



mineral resources

**Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA**

Private Bag X6093, Kimberley, 8300, Tel: (053) 807 1700, Fax: (053) 832 5631
First Floor, Liberty Corner, 29-31 Curry Street, Kimberley 8301

From: Directorate: Mineral Regulation: Northern Cape **Date:** 06 December 2011
Enquiries: Ms. Linah Tshikororo E-Mail: Tshisikhawe.Tshikororo@dmr.gov.za
Ref: NC 30/5/1/3/3/2/1/5007 EM (Temporary file number)

The Director
South African Heritage Resources Agency
PO Box 4637
CAPE TOWN
8000

On Sahn's
CaseID: 823

Attention: Mrs Nonofho Ndobochani

CONSULTATION IN TERMS OF SECTION 40 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT 2002, (ACT 28 OF 2002) FOR THE APPROVAL OF AN ENVIRONMENTAL MANAGEMENT PLAN FOR MINING PERMIT ON THE REMAINING EXTENT OF THE FARM ERF 1 SITUATED IN THE MAGISTERIAL DISTRICT OF CARNAVON, NORTHERN CAPE REGION.

APPLICANT: SOUTH AFRICAN NATIONAL ROADS AGENCY LIMITED (SANRAL)

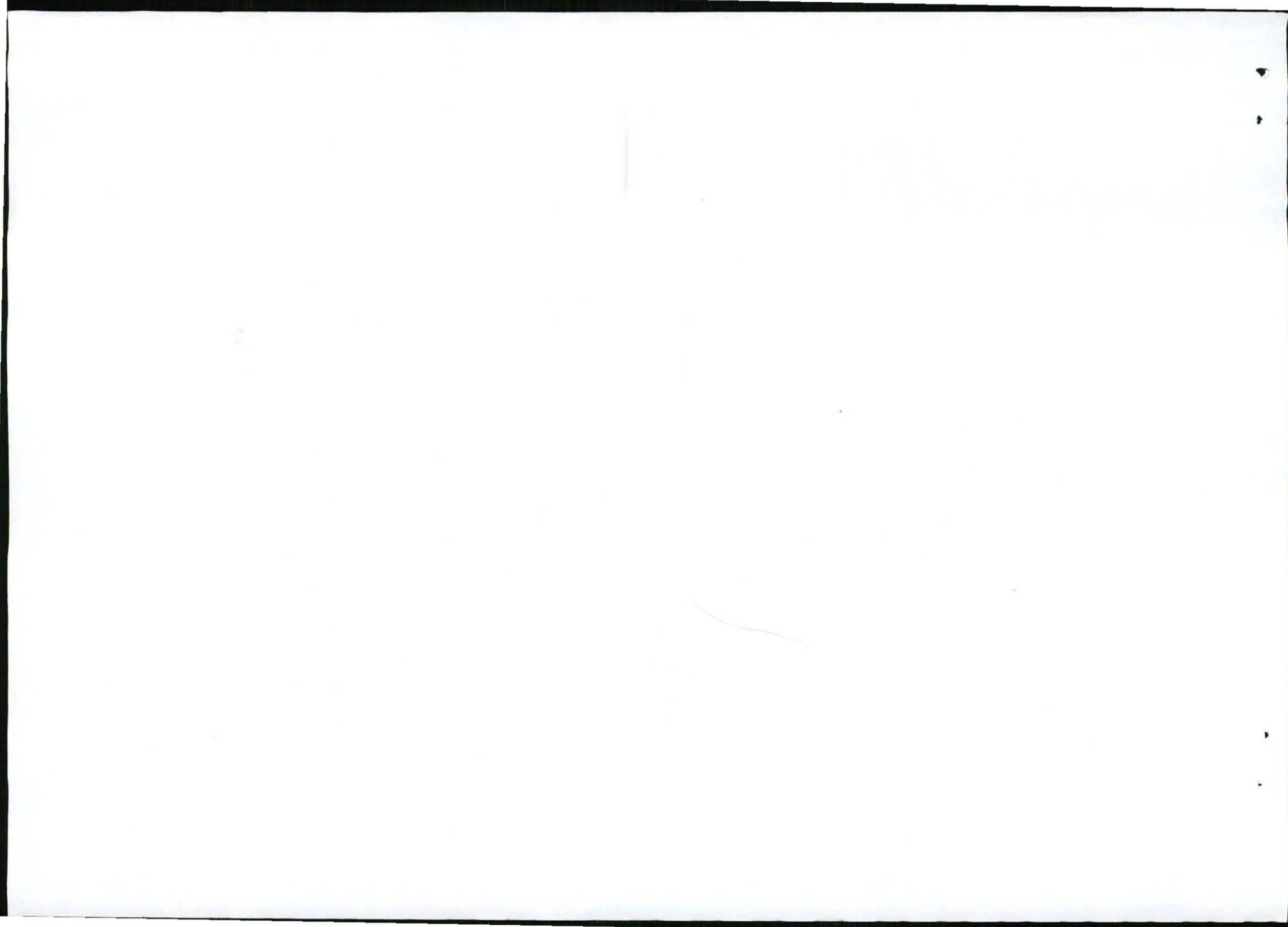
Attached herewith, please find a copy of an EMP received from the above-mentioned applicant for your comments.

It would be appreciated if you could forward any comments or requirements your Department may have to this office and to the applicant before **27 January 2012** as required by the Act.

Consultation in this regard has also been initiated with other relevant State Departments. In an attempt to expedite the consultation process please contact **Linah Tshikororo** of this office to make arrangements for a site inspection or for any other enquiries with regard to this application.

Your co-operation will be appreciated.

**REGIONAL MANAGER: MINERAL REGULATION
NORTHERN CAPE REGION**



**ENVIRONMENTAL MANAGEMENT PROGRAMMES
FOR THE RE-USE/EXTENSION OF
THREE EXISTING BORROW PITS
FOR
USE IN ROAD SHOULDER STABILIZATION OF THE CURRENT
SANRAL CONTRACT: NRA-N012-080-2009/1
Rehabilitation of National Route 12 Section 8
Strydenberg km 0.0 to Hopetown km 52.0
Three borrow pits: (now including the 4th)**

- Hopetown Municipal Borrow Pit, BP-HM
- Ganna Bridge Borrow Pit, BP-GB
- Strydenberg Municipal Borrow Pit, BP-SM
- **Karee Tree Borrow Pit, BP-KT**

Environmental Management Programme For Borrow Pits (Compiled i.t.o. Section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002); Government Notice R762 dated 25 June 2004; and Section 39(1) and Regulation 49 of the MPRDA)

Prepared for the Applicant:

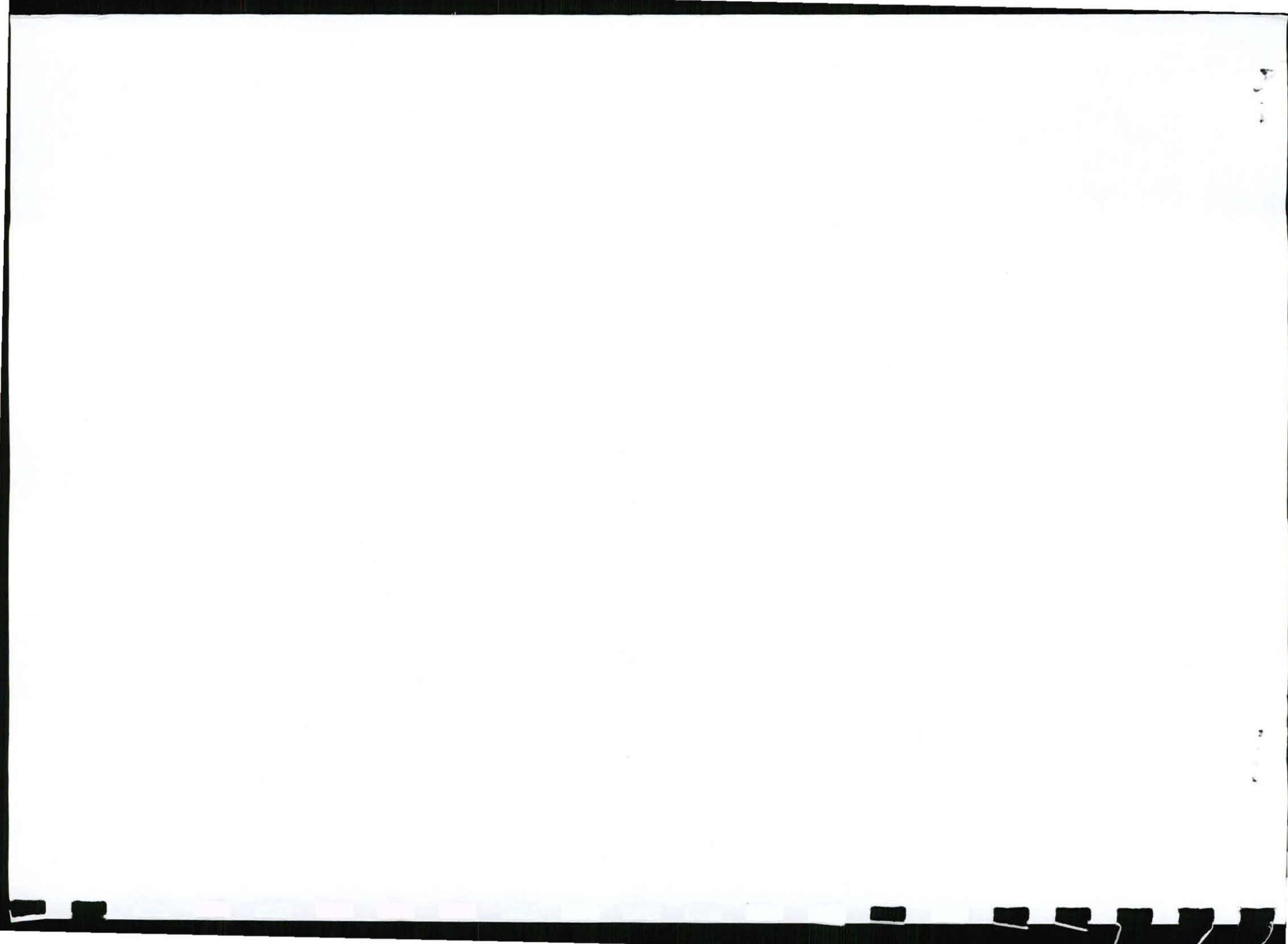
SANRAL (Cape Town)
Mr Mike Vinello-Lippert
Private Bag X19
Bellville
7535
Tel: 021-957 4600
Fax: 021-946 1630



Consulting Engineers
ERO Engineering (Pty) Ltd
Mr Kobus Visser
PO Box 4344
Durbanville
7551
Tel: 021-975 6200
Fax: 021-975 6400
Cell: 082 555 7817

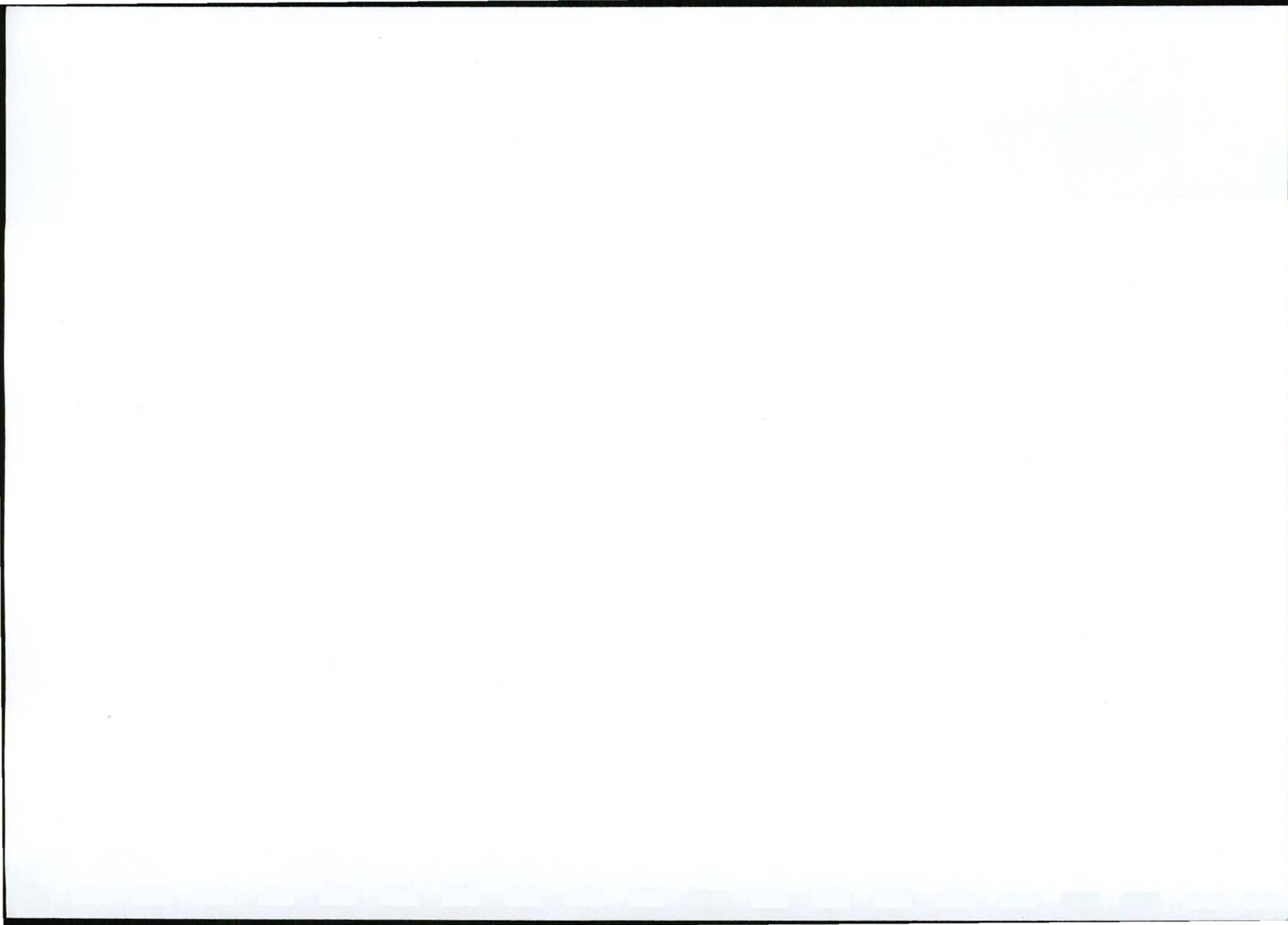
Compiled By:

Site Plan Consulting
PO Box 28
Strand
7139
Tel: 021-854 4260/98
Fax: 021- 854 4321
Email: david@siteplan.co.za



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PHOTOGRAPHS

Photo Pages with Individual Borrow Pits in Annexure A

- Photo page BP-HM (Hopetown Municipal Borrow Pit)
- Photo page BP-GB (Ganna Bridge Borrow Pit)
- Photo page BP-SM (Strydenberg Municipal Borrow Pit)

FIGURES

General Contract Area Figures

Figure A	Locality Plan (showing chosen borrow pits and alternative sites not selected)	1:100 000
Figure B	Regional Geology (after Council for Geoscience published sheets)	1:150 000
Figure C	Botanical Veld Type Classification (after SANBI (Musina) classification)	1:200 000

Note: Figures of Individual Borrow Pits in Annexure A.

ANNEXURE A

Individual Borrow Pit EMPs: Site Specific Description and Prescriptions with Figures and Photo Pages:

- Hopetown Municipal Borrow Pit (BP-HM)
- Ganna Bridge Borrow Pit (BP-GB)
- Strydenberg Municipal Borrow Pit (BP-SM)

ANNEXURE B

Letters of Approval from the Required Landowners

ANNEXURE C

Public Notice: Posters placed on farm fences & gates and at Municipal Libraries in Strydenburg & Hopetown

1.0 INTRODUCTION

This report is the EMP (Environmental Management Programme) compiled in terms of Section 39 of the Mineral & Petroleum Resources Development Act 28/2002 in respect of the finally selected 3 borrow pits now additionally required for the upgrade of National Road N-12 Strydenberg to Hopetown to supplement the material being quarried at present from the approved Borrow pit at km 26.6 under DMR ref NC1990 EM BP (refer Fig A: Locality Plan).

In the selection of these borrow pits, the materials investigation by the Resident Engineer on the N-12 contract and environmental assessments by Site Plan Consulting ran in parallel, with the environmental consultant involved in the borrow pit considerations and subsequent selection.

The decisions facing the selection of borrow pits were:

- The first point of departure was to assess the potential further use of existing borrow pits in order to avoid creating new pits.
- While pits close to the road will increase visual impact during operation their re-use would offer the opportunity to rehabilitate these existing pits thereby reducing total visual impact and making close proximity to the road not a negative factor.
- While the sought-after calcrete occurs widely in the contract area, the general presence of very hard surface "hard-pan" horizon would require blasting or very heavy ripping and crushing, with such crushing eliminated by mining the selected sites thereby not contemplating crushing in this proposal.
- The positive results of trial pits revealed the opportunity for rational extension of the chosen borrow pits with their existing impacts being rehabilitated in the overall rehabilitation.

From the outset the environmental assessor and materials team were aware of the above required decisions and wherever possible focussed on disturbed, previously disturbed or less sensitive areas and areas with vast expanses of similar biome surrounding them.

2.0 DETAILS OF APPLICANT

2.1 Name of Applicant;

South African National Roads Agency Limited (SANRAL); Bellville office.

These borrow pits are being re-established in terms of Section 106(1) of the Mineral and Petroleum Resources Development Act (28/2002) in terms of which the Roads Authority is exempt from making application but which nevertheless requires approval of the EMP's (Environment Management Programmes) for each borrow pit prior to continued use thereof.

The report is prepared by Site Plan Consulting (S.P.C.) as a specialist consultant to the Project Engineers; ERO Engineers (Pty) Ltd.

2.2 Contact Details

Environmental-Geology	Project Engineers	Client
Site Plan Consulting (S.P.C.)	ERO Engineering	SANRAL
P O Box 28 Strand, 7139	P O Box 4344 Durbanville, 7551	P O Box X19 Bellville, 7535
Shop 5, Goedehoop Shopping Centre, Broadway Boulevard Strand, 7140	On site RE: Ian Melville 079 509 0935 Bellville Office: Kobus Visser	

Tel : 021-854 4260	021-975 6200 082 555 7817	Tel : 021-9574600 082 283 5968
Fax : 021- 854 4321	Fax : 021-975 6400	Fax : 021-946 1630
Email : david@siteplan.co.za	Ian Melville: imelville@groupfive.co.za Kobus Visser: kvisser@ero-engineers.co.za	Email :Lippertm@nra.co.za
Contact : David Cotton Steve van der Westhuizen	Contact : Kobus Visser	Contact : Mr Mike Vinello-Lippert

3.0 PROJECT DESCRIPTION

3.1 Overview

These additional borrow pits are required during the current construction to supplement the similar material presently quarried at the approved borrow pit at km26.6 under DMR ref: NC1990EM BP This late identification of the need for additional material stems from a decision to upgrade the road shoulders and hence vast amounts of "fill" and "selected" layer materials are required. In order to reduce the road safety hazard and wear and tear on the road, these pits are selected along the road to reduce the haul distances.

3.2 General Geology and Materials Required (refer Figure B)

Figure B shows the published geology of the route reflecting the distribution of the identified calcrete surface deposits (resource).

To meet the specifications of the required material and to afford direct loading without crushing or screening, of the 10 sites investigated only 4 yielding suitable materials results and also presenting acceptable environmental considerations (refer Figure A for Location of Selected and Alternative Sites considered) were identified of which 3 are presented herein. While a further site has been earmarked for later inclusion, the material testing has not yet been completed and will be submitted as an Addendum hereto if proved positive. (This is the so-called Karee Tree Borrow Pit at km 41.6).

The critical materials considerations for using the calcrete include:

- Required absence of thick very hard "hard-pan".
- At least 1.5m recoverable loose laminar or nodular calcrete
- Plasticity (clayeyiness which binds the material but is not too high to present a plasticity problem).

The final selection of pits from a geological perspective included the 3 selected pits and the so-called existing Karee Tree Borrow Pit at km 41.6 (a probable fourth site to be selected once proven)

3.3 Vegetation (General) (refer Figure C)

3.3.1 General SANBI Classification and Sensitivity

Figure C shows the 4 sites to fall within the main SANBI vegetation type of Northern Upper Karoo Vegetation and is described by Musina and Rutherford (SA Vegmap) as follows.

Veld Type	% Remaining	Conservation Status
Northern Upper Karoo	27 891,89km ² 96.6%	Least threatened

The team took cognisance of this classification and its conservation-worthy rating and assessed the current condition of the vegetation at each assessed site and found it to be largely disturbed or very overgrazed.

As the borrow pit extensions only comprise between 2ha and 4ha, the impact of such extensions on the vegetation described above is generally negligible.

Given the above, botanical impact of the 3 proposed borrow pit extensions is rated as follows:

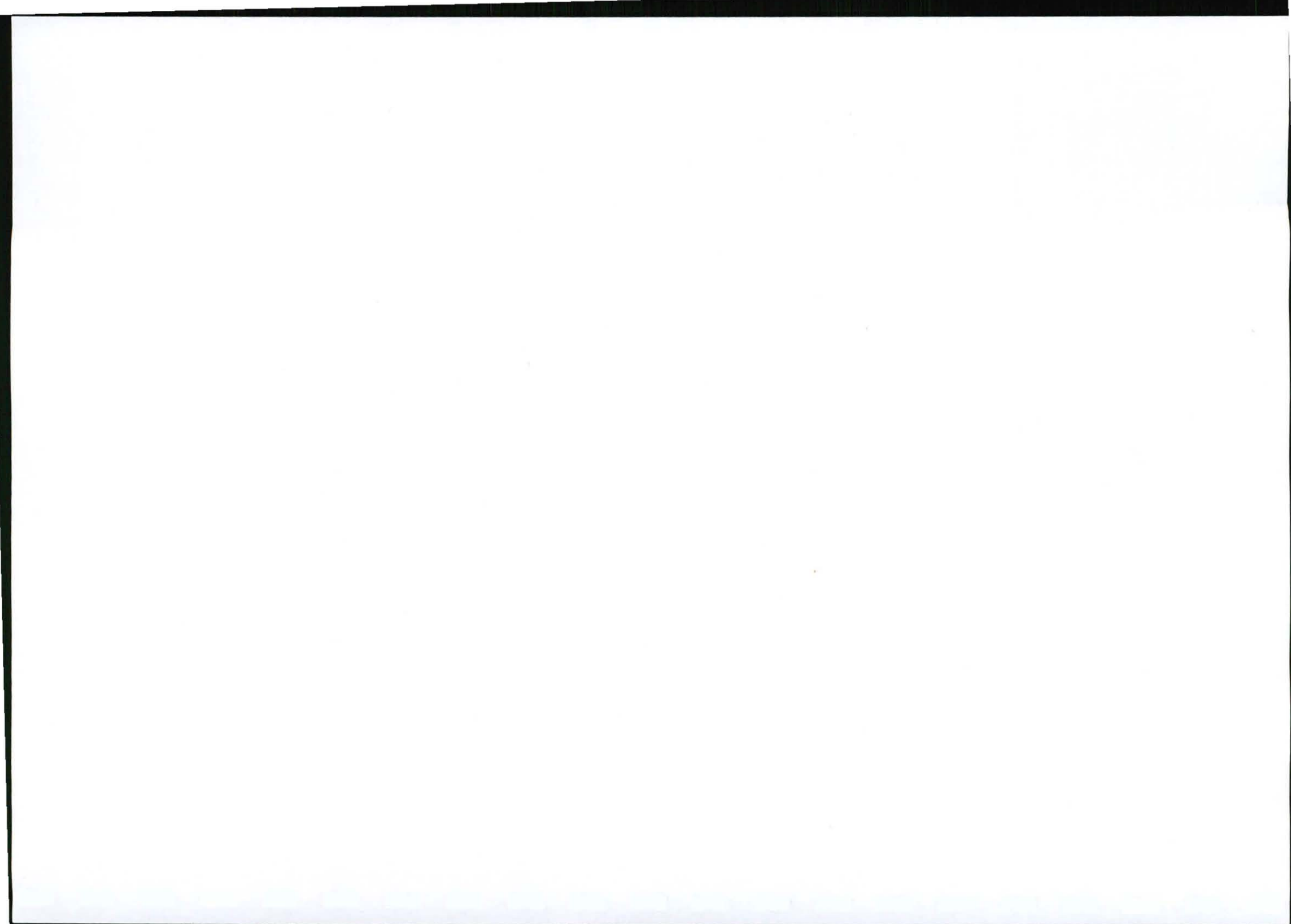
Borrow Pit No	Vegetation Sensitivity Overall	During Operation	Post Rehabilitation after Mining, Topsoiling and Seeding
BP-HM	Low	Temporary High	Low
BP-GB	Low	Temporary High	Low
BP-SM	Low	Temporary High	Low

3.3.2 Mitigation and EMP recommendations

- Approved quarrying areas should be demarcated by means of visual posts and a minimum temporary two strand wire fence prior to any activity on site. No personnel or equipment movement outside of the site shall be permitted
- Topsoil of 100-300mm must be set aside in perimeter topsoil berms for use in rehabilitation of quarried sites. Topsoil must be replaced on the shaped and scarified areas as soon as is feasible. Topsoil must be stored within the designated and approved quarrying areas. The optimum time to seed is during the early summer rainfall season.
- The following grass seed mix as approved for the existing borrow pit at km26.6 shall be used:
 - *Eragrostis curvula* 5kg/ha
 - *Eragrostis tef* 15kg/ha
 - *Smitsvinger grass* 15kg/ha
 - *Rhodes grass* 30kg/ha
 - Plus any available seed of *Stipogrostis obtuse*, *Themeda triandra*, *Themeda racemosus* and *Aristida sp.*
- As the disturbance associated with quarrying may encourage alien invasive plant establishment, the contractor or their representative should be responsible for removal of all alien invasive vegetation from the rehabilitated quarry sites for a period of up to one year from quarry closure (or as long as the road contract maintenance period lasts if longer than the minimum 1-year long period stipulated above).

3.4 Climate

The site falls within the Central Continental climatic zone of South Africa, characterised by summer rainfall, and a wide temperature range seasonally and daily with 11,5 days of frost in winter and extreme heat in summer with highest recorded monthly average maximum temperature of 39°C in January.



The tables below for Kareekloof at Strydenburg best reflect the climate of the site.

Temperature and Rainfall Statistics Source: WB40 Strydenburg

	Rainfall mm	Temp °C
Jan	34	26.3
Feb	42	25.2
Mar	49	23.1
Apr	33	18.2
May	14	14.4
Jun	7	11.2
Jul	9	11.2
Aug	3	13.1
Sep	4	17.1
Oct	18	19.9
Nov	24	23.1
Dec	31	25.1
	268	

MAR = 268mm/yr

Number of days of Rain:

> 0,1mm 33.1 days

> 1,0mm 26.5 days

> 10mm 8.9 days

Number of days of frost/year – 11.5

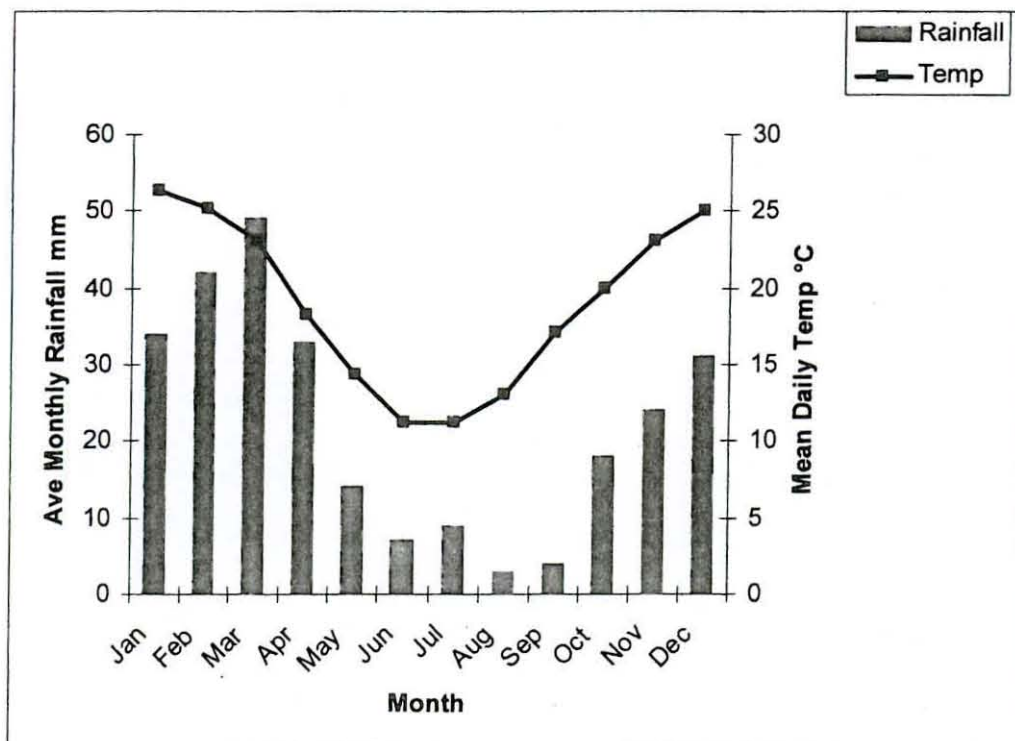
Highest monthly average maximum temperature - 39°C
(January)

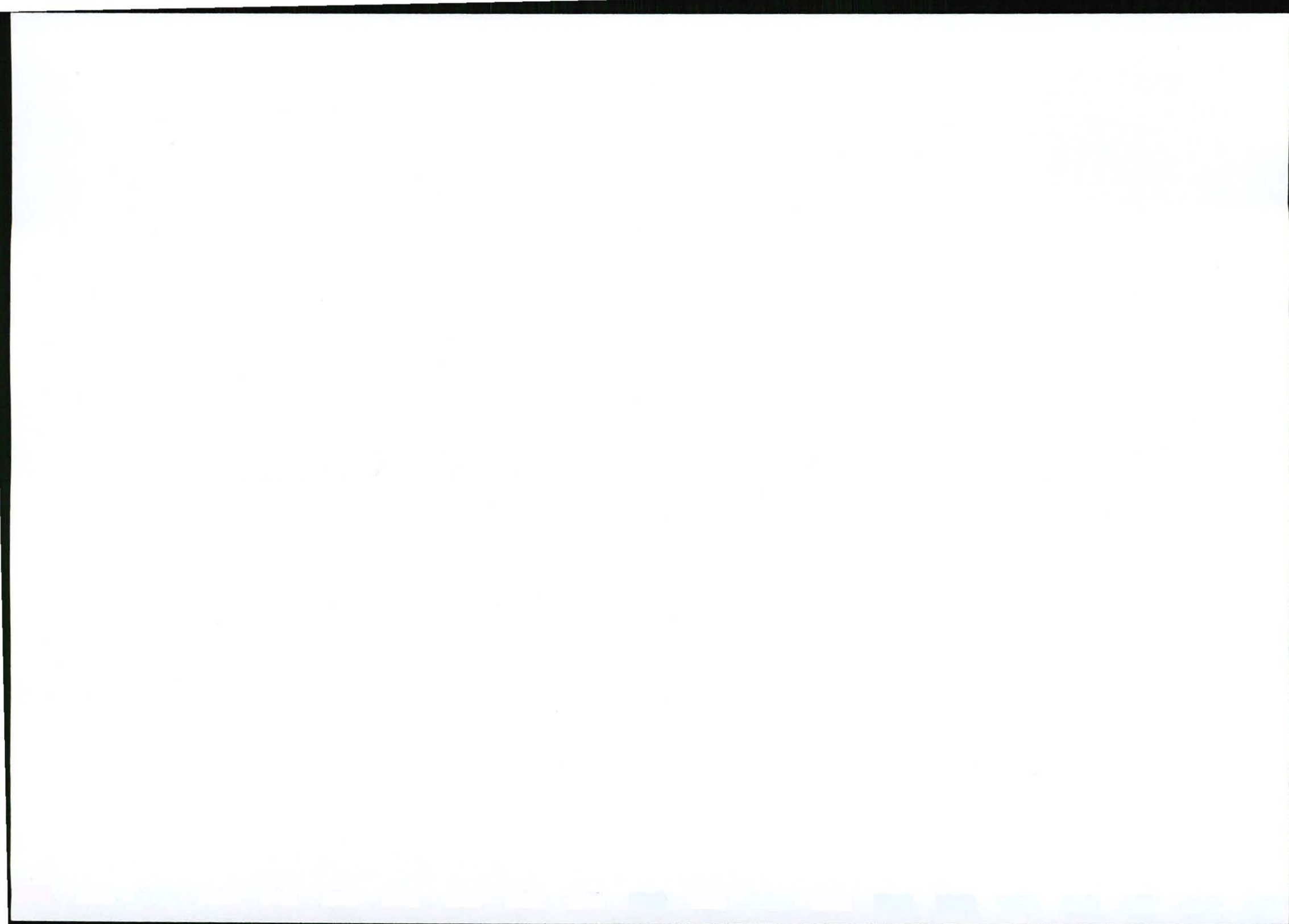
Average days of hail – 1 day per year

Source: WB40 Kareekloof, Strydenburg

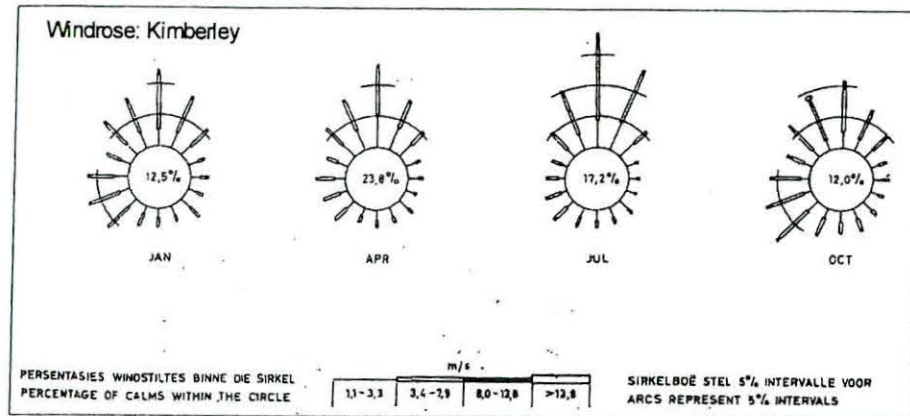
Highest 24-hour rainfall : 66mm in 1952

Climatograph for Kareekloof, Strydenburg:





Annual Wind-Rose for Kimberley (as best representative wind-rose for the sites)



The Implications of Climate on the Consideration of Borrow Pit Development and Rehabilitation

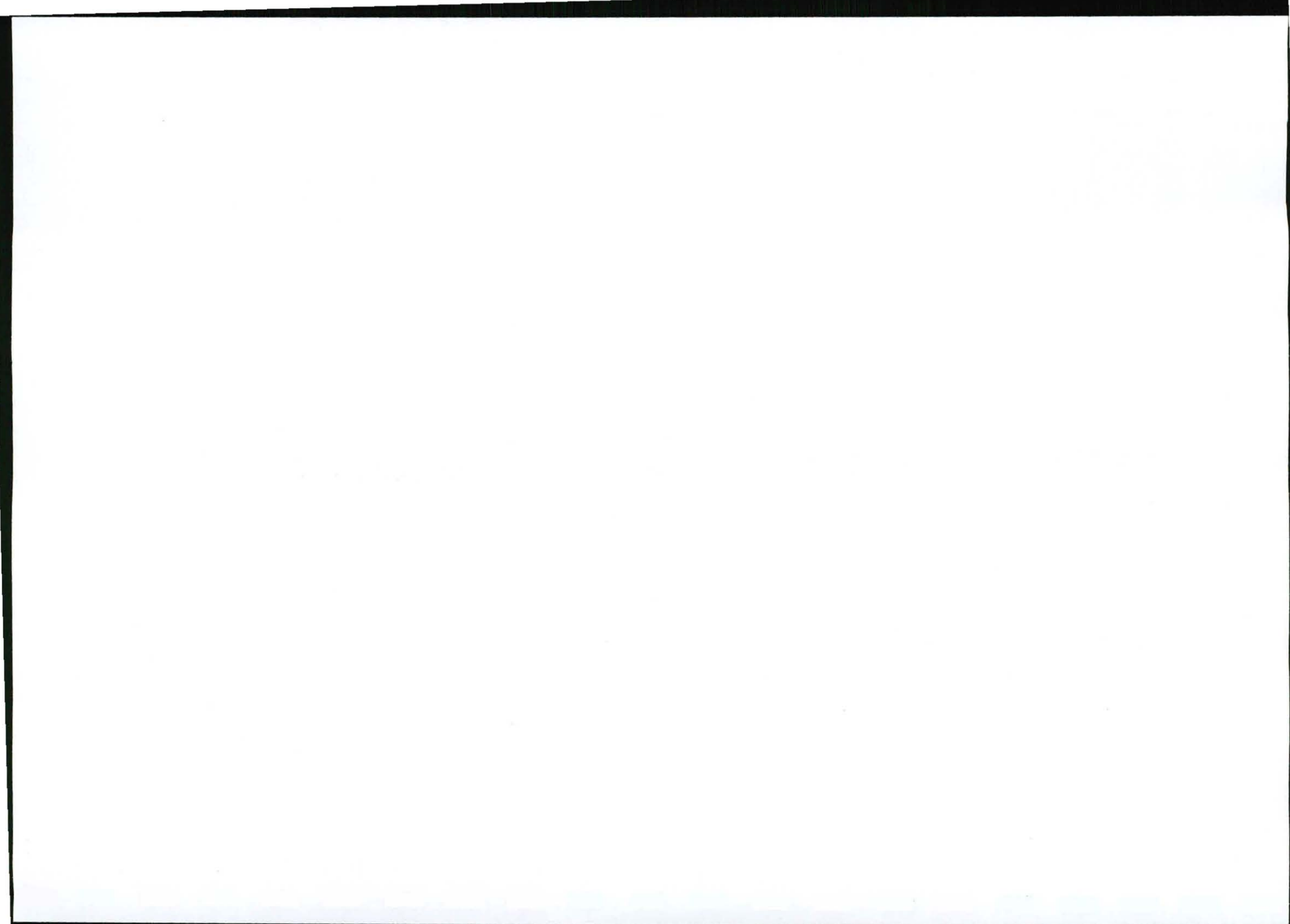
- In light of the summer rainfall the revegetation demands use of a summer grass seed mix which as specified in Para. 3.3.2 will work well in the rehabilitation of re-topsoiled areas (as evidenced by natural re-grassing since earlier disturbance)
- As rainfall episodes can be intense it is important to first rip/scarify compacted sub-strate prior to and after placement of topsoil in order that the topsoil keys into the sub-strate to avoid erosion of the placed soil
- As a large percentage of the wind does blow from the North/NNW and NNE sectors, dust will primarily not impact on the N-12 traffic or urban areas of Hopetown from the Hopetown Borrow pit nor on the N-12 from the Ganna Bridge Borrow pit. Likewise quarry dust will not impact on the Strydenberg/Prieska gravel road R387 in the case of BP-SM. As per the site specific Borrow Pit EMPs detail assessments and attenuation measures are specified

3.5 Archaeology

While a specialist archaeologist was employed to assess the potential of archaeological impact of the main gravel pit at km 26.6 (the approved existing pit) given rock outcrops and extent of the site, the site assessments by SPC of the additional borrow pits has not warranted a specialist archaeological assessment in light of the following characteristics of the additional sites:

- Absence of rock outcrops on which engravings may be found
- The extensive disturbance of the extension areas adjacent to the existing borrow pits
- The limited extent of the extensions
- Absence of any indications of graves or earlier structures

Notwithstanding the above, the site foreman and dozer and excavator operators on the sites shall be instructed to immediately terminate their activities in order to report any finds of bones indicating possible burial or fossil remains. In such case the RE shall notify the consultant archaeologist David Morris who conducted the km 26 site assessment at telephone 082 2224777 (Office no: 053 8392706)



4.0 SUMMARY OF ELEMENTS OF THE SITES

Borrow Pit Name and No	Farm Portion and Name	Title Deed No	Extent of Farm	Owners Name and Address	Owners Contact Details
Hopetown Municipal BPHM	Erf 1, Hopetown	T309/1951	Entire commonage (800.0000DUM)	Thembelihle Municipality	Freek Human 072 799 1935 freek.human@workmail.co.za
Strydenberg Municipal BPSM	Erf 260, Strydenburg	T8112/1964	1475.3898 ha		
Ganna Bridge BPGB	Farm Ganna Hoek 140 Ptn 1 (rem)	T46399/2003	1631.1010 ha	Ockie Vermeulen Familie Trust	Dr Waltie Vermeulen 082 829 5395 waltie@rooksein.co.za

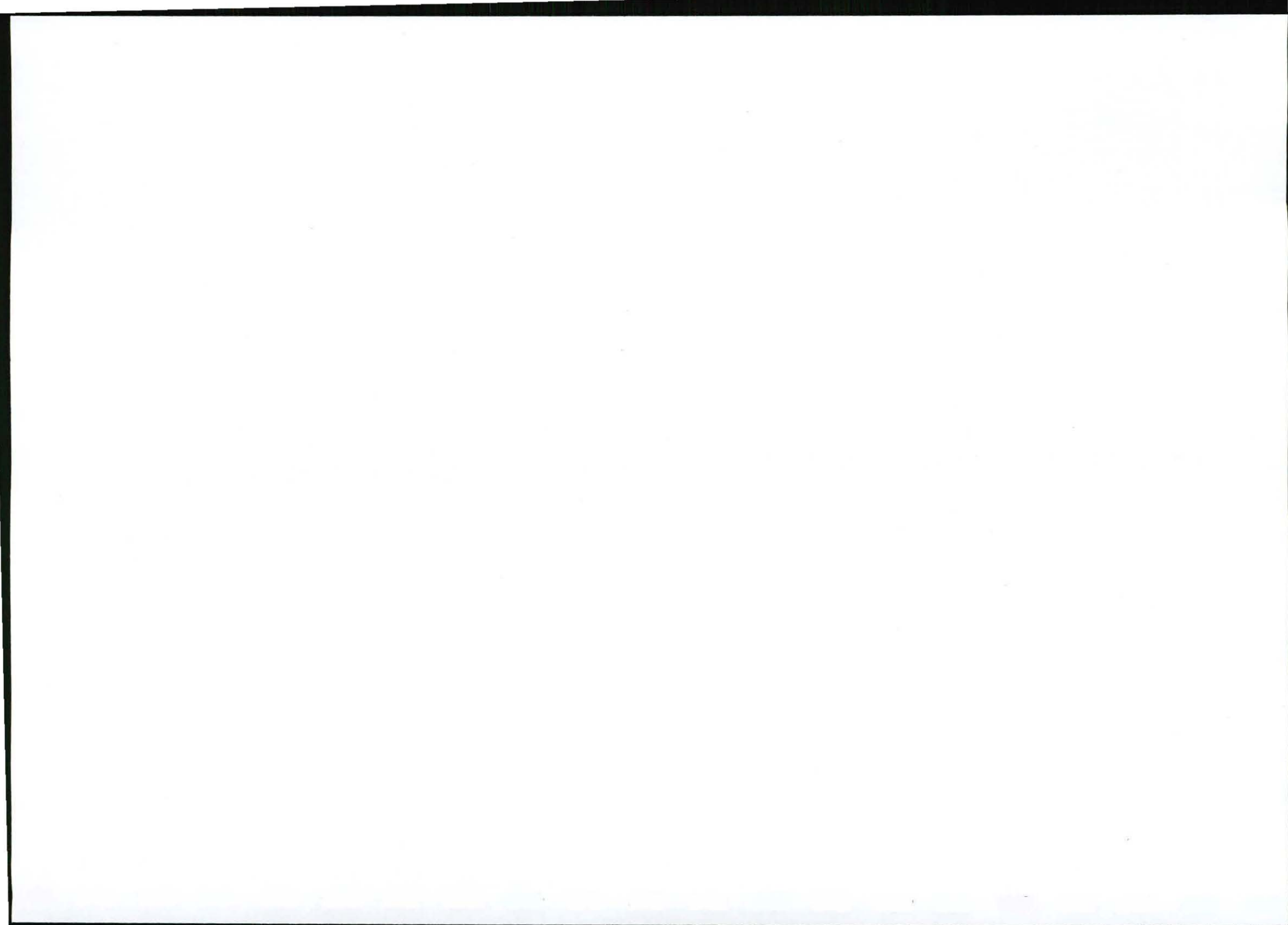
5.0 GENERIC ENVIRONMENTAL MANAGEMENT METHODS

5.1 Generic Management of Sites

Note: The prescriptions below shall apply to each and every borrow pit dealt with-in paragraph 6.0, either parallel or over and above the specifications given in the individual borrow pit documents and the contractor shall be responsible for implementation thereof as they may be applicable to the respective sites.

5.1.1 Site Management

- (i) Prior to any disturbance on site or site establishment, the Resident Engineer (RE) shall demarcate the extent of the **Borrow Pit Area** with clearly visible posts in the veld and a two-strand wire fence shall be erected between such posts. No movement, vehicular or pedestrian shall be permitted in the no-go area outside of such demarcated site. The Resident Engineer shall instruct the contractor in this regard who shall instruct all staff during the environmental induction training and shall have penalties for non-compliance.
- (ii) No open fires shall be permitted on site.
- (iii) The RE shall identify an area within the demarcated site unless otherwise provided for in the EMP for the location of a lockable storage container in which all lubricants and loose equipment shall be stored and shall site a suitable chemical toilet within the perimeter of the demarcated area unless otherwise provided for.
- (iv) The RE and contractor shall instruct their staff and provide penalties to prohibit all forms of hunting or snaring and shall raise their awareness of the criminal consequences of stock theft.
- (v) No persons shall be housed on site and only in cases which warrant it, shall permission be granted for a night-watchman to remain on site after hours.
- (vi) The contractor shall exercise alien vegetation/weed control on each of the sites for the duration of the contract and shall ensure that final site inspection reveals adequate eradication at time of application for closure in order for retention monies to be released.



- (vii) In general the contractor shall maintain a high level of good housekeeping of the site.

5.1.2 Vegetation Management

- (i) The Environmental Awareness Programme included in the Induction Training manual (refer Annexure E to the approved km26.6 Borrow Pit EMP) shall apply to all employees with emphasis placed on the no-go areas and additionally the danger which fire poses to surrounding vegetation.
- (ii) Disturbance extent (boundary) is properly demarcated prior to the contractor establishing on site.
- (iii) The contractor removes topsoil and saves it in topsoil stockpiles or berms for later re-use prior to any disturbance of previously undisturbed areas.
- (iv) The contractor controls alien vegetation during and at end of contract (with final alien vegetation clearing late in the contractor's obligated 11-month maintenance contract period.
- (v) The contractor re-topsoils each borrow pit as specified per pit and then seeds with the following seed mix:
 - *Eragrostis curvula* 5kg/ha
 - *Eragrostis tef* 15kg/ha
 - *Smitsvinger grass* 15kg/ha
 - *Rhodes grass* 30kg/ha
 - Plus any available seed of *Stipogrostis obtuse*, *Themeda triandra*, *Themeda racemosus* and *Aristida sp.* during the summer rainfall season.

5.1.3 Topsoil Management

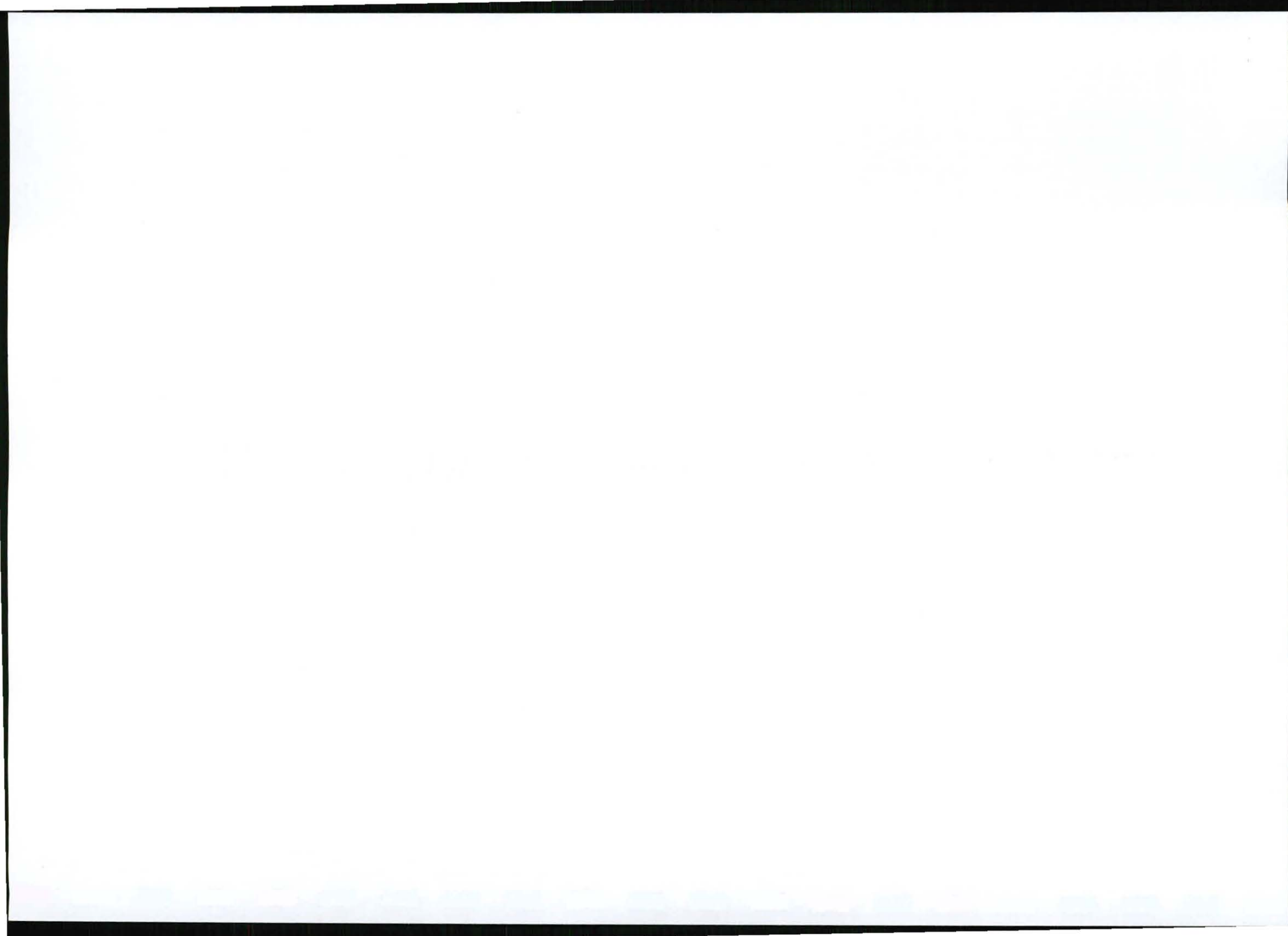
As a general prescription to all borrow pits, all topsoil together with its vegetation and seedbank shall be stripped in advance of mining and shall be temporarily stored in topsoil berms not exceeding 1,5m high in order to preserve the soil characteristics and seedbank until replaced as re-topsoiling over the mined out area. No topsoil shall be allowed to be removed from site for use on road shoulders or otherwise. The detail topsoil management prescriptions as per each borrow pit as specified per pit. In borrow pits which include the rehabilitation of adjacent existing borrow pits where topsoil has already been lost, the topsoil removed from the extension shall be shared in the re-topsoiling of the entire area by re-applying topsoil to a minimum of 50-100mm. Prior to topsoiling, the substrate of the pit shall be ripped and following topsoiling the topsoiled area shall be lightly scarified to provide suitable traps for windblown seed catchment and conditions suitable for germination.

5.1.4 Fuel and Lubricant Management

The handling of fuel and lubricants to service the borrow pits shall form part of the civils contract for the road rehabilitation and fuel will preferably not be stored at each borrow pit, but where required, the following shall apply:

(a) Overhead Diesel Tanks

Such tanks shall be provided with a concreted floor and bund wall capable of receiving 1,2 x the capacity of the tank in the event of leakage or spillage.



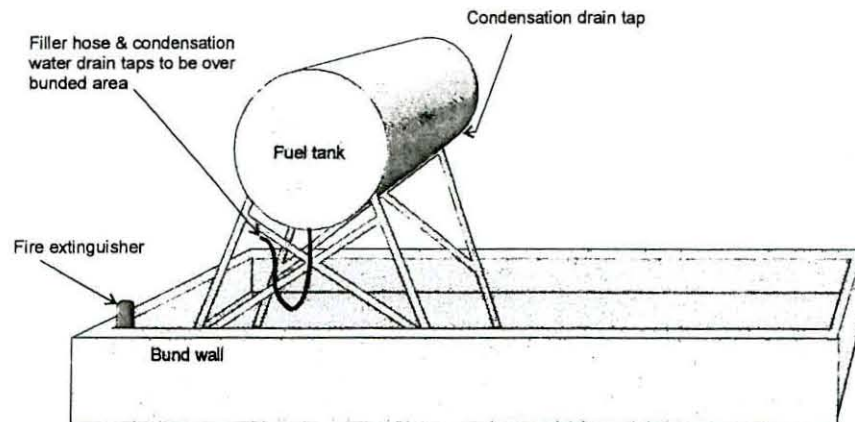


Diagram 1: Bunded fuel tank construction principles (preferably a steel bath (not a brick structure) for lower establishment and rehabilitation impact)

Capacity of such tanks at any site shall in total not exceed 4 000 litres

(b) In-pit Refuelling and Servicing

- The fuel delivery bowser driver shall be cautioned to adhere to safe driving speeds and drive cautiously on site.
- During dispensing of fuel to the equipment on site, the dispensing vehicle is to be fitted with suitable pumps and funnel extensions to reduce the risk of spillage in the transfer of fuels.

(c) Lubricant Storage and Used Oils

All lubricants shall be kept in a lockable container on site and all used oils shall be drained and transferred into a drum for immediate removal from site to the contractors depot for recycling with no used oils being stored on site.

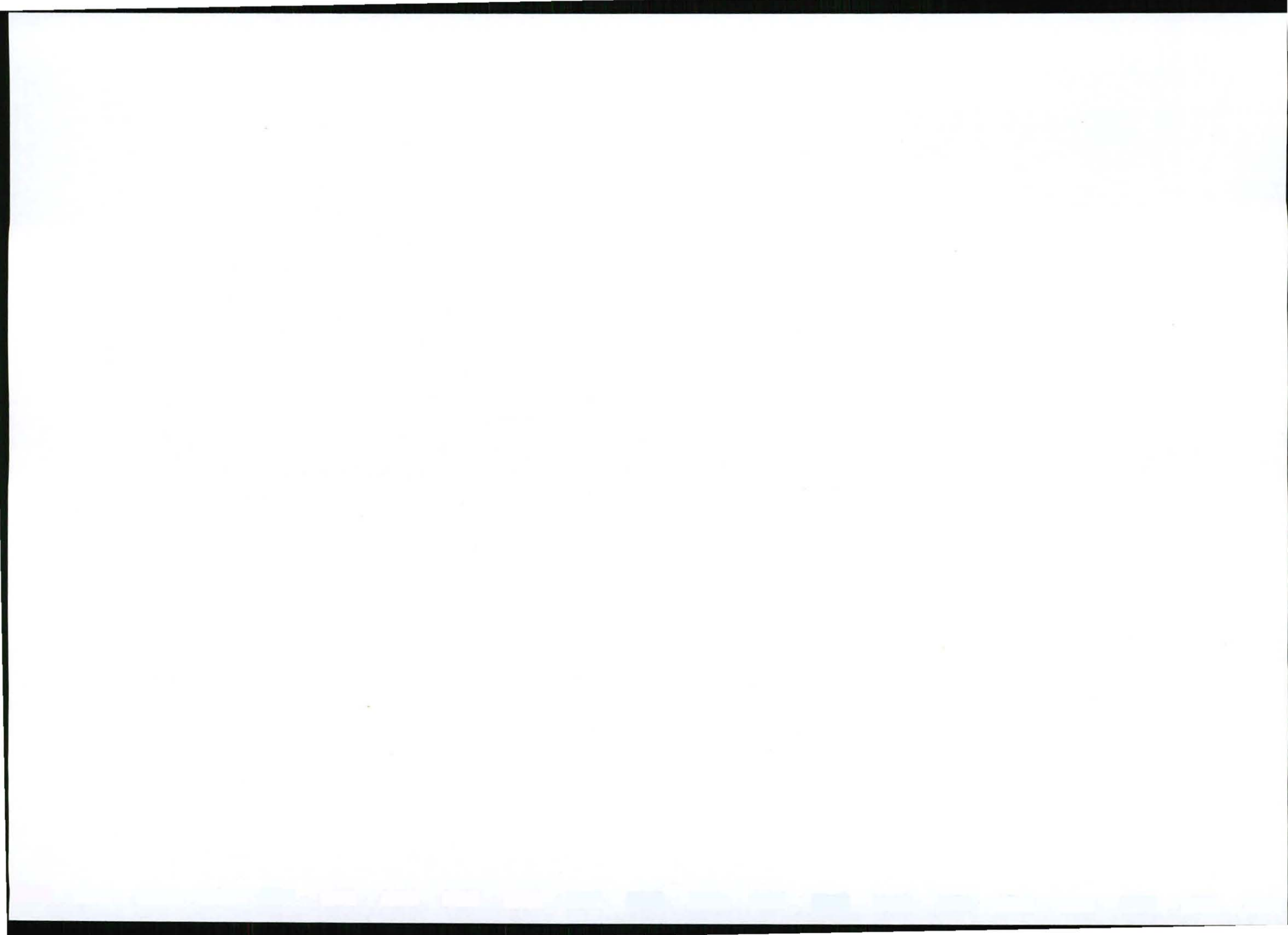
(d) Diesel or Oil Spills

Emergency repairs on site:

In order to suitably deal with a breakdown repair being required in the field, the staff should be trained in use of drip trays and suitable funnels (not to drain oil into the sand) for filling and draining of lubricants and the staff shall be provided with such equipment to prevent oil contamination.

In addition:

- Used/replaced filters, hoses, belts, cloths, etc. are to be placed in a bin which is to be placed in the container for removal from site. Used filters are not to be buried at the site of repair (nor discarded in the excavation to be topsoiled).
- In the event of soil contamination, the soils are to be treated with a suitable decontaminant such as the OT8™ product range, Spillsorb™ or similar product.



All staff involved in mobile plant operation and maintenance is to be made aware of these oil and lubricant procedures. Staff will require instruction in the:

- Deleterious effects of oil / fuel on the environment
- Neutralization of oil leaks
- Use of neutralisation products.

General Provisions

- All operators are to check their equipment for leaks at morning start-up and during the day and report such leaks on a daily basis.
- No used oils are to be used as dust suppressants on manoeuvring areas. Used oils collected in the drums are to be taken from site daily to be collected by an oil recycling company (such as Oilkol).
- All staff to be instructed to report oil spills immediately and be trained in fire fighting.

5.1.5 Ablutions

A chemical toilet which is properly maintained shall be provided at each site for the duration of the use of such site and all staff shall be instructed in the proper use and care thereof and the staff shall be cautioned not to use the surrounding veld for ablutions in which events the RE shall apply penalties.

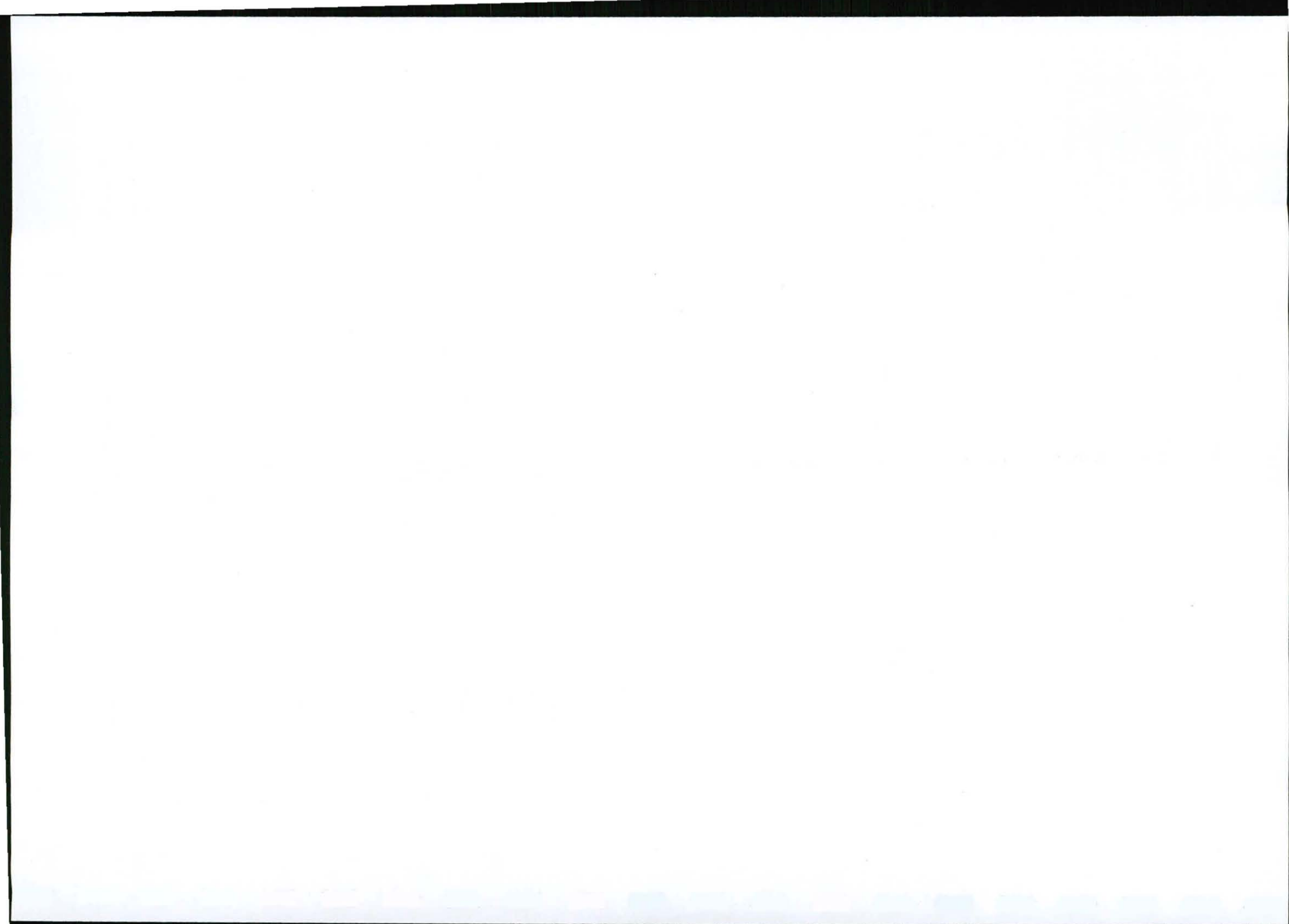
5.2 Mobile Crushing and Screening Plants & Stockpiling on Borrow Pit Sites

5.2.1 Crushing and Screening

As the selected borrow pit materials do not require crushing or screening on site, **no crushing or screening equipment will be used and accordingly no assessments or prescriptions are required.**

5.2.2 Specific Requirements for Stockpiles and General

- (i) Of specific note is that the stockpiles may only be located within the Development Area of a pit and that its' stockpiles may not be located closer than 5m from the permitted area demarcation line.
- (ii) The stockpiles are to be located so as to drain internally to the existing pit.
- (iii) Upon cessation of crushing and screening all logistical facilities such as fuel tanks, office/stores container etc., shall be removed.
- (iv) Any concrete, cement-block or steel supports/foundations used for the logistical facilities or the plant shall be removed from site.
- (v) Regarding stockpiles, the following shall apply:



- Any material retained for use by either the local roads authority, SANRAL or Provincial Roads Authority maintenance teams or the landowner in his farm road maintenance shall be neatly stockpiled in an accessible portion of the site with such stockpile not exceeding 2,5m in height.
- All other crushed material shall be removed from site.
- The footprints of the removed stockpiles shall be rehabilitated as per the remainder of the site.

6.0 INDIVIDUAL BORROW PIT EMP'S

The individual EMPS for the 3 borrow pits BP-HM, BP-GB, BP-SM are bound as Annexure A hereto.

7.0 PUBLIC / I & A P PARTICIPATION PROCESS

The I & A P / Public and Landowner Participation Process is as follows.

- (i) The letters of approval from each of the landowners are attached in Annexure B hereto. These letters follow discussion between the Resident Engineer and the respective landowners to whom copies of the EMPs have been given.
- (ii) Posters as per the reduced copies in Annexure C have been placed on the farm fences and gates for public response.
- (iii) Copies of this report have been placed for public comment at:
 - a. Hopetown Public Library
 - b. Strydenberg Public Library
 - c. The site office at the existing quarry at km 26.6

Any comment received will be forwarded to DMR office by end November 2011.

8.0 REHABILITATION FUND PROVISION (Financial Provision for Rehabilitation)

A fund as required in terms of Section 41 of the Act shall be provided by the applicant (SANRAL) prior to extension of the borrow pits. The value of the fund is to be calculated based on the attached Plans of the respective borrow pits and the value as agreed to between DMR Regional Manager and the Resident Engineer representing SANRAL in discussion in DMR's Kimberley office, which amount will be made paid-up in the form of a guarantee by SANRAL or its Consulting Engineer.



9.0 UNDERTAKINGS

I,, the undersigned and duly authorised thereto by
..... have studied and understand the contents of this document
in it's entirety and hereby duly undertake to adhere to the conditions as set out herein
including any amendment(s) agreed to by the Regional Manager and approved on
.....

Signed at this day of 2011

.....
Signature for SANRAL

.....
Designation

.....
Signature for Contractor

.....
Date

.....
Designation

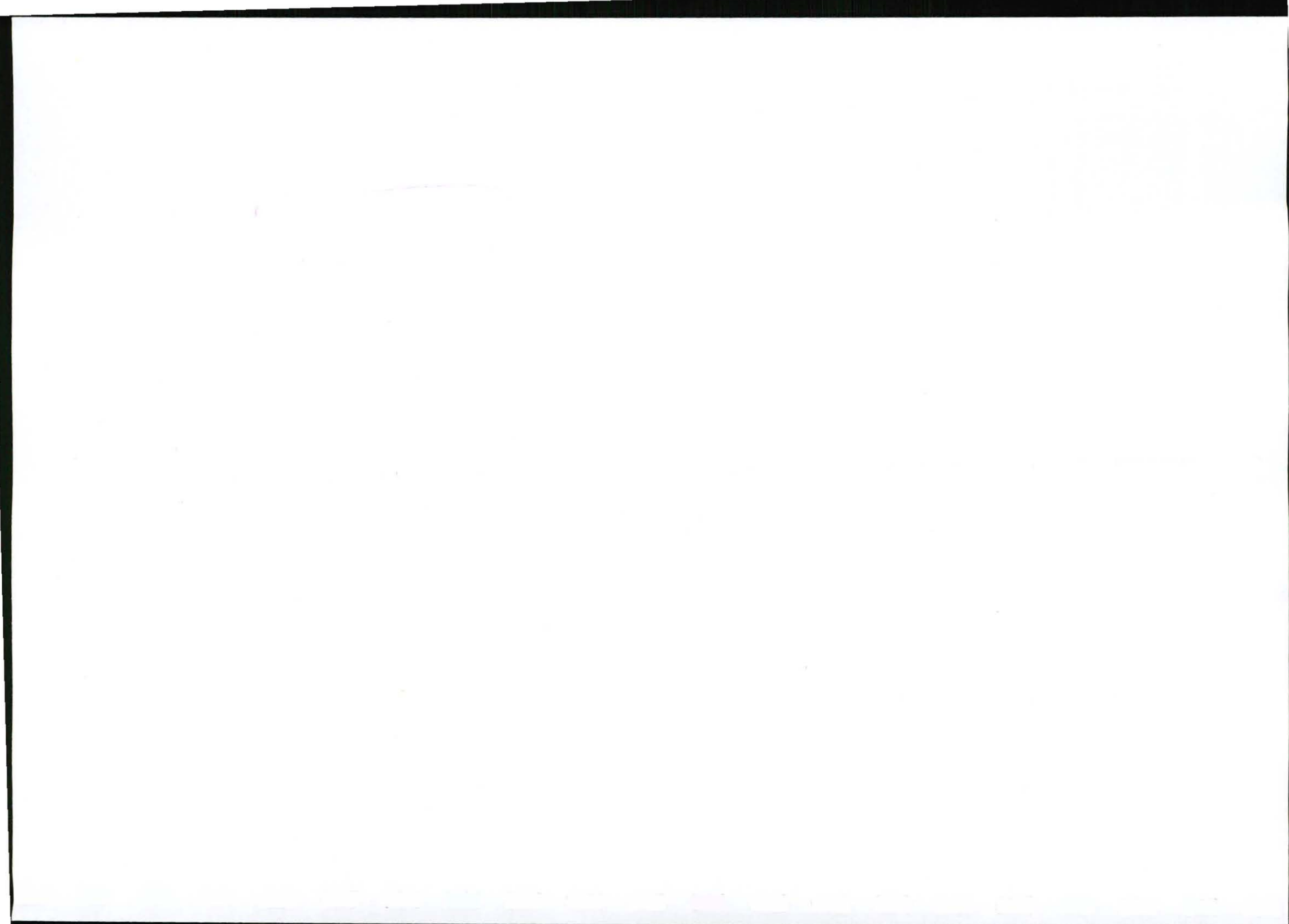
10.0 APPROVAL

Approved in terms of Section 39(4) of the Mineral and Petroleum Resources Development Act,
2002 (Act 29 of 2002)

Signed at this day of 2011

.....
REGIONAL MANAGER

REGION:



NAME	Northern Upper Karoo
POLYSQKM	27891.8923
REMAINING	96.60%
CONSERVATION STATUS	Least threatened

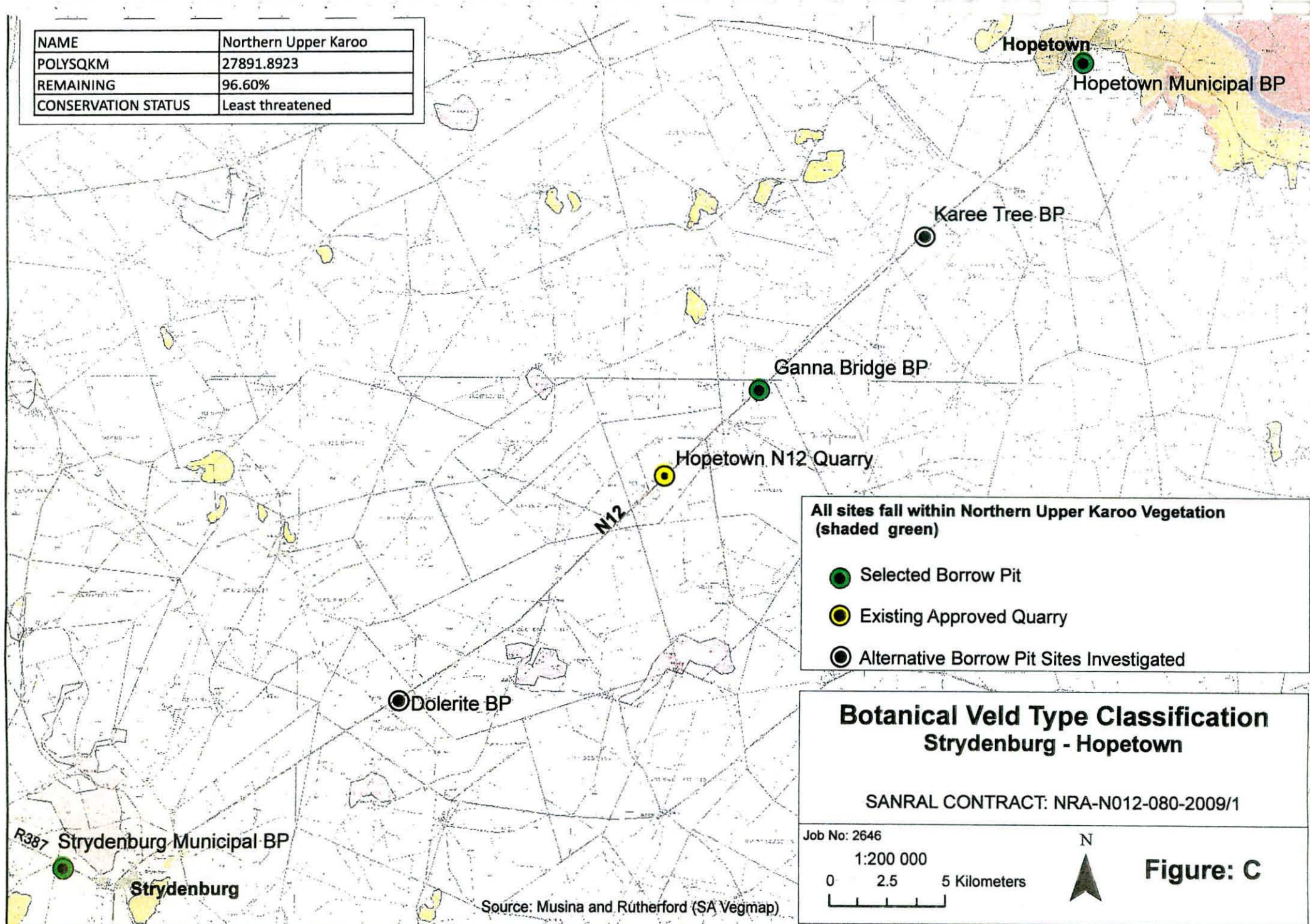
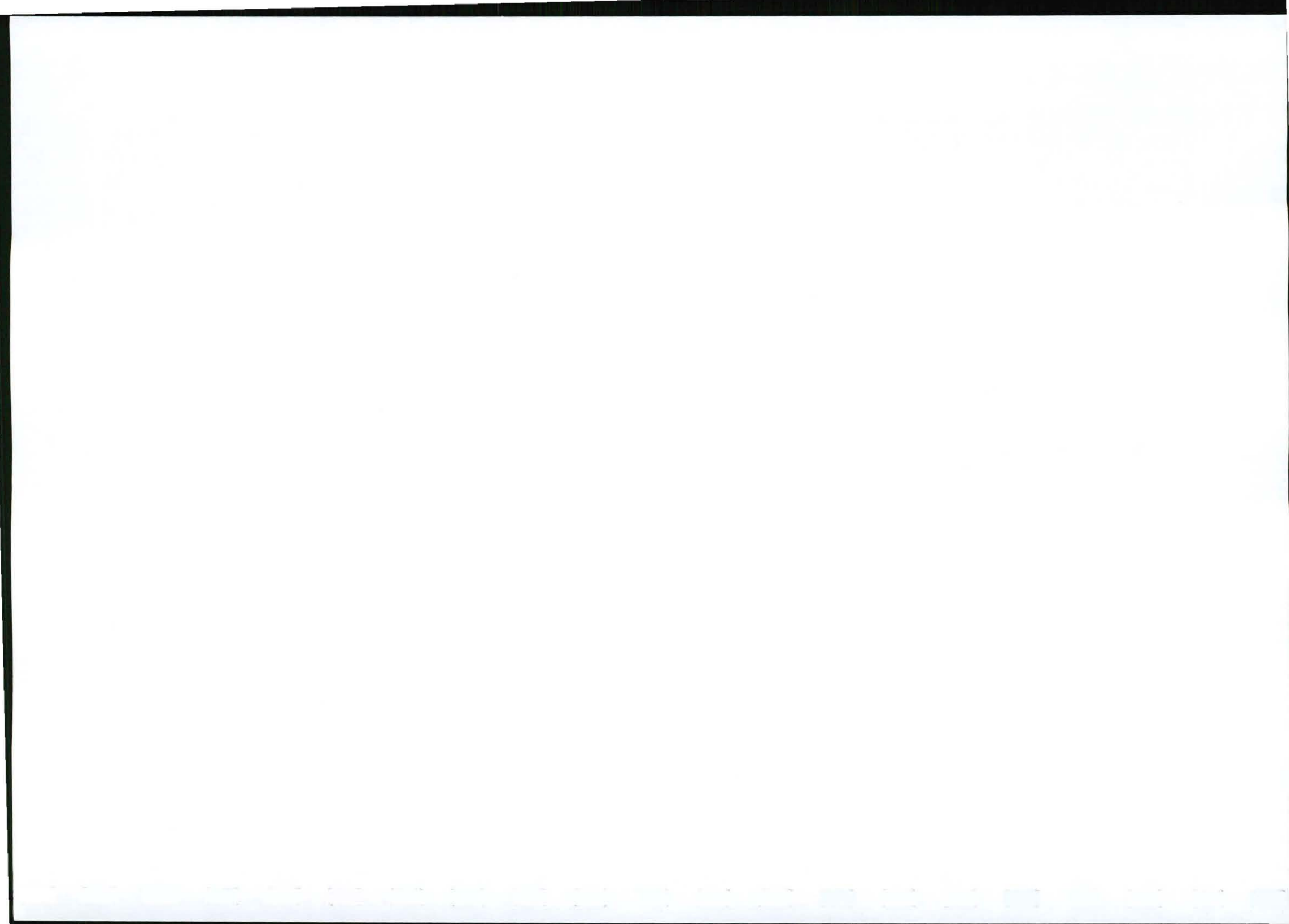


Figure: C

ANNEXURE A

EMP

Karee Tree Borrow Pit (BP-KT)



BP-HM: HOPETOWN MUNICIPAL BORROW PIT**1.0 LOCALITY AND ACCESS**

As seen in Figures A and BP-HM, the site is located at km51,8 within the Hopetown Commonage and accessed off the N12 (Strydenburg-Hopetown) via an existing farm track. Given that the N12 is under re-construction, the Resident Engineer (RE) will designate a safe alternate access point for which appropriate traffic warning signage and flagged control will be implemented to serve the duration of the current contract. The site is located between 50m and 225m east of the N12 roadway and is an extension of an existing un-rehabilitated borrow pit.

2.0 ADMINISTRATIVE DETAIL

2.1 Property; Erf 1 Hopetown

2.2 Registered Owner; Thembelihle Municipality

2.3 Contact Person; Freek Human

2.4 Contact Number; 072 799 1935

2.5 Contact Email Address; freek.human@workmail.co.za

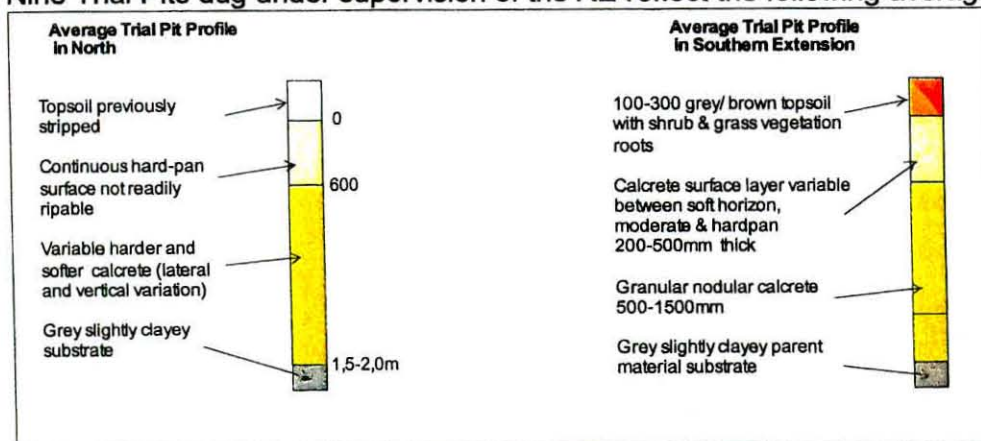
3.0 GENERAL DESCRIPTION

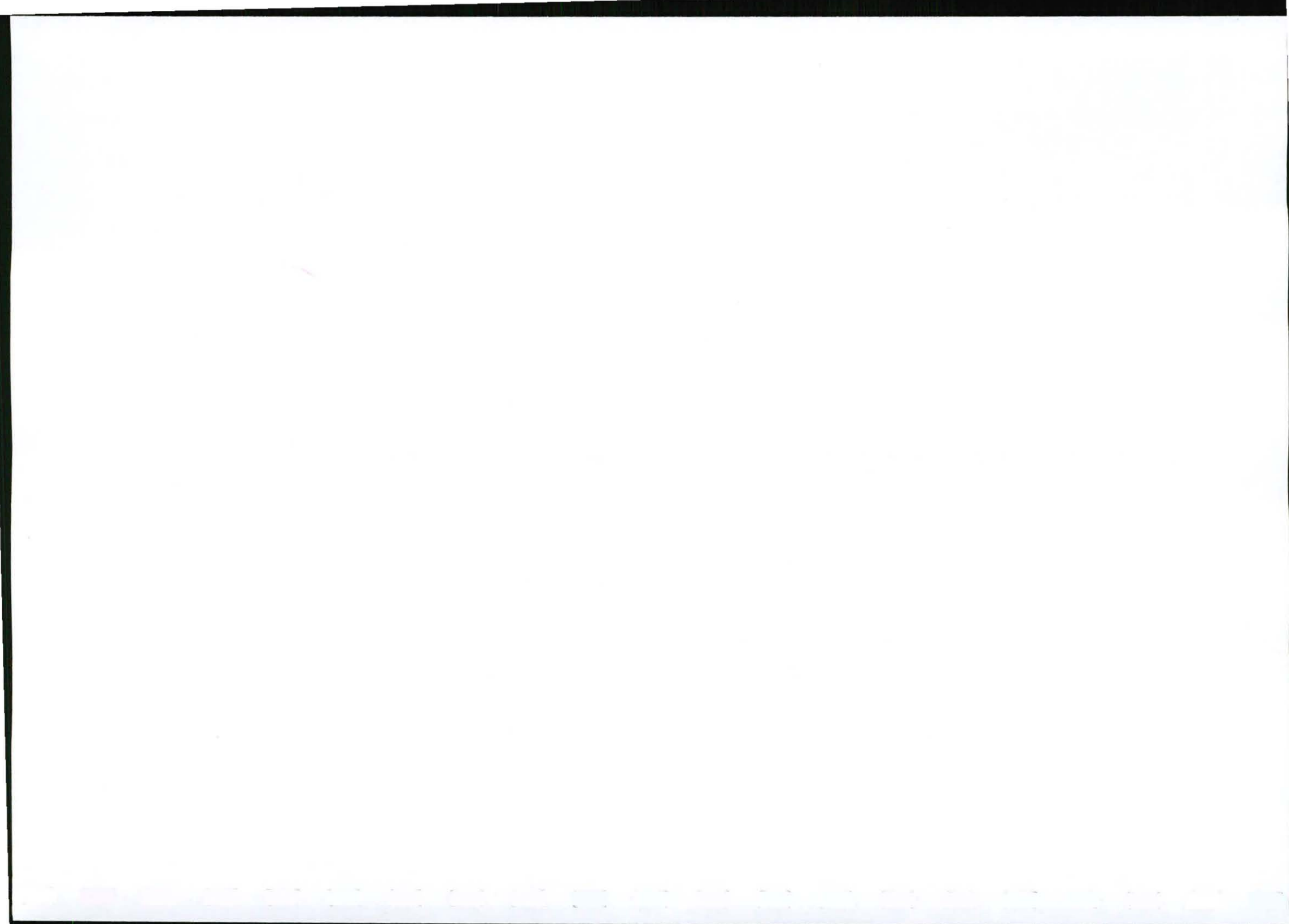
As shown in Photopage BP-HM and the aerial photo image in Figure BP-HM, the site is chosen as an extension of an existing municipal borrow pit that has not been rehabilitated. The existing pit is situated on a very flat area of degraded karoo veld with the existing floor comprising part calcrete and part underlying grey shale. The mining of the perimeter of laminar and nodular calcrete overlying slightly weathered shale offers the best material by lateral extension of the pit to the South as the northern area shows thick hard calcrete (hard-pan) capping which would require crushing.

4.0 GEOLOGY AND TRIAL PIT RESULTS

The material on site consists of a large surface deposit of calcrete which has developed as a pedocrete from leaching of calcium carbonate from the parent rock below. As a typical pedocrete it has limited depth which in this case is between 1,5m and 2,5m thick and typically shows vertical and lateral variation between very hard (hard-pan) calcrete (often too hard to bulldoze) and softer laminar or nodular calcrete material with soils or remnants of parent shale. The further consideration is that of clay content derived from the parent rock and which must be present to bind the material but not excessively clayey to exceed the plasticity limit. (Plasticity index (PI)).

Nine Trial Pits dug under supervision of the RE reflect the following average profiles:





5.0 BORROW PIT DEVELOPMENT PLAN (refer Figure BP-HM)

Pre development logistics

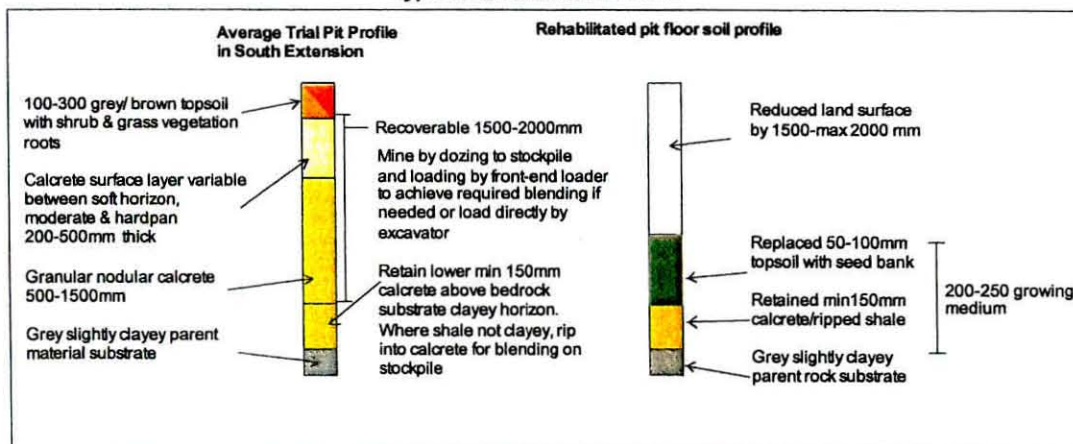
- Demarcate site with clearly visible posts on Borrow Pit area corners
- Establish:
 - Ablutions (trailer type chemical toilet)
 - Stores Container
- Establish new access road to N12

Mining

1. Northern Area: Trim existing faces and remove all suitable material within the northern extent of old borrow pit by shaping final edge by either dozing or backfilling to 1:3 gradient ready to receive topsoil.
2. Commence mining in a southerly direction including:
 - a. Remove exposed calcrete gravel in existing southern floor
 - b. Initiate topsoil removal ahead of the face advance
 - i. use initial topsoil to directly cover rehabilitated area in northern pit extent
 - ii. doze all further topsoil to topsoil stockpile berms on pit perimeter in east, west and south.
3. Advance pit southward to planned perimeter extent

Note: No crushing or screening will take place as the material is suitable for direct use on the road.

Typical Soil & Subsoil Profile

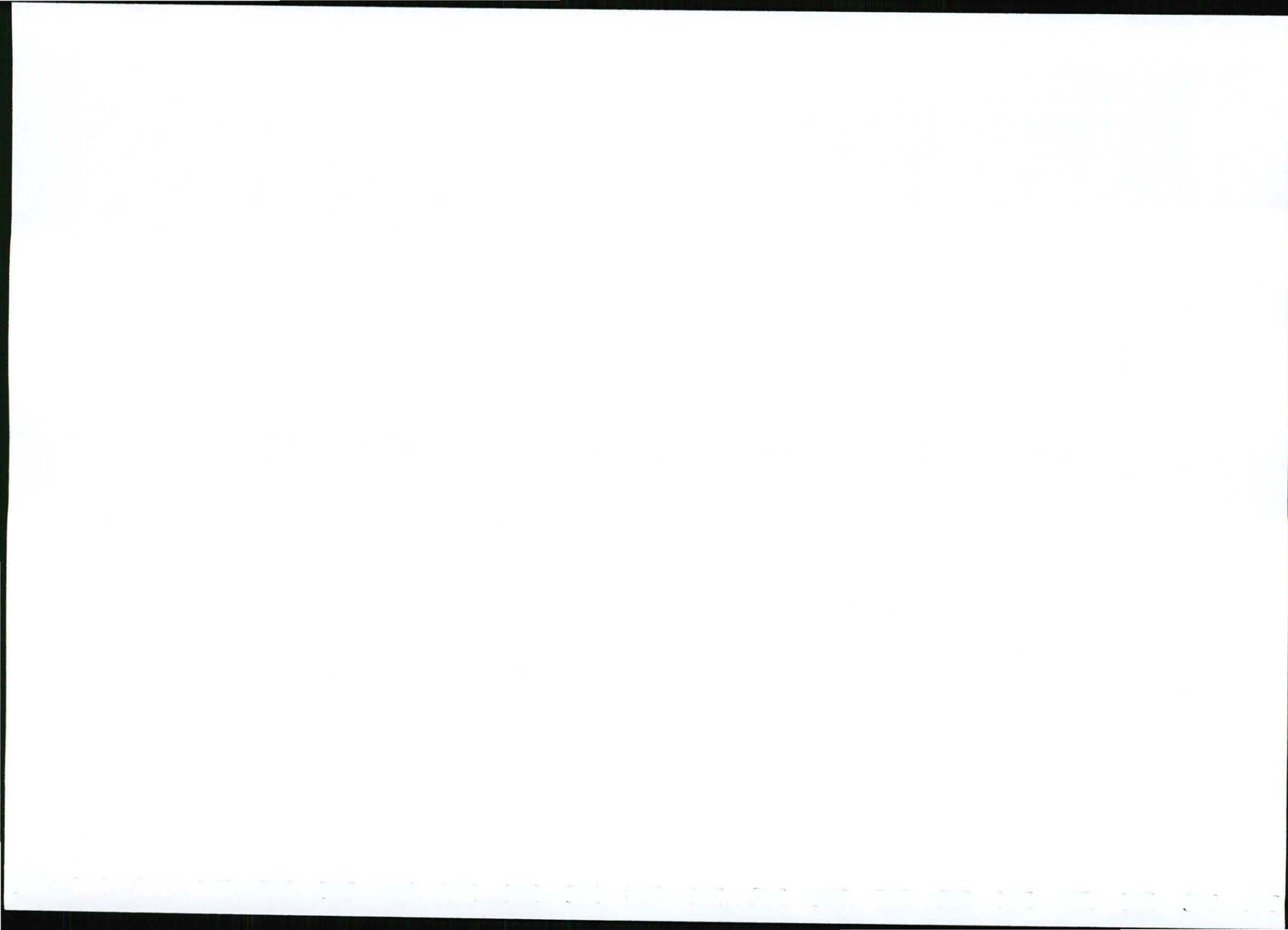


Reserves of the extension: At 1750mm recoverable gravel depth, the borrow pit extension area yields the following reserve : $2,2\text{ha} = 22\,000\text{m}^2 \times 1,75\text{m deep} = 38\,500\text{m}^3$ tight + estimated 1500m^3 from existing southern pit = **TOTAL $40\,000\text{m}^3$ tight**

6.0 ENVIRONMENTAL FACTORS: Informants to site choice/site development, assessment of impact and attenuation measures prescribed

The site was chosen based on the following characteristics:

- Location to serve relevant sector of road.
- Re-use of existing borrow pit & opportunity to rehabilitate the existing pit and reduce it's visual impact on N12
- The excellent quality of laminar and nodular calcrete offered by the pit's southward extension
- Level ground with limited residual visual impact despite proximity to N12 given prescription in the EMP of 1:3 perimeter slopes with topsoiling and re-vegetation



- o Extensive existing disturbance which will be largely rehabilitated as part of the further use of the site and hence is included in the borrow pit area.

6.1 Land Use

The current land use is a borrow pit and stock grazing on commonage land. The extension of the pit will have a temporary high visual impact during removal of the remnant vegetation but this vegetation will be restored by topsoil and seeding as **attenuation measures** of both the existing and proposed disturbance areas

6.2 Surrounding Land Use

- The N-12 and Hopetown urban area to the West of the N-12 including the Hopetown hospital to the south-west
- Previously disturbed workshop area to the North
- Abandoned old municipal airfield to the East
- Degraded/overgrazed but natural veld to the South

Potential impacts on surrounding land use are dust and noise as in paragraphs 6.8 & 6.9 below but these must be considered within the context that the N-12 between the Borrow pit and the urban area to the west of the road will be under reconstruction with its closer noise and dust impact all of which will be under control of the Resident Engineer to ensure that these impacts are minimised.

6.3 Visual Considerations

Visual impact during use for 12-18 months will be temporary but high on the N-12 road users but as the road itself will in any event be under construction, the temporary visual impact is considered low/ moderate within this context.

Attenuation of the post mining visual impact includes the 1:3 perimeter for sloping and topsoiling and revegetation thereof by grass seeding and opportunity to rehabilitate the existing old borrow pit's existing visual impact on the N-12 which will be significantly reduced in post contract period.

While significant visual impact will occur during the pit's operation of ± 18 months, this will be temporary and seen against the high visual impact of the N-12 reconstruction disturbance in any event.

6.4 Soil

(a) Topsoil

The development of the site would result in the temporary removal of 2,286 ha of topsoil to a depth of 200 – 300mm but this soil is to be stockpiled in perimeter berms and re-used to re-topsoil the entire site to 50-100mm thickness with a positive impact over the current disturbed site which has little/ no chance of ever rehabilitating without topsoil cover.

As such the **impact on topsoil** is considered high but temporary during the operation but low/moderate in post mining.

Attenuation Measures:

Prior to any face advance, all topsoil in the area will be dozed to perimeter berms where it will be retained and re-used during final rehabilitation of the site (including both the existing site and the extension are).

(b) Subsoil

The subsoil constitutes the calcrete material to be removed for the road resurfacing. Such subsoil together with underlying shale will be removed to max 2,5 m in depth below ngl.

6.5 Vegetation

The vegetation over the entire area is classified by Musina and Rutherford (SA Vegmap) as Northern Upper Karoo Vegetation with a **conservation status of "least threatened"**. The mapped area of this vegetation type exceeds 27891.89km² with **96.6% of this veld type remaining**.

As the borrow pit extension will comprise only 2.2 ha, the impact of such **impact on vegetation is negligible**.

Attenuation: The removal, storage and re-use of the topsoil with seedbank to be supplemented by follow-up seeding after re-seeding serves as significant attenuation measures to further reduce the impact on vegetation.

6.6 Drainage

The site is located on relatively flat ground with no major run-off implications. There are no identifiable drainage courses.

Impact of the quarry extension is therefore **negligible** on drainage and no attenuation measures need be considered.

After rehabilitation, the pit floor (as in the case of the existing pit) will temporally flood after thunderstorms as do many other local depressions in the surrounding veld after rains.

6.7 Archaeology

Given the limited extent of the expansion area of 2,286ha and the level of disturbance to date, no archaeological assessment has been conducted.

6.8 Dust

Dust will be generated by dozing of topsoil and the loading of delivery/haul trucks. Road dust generated by the haul trucks on the haul/delivery from the pit to the N-12 will be limited by the short length of the direct access road to the N-12 to be chosen by the RE. As both the quarry site and the haul road will be administered as part of the N-12 reconstruction contract by the contractor and the RE and as dust will be **attenuated** by wetting by water cart as is done on the N-12 road section under the contract. As post mining rehabilitation measure, the road and borrow pit will be topsoiled and grass seeded to reduce dust to normal ambient levels.

As the site and its access road will be under management of the road contractor, the contractor will control dust to ensure safety on the N-12 and acceptable nuisance levels on the urban users west of the N-12.

Attenuated dust levels will therefore be moderate during the operation and low/negligible in post mining.

6.9 Noise

The site is located within a peri-urban area adjacent to the N-12 with high current ambient national road & urban noise levels and additional noise from the N12 re-construction. As site activities will be limited to day-time hours no noise impact by the borrow pit activities on the urban area west of the N-12 is expected (i.e. no noise level above 60dBA).

The restriction of activities to normal working hours is considered the only required and appropriate **attenuation measure**.

Under such control it is envisaged that site activities will not have an increased noise impact on the hospital to the south-west as the hospital is presently subject to high N-12 traffic noise and will also be subject to N-12 reconstruction noise. Notwithstanding, the RE will ensure that noise is minimised and limited to daytime hours and will consult regularly during the contract with hospital management regarding any noise and dust impacts.

6.10 Fuel/Lubricant Spillage (generic methods in paragraph 5.3 of the overall report shall apply)

6.11 Ablutions (see generic method in paragraph 5.4 of the overall report)

6.12 Access Road Development and Maintenance

The access point is to be designated by Resident Engineer (RE) on the N-12 road contract temporary access to the pit & RE is to arrange appropriate road safety signage & flagged traffic control.

6.13 Site Management

Generic site management prescribed in Chapter 5.1 of the overall report shall apply.

6.14 Socio-Economic Impact / Land Owner's Concerns

The site will be developed as part of the N12 upgrade contract and consequently all socio-economic requirements with respect to labour recruitment, employment, training, BEE requirements and promotion of SMME's etc will be met in terms of the specifications of the SANRAL contract, in this regard.

7.0 BORROW PIT ENVIRONMENTAL MANAGEMENT AND REHABILITATION PLAN (refer Figure BP-HM – for numbered items below)

- 1. **Northern Area** : Slope existing white, north faces to 1:3 slope by either dozing where soft or backfilling hard faces to prepare for topsoiling and revegetation.
- 3. **Mine in Southerly Direction**
- f&b(i) Thinly re-topsoil shaped northern area (to 50-100mm thick) with directly transferred topsoil from southward advance of pit's topsoil removal
- b) Advance southward topsoil stripping (300mm) by dozing to west and east perimeter topsoil stockpile berms (bii)
 - advance southward excavation of calcrete towards south to mining profile shown in Figure HB-HM with thickness of recovered material between 1500 & 2000mm and total

- excavation depth of 2,5m while retaining 150mm calcrete or non-clayey shale substrate in the floor over clayey horizon.
- c) Trim west & east final pit perimeter to 1:3 as pit excavation face advances southward
 - d) Re-topsoil final 1:3 perimeter slopes to 50-100mm depth of topsoil
 - e) Re-topsoil the extension pit floor to 50-100mm in depth
 - f) Seed with grass seed mixes specified for road verges, during summer rainfall season

Topsoiling Method

- Ensure all final perimeter edges are trimmed and scarified/light ripped to 100mm before topsoiling to provide a key for topsoil and then topsoil to 50-100mm thick
- Ensure all topsoil replaced on floor and over trimmed final edges.
- Lightly scarify topsoiled area and seed with seed specified in para 3.3.2 or by the road contractor's environmental officer and conduct under his supervision.

BP-SM: STRYDENBURG MUNICIPAL BORROW PIT

1.0 LOCALITY AND ACCESS

As seen in Figures A and BP-SM and Photopage BP-SM, the site, an existing borrow pit, is situated at $\pm 2,4$ km west of Strydenburg on the R387 gravel road to Prieska. The site is located 50-250m south of the R387.

2.0 ADMINISTRATIVE DETAIL

- 2.1 **Property;** Erf 260 ,Strydenburg Municipal Land
- 2.2 **Registered Owner;** Thembelihle Municipality
- 2.3 **Contact Person:** Freek Human
- 2.4 **Contact Number:** 072 799 1935
- 2.5 **Contact Email Address:** freek.human@workmail.co.za

3.0 GENERAL DESCRIPTION

As shown in Photopage BP-SM the site is chosen as an extension of an existing borrow pit to be extended to the south and to the west into the flat surrounding area. No northern expansion will be contemplated given the proximity of an underground pipe line / an overhead powerline running parallel with the R387 and the R387 itself.

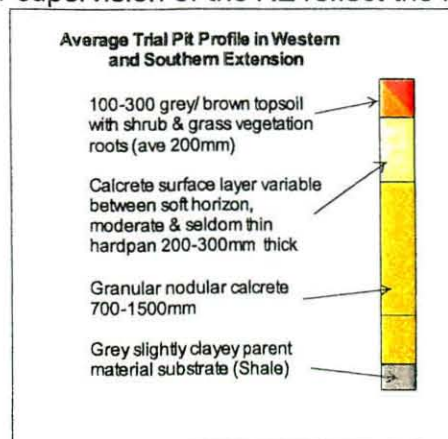
The existing pit consists of a mined denuded floor with 1,5m high faces near vertical faces to be advanced in proposed expansion.

Previously removed topsoil is stored in low berms adjacent to the existing excavation and will be used immediately as topsoiling of the proposed early sloping of the Northern face of the excavation to facilitate the expansion of the pit Southward and to the West.

4.0 GEOLOGY AND TRIAL PIT RESULTS

The material on site consists of a large surface deposit of calcrete which has developed as a pedocrete from leaching of calcium carbonate from the parent rock below. As a typical pedocrete it has limited depth which in this case is between 1,5m and 2,5m thick and typically shows vertical and lateral variation between very hard (hard-pan) calcrete (often too hard to bulldoze) and softer laminar or nodular calcrete material with soils or remnants of parent shale. The further consideration is that of clay content derived from the parent rock and which must be present to bind the material but not excessively clayey to exceed the plasticity limit. (Plasticity index (PI)).

Eight Trial Pits dug under supervision of the RE reflect the following average profiles:



5.0 BORROW PIT DEVELOPMENT PLAN (refer Figure BP-HM)

Pre development logistics

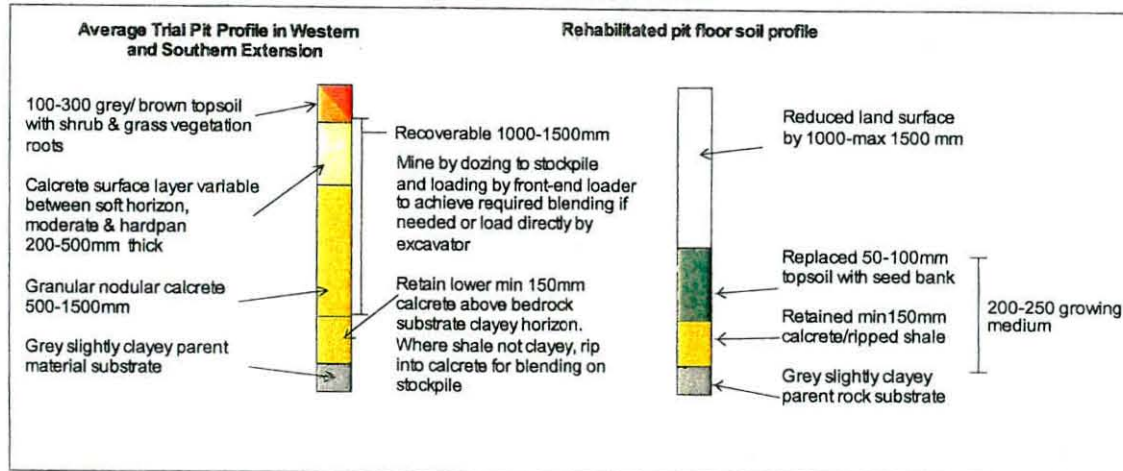
- Demarcate site with clearly visible posts on Borrow Pit area corners
- Establish:
 - Ablutions (trailer type chemical toilet)
 - Stores Container if required
- Retain existing access road to R387

Mining

1. Existing Northern Pit edges:
 - Slope existing face to 1:3 with caution regarding pipeline between pit and road
 - Then topsoil the sloped north face with topsoil from existing topsoil stockpiles
2. Commence mining in a Southerly and Westerly direction including:
 - a. Remove exposed calcrete gravel in existing pit floor
 - b. Initiate topsoil removal to 100-300mm deep) ahead of the westerly and southerly face advance
 - i. transfer existing topsoil to finished northern areas of pit
 - ii. doze all further topsoil (100-300mm deep) to perimeter topsoil stockpile berms on pit perimeter in east, west and south.
3. Advance pit southward and westward to planned perimeter extent by dozing material to stockpile and loading by front-end loader to achieve required blending if needed or load directly by excavator to delivery trucks to transport to N-12 upgrade contract.

Note: No crushing or screening will take place as the material is suitable for direct use on the road.

Typical Soil & Subsoil Profile

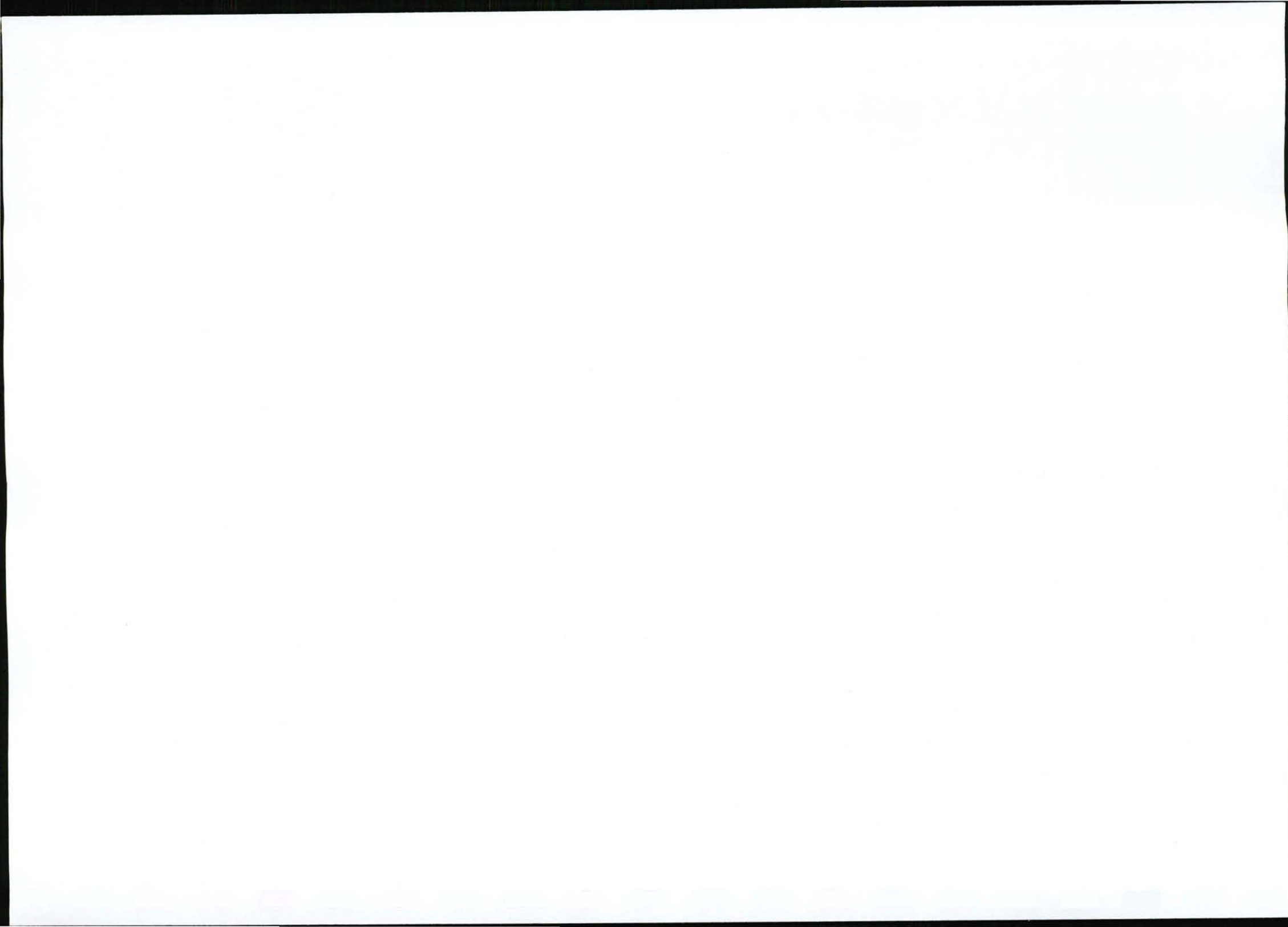


Reserves of the extension: At 1500mm recoverable depth, the borrow pit extension area yields the following reserve : $2,04\text{ha} = 20\,400\text{m}^2 \times 1,5\text{m deep} = 30\,600\text{m}^3$ tight

6.0 ENVIRONMENTAL FACTORS: Informants to site choice/site development, assessment of impact and attenuation measures prescribed

The site was chosen based on the following characteristics:

- Location to serve relevant sector of road.
- Re-use of existing borrow pit & opportunity to rehabilitate the existing pit and reduce it's visual impact on the R387
- The excellent quality of laminar and nodular calcrete offered by the pit's southward and westward extension



- Level ground with limited residual visual impact despite proximity to R387 given prescription in the EMP of 1:3 perimeter slopes with topsoiling and re-vegetation
- Extensive existing disturbance which will be largely rehabilitated as part of the further use of the site and hence is included in the borrow pit area.

6.1 Land Use

The current land use is a borrow pit with stockpiles of topsoil located on site. Possible other use would be that of stock grazing on the municipal land surrounding the pit. The extension of the pit will have a temporary high visual impact during removal of the remnant vegetation but this vegetation will be restored by topsoil and seeding as **attenuation measures** of both the existing and proposed disturbance areas

6.2 Surrounding Land Use

- The closest urban use is that of the municipal sewage treatment works 800m east along the R387
- The site is relatively isolated with the nearest occupancy being the Western residential area of Strydenburg Town located over 1,2km to the East
- The unsurfaced R387 (Strydenburg – Prieska road) is located 50m north of the site.
- A 15m wide pipeline servitude is provided for an underground pipeline located between the existing pit's northern face and the R387
- Degraded/overgrazed but natural veld to the South and west of the existing pit

No impacts on surrounding land use with regards to dust and noise are anticipated given the isolation of the site. Road dust from delivery vehicle use of the public R387 passed the residential area will be reduced by water-cart wetting of the road during delivery periods.

6.3 Visual Considerations

Visual impact during use for 12-18 months production period will be temporary but high on the R387 road users. However, given the re-use and proposed rehabilitation of the existing borrow pit together with the extension area will have a positive impact on visual impact in the post mining period.

Attenuation of the post-mining visual impact includes the 1:3 perimeter sloping and topsoiling and revegetation thereof by grass seeding and opportunity to rehabilitate the existing old borrow pit's existing visual impact on the N-12 which will be significantly reduced in the post contract period.

6.4 Soil

(a) Topsoil

The development of the site would result in the temporary removal of 4,41 ha of topsoil to a depth of 100–300mm but this soil is to be stockpiled in perimeter berms and re-used to re-topsoil the entire site to 50-00mm thickness with a positive impact over the current disturbed site which has little/ no chance of ever rehabilitating without topsoil cover.

As such the **impact on topsoil** is considered high but temporary during the operation but low/moderate in post-mining.

Attenuation Measures:

Prior to any face advance, all topsoil in the area will be dozed to perimeter berms where it will be retained and re-used during final rehabilitation of the site (including both the existing site and the extension area).

(b) Subsoil

The subsoil constitutes the calcrete material to be removed for the road resurfacing. Such subsoil together with underlying shale where not clayey will be removed to max 1,8 m in depth below ngl.

6.5 Vegetation

The vegetation over the entire area is classified by Musina and Rutherford (SA Vegmap) as Northern Upper Karoo Vegetation with a **conservation status of "least threatened"**. The mapped area of this vegetation type exceeds 27891.89km² with **96.6% of this veld type remaining**.

As the borrow pit extension will comprise only 4.41 ha, the **impact on vegetation is negligible**.

Attenuation: The removal, storage and re-use of the topsoil with seedbank to be supplemented by follow-up seeding after re-topsoiling serves as significant attenuation measures to further reduce the impact on vegetation.

6.6 Drainage

The site is located on relatively flat ground with no major run-off implications. There are no identifiable/distinct drainage courses.

Impact of the quarry extension is therefore **negligible** on drainage and no attenuation measures need be considered.

After rehabilitation, the pit floor (as in the case of the existing pit) will temporally flood after thunderstorms as do many other local depressions in the surrounding veld after rains.

6.7 Archaeology

Given the limited extent of the expansion area of 4,41ha, the absence of any rock outcrops, graves or structures, and the level of disturbance to date, no archaeological assessment has been conducted.

6.8 Dust

Borrow Pit Activities

Dust will be generated by dozing of topsoil and the loading of delivery/haul trucks but given the relative isolation of the site (over 1,2km from nearest resident) such impact will be negligible.

As post mining rehabilitation measure, the borrow pit access road and borrow pit will be topsoiled and grass seeded to reduce dust to normal ambient levels.

Delivery Route Dust Impact

Road dust will be generated by the haul trucks delivering material along the un-surfaced R387 to the N-12.

Dust impact by trucks passing the residential area on unsurfaced R387 to the intersection with N-12 could be high when used for delivery.

This Dust will be **attenuated** by wetting by water cart as is done on the N-12 road section under the contract.

Attenuated dust levels will therefore be moderate during the operation and low/negligible in post mining.

6.9 Noise

On site

The site is isolated from nearby users and therefore there will be no noise impact on the closest residential area some 1,2km to the east.

Delivery Route Noise

The delivery trucks will only deliver material during normal working hours and delivery will occur on this public road by licensed vehicles which do not generate excessive noise.

The restriction of activities to normal working hours is considered the only required and appropriate **attenuation measure**.

6.10 Fuel/Lubricant Spillage (generic methods in paragraph 5.3 of the overall report shall apply)

6.11 Ablutions (see generic method in paragraph 5.4 of the overall report)

6.12 Access Road Development and Maintenance

The existing access point on the R387 is to be used and any alternative is to be designated by Resident Engineer ((RE) on the N-12 road contract) as temporary access to the pit & RE is to arrange appropriate road safety signage & flagged traffic control as well as road wetting passed the residential area when required.

6.13 Site Management

Generic site management prescribed in Chapter 5.1 of the overall report shall apply in terms of "good housekeeping".

6.14 Socio-Economic Impact / Land Owner's Concerns

The site will be developed as part of the N12 upgrade contract and consequently all socio-economic requirements with respect to labour recruitment, employment, training, BEE requirements and promotion of SMME's etc will be met in terms of the specifications of the SANRAL contract, in this regard.

7.0 BORROW PIT ENVIRONMENTAL MANAGEMENT AND REHABILITATION PLAN (refer Figure BP-SM – for numbered items below)

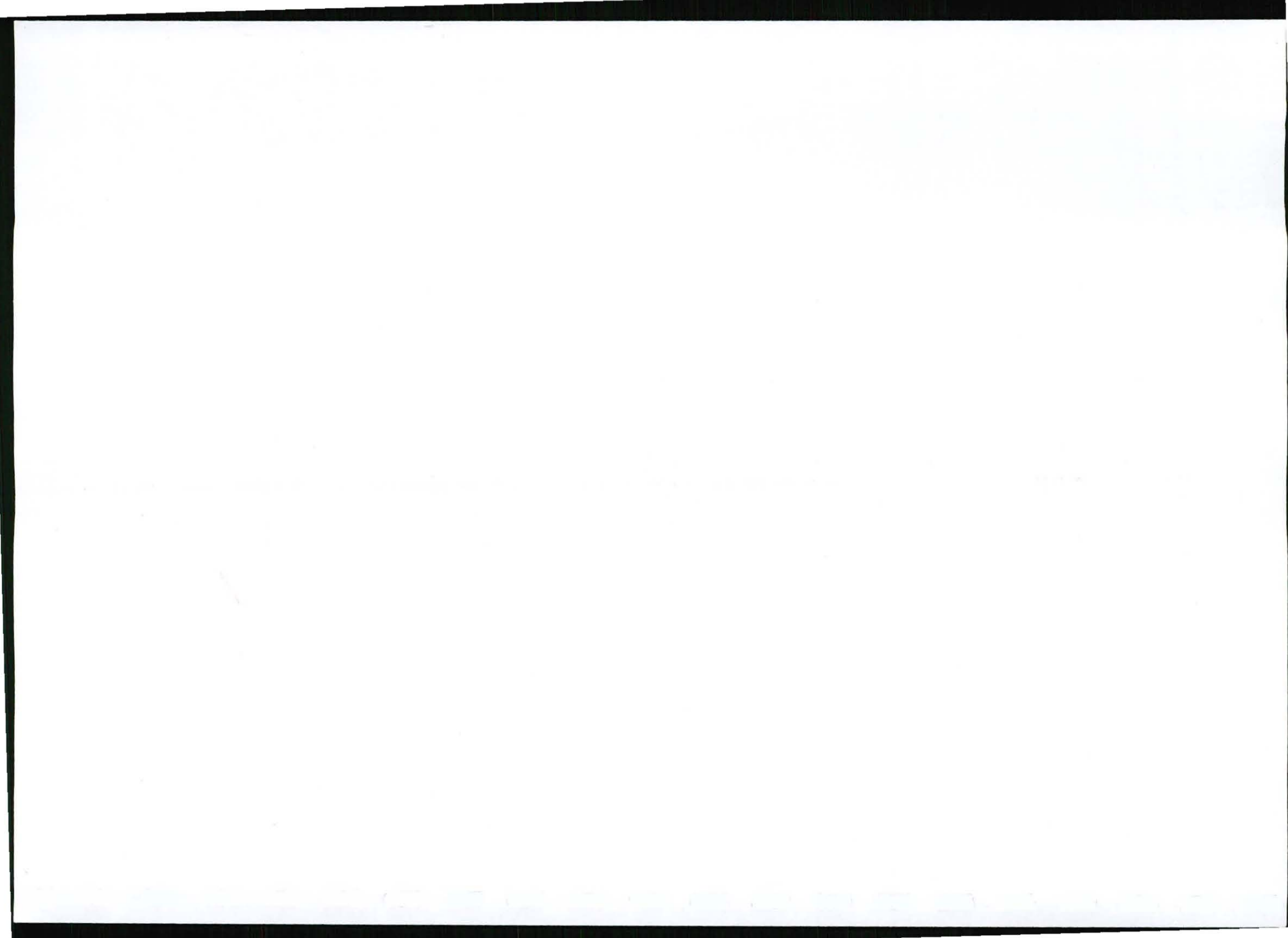
- 1. **Northern Face** : Slope existing north faces to 1:3 slope by dozing with due regard to the pipeline between the pit and the borrow pit as well as for the overhead powerline
- 3. **Mine in Southerly and Westerly Direction**
- b(i) Thinly re-topsoil shaped north face and northern floor area (to 50-100mm thick) with directly transferred topsoil from existing topsoil stockpiles on site
- b) Advance topsoil stripping (300mm) southward and westward by dozing to south, west and east perimeter topsoil stockpile berms (bii)
 - advance existing excavation of calcrete towards south and west to mining profile shown in Figure BP-SM with

thickness of recovered material between 1000 & 1500mm and total excavation depth of 1,8m while retaining 150mm calcrete or non-clayey shale substrate in the floor over clayey horizon.

- c) Trim final pit perimeter to 1:3 as pit excavation face advances
- d) Re-topsoil final 1:3 perimeter slopes to 50-100mm depth of topsoil
- e) Re-topsoil the southern and western extension pit floor to 50-100mm in depth
- f) Seed with grass seed mix specified for the N12 road contract road verges, during summer rainfall season

Topsoiling Method

- Ensure all final perimeter edges are trimmed and scarified/light ripped to 100mm before topsoiling to provide a key for topsoil and then topsoil to 50-100mm thick
- Ensure all topsoil is replaced on floor and over trimmed final edges.
- Lightly scarify topsoiled area and seed with seed specified in para 3.3.2 or by the road contractor's environmental officer and conduct seeding under his supervision.



BP-GB: GANNA BRIDGE BORROW PIT

1.0 LOCALITY AND ACCESS

As seen in Figures A and BP-GB, the site is located immediately east of the N12 tar road at km 32 along the N12 (Strydenburg-Hopetown). The Site is an existing borrow pit situated on the farm Ganna Hoek 140 ptn 1 (rem). The access point is located on the N12 approximately 200m South of the Gannaspruit bridge where an existing farm track gives access to the site.

Given that the N12 is under re-construction, the Resident Engineer (RE) will designate a safe alternate access point, if necessary, for which appropriate traffic warning signage and flagged control will be implemented to serve the duration of the current contract.

2.0 ADMINISTRATIVE DETAIL

- 2.1 **Property;** Farm Ganna Hoek 140 ptn 1 (rem)
- 2.2 **Registered Owner;** Ockie Vermeulen Familie Trust
- 2.3 **Contact Person:** Dr Waltie Vermeulen. PO Box 170, Hopetown, 8750
- 2.4 **Contact Number:** 082 829 5395
- 2.5 **Contact Email Address:** waltie@rooksein.co.za

3.0 GENERAL DESCRIPTION

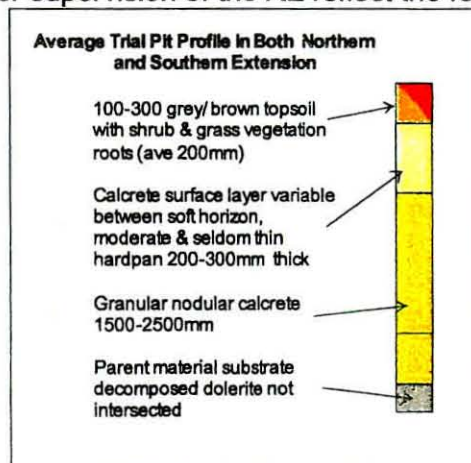
As shown in Photopage BP-GB the site is chosen as an extension of an existing borrow pit to be extended to the south and to the north into the flat surrounding area.

The existing pit consists of a mined, denuded floor with 2,5m high faces of variable slope of which the southern and northern faces are to be advanced in proposed expansion, while the existing east face is to be sloped to 1:3 to facilitate topsoil and re-vegetation to reduce current visual impact.

4.0 GEOLOGY AND TRIAL PIT RESULTS

The material on site consists of a large, very thick, surface deposit of calcrete which has developed as a pedocrete from leaching of calcium carbonate from the parent rock (dolerite) below. As a typical pedocrete it has a finite depth which in this case is thicker than 2,5m thick and typically shows vertical and lateral variation between a thin hard (hard-pan) calcrete and softer laminar or nodular calcrete material with soils or remnants of parent decomposed dolerite. The further consideration is that of clay content derived from the parent rock and which must be present to bind the material but not excessively clayey to exceed the plasticity limit. (Plasticity index (PI)).

Eight Trial Pits dug under supervision of the RE reflect the following average profile:



5.0 BORROW PIT DEVELOPMENT PLAN (refer Figure BP-GB)

Pre development logistics

- Demarcate site with clearly visible posts on Borrow Pit area corners
- Establish:
 - Ablutions (trailer type chemical toilet)
 - Stores Container if required
- Retain existing access road to N12

1. Trimming Existing Eastern Pit Edges:

- Remove topsoil with plant material in 10m wide strip above East face & retain soil on windrow for re-use on shaped face
- Slope existing face to 1:3 while retaining all trees
- Then re-topsoil the sloped north face with topsoil from topsoil windrow

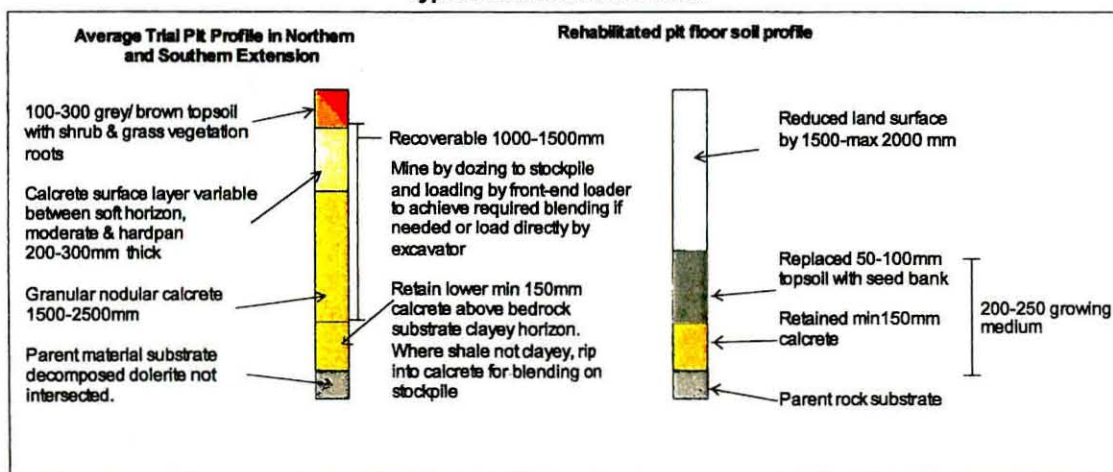
2. Commence mining in a Southerly and Westerly direction including:

- a. Remove exposed calcrete gravel in existing pit floor
- b. Initiate topsoil removal to 100-300mm deep) ahead of the northerly and southerly face advance
 - i. transfer initial topsoil to finished eastern slope of pit
 - ii. doze all further topsoil (100-300mm deep) to perimeter topsoil stockpile berms on pit perimeters

3. Advance pit southward and northward to planned perimeter extent by dozing material to stockpile and loading by front-end loader to achieve required blending if needed or load directly by excavator to delivery trucks to transport to N-12 upgrade contract.

Note: No crushing or screening will take place as the material is suitable for direct use on the road.

Typical Soil & Subsoil Profile



Reserves of the extension: At 1800mm recoverable depth, the borrow pit extension area yields the following reserve: $1.859\text{ha} = 18\,590\text{m}^2 \times 1.8\text{m deep} = 33\,000\text{m}^3$ tight

