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Incorporating Drennan Maud & Partners (Est.1975) and GAP Consulting



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OUR REF.: 31366
YOUR REF

18th March 2016

Lisa Rorich Architects
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E-mail; lisa@lrarchitect.co.za

Attention : Lisa Rorich

Dear Sirs,

**GEOTECHNICAL ASSESSMENT PROPOSED 'PENNY LODGE' DEVELOPMENT,
ZULULAND RHINO RESERVE.**

Following our preliminary discussions held with Ms. L. Ness of Linda Ness and Associates and our subsequent site visit on 11 March 2016, we have reviewed the development proposals, as discussed on site and shown on your drawings in the e-mails supplied by Linda Ness and Associates and comment below on the general geotechnical conditions relevant to the aspects of the proposed development.

1. DEVELOPMENT PROPOSALS

- 1.1 In terms of our discussions and an e-mail received, the development is to comprise the development of a luxury lodge and four associated accommodation units overlooking the Msunduzi River.
- 1.2 The main lodge is to comprise a single story covered portion comprising a living area, dining area and kitchen and back of house, and covered living area on a deck adjacent to a pool and a sunken fire pit.
- 1.3 The accommodation units comprise single story units with bedroom, living area, bathroom area and deck.

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2. SITE DESCRIPTION

- 2.1** The site is located on the northern bank of the Msunduzi River which flows in a north easterly direction towards the inside curve of a prominent north west/south east striking spur around which the river flow changes direction by about 90°, such that below the proposed main lodge the river flows in a south easterly direction.
- 2.2** Below the ridge forming the outside bend is a relatively level area which forms part of the flood plain of the Msunduzi River. The lower slopes forming the floodplain are underlain by alluvial sediments likely to be overlying weathered bedrock.
- 2.3** No weathered bedrock was exposed in the area of the proposed Lodge nor on either bank of the Msunduzi River. However, weathered bedrock occurs on the access roads to the area.
- 2.4** No detailed survey of the site is available. However, based on our visual assessment it appears that the proposed Lodge site occurs on a relatively gently sloping elevated plane above the Msunduzi River. The plane may be an ancient floodplain overlying the weathered bedrock and appears to be approximately 8 m above the river bed level. The riverbank below plane is steep and may be vertical in some instances.
- 2.5** A drainage line crosses the northern portion of the elevated plane draining in an easterly direction along a small stream valley channel into which a small dam to the north west of the Lodge site drains.

3. SITE GEOLOGY

- 3.1** The general location of the development, showing the general geology from the 1:250,000 St Lucia geological plan, Plan No.27½ 32, is included herewith as Figure 1.
- 3.2** The regional geology of the immediate area is dominated by Jurassic basaltic bedrock of the Letaba Formation of the Lebombo Group and the colluvial and residual soils derived therefrom. However as the site is located adjacent to and within the floodplain of the Msunduzi River some alluvial sediments are likely to underlie the site.
- 3.3** Observations on site indicate that the immediate upper colluvial soils comprise a dark grey and very dark grey, firm, fissured, slightly sandy silty clay. This colluvial material derived from the basalt is likely to be highly active and is sometimes referred to as cotton soils. In the small elevated stream valley crossed by the access road the subsoils comprise a reddish brown to orange brown mottled and blotched grey and white, sandy gravel with rock corestones. This material comprises the residual materials overlying the basalt.

3.4 From available information in the area we consider it likely that underlying the residual soil is the weathered bedrock which is generally brown to orangish brown, highly to completely weathered, highly fractured, soft to medium hard rock basalt.

4. GEOTECHNICAL ASSESSMENT

4.1 General

4.1.1 In terms of the development proposals, our discussions on site and subsequent discussions the assessment was to determine the general geotechnical conditions on the site to be used in the planning for the architect and the environmental consultant, and to provide the design engineers sufficient preliminary information for the founding and construction of the proposed structures. In addition, a preliminary assessment for the feasibility of wastewater disposal was required.

4.1.2 Taking the above into consideration, the following are the aspects relevant to the proposed development;

- The suitability of the *in-situ* soils/bedrock for the founding of structures including the road and parking areas.
- The suitability of the *in-situ* subgrade materials for construction purposes.
- The collapse/heave potential of the upper loose sandy/clayey soils in terms of excavations.
- The suitability of the in situ materials for the disposal of wastewater by means of subsoil percolation.
- The presence of a perched water table.
- The stability of slopes.

4.2 Founding Conditions

4.2.1 To obtain an indication of the subsoil consistency in the area of proposed development limited dynamic cone penetrometer testing was carried out. The approximate position of the tests are indicated on the attached site plan Figure 2 and the results of the tests are included as figure is 3 to 5.

4.2.2 From the drawings provided it is evident structures are to be located on the upper terrace area on the relatively level ground overlooking the Msunduzi River. This area is likely to be overlain by colluvial and residual soils overlying the basalt bedrock that may be overlying alluvial soils.

4.2.3 Based on the results of the DCP tests, founding conditions for the proposed development are considered generally good based on the proposed structures and depending on the location on the crest of the slope.

4.3 Excavatability

4.3.1 *Alluvium/Residuum*

Excavation through the alluvial and residual materials occurring on the site is expected to be easy. These materials may be unstable and side wall collapse should be expected when excavating foundations. All sidewalls within the sediments have to be shored according to the safety regulations at the discretion of the Engineer.

4.3.2 *Basalt*

Excavation through the basalt bedrock may however become soft to medium hard rapidly with depth and intermediate excavation at depths in excess of 3 m is expected.

4.4 Groundwater Conditions

4.4.1 No groundwater is likely to occur on the upper terraced area where the development is proposed. However, during periods of high rainfall groundwater seepage may occur at the contact between the colluvial soils and the residual soils and underlying weathered bedrock.

4.5 Slope Stability

4.5.1 The existing riverbank is considered over steep and appears to be undermined during periods of flooding such that there is evidence of collapse of the existing riverbank.

4.6 Waste Water Disposal

4.6.1 The disposal of sewage in remote areas is problematic in that there are no major treatment plants in the areas to accept sewage either through a piped reticulation system or by tanker truck from a conservancy tank, and on site disposal is the only option. Two alternatives therefore exist, these being;

- Sub surface system (septic tank and french drain)
- Package treatment plant (package treatment plant)

4.6.2 *Sub surface system*

Subsoil disposal is environmentally the preferred option. However, it is dependent on the soils being suitable and is preferred for relatively small volumes.

4.6.3 *Package treatment plant*

Package treatment plants are available from various suppliers/manufacturers. These are however generally more suitable to larger types of developments..

4.7 Materials Suitability

- 4.7.1** Two samples of the materials occurring on site were selected for laboratory testing. The testing has not yet been completed. However based on a visual observation we consider it likely that the materials classify as an A-6 or A-7-6 materials in terms of the Revised US Classification and are not likely to be suitable for use as subgrade or bulk fill material given their likely generally high clay content.
- 4.7.2** The weathered basaltic bedrock may be more suitable as subgrade and can be used as lower and upper selected layer level below road and building platforms.
- 4.7.3** No materials occurring in the area are likely to be suitable for use as upper selected layers (G6/G7), subbase (G5) and base material (G2/G3) and these materials will need to be imported to site from a local commercial quarry source.

5. RECOMMENDATIONS

5.1 Location of Structures

- 5.1.1** From the site inspection and the examination of the Google satellite image and the plans provided it is evident that the preliminary siting of the proposed lodge and accommodation units of the proposed development, on the terrace overlooking the Msunduzi River is likely to be satisfactory with the structures being underlain by stiff/dense residual/alluvial soils.
- 5.1.2** However, prior to the final siting of the structures we consider it essential that the following is undertaken;
- a detailed topographical survey of the development site is carried out to determine the slope geometry and limit of the proposed development to the edge of the riverbank.
 - a detailed flood analysis is carried out to determine the limit of the location of the structure in terms of the 1:100 year flood level or any other requirements of the environmentalists.

5.2 Founding

- 5.2.1** Based on our assessment on site consider that, founding of the structures on shallow strip footings or column base foundations is likely to be possible. Both strip footings and column base footings should be taken into the stiff/dense subsoils, that are likely to be either alluvial or residual basaltic soils, taken to a minimum depth of 1.2 m below the current ground level.

5.3 Slope Stability

5.3.1 As indicated above, a detailed geotechnical assessment needs to be undertaken to determine the effects of construction on the edge of the riverbank based on the results of a detailed topographical survey.

5.4 Services

5.4.1 Due to the likely presence of alluvial/residual soils overlying the weathered bedrock it is likely that it will be possible to bury all the services in the positions of the proposed development.

5.5 Waste Water Disposal

5.5.1 As indicated in Section 4.6 above, the most practical means of waste water disposal on a remote site is a sub surface system such as a septic tank french drain system.

5.5.2 Although not likely to be ideal due to the clayey soil cover in the area of the proposed development, from our site assessment it appears that a suitable area for waste water disposal by subsoil percolation with a suitable evapotranspiration area is likely to occur on the slopes to the north east of the proposed development.

5.5.3 Once the development proposals are finalised and details of the lodge uses are available detailed design of the wastewater disposal system must be carried out.

6. CONCLUSION

Based on the results of the preliminary geotechnical assessment carried out of the site we consider that the proposed development of lodge and associated facilities on the site is feasible.

As the terrain in the area of proposed development is topographically slight to moderate and the area is underlain at a relatively shallow depth by stiff/dense soils, conventional structural development comprising shallow founding on normal strip or column base foundations is considered feasible.

In addition, we consider it feasible to use a septic tank and french drain system for the effective and efficient disposal of effluent for the development, provided the system is correctly constructed and placed, in terms of the recommendations given once the details of the development have been made available.

It should be noted that this report is a preliminary report outlining the concept and feasibility of the development and a detailed geotechnical assessment may be required prior to final design and during the development of the site.

We trust that this meets with your immediate requirements in this matter and will be pleased to furnish you with any further information you may require.

Yours faithfully

DRENNAN MAUD (PTY) LTD

A handwritten signature in black ink, appearing to be 'M.J. Hadlow', written in a cursive style.

M.J. HADLOW Pr.Sci.Nat.

<i>Encls.</i>	Fig 1.	Geological Plan
	Fig 2.	Site Plan.
	Fig 3 - 5	DCP Test Results.

cc: Linda Ness Associates

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