised.	• The transportation of the mined material to an off-site processing plant may result in negative impacts on the bio-physical environment. • The transport and processing of the mined material will result in a high cost investment as processing may then need to be undertaken by another company. • High cost investment for constructing a Processing plant. • A higher cost implication may be applicable if the material has to travel great distances before being processed.
Scheduling alternatives	**Alternative SCH1:** Mining of the mineral from the quarry areas utilising a phased approach (i.e. two phases) with an overlap between the Bowden North Quarry extension (north) and Quarry 2 (approximately in 2020).	• This alternative allows for the Bowden North Quarry to be mined in a northerly direction (as part of Phase 1), followed by the mining of Quarry 2 (as part of the existing mining right) and the Mega-pit area in a western / north-western direction (as part of Phase 2), as per mine planning. • The phased approach will also minimise the potential impacts that may occur as	• An overlap between Phase 1 and Phase 2 is however anticipated in approximately 2020.

Alternative		Advantages	Disadvantages
		only one quarry area will be disturbed at a time, with backfilling of previously mined quarries continuing during other quarries are mined.	
	Alternative SCH2: Mining all the proposed quarries simultaneously.	• None	• The mining of all the proposed quarries, at once, may result in higher cumulative impacts than that of mining the quarries individually. • The mining of all the quarries at once may also require the stockpiling of topsoil for longer periods than with a phased approach. • May not be able to follow the direction of the mining faces (based on the mining, logistical and cost-related aspects).
Scale alternatives	**Alternative SCA1:** The mining of the mineral in the proposed quarries as per the site layout plans.	• This alternative allows for the Bowden North Quarry to be mined in a northerly direction (as part of Phase 1), followed by the mining of Quarry 2 (as part of the existing mining right) and the Mega-pit area in a western / north-western direction (as part of Phase 2), as per mine planning. • The phased approach will also minimise the potential impacts that may occur as only one quarry area will be disturbed at	• An overlap between Phase 1 and Phase 2 is however anticipated in approximately 2020.

Alternative		Advantages	Disadvantages
		a time, with backfilling of previously mined quarries continuing during which other quarries are being mined.	
Scale alternatives	**Alternative SCA2:** The mining of the mineral in larger or smaller quarries.	• The mining of limestone in smaller quarries may minimise, in some instances, the potential impacts that may occur.	• All quarries may not be feasible to mine as one large quarry or in smaller quarries, due to mining-related reasons (i.e. it is preferred that mining is to be undertaken in the direction of the mining face for practical and cost related reasons). Due to the existence of a fault located between the existing Bowden North quarry, including its northern extension (Phase 1) and the Quarry 2 and Mega-pit areas (Phase 2), mining all of the proposed quarries simultaneously as one large, will not be possible. • The mining of larger quarries may also result in a greater significance of potential impacts. • May not be able to follow the direction of the mining faces (based on the mining, logistical and cost-related aspects).
Design or layout alternatives	**Alternative DL1:** Mine the whole reserve	• All of the available reserve will be mined, which makes this option the best in terms of mining yield.	• The section of the pan located within the proposed quarry extension area will be mined through.
Design or layout alternatives	**Alternative DL2:** Exclusion of the pan (of which a section is located within the proposed mining	• Potential impacts on the pan (a section of which is located within the proposed	• Portions of the reserve will not be mined.

Alternative		Advantages	Disadvantages
	area) with a defined buffer zone surrounding the pan.	quarry extension area) will be avoided.	
No-go versus quarry extension	**Alternative NQ1:** Quarry extension	• Mining of the available reserves can continue. • Job security of the mine's current employees will continue, along with other benefits arising from the Social and Labour Plan.	• A number of environmental impacts will be associated with the proposed quarry extension.
	Alternative NQ2: No-go option	• The implementation of the no-go option would result in the continuation of the current land uses (game farming and livestock grazing). Therefore no additional impacts on the bio-physical environment will occur, besides those that are currently already occurring and / or which may potentially occur if the areas are not managed appropriately.	• The Life of Mine will not be extended and job security for mine employees and contractors will not continue beyond the current Life of Mine. • It is also very important to note that the implementation of the no-go option may not necessarily prevent the mining of these resources on the property, as other companies may apply to mine the resources, unless the DMR sterilizes the reserves.

8.8 Possible mitigation measures that could be applied and the level of risk

Table 62 below provides a summary of the issues and concerns as raised by affected parties and an assessment of the mitigations or site layout alternatives available to accommodate or address their concerns, together with an assessment of the impacts or risks associated with the mitigation or alternatives considered.

Table 62: Summary of issues and concerns raised by I&APs

This table will be completed once the initial Public Participation Process has ended, prior to the Scoping Report being submitted to the DMR.

Concerns as raised by affected parties	Mitigation measures or site alternative

After this Scoping Report has been made available for public review for a period of thirty (30) days, any additional comments received will be included into the above table, where after the report will be finalised and submitted to the DMR.

8.9 The outcome of the site selection Matrix. Final Site Layout Plan

As described in Part 8.10 below, no site alternatives were considered for the proposed project. Refer to Figures 4 and 5.

8.10 Motivation where no alternative sites were considered

As per the Prospecting EMP, the deposit is situated in the Lime Acres Member of the Ghaap plato Formation, Campbell Group, Griqualand West Sequence. It consists of high-grade strata bound limestone beds on the eastern flank of a large north/south striking syncline. Therefore no alternative site locations could be considered due to the locality of the mineral deposit.

8.11 Statement motivating the preferred site

Evaluating the alternatives, through evaluating the risks pertaining to the various options, and the concerns as raised by the affected parties and the mitigation measures or site alternatives, the preferred options are:

Preferred alternative	Motivation
The proposed activity entails the mining of limestone in the proposed quarry extension areas, utilising a phased approach (two (2) phases), as indicated in the in Figures 4 and 5 of the Scoping Report. *Note: The various alternatives are still being investigated as part of the process and will further be assessed as part of the EIA phase. The EIAR and its associated Alternatives Assessment Report will also (apart from indicating the preferred option from a technical / engineering perspective) provide the assessment results from an environmental and socio-economic perspective.*	**Current preferred Alternative MM1:** The shallow nature of the limestone deposit can easily be mined by means of opencast mining. Underground mining is not feasible due to shallow nature of limestone deposit.[50] **Current preferred Alternative PT4:** The haul trucks can haul a large amount of mined material at once. The use of haul trucks is more financially viable for the initial stages of mining and the current Bowden North Quarry mineral deposit is currently also transported to the existing primary crusher. The ease of being able to crush material in-pit before it being transported to the remainder of the existing Processing plant during the later stages of mining makes Alternative PT4 the preferred option. Furthermore, the utilisation of a conveyor (along with the in-pit Primary crusher) during the later stages of mining, would eliminate the use of haul trucks thereby minimising the potential impacts on fauna and flora. **Current preferred Alternative P1:** PPC Lime Limited operates an existing processing plant on the farm Bowden on which the current mining activities occur. Therefore no further infrastructure would be required and no additional costs would be incurred, if the existing processing plant is continued to be operated.

[50] Alternatives that are not feasible (such as underground mining) may not be included as part of the impact (risk) assessment section in the EIAR and EMPr that will be compiled for the proposed project (as well as the existing mining area) and submitted to the DMR.

Preferred alternative	Motivation
	Current preferred Alternatives SCH1 and SCA1: Mining of the mineral in the two phases allows for the Bowden North Quarry to be mined in a northerly direction (as part of Phase 1), followed by the mining of Quarry 2 (as part of the existing mining right) and the Mega-pit area in a western / north-western direction (as part of Phase 2), as per mine planning. The phased approach will also minimise the potential impacts that may occur as only one quarry area will be disturbed at a time, with backfilling of previously mined quarries continuing during which other quarries are being mined. **Design or Layout Alternatives:** A detailed Wetland Assessment will be conducted as part of the EIA. The resultant report will advise on the current ecological sensitivity and status of the pan (depression wetland) located within a section of the proposed quarry extension area, the final recommended buffer zone (if and where applicable) and the relevant mitigation and / or management measures associated therewith. Alternatives in terms of design / layout of the mine plan will further be investigated as part of the EIA Phase. **Current preferred Alternative NQ1:** Should the proposed quarry extension be authorised and the no-go option not be implemented, mining of the available reserves can continue. This will ensure job security for the mine's current employees and contractors, along with the continued and long-term benefits arising from the Social and Labour Plan.

9. Plan of study for the Environmental Impact Assessment process.

9.1 Description of alternatives to be considered including the option of not going ahead with the activity

The limestone horizones occur within the prospected area and are therefore only present in the location as proposed to be mined (refer to Figures 4 and 5). PPC Lime Limited: Lime Acres is an existing mine operating in the direct vicinity (to the east and south-east) of the proposed quarry extension area. No alternatives in terms of site location could be considered due to the locality of the limestone mineral seams within the vicinity of the existing PPC Lime Limited Bowden North Quarry.

However, alternatives in terms of mining method, transport methods, processing, design and layout and the "No-go" options are considered. A description of each of the mentioned alternatives has been provided in Part 8.1 as well as the Alternatives Assessment report attached hereto as Annexure H.

The proposed site layout (as presented in Figure 4) consists of two (2) Phases of quarry development. These quarries are labelled Phase 1 to 2. Mining will commence at the first location (Phase 1) and once complete (with an overlap in approximately 2020), will continue to the second location (Phase 2). All limestone mined at the quarry extension areas will be transported to the existing primary crusher which is currently operational and approved as part of the mine's current Environmental Management Programme (EMP). The possibility exists for PPC Lime to establish an in-pit primary crusher during the later stages of mining. Therefore this alternative as also been considered during the process thus far and the relevant listed activities associated therewith has been included in the Environmental Authorisation Application.

Table 63 below presents the identified alternatives as well as the identification of the preferred alternative.

Table 63: Identification of alternatives and the preferred alternatives

Alternative type	Identified alternatives	Preferred alternative
Activity alternatives (primary crushing and transport alternatives)	• **Alternative PT1**: The transportation of the mined mineral from the proposed quarry extension areas to the existing primary crusher via truck (haulage) from where it is transported to the remainder of	The current preferred activity alternative is Alternative PT4.

Alternative type	Identified alternatives	Preferred alternative
	the existing processing plant via conveyor. • **Alternative PT2**: The transportation of the mined mineral from the proposed quarry extension areas to the existing primary crusher via conveyor (to be newly constructed) from where it is transported to the remainder of the existing processing plant via conveyor • **Alternative PT3:** The establishment of an in-pit primary crusher at the proposed quarry extension areas from where mined material is transported via conveyor to the remainder of the existing processing plant. • **Alternative PT4:** A combination of Alternative 1 and Alternative 3. During Phase 1 and possibly the first section of Phase 2 of the proposed quarry extension, Alternative 1 is considered by PPC Lime as being the most practical (i.e. transporting the mine mineral to the existing primary crusher via haul truck). However, as mining progresses further to the west and to the north as part of the Mega-pit (during the later sections of Phase 2 of mining), the distance between the mining area and the existing primary crusher increases and from a cost and practical implementation perspective, an in-pit primary crusher (as per Alternative 3) may be established at the proposed quarry extension	

Alternative type	Identified alternatives	Preferred alternative
	areas from where the crushed material will be transported via conveyor to the remainder of the existing Processing facility.	
Process alternatives	• **Alternative P1:** Processing of the mined mineral at the existing processing plant. • **Alternative P2:** Processing of the mined mineral at another processing plant.	The current preferred process alternative is Alternative P1.
Scheduling alternatives	• **Alternative SCH1:** Mining of the mineral from the quarry areas utilising a phased approach (i.e. two phases) with an overlap between the Bowden North Quarry extension (north) and Quarry 2 (approximately in 2020). • **Alternative SCH2:** Mining all the proposed quarries simultaneously.	The current preferred scheduling alternative is Alternative SCH1.
Scale alternatives	• **Alternative SCA1:** The mining of the mineral in the proposed quarries as per the site layout plans. • **Alternative SCA2:** The mining of the mineral in larger or smaller quarries.	The current preferred scale alternative is Alternative SCA1.
Design or layout alternatives	• **Alternative DL1:** Mine the whole reserve • **Alternative DL2:** Exclusion of the pan (of which a section is located within the proposed mining area) with a defined buffer zone surrounding the pan.	The current preferred design and layout alternative is Alternative DL1. *A detailed Wetland Assessment will be conducted as part of the EIA. The resultant report will advise on the current ecological sensitivity and status of the pan (depression wetland) located within a section of the proposed quarry extension area, the final recommended buffer zone (if and where applicable) and the relevant mitigation and / or management measures associated*

Alternative type	Identified alternatives	Preferred alternative
		therewith. Alternatives in terms of design / layout of the mine plan will further be investigated as part of the EIA Phase.
No-go versus quarry extension	• **Alternative NQ1:** Quarry extension. • **Alternative NQ2:** No-go option	The current preferred alternative is Alternative NQ1.

9.2 Description of the aspects to be assessed as part of the environmental impact assessment process

As Part of the EIA and EMP phase of the project all aspects of the bio-physical, socio-economic and cultural environment will be assessed and include (but is not limited to) the following:

- Geology.
- Topography.
- Soil.
- Land use and land capability.
- Vegetation.
- Fauna.
- Surface water.
- Groundwater.
- Sensitive landscapes (including wetlands).
- Visual aspects.
- Air quality.
- Noise.
- Protected areas and conservation planning.
- Sites of archaeological and cultural importance.
- Socio-economic aspects.

9.3 Description of aspects to be assessed by specialists

Several specialist were appointed to conduct studies on various aspects of the bio-physical and cultural environment, and include:

- Sites of cultural and archaeological importance.
- Palaeontological aspects (Desktop).
- Flora.

- Fauna.
- Wetlands (Desktop).
- Environmental Noise.
- Groundwater – Hydrocensus.

These studies have been conducted and completed with the background information included in the Scoping Report in Part 8.4.1. These specialist studies, and their respective reports will also be included and discussed in the EIA and EMP phase of the project.

Additional specialist studies to be undertaken as part of the EIA:

The following additional specialist studies have been identified to be undertaken for the EIA / EMP Phase:

- A detailed Wetland delineation and functional assessment.

9.4 Proposed method of assessing the environmental aspects including the proposed method of assessing alternatives

9.4.1 Proposed method of assessing environmental aspects

Certain environmental aspects have been assessed by qualified specialists, as described above. These aspects have been assessed by the specialists with the resultant specialists reports being attached as appendices to this Scoping Report as described in Table 64 below.

Table 64: List of specialist studies

Annexure	Specialist study	Title
Annexure E1	Flora Assessment	*PPC Lime Acres, Northern Cape Province Vegetation Assessment,* dated October 2014 and compiled by Dimela Eco Consulting.
Annexure E2	Fauna Assessment	*An Assessment of vertebrate species richness for the undeveloped portions of the PPC (Lime) Mine, Danielskuil District, Northern Cape,* dated September 2014 and compiled by I.L Rautenbach, A.C. Kemp and J.C.P van Wyk.
Annexure E3	Desktop Wetland Study	*PPC Lime Acres prospecting area, Northern Cape. Wetland Delineation Report,* dated March 2015 and compiled by Limosella Consulting.
Annexure E4	Hydrocensus	*PPC Lime Limited. Hydrocensus,* dated February 2015 and compiled by Shangoni AquiScience.
Annexure E5	Noise Survey	*PPC Lime Limited. PPC Lime Quarries. Environmental Noise Impact Assessment Report,* dated April 2015 and compiled by Varicon cc.
Annexure E6	Archaeological Assessment	*Archaeological impact assessment for the proposed PPC Lime Opencast Extension, PPC Lime Acres, Northern Cape*

Annexure	Specialist study	Title
		Province, dated August 2015 and compiled by Heritage Contracts and Arachaeological Consulting cc.
Annexure E7	Desktop Palaeontological Assessment	*Desktop palaeontological heritage impact assessment report on the site of a prospecting area proposed to become an extension of the existing PPC Lime Acres Quarry, to be located to the immediate west and north-west of the existing PPC Lime Acres Quarry on the farm Carter Block 458, Postmasburg Magisterial District, Northern Cape Province*, dated April 2015 and compiled by Millsteed, B.D.

9.4.2 Proposed method of assessing alternatives

As described in Part 8.1 above, no alternative site locations could be considered due to the locality of the limestone mineral seams within the properties. However, alternatives in terms of mining method, transport methods, processing, layout and design and the "No-go"options are considered. The proposed method of assessing the alternatives during the EIA Phase has been described in detail in the Alternative Assessment Report attached hereto as Annexure H.

9.5 The proposed method of assessing duration significance

The method used in determining the significance of the duration of the impact is described above in Table 57. Duration is divided into five (5) periods as seen in Table 65. A score of between 1 and 5 is assigned to the impact based on the characteristics of the impact and the period for which the impact will occur and have an impact on the socio-economic, cultural and biphysical environment. The score assigned to the specific impact for duration is then used in determining the magnitude of the impact (refer to Table 58 above).

Table 65: Determination of the duration of an impact

Duration of impact	Score
Lasting days to a month	1
Lasting 1 month to 1 year	2
Lasting 1 – 5 years	3
Lasting 5 years to Life of Organisation	4
Beyond life of Organisation / Permanent impacts	5

9.6 The stages at which the competent authority will be consulted

The competent authority, in this case the Department of Mineral Resources (DMR) will be consulted throughout the application process. Prior to the submission of the application form, the DMR was

consulted (during a meeting held on 19 March 2015 and a site visit held on 15 September 2015), regarding the proposed listed activities. The application form was subsquently submitted.

This Scoping Report was compiled and made available for public and stakeholder review for a period of thirty (30) days. Upon completion of the review period and finalisation of the Scoping Report, this Scoping Report will be submitted to the DMR, whereafter the DMR will have 43 days to refuse environmental authorisation or accept the Scoping Report and inform the aplicant to proceed with the tasks contemplated in the plan of study for the Environmental Impact Assessment (EIA).

The competent authority (the DMR) will then be consulted during the EIA phase of the project, in a similar manner as above. The EIAR and EMPr will be made available for a public and stakeholder review period of thirty (30) days. Upon completion of the review period, the EIAR and EMPr will be finalised and submitted to the DMR, whereafter the DMR will have a period of 107 days to consider the application and, in writing, notify the applicant of the decision to grant or refuse environmental authorisation.

9.7 Particulars of the public participation process with regard to the Impact Assessment process that will be conducted

9.7.1 Steps to be taken to notify interested and affected parties.

Steps have already been taken to notify the public of the proposed project during the Scoping Phase. These steps will also be described in detaill in the public particpation report, attached hereto as Annexure G, as soon as public participation has been undertaken. The public was notified through the following means:

- An advertisement placed in the Kathu Gazette.
- Notification letters and BIDs sent to already registered I&APs and stakeholders.
- Electronic notification letters (via email) delivered to already registered I&APs and stakeholders.
- Site Notices placed at the proposed activity site as well as at other places conspicuous to the public.

9.7.2 Details of the engagement process to be followed.

The notification letters, BID and the newspaper advertisement (mentioned above) present a background to the proposed listed activities, present the location of where this Scoping Report is available for review as well as indicates that all I&APs and stakeholders are invited to peruse the Scoping Report and provide comment within thirty (30) days. Details of where comments should be directed was also provided.

I&APs and stakeholders will further be notified during the process of the availability of the EIAR and EMPr for public and stakeholder review by means of notifications (via e-mail and post). The

documents will be made available for public review on Shangoni Management Services website (www.shangoni.co.za). All comments received on the EIAR and EMPr will be incorporated and responded to in the final EIAR and EMPr to be submitted to the DMR.

9.7.3 Description of the information to be provided to Interested and Affected Parties.

Notification letters, including a Background Information Document (BID) have been provided to I&APs and stakeholders during the Scoping Phase. As mentioned above, I&APs and stakeholders will further be notified during the process of the availability of the EIAR and EMPr for public and stakeholder review by means of notifications (via e-mail and post). The documents will be made available for public and stakeholder review on Shangoni Management Services website (www.shangoni.co.za). All comments received on the EIAR and EMPr will be incorporated and responded to in the final EIAR and EMPr to be submitted to the DMR.

9.8 Description of the tasks that will be undertaken during the environmental impact assessment process

The Environmental Impact Assessment Phase will be undertaken subsequently to the Scoping Phase as stipulated in Regulation 23 of the Environmental Impact Assessment Regulations R.982, 2014 (dated 04 December 2014), under the National Environmental Management Act, 1998 (Act No. 107 of 1998). The EIR and EMPr for the proposed project will include detailed information relating to the potential or anticipated impacts that may arise as a result of the proposed activity.

The EIR in accordance with the EIA Regulations R.982 of 4 December 2014, will include, but is not limited, to the following:

(a) Details of-
  (i) The EAP who prepared the report; and
  (ii) The expertise of the EAP, including a curriculum vitae;
(b) The location of the activity, including:
  (i) The 21 digit Surveyor General code of each cadastral land parcel;
  (ii) Where available, the physical address and farm name; and
  (iii) Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;
(c) A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is-
  (i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken;
  (ii) On land where the property has not been defined, the coordinates within which the activity is to be undertaken;

(d) A description of the scope of the proposed activity, including-
  (i) All listed and specified activities triggered and being applied for; and
  (ii) A description of the associated structures and infrastructure related to the development;
(e) A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;
(f) A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location;
(g) A motivation for the preferred development footprint within the approved site;
(h) A full description of the process followed to reach the proposed development footprint within the approved site, including:
  (i) Details of the development footprint alternatives considered;
  (ii) Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;
  (iii) A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;
  (iv) The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;
  (v) The impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts-
    (aa) Can be reversed;
    (bb) May cause irreplaceable loss of resources; and
    (cc) Can be avoided, managed or mitigated;
  (vi) The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;
  (vii) Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;
  (viii) The possible mitigation measures that could be applied and level of residual risk;
  (ix) If no alternative development locations for the activity were investigated, the motivation for not considering such; and
  (x) A concluding statement indicating the preferred alternative development location within the approved site;
(i) A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including-
  (i) A description of all environmental issues and risks that were identified during the environmental impact assessment process; and

(ii) An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;

(j) An assessment of each identified potentially significant impact and risk, including-
  (i) Cumulative impacts;
  (ii) The nature, significance and consequences of the impact and risk;
  (iii) The extent and duration of the impact and risk;
  (iv) The probability of the impact and risk occurring;
  (v) The degree to which the impact and risk can be reversed;
  (vi) The degree to which the impact and risk may cause irreplaceable loss of resources; and
  (vii) The degree to which the impact and risk can be mitigated;

(k) Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;

(l) An environmental impact statement which contains-
  (i) a summary of the key findings of the environmental impact assessment:
  (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and
  (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives; based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;

(m) Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;

(n) The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;

(o) Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation

(p) A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;

(q) A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;

(r) Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;

(s) An undertaking under oath or affirmation by the EAP in relation to:
  (i) The correctness of the information provided in the reports;
  (ii) The inclusion of comments and inputs from stakeholders and I&APs;
  (iii) The inclusion of inputs and recommendations from the specialist reports where relevant; and
  (iv) Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;

(t) Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;

(u) An indication of any deviation from the approved scoping report, including the plan of study, including-
  (i) Any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and
  (ii) A motivation for the deviation;

(v) Any specific information that may be required by the competent authority; and

(w) Any other matters required in terms of section 24(4)(a) and (b) of the Act.

The EMPr in accordance with the EIA Regulations R.982 of 4 December 2014, will include, but is not limited, to the following:

An EMPr, in support of the Environmental Impact Assessment, in terms of the NEMA requirements, will be compiled and submitted simultaneously with the EIAR.

(1) An EMPr must comply with section 24N of the Act and include-

(a) Details of
  (i) The EAP who prepared the EMPr; and
  (j) The expertise of that EAP to prepare an EMPr, including a curriculum vitae;

(b) A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;

(c) A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers;

(d) A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including-
  (i) Planning and design;
  (ii) Pre-construction activities;
  (iii) Construction activities;
  (iv) Rehabilitation of the environment after construction and where applicable post closure; and
  (v) Where relevant, operation activities;

(e) A description and identification of impact management outcomes required for the aspects contemplated in paragraph (d);

(f) A description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to –
  (i) Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
  (ii) Comply with any prescribed environmental management standards or practices;
  (iii) Comply with any applicable provisions of the Act regarding closure, where applicable; and
  (iv) Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;
(g) The method of monitoring the implementation of the impact management actions contemplated in paragraph (f);
(h) The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);
(i) An indication of the persons who will be responsible for the implementation of the impact management actions;
(j) The time periods within which the impact management actions contemplated in paragraph (f) must be implemented;
(k) The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);
(l) A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;
(m) An environmental awareness plan describing the manner in which-
  (i) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and
  (ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment; and
(n) Any specific information that may be required by the competent authority.

9.8.1 Compilation of Integrated consolidated EIAR and EMPr

A pre-application Authorities meeting was held on 19 March 2015 between representatives of the Department of Mineral Resources (DMR), PPC Lime Limited (Lime Acres) (the applicant) and Shangoni Management Services (the EAP). Minutes of the mentioned meeting are attached in Annexure I.

The purpose of the meeting was to discuss the existing and proposed activities of PPC Lime Limited (Lime Acres) and to obtain clarity on the way forward and the process to follow in terms of applying for a Mining Right as well as for Environmental Authorisation, taking into account the new Integrated System and new EIA Regulations, which came into effect on 08 December 2014.

Discussions were held following this and a number of questions raised by the applicant and EAP were answered by the DMR attendees (refer to the minutes of the meeting in Annexure I).

Following this, another pre-application meeting and site visit with the DMR was held on 15 September 2015 to confirm the way forward and to obtain guidance from the DMR in terms of the process to follow.
Refer to the minutes of the meeting and site visit in Annexure I.

The following outcome and way forward were reached from the mentioned meeting and site visit[51]:

- An application in terms of a Section 102 amendment needs to be made for the Environmental Authorisations to be obtained for the proposed PPC Lime Limited quarry extension. The Environmental Authorisation application for the proposed project will be followed by a Scoping Report for the proposed quarry extension project (44 days after the application was submitted – as per the EIA Regulations, 2014), and lastly a combined (integrated) EIAR/EMPr (for the existing mining operations as well as the proposed extension project) (the latter included in this Scoping Report) may be submitted (106 days from acceptance of Scoping Report). It was indicated that no "new mining rights application" should be made.

The minutes of the meeting, along with a cover letter was submitted to the DMR subsequent to the meeting, in order to obtain written confirmation from the Department on the agreed way forward. Refer to Annexure I.

A confirmation letter was subsequently received from the DMR, dated 09 October 2015 where in the DMR confirms the following: "*Be informed that the Department has looked into your proposal on the application for Section 102 for quarry extension activity and the integration of the quarry extension as well as the existing mining operation. You are at liberty to apply for Section 102 and to obtain one Environmental Authorisation."* Refer to Annexure I for a copy of the mentioned letter.

9.9 Measures to avoid, reverse, mitigate, or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

Table 66 below is the Risk assessment table in which preliminarily identified impacts have been identified. Mitigations measures (to avoid , reverse, mitigate, or manage identified impacts) as well as the extent to which these impacts are anticipated to result in residual risks are also provided in Table 66 below.

[51] Note that the outcome from the first pre-application meeting (March 2015) and the second pre-application meeting and site visit (September 2015) is different (i.e. during the first meeting DMR indicated that a new Mining Rights application is to be submitted and during the second meeting it was agreed that a Section 102 Amendment Application is the best way forward, as it was indicated by the DMR attendees that a new mining rights application for the proposed project may not be the best option, as the nature of the project was explained as being an extension (continuation) of the existing operations to the north and west. He added that the DMR would prefer to amend the current mining right, rather than to issue another mining right to PPC, since it is for the same reserve (continuation of activities).

Table 66: Risk assessment and mitigation type

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
Geology	• Mining of limestone from the quarry extension areas	A permanent impact on the localised geology of the areas associated with the proposed quarry extension areas will result from the mining and removal of limestone.	Control	High. The impact is of a permanent nature.
Topography	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries.*	The construction and progressive development of the quarries will temporarily alter the topography.	Control and modify	Medium. If rehabilitation is not implemented adequately, a residual impact on topography may occur.
	• Placement of overburden material on the overburden dump (and on walls of evaporation pond area). • Disposal of slurry mix (lime and dolomite dust collected from processing facility and mixed with water) on existing evaporation ponds. • processing plant residue will continue to be disposed of at the existing	The continuation of placement of overburden material on the overburden dumps, slurry on the evaporation ponds and Plant Processing residue on the Kiln Waste Dump, will continue to influence the flat nature of the topography that is typical of the surrounding area. Although all dumps will be landscaped as part of the decommissioning phase, the topography will differ from the original.	Control and modify	Medium. If rehabilitation is not implemented adequately, a residual impact on topography may occur.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
	kiln waste dump situated adjacent to the existing dolomite quarry.			
Topography	• Rehabilitation of quarry areas (Backfilling with overburden; and subsequent topsoil placement).	During rehabilitation the quarry will be backfilled and the disturbed area reshaped to be free draining and to as close as possible to pre-mining conditions. The topography of the localised area will however most likely be permanently altered.	Control and modify	Medium. See above.
Soil, land use and land capability	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries.*	The original (pre-mining) and current land use in the area is restricted to livestock grazing, as crop farming is not possible because of the lack of soil and the harsh climatic conditions in the area. A section where the proposed Quarry Extension Mega-pit is proposed to be located, is currently utilised for game farming. The disturbed terrain (associated with the proposed quarry extension) will therefore be unavailable for grazing or game farming during the operational phase of the mine.	Control	Low. If rehabilitation is not implemented adequately, a residual impact on land use and land capability may occur.
	• Removal of topsoil and	The removal of topsoil may result in the mixing of the horizons of the soil which will have an impact on the	Control	Low. If mitigated / managed

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
	overburden from the quarry extension areas. • Placement of topsoil into stockpiles (located at the quarry areas) for transportation to rehabilitation areas. Topsoil is utilised as soon as possible for rehabilitation activities.	fertility and production potential of the soil.		appropriately.
		The temporary stockpiling of topsoil may result in a decrease in the fertility of the soil and the leaching of minerals due to exposure of the soil to elements.		
		A loss of microbes and viable seed may occur as a result of the temporary stockpiling of topsoil.		
		Soil compaction and topsoil loss through erosion may occur as a result of the mining and mining related activities (including the temporary stockpiling). This will further lead to a loss of soil fertility.		
	• Use and maintenance of chemical / portable toilets at quarry extension areas.	The ineffective control and management of the proposed chemical toilets, to be placed at the quarry locations, may lead to the contamination of soil, surface water and ground water resources.	Control	Low. If mitigated / managed appropriately.
	• Use of mobile transformer units.	The ineffective handling of hydrocarbon spillages may lead to the contamination of soil, surface water and ground water resources.	Control	Low. If mitigated / managed appropriately.
	• Use and maintenance of process water or slurry pipes.	The ineffective prevention or management of leaks from pipelines may lead to the contamination of soil, surface water and ground water resources.	Control	Low. If mitigated / managed appropriately.
	• Hauling of mined minerals to existing primary crusher.	Ineffective erosion control along haul roads towards the quarries may lead to siltation of downstream water resources and scouring of soil.	Control	Low. If mitigated / managed appropriately.
Surface water	• Mining of limestone from	Due to the proximity of the proposed quarries to the	Modify and / or remedy	High.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
	the quarry extension areas: *Construction and progressive development of the quarries.* • Placement of overburden material on the overburden dump (and on walls of evaporation pond area) for subsequent backfilling into the quarries as part of rehabilitation.	delineated pan (depression wetland) and the drainage-way along the western boundary of the study site, surface water quality of such resources may be impacted upon.		Should the section of the pan located within the proposed quarry extension be mined out, a residual impact may occur.
		In the event of chemical or hydrocarbon spillages on soil, surface water runoff which comes into contact with the soil may become contaminated and enter the receiving environment and / or water resources. This will have an impact on, not only the surface water quality, but the aquatic vegetation, animal life and any other downstream water users.	Control	Low. If mitigated / managed appropriately.
		Surface water contamination may occur should the separation of clean- and dirty water management areas not be effectively implemented.	Control	Low. If mitigated / managed appropriately.
		A reduction in the catchment yield may result from the ingress of surface water runoff into the quarries, which may have an impact on the downstream surface water users.	Control	Low. If mitigated / managed appropriately.
	• Dewatering of water contained in the quarry extension pit areas and pumping of water to Quarry 5 for subsequent	Potential aquifer depletion due to quarry dewatering.	Control and / or remedy	Medium May result in a residual impact.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
	treatment and supply to the villages for domestic use (as per current practice).			
Groundwater	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*. • Placement of overburden material on the overburden dump (and on walls of evaporation pond area). • Disposal of slurry mix (lime and dolomite dust collected from processing facility and mixed with water) on existing evaporation ponds. • processing plant residue will continue to be disposed of at the existing	Potential seepage of water from the quarry areas and dumps to the groundwater regime may contaminate groundwater resources. Parameters that recorded high to elevated concentrations in monitoring boreholes during the Geohydrological Assessment: Hydrocensus conducted for PPC Lime Limited (Annexure E4) include: Electrical Conductivity (EC); inorganic nitrogen (in the form of total ammonia (NH4 + NH3) but also nitrate (NO3)); and Manganese (Mn). A pollution risk towards groundwater remain but only within the immediate vicinity of the mining area due to the cone of depression and groundwater flow patterns. This may only hold true for the operational phases of mining when active dewatering takes place. As mentioned in the Geohydrological Assessment: Hydrocensus report (Annexure E4), it must be noted that due to mine abstractions and the subsequent formation of the cone of depression, polluting substances generated due to the mining processes cannot migrate	Control	Low. If mitigated / managed appropriately.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
	kiln waste dump situated adjacent to the existing dolomite quarry.	in a pollution plume away from PPC since all polluting substances will move with groundwater (through advection) which are drawn inwards towards the areas of abstraction. This, together with the flow groundwater being either towards PPC Lime or towards the east from the probable igneous intruded body acting as a flow boundary, imply that PPC Lime cannot be responsible for substandard water quality recorded for the some of the farm boreholes.		
		Groundwater quality may be impacted in the event of a spillage of chemicals or hydrocarbon materials (e.g. oil spill from vehicles and machinery).	Control	Low. If mitigated / managed appropriately.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
Vegetation	• Clearance of vegetation. • Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*. • Hauling of mined minerals to existing primary crusher.	The indigenous and natural vegetation will be impacted upon within the proposed Quarry extension areas as a result of clearance of vegetation and mining and related activities. Other than for the area transformed by the current mining extent, the site was dominated by the *Tarchonanthus camphoratus-Olea europea subsp africana* vegetation. Variation in soil depth, the presence of gravelly, shallow soils or watercourses resulted in smaller habitats within the dominant *Tarchonanthus camphoratus-Olea europea subsp africana* vegetation. No nationally Threatened or Protected Species (TOPS) were recorded. However, a number of plants protected by the Northern Cape Nature Conservation Act, 2009 (No.9 of 2009) were recorded on the site, as well as one individual of the national protected tree *Boscia albitrunca*.	Control and / or stop	Medium. The removal of natural vegetation is regarded as a significant impact. However, should rehabilitation to as close as pre-mining conditions be undertaken appropriately and adequately, as well as the control of alien invasive species, a residual impact on vegetation may be prevented.
		Declared alien and invasive plant species may establish in disturbed areas, if not controlled properly.	Control and / or stop	
Fauna	• Mining of limestone from	Noise generated by the mining and mining related	Control	Low.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
	the quarry extension areas: *Construction and progressive development of the quarries*.	activities may frighten animals which may lead to injuries, deaths as well as the animals migrating away from the site.		If mitigated / managed appropriately.
		Animal life may move to and from the mining areas and the adjacent properties, should the mining areas not be demarcated and fenced in, animals may be injured, deaths may result and the animals may damage infrastructure on site.	Control and /or modify	Low. If mitigated / managed appropriately.
		Any poaching, killing or snaring of animals will have a negative impact on animal life. It will result in migration of these species but the lack of suitable habitat in the surrounding areas may further contribute to loss of animal life.	Control	Low. If mitigated / managed appropriately.
		Veld fires can be a risk to fauna and flora as well as the community (including adjacent landowners and employees).	Stop and / or control	Low. If veldt fires are prevented.
	• Hauling of mined minerals to existing primary crusher.	Animal deaths may occur should they be struck by haul vehicles, due to the hauling of the mined material between the quarries and the primary crusher and Processing plant.	Control	Low. If mitigated / managed appropriately.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
Sensitive landscapes (including wetlands)	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*. • The application area will extend into a section of a pan (depression wetland area) located to the north.	A pan (depression wetland) has been identified. The mentioned pan forms part of the larger Rooi Pan, and a section thereof is located within the proposed quarry extension area. As mentioned in the Desktop Wetland Assessment (Annexure E3), several locally and regionally important plant species are known to occur in the pans, including *Boophone distichia* on the margins of the pan. It is unknown what important diatoms and invertebrates occur in the pan and further investigation would be required. As the wetland delineated on the study site forms the upper reaches of the much larger Rooipan it is expected that any contaminants entering the system from the mine will flow into and accumulate there. Potential impacts to be taken into account include: • Loss and disturbance of wetland habitat (including possible diatom and invertebrate communities) and fringe vegetation. • Introduction and spread of alien invasive vegetation. • Changes in the amount of sediment entering the	Modify and / or remedy	High. Should the section of the pan located within the proposed quarry extension be mined out, a residual impact may occur. See above.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
		system. • Changes in water quality due to toxic contaminants and increased nutrient levels entering the system. • Changes in water flow regime due to the alteration of surface characteristics. Further investigations on the wetland (pan) system have been identified as part of the Scoping process and a detailed Wetland Assessment will be conducted as part of the EIA Phase.		
Site of archaeological importance	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*.	As mentioned in the Archaeological Impact Assessment report (Annexure E6), in terms of the archaeological component of Section 35 of the NHRA isolated Middle Stone Age (MSA) artefacts were recorded scattered over the study area. The artefacts are scattered too sparsely to be of any significance apart from noting their presence, which has been done so in this report. Two contemporary middens associated with mine workers/farm labourers were recorded within the proposed Quarry extension area. These sites are of low significance as they are not older than 60 years and in the case of Midden 2 probably represent secondary dumping of household refuge amongst other things.	Control	Low. If mitigated / managed appropriately.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
		Outside of the proposed quarry area two cemeteries were recorded that will not be impacted on.		
Site of archaeological importance		As per the Desktop Palaeontological Assessment report (Annexure E7), the palaeontological potential of the Campbell Rand Subgroup is, accordingly, high. The probability and significance of any negative impact occurring in the rocks of the Campbell Rand Subgroup is assessed as being high, but the impact will be low.	Control	High. Impact on geological structure will be permanent. The significance of the impact is however low.
Protected areas and conservation planning	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*.	There are no protected areas within the direct vicinity of the PPC Lime Limited proposed Quarry Extension. The Olifantshoek Plains Thornveld, in which the proposed Quarry extension area of PPC Lime Limited falls, is identified in the EMF and Mining and Biodiversity Guidelines from SANBI as a "medium" priority. The EMF, 2008 further states that due to the nature of the vast area with a low population there are no significant land use conflicts in the area that need to be addressed in the EMF with the exception of activities within the Orange River floodplain. PPC Lime Limited and proposed Quarry extension area falls within "Zone 1: Potential sensitive groundwater resources". Refer to Figure 35 below. A description of	Control	Low to medium. Refer also to 'sensitive landscapes' and 'groundwater' above.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
		"Zone 1" as follows: "The karst aquifers that occur in the dolomite and lime stone rocks in the area represent a major strategic water resource. It is sensitive both in respect to the abstraction and potential pollution of groundwater."		
Air quality	• Mining (including blasting) of limestone from the quarry extension areas: *Construction and progressive development of the quarries*. • Loading of mined minerals. • Hauling of mined minerals to existing primary crusher or alternatively establishing an in-pit primary crusher during the later stages of mining (alternatives still being investigated). • Rehabilitation of quarry areas (Backfilling with overburden; and	During the construction of the quarries, mining of the ore body, transport of the mined material to the primary crusher, and rehabilitation activities, dust may be generated which may have an impact on the ambient air quality of the area.	Control	Low. Mining and related activities will have ceased after Closure, and therefore dust will no longer be generated.
		All vehicles and mining machinery may have an impact on the air quality of the surrounding area as a result of the emissions released by the vehicles and machinery.	Control	Low. Mining and related activities will have ceased after Closure, and therefore emissions will no longer pose a risk.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
	subsequent topsoil placement).			
Noise	• Mining (including drilling and blasting) of limestone from the quarry extension areas: *Construction and progressive development of the quarries*. • Hauling of mined minerals to existing primary crusher or alternatively establishing an in-pit primary crusher during the later stages of mining (alternatives still being investigated).	The removal of vegetation, topsoil, overburden and the mining of the limestone will be conducted where after the mined material will be transported to the primary crusher via haul truck, or alternatively an in-pit primary crusher may be operated during the later stages of mining. These activities, as well as rehabilitation (backfilling) activities will produce noise which may impact on the surrounding landowners.	Control	Low. Mining and related activities will have ceased after Closure, and therefore noise will no longer be generated.
Visual	• Mining of limestone from the quarry extension areas: *Construction and progressive development of the quarries*. • Hauling of mined minerals to existing primary crusher or alternatively	The proposed mining activities may be intrusive, in terms of visual aspects, which may result in a change of sense of place to the local community and tourist passing through the area. It is however important to note that mining activities (including the processing activities) are currently taking place. Therefore it is likely that regular passers-by and the local residents are desensitised to the mining and proposed mining activities.	Control and modify	Medium. If rehabilitation is not implemented adequately, a residual visual impact may occur.

Environmental component (Aspects affected)	Activity	Potential Impact	Mitigation type Modify/Remedy/Control/ Stop	Potential for residual risk
	establishing an in-pit primary crusher during the later stages of mining (alternatives still being investigated).			
Socio-economic	• Mining and mining related activities	Job security of the mine's current employees will continue, along with other benefits arising from the Social and Labour Plan.	Control	Low. Job security will not continue after the mine has closed.
		The excavation of material will hinder the opportunity to utilise the proposed sites for grazing or game farming activities for the duration of the operational phase, until such a time as the land has been rehabilitated.	Control	Low. If rehabilitation is not implemented adequately, a residual impact on land use and land capability may occur.
	• Mine Closure	During mine closure, a loss of jobs will occur which may not only impact on the employees but on the socio-economic status of the local community and economy.	Control and stop	High. Jobs will be lost upon mine Closure.

10 Other information required by the competent Authority

10.1 Compliance with the provisions of section 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:-

10.1.1 Impact on the socio-economic conditions of any directly affected person.

Results of investigation, assessment and evaluation of impact on any directly affected person	Reference to where mitigation is reflected
Should the proposed quarry extension be authorised and the no-go option not be implemented, mining of the available reserves can continue. This will ensure continued job security for the mine's current employees and contractors, along with the continued and long-term benefits for the local community arising from the Social and Labour Plan. This impact will be further discussed in detail, assessed and the significance determined during the EIA and EMP Phase of the project.	Refer to Part 9.9 above and Annexure F.

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

Results of investigation, assessment and evaluation of impact on any national estate	Reference to where mitigation is reflected
As mentioned in the Archaeological Impact Assessment report (Annexure E6), in terms of the archaeological component of Section 35 of the NHRA isolated Middle Stone Age (MSA) artefacts were recorded scattered over the study area. The artefacts are scattered too sparsely to be of any significance apart from noting their presence, which has been done so in this report. Two contemporary middens associated with mine workers/farm labourers were recorded within the proposed Quarry extension area. These sites are of low significance as they are not older than 60 years and in the case of Midden 2 probably represent secondary dumping of household refuge amongst other things. Outside of the proposed quarry area two cemeteries were recorded that will not be impacted on.	Refer to Part 9.9 above and Annexure E6.

11. Other matters required in terms of section 24(4)(a) and (b) of the Act.

Section 24(4)(b) of the NEMA (1998) states that the following:

"24(4) Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment -

(b) must include, with respect to every application for an environmental authorisation and where applicable-

(i) investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity;"

An Alternative Assessment Report has been compiled and is attached hereto as Annexure H. The Alternative Assessment Report has been compiled to include the following:

- Brief description of the proposed project.
- A description of the proposed activities to be undertaken.
- A description of the proposed alternatives.
- An assessment of the positive and negetive implications of eah of the alternatives.
- A description of the method to be followed during the EIA and EMPr Phase, in terms of quantitavely assessing the alternatives.

12. Undertaking regarding correctness of information

I_____herewith undertake that the information provided in the foregoing report is correct, and that the comments and inputs from stakeholders and Interested and Affected parties has been correctly recorded in the report.

This section will be signed by the EAP once the Public Participation Report has been compiled and is submitted along with the Final Scoping Report.

_____

Signature of EAP

Date:

13 Undertaking regarding level of agreement

I_____herewith undertake that the information provided in the foregoing report is correct, and the level of agreement with Interested and Affected parties and stakeholders has been correctly recorded and reported herein.

This section will be signed by the EAP once the Public Participation Report has been compiled and is submitted along with the Final Scoping Report.

_____

Signature of EAP

Date:

- END -