

APPENDIX D₄

Geotechnical and Stormwater Report



KAKAMAS
PROPOSED NEW CEMETERIES

REPORT ON
STORM WATER DRAINAGE &
GEOTECHNICAL CONDITIONS

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1. BACKGROUND

Kai !Garib Municipality appointed Stabilis Development (Pty) Ltd to conduct a feasibility study for the development of a new cemeteries for the town of Kakamas.

The feasibility study was funded by Kai !Garib Municipality and also includes the subdivision and rezoning and the required EIA requirements of the portions of land required for a new cemeteries. The two sites were identified for the development of two cemeteries to cater for the needs of the community on the short and longer terms.

An application for the funding of the capital costs involved for the development of the proposed new cemeteries will be lodged at the Department of Corporate Governance, Human Settlements and Traditional Affairs on the MIG program.

2. INTRODUCTION

The town of Kakamas, the main centre of Kai !Garib Municipality, is located approximately 80 Kilometres to the south west of Upington, the main centre of ZF Mgcawu District Municipality.

The existing cemetery at Kakamas currently in use is situated in the town of Kakamas within walking distance from the local community and adjacent to a natural major storm water drainage channel.

The existing cemetery is also approximately 99 % full and reaching its capacity. Therefore a new cemetery is urgently required to meet the needs of the Kakamas Community.

This report addresses the storm water drainage, external and internal, and the geotechnical conditions at the portions of land identified for the new proposed cemeteries at Kakamas.

3. GENERAL INFORMATION

The portions of land identified for the development of the proposed new cemeteries are located as follows:

- The existing cemetery is located within the residential area of Kakamas and can be extended to cater for the shorter term needs of the community
- To cater for the longer term, a site was identified towards the western side of the existing residential area. It is the intention of the municipality to develop some 800 new residential sites on the portion of land.

The locality of the proposed extension of the exiting cemetery and the new cemetery site is indicated on the attached drawing SK 3472/1

These sites are located on land that belongs to Kai !Garib Municipality and the proposed new cemetery site will be part of the new town extension to the existing residential area.

The proposed extension to the existing cemetery is approximately 1,8 Ha and can accommodate approximately 3 100 and 1 300 adult graves and children graves respectively to cater for the short term needs of the community.

The site identified for the development of the proposed new cemetery site is approximately 3,0Ha and can accommodate at least 5 500 graves.

Water will be supplied from the existing water networks in the town and new gravel access roads will form part of the development of the new proposed cemeteries.

4. STORM WATER AND GEOTECHNICAL

The prevailing storm water and geotechnical conditions at the sites identified for the extension the existing cemetery and the development of the proposed new cemetery at Kakamas are described in the following paragraphs.

4.1 Storm Water Drainage

4.1.1 Climatic Conditions

The mean annual rainfall in this area is approximately 169 mm per year according to the rainfall statistics of the weather station, station number 0317/447AX, at Upinton.

This area falls within the summer rainfall region of South Africa with approximately 80% of the annual rainfall that occurs normally from January to April. Thunderstorms are typical of the rainfall pattern in this area.

4.1.2 Catchment Characteristics

The percentage run-off in this area is expected to be relatively high due to the scarce vegetation and the semi-permeable soil.

Normally the run-off from rain storms is concentrated in natural storm water drains or channels that flow down to the Orange River.

- Extension of existing cemetery site
The existing natural storm water channel located approximately 80meters to the south eastern side of the existing cemetery is in operation and drains the external storm water runoff from the catchment located to south of this cemetery site.
- Proposed new cemetery site
Runoff water at rainstorms drains from the highest point on this site in a north, north eastern and north western direction towards non-perennial drainage lines that drains in an general northern direction to the storm water network that flow into the Orange River, approximately 4,5 Km from the proposed site. The proposed site is situated close to the upper boundary of a localized water shed. The position of the site will be finalised at the detail design stage as to leave a clear distance between the site and the major runoff water drainage lines.

The run-off from this land, and the identified sites, can thus be accommodated by the natural gradient and be accommodated in the natural drainage channels in the area.

4.1.3 Suitability of Site

The identified sites are suitable for the development of new cemeteries as far as the external storm water drainage is concerned. The natural storm water channel adjacent to the existing site can be utilised to drain the run-off from external storm water.

The new identified site is situated on a higher level than the existing natural storm water drainage lines and flooding of the proposed new cemetery is not likely to occur.

The drainage of the internal storm water will be addressed at the design and the development of the new proposed cemetery. An earth embankment can be constructed on the side of the extension of the existing cemetery to prevent storm water from flowing into the cemetery and to drain any run-off that originates from the surrounding land.

4.2 Geotechnical

4.2.1 General Geological Information

The local geology of the two sites are briefly described below as summarised from the Geo-hydrological reports compiled by Tucana Solutions for the Basic Assessment Report, March 2019..

- Extension to existing cemetery

The proposed site is situated on the intrusive Riemvasmaak Gneiss associated with the Gordonia Subprovince. Although the Riemvasmaak Gneiss appears highly weathered, it has a tendency to form large exfoliation domes.

Alluvium deposits are found in the lower laying areas that border the Orange River. These fine-grained silt sediments were deposited by slow moving, silt laden water.

- Proposed new cemetery site

The proposed site for the development of the new cemetery is situated on the intrusive Kenhardt Migmatite associated with the Gordonia Subprovince. The Kenhardt Migmatite of the Vyfbeker Metamorphic Suite of the Hartebies River Complex of the Gordonia Subprovince consists of coarse-grained biotite gneiss with scattered augen-shaped porphyroblasts. In places the banded character of the gneiss is displayed.

Although the Riemvasmaak Gneiss appears highly weathered, it has a tendency to form large exfoliation domes.

Alluvium deposits are found in the lower laying areas that border the Orange River. These fine-grained silt sediments were deposited by slow moving, silt laden water.

4.2.1 Site Conditions

To establish the properties of the in-situ soil conditions on the two sites, trial holes were made at each of the proposed sites by means of a TLB excavator from Overroxx Trading cc, a civil engineering contractor – see Annexure A, trial holes positions indicated on attached drawing SK3472.

The TLB is a relative small construction plant with limited excavation capacity.

- Extension to existing cemetery

Two trial holes, number 1 and 2, were excavated to establish the typical in-situ soil profiles on this site- see Annexure A

Trial hole 1 was excavated up to a depth of approximately 2,0 meter below natural ground level without any difficulty. The upper 550 mm was identified as firm red soil and the next 1 450 mm in the profile firm, stiff red soil. The excavated test hole indicated stable soil conditions with mainly stiff red sandy soil.

Trial hole 2 was excavated to a depth of 550 mm below natural ground level till intermediate and hard rock was encountered.

Intermediate material or hard rock may be encountered below a level of 0.50m. The upper 150mm entails loose sandy soil and the next 400mm comprises of a red soil mixed with fractured gravel material.

The profiles of this trial holes is shown in Annexure B.

- New cemetery

Two trial holes, number 3 and 4, were excavated to establish the typical in-situ soil profiles on this site- see Annexure A.

Trial hole 3 was excavated to a depth of 0,50m below natural ground level till intermediate and hard rock was encountered. The upper 100mm entails a red sandy soil and the next 400mm comprises of red soil mixed with fractured gravel.

Trial hole 4 was excavated to a depth of 0,6m below natural ground level till intermediate and hard rock was encountered. The upper 150mm entails red sandy soil and the next 450mm comprises of red soil mixed with greyish fractured intermediate material.

The profiles of this trial holes is shown in Annexure B.

4.2.3 Suitability of Sites

As far as the geotechnical conditions are concerned, both sites are suitable for the development of a new cemeteries, but it is recommended that the graves be pre-excavated to the required depth of 1,8 meter. The exfoliation domes formed in the geological formations are typical in this area.

The pre-excavation of the graves are normally done where hard materials are encountered and the cost thereof is then part of the development costs of the cemetery.

5. REMARKS AND RECOMMENDATIONS

The following remarks recommendations regarding the storm water and geotechnical conditions are relevant;

5.1 Storm Water Drainage

The identified sites can be regarded as suitable for the development cemeteries as far as the external and internal storm water drainage is concerned.

It is recommended that a small earth embankment or berm, of approximately 300mm in height, be constructed on the eastern side of the site of the exiting cemetery to prevent external storm water flowing onto the site from the adjacent natural storm channel.

The internal storm water drainage can be accommodated by shaping the roads on the site.

5.2 Geotechnical Conditions

The trial holes excavated on the sites indicated that intermediate and hard rock material may be encountered at depths of more than 600mm below natural ground level. This material is typical of this area and therefore it is recommended that the graves be pre-excavated as part of the development of the new cemeteries

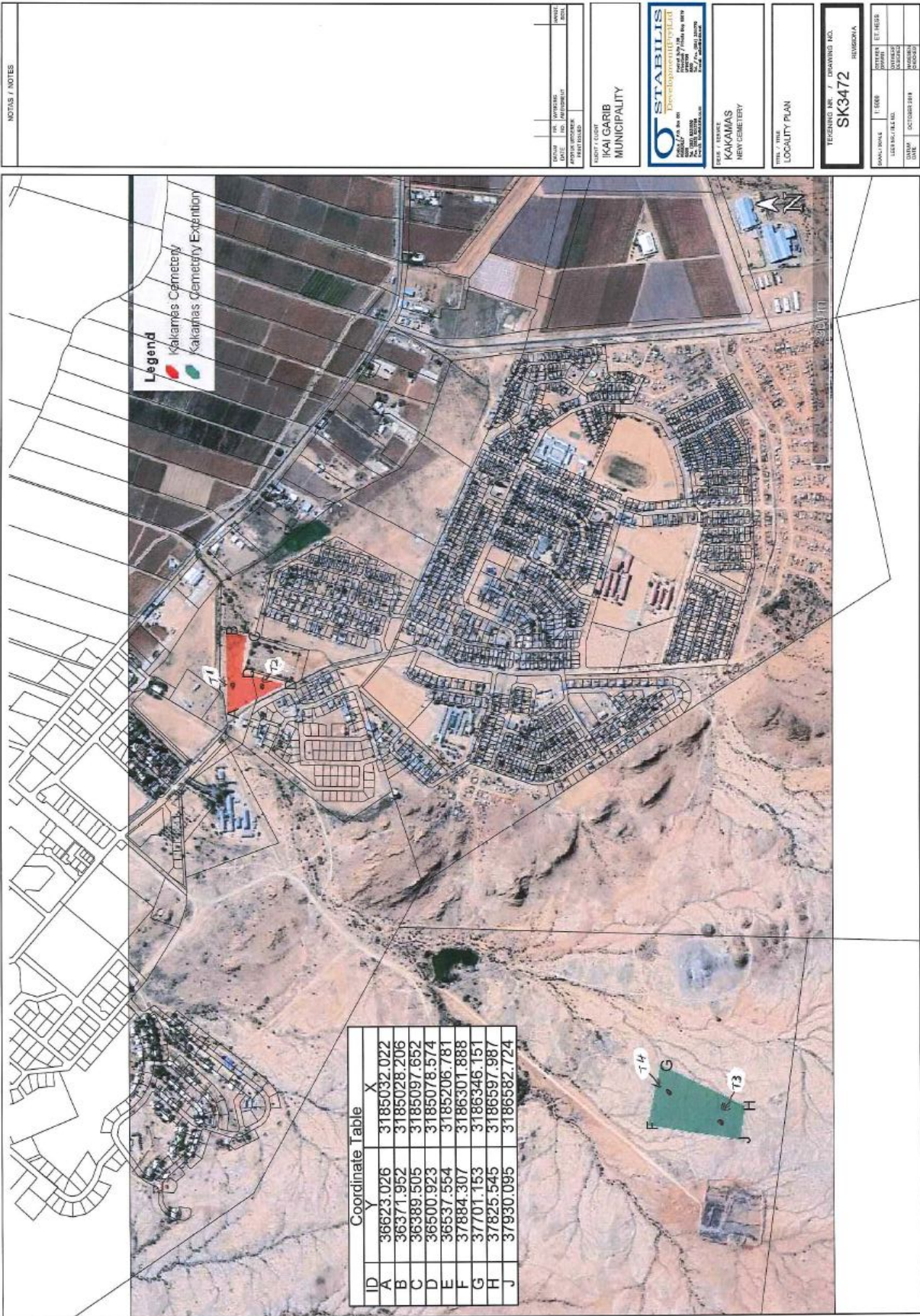
6. REFERENCES

- TUCANA SOLUTIONS, GEOHYDROLOGICAL REPORT, KAKAMAS CEMETERY EXTENTION, 29 March 2019
- TUCANA SOLUTIONS, GEOHYDROLOGICAL REPORT, KAKAMAS PROPOSED NEW CEMETERY, 29 March 20149.

C.J Botha Pr.Eng
Stabilis Development (Pty) Ltd

ANNEXURE A

LOCALITY PLAN & TRIAL HOLE POSTIONS



NOTAS / NOTES

SCALE	1:5000	DATE	10/2018
APPROVED BY	DATE	APPROVED BY	DATE

LIBERTY CLERK
KAI GARIB
 MUNICIPALITY



DESIGN & SERVICE
KAKAMAS
 NEW CEMETERY

TITLE / TITLE
LOCALITY PLAN

TEKENING NO. / DRAWING NO.
SK3472

REVISION	DATE	BY	REASON
1	10/2018	ET	ISSUE

Legend
 Kakamas Cemetery
 Kakamas Cemetery Extension

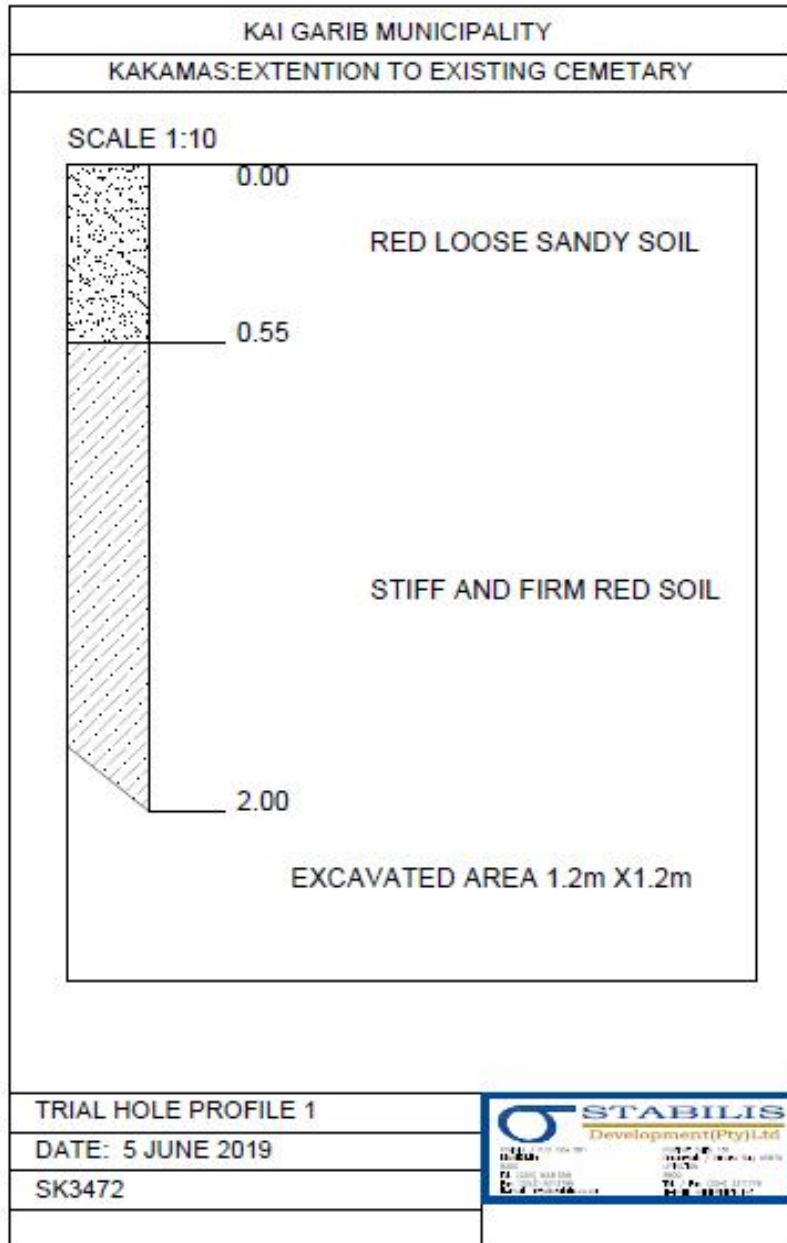
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F	37884.307	3186301.888
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H	37825.545	3186597.987
J	37930.095	3186582.724

ANNEXURE B

TRIAL HOLE PROFILES

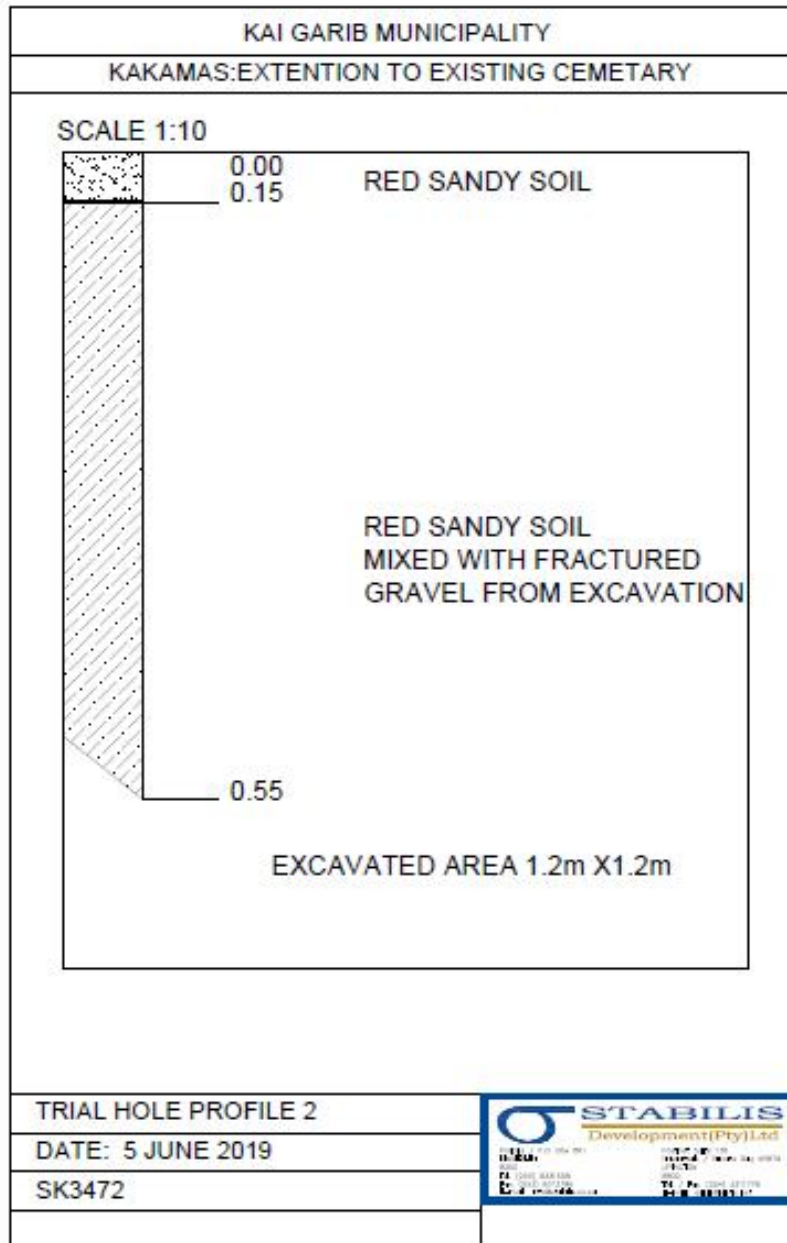
EXPANSION OF EXISTING CEMETERY

TRIAL HOLE 1



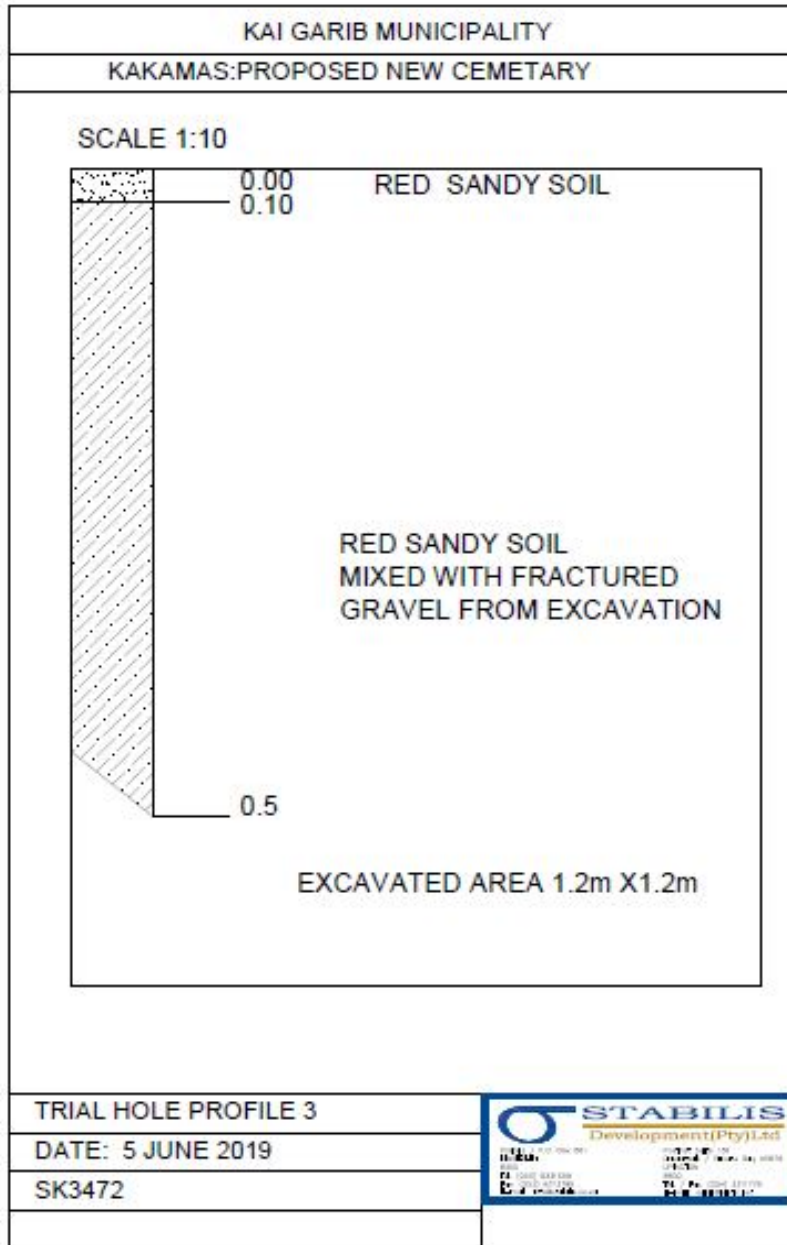
EXPANSION OF EXISTING CEMETERY

TRIAL HOLE 2



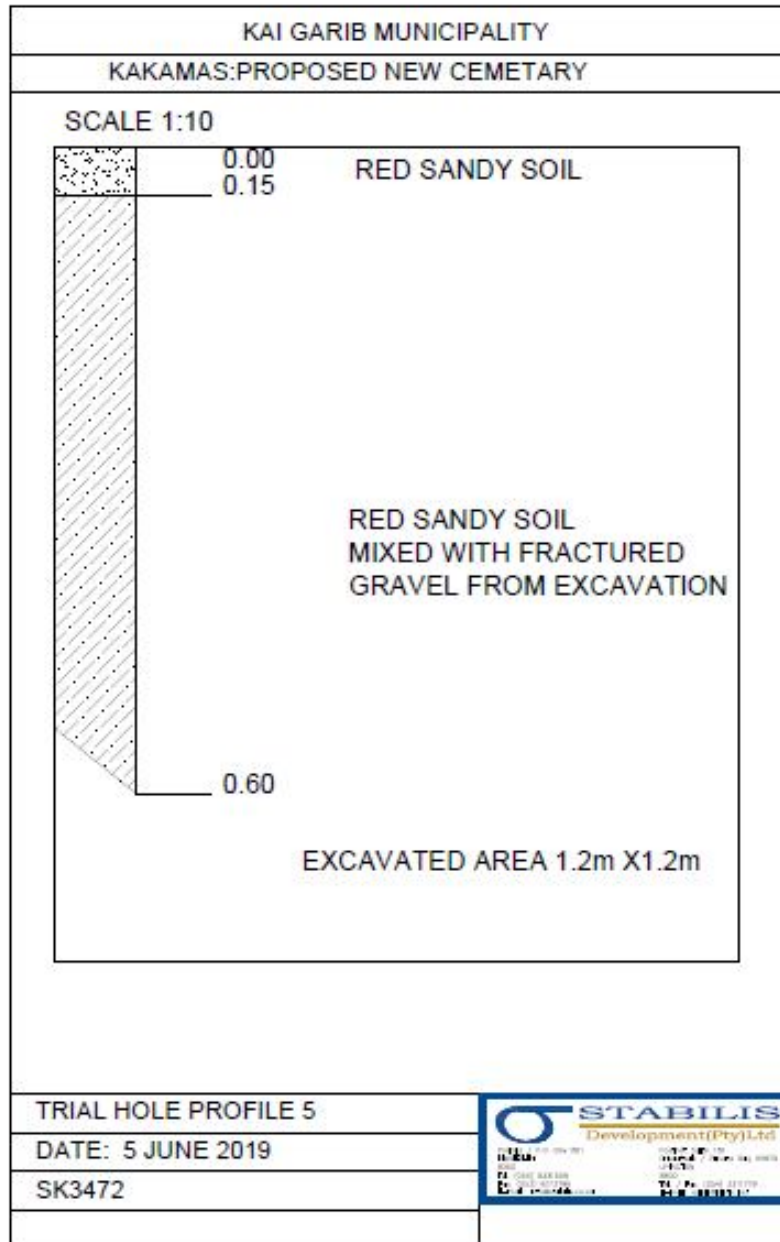
NEW CEMETERY

TRIAL HOLE 3



NEW CEMETERY

TRIAL HOLE 4



ANNEXURE C
PHOTOGRAPHS OF TRIAL HOLES

EXPANSION OF EXISTING CEMETERY

TRIAL HOLE 1



Trial hole 1 – 2,0 meter in depth

EXPANSION OF EXISTING CEMETERY

TRIAL HOLE 2



Trial hole 2 – 0,50 meter in depth



Trial hole 2 – Excavated material

NEW CEMETERY

TRIAL HOLE 3



Trial hole 3 – 0,50 meter in depth



Trial hole 3 – Excavated material

NEW CEMETERY

TRIAL HOLE 4



Trial hole 4 – 0,60 in depth



Trial hole 4 – Excavated material

