RECONNAISSANCE SITE INVESTIGATION OF THE PROPOSED BARBERTON CROSSINGS DEVELOPMENT

By

ESS
Earth Science Solutions

Compiled for

Tautoni Property Development cc

December 2007

DOCUMENT ISSUE STATUS

Report Issue	Reconnaissance Site Investigation		
Report Number			
Title	Name	Signature	Date
Author	Ian Jones		23rd December 2007
Project Director	Ian Jones		23rd December 2007
Technical Review	Ian Jones		23rd December 2007

* This report is not to be used for contractual or engineering purposes unless permissions are obtained from the authors.

Stonecap Trading 14 (Pty) Ltd

Our Ref: BSL.BC.EIA.07.01.013
Your Ref:

23rd December 2007

Barberton Crossings Development
Tautoni Property Development CC
P O Box
BARBERTON
1300
Mpumalanga

Tel: 013-712 4345, Fax: 013-712 6258

Attention: Mr. Ben Theron

Dear Sir,

Re: RECONNAISSANCE SITE INVESTIGATION
BARBERTON CROSSINGS – TAUTONI PROPERTY DEVELOPMENT

Herewith please find our draft report detailing the findings of the reconnaissance site investigation for the proposed development – Barberton Crossings, owned by Tautoni Property Development CC.

Please do not hesitate to contact us should you require any additional information in this regard.

Yours faithfully
Earth Science Solutions (Pty) Ltd

Director
IPC Jones

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

EXECUTIVE SUMMARY

An in depth investigation of the geological conditions associated with the proposed development site has been conducted for the area known as "Barberton Crossings" a development being investigated by Tautoni Property Developers CC Barberton, a BEE registered company in the Lowveld Region of the Mpumalanga Province of South Africa.

The investigation was undertaken in terms of the conditions of the Scoping Investigation that was undertaken in terms of the National Environmental Management Act (NEMA), and was required to determine the properties of the founding materials and the general geological conditions of the site proposed for the development.

In terms of the zoning principles a significant proportion of the area surveyed is regarded as being suitable for the proposed development of medium to high income housing and its supporting infrastructures, but will require additional detailed investigations for the founding of all proposed and planned structures. The reconnaissance study has been undertaken as a screening survey in an attempt at determining the presence and percentage of the area that is un-usable for building of structures or servitudes.

The areas classified as 2B and 2C in terms of the site assessment nomenclature, indicative of areas that need "little to no" additional input, and pose no major problems to structural development, and hence no restrictions to single story buildings.

It is important to note, that all services will be provided by the town council. There will be no soak away type sewage systems or open storm water systems, with all sewage being piped to the municipal system. Domestic water will also be supplied by the council, and all waste (domestic and garden refuse) will be disposed of in the licensed landfill site outside Barberton.
In this way the problems of domestic waste and water supply from groundwater supplies is eliminated.

1. TERMS OF REFERENCE

In terms of a proposal submitted to Tautoni Property Developers, Earth Science Solutions (Pty) Ltd were requested to proceed with the site assessment investigation of the 18ha that was purchased from the Emjundini Town Council for the proposed housing development (Barberton Crossings). The site is situated approximately four kilometres from the Barberton town centre on the outskirts of the Barberton Townlands opposite the Private Hospital at the Kaapmuiden – Nelspruit intersection (Refer to Figure 1 – Locality Plan).

This report gives details and comments on the findings of the reconnaissance site assessment conducted on the area proposed for development. The zoning of this land and all of the required purchasing and development negotiations for the land are assumed to have been undertaken, and are outside the scope of this specialist study.

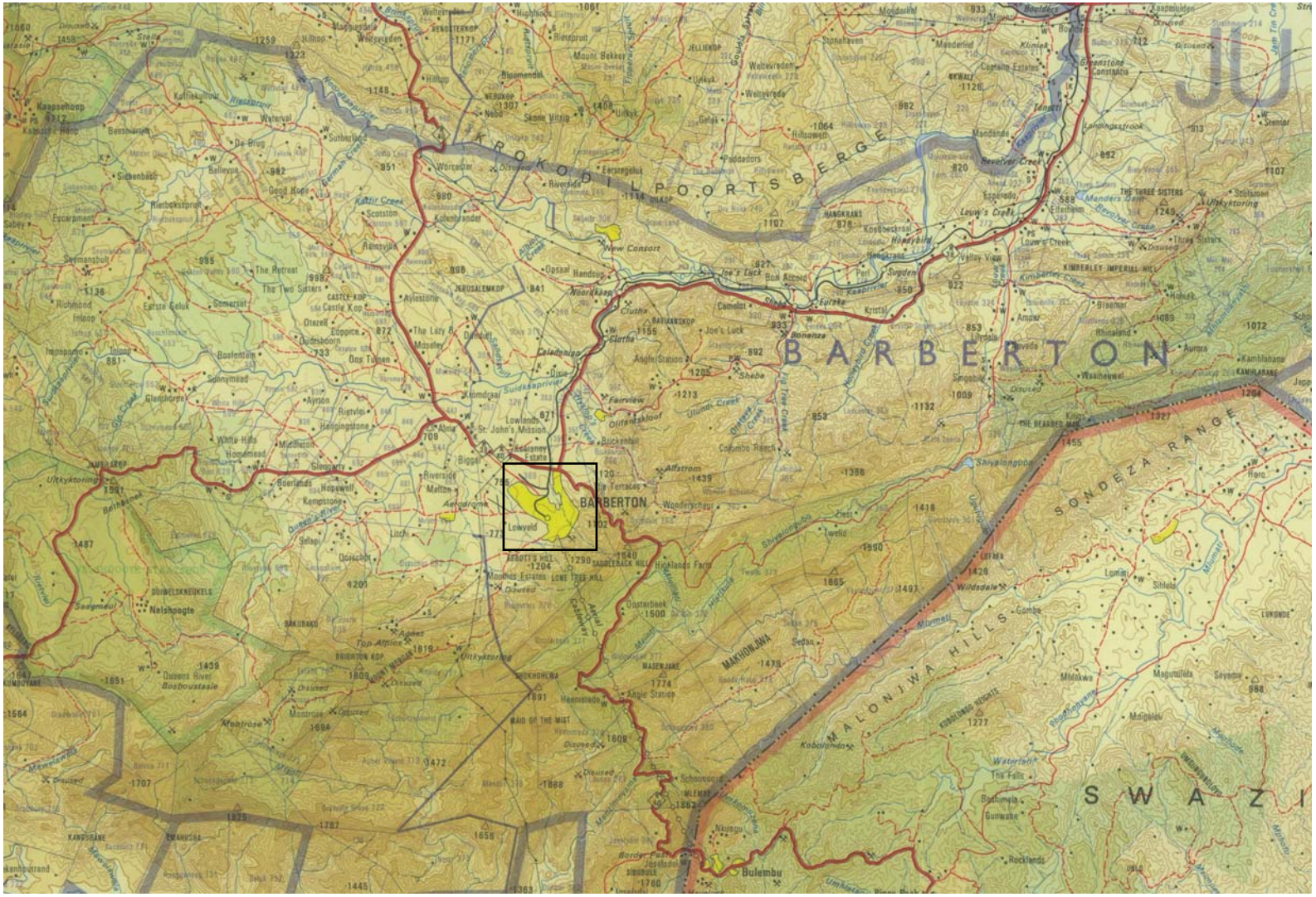
The investigation was undertaken to determine the soils and bedrock conditions underlying the site, obtain results from standard engineering geological test work on the materials and soil variables, and assess the impacts of a housing development on the area. These factors have been used to assess the suitability of the area for residential development and have been measured against the norms as laid down in the NHBRC Manual (February 1999).

Objectives of the Investigation

The objectives of the investigation were to:

i) Examine and record the sub-soils in the area
ii) Carry out the necessary tests to determine the engineering properties of the various soil/rock horizons, and
iii) Provide input into the detailed studies that might be required for the determination of the foundation conditions for the development.

Figure 1 Locality Plan (1:250 000)

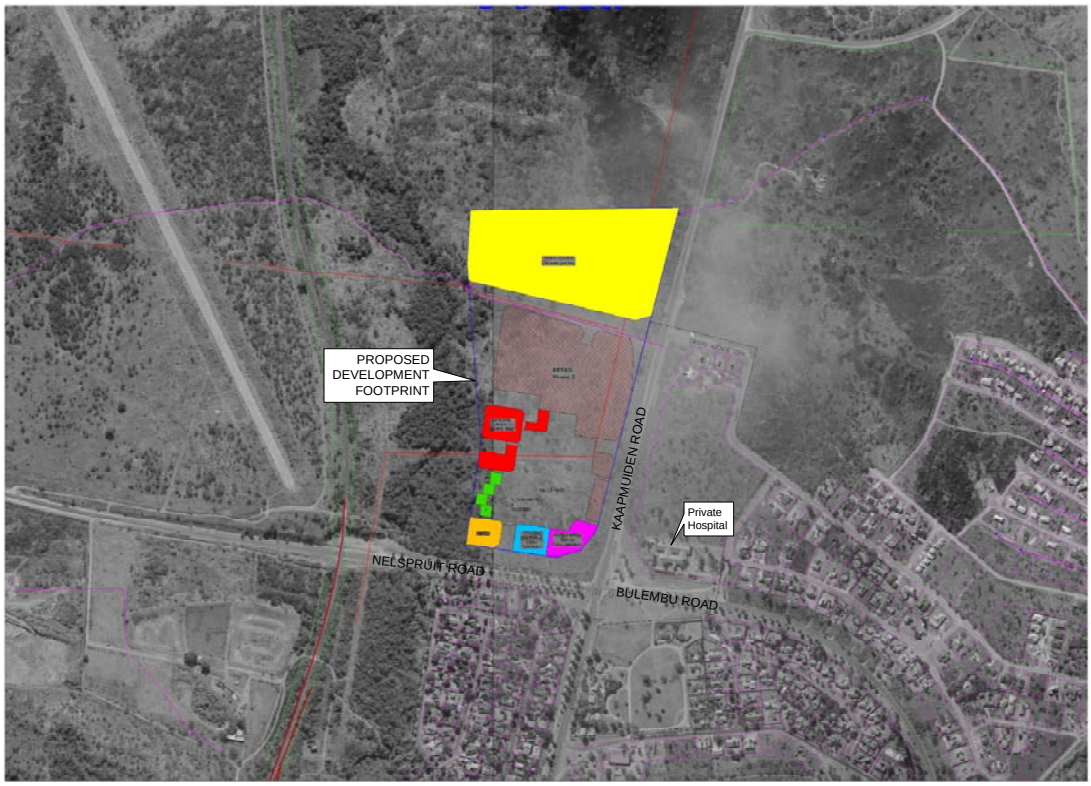


2. INFORMATION SUPPLIED

The following information was supplied for the purpose of the investigation:

- Copies of the 1:50,000 scale topocadastral map sheet covering the relevant area (sheet 2531 CC) and showing the topography, dwellings and roads;
- Aerial/ortho photographs and line drawings supplied by Tautoni Property Developers showing the areas for development;
- Geological Information - map sheet Barberton 2531 CC - 1:250 000 scale;
- Report (8/97) by P. G. Hansmeyer:

Figure 2 Site Plan



3. FIELD INVESTIGATION

The site was visited between 18th and 24th October 2007. During this visit, the area was assessed in terms of its geological and soil parameters on a reconnaissance base during a walk over study, and inspection pits were sited for excavation.

3.1 Geological Mapping

The general geology of the site was mapped using the limited exposures occurring in the borrow pits/quarries and as rock outcrops on surface. Representative profiles were logged in shallow cuttings as well as a number of auger points. The approximate positions of these exposures and auger holes are indicated on the Site Plan, Figure 2 and the profile descriptions are included in Appendix 1.

3.2 Excavation of Inspection Pits

In addition, a total of four (5) inspection pits were excavated. The materials exposed in these pits were also examined and logged. From these pits, two representative samples of the materials occurring on site were taken and submitted to Geo Africa Laboratory (Nelspruit) for testing.

Vehicle access to the site is good, with little other than occasional grazing having occurred on the land in the recent past. At present there is little to no activity on the site.

The laboratory test results are included in Appendix 3 and in Table 4.3 below.

4 DESCRIPTION OF THE SITE

4.1 Topography

The topography of the area comprises undulating to open, flat terrain with resultant wide, open drainage lines. (Refer to Plan 1 - Locality Plan).

The site is at an elevation of approximately 725m.a.m.s.l. The site is generally east facing, bounded by the R38 in the west, the railway line in the east and the R38 to Nelspruit in the north.

4.2 Drainage

Drainage in this area is predominantly to the south along a quaternary waterway that is part of the Queens River that flows into the Suidkaap River part of the greater Crocodile River Catchment.

4.3 Climate

The climate is typical of the middleveld to highveld and representative of the humid, warm to hot subtropical climatic zone. Frost is uncommon in winter, and the annual rainfall is between 850 and 1050mm, occurring predominantly during the summer months. The summers are generally hot to very hot, humid and wet, while the winters are cool to temperate and dry.

4.4 Geology and Soils

The site comprises predominantly porphyritic granites of the Kaap Valley Granite Suite, with minor intrusive (and younger) Diabase dykes.

4.4.1 Kaap Valley Granite

Granites of the Kaap Valley type (Zk), underlie the majority of the site (99%) and where these lithologies sub outcrop, they produce pale red brown to red shallow soils, on a moderate to deep saprolite, with a hard rock base that exhibits moderate jointing and quartz veining, migmatites and banded gneiss. For the major part of the site, the soils are moderately deep (600m to 1100mm) with a weathered saprolitic base (C horizon). On weathering the granites become red to reddish orange and returned a sandy clay to sandy clay loam texture, medium grain texture, moderate rooting depths and relatively soft saprolitic layer, on a hard rock base.

A residual/soil layer varies in thickness from 600mm to greater than 2000mm. These soils generally comprise slightly moist to dry red brown to dark red apedal to moderately structured clay loams (topsoil), on red or dark red medium to coarse grained sandy clay to sandy clay loams, dystrophic to mesotrophic in leaching status, with a firm consistency. These soils are moderately active.

4.4.2 Diabase Intrusive

The diabase intrusive occurs as cross cutting, generally high angled (steeply dipping) dykes, with a common southwest to northeast orientation. Weathering depths of between 800mm and 2500mm are the norm, and the parent material generally weathers to produce a sandy clay loam, red to dark red colours and a mesotrophic leaching status.

The deep weathering of the diabase is often coupled with a boulder layer within the subsoil horizon. The saprolitic zone is generally highly weathered, yellow stained orange and dark red, fine grained, closely jointed, soft to medium hard rock.

There where no outcrops of intrusive materials within the area designated for development. These facts will need to be verified once the site has been cleared, and during the excavation of foundations. A qualified technician should be employed to over see all founding conditions prior to building taking place.

5. LABORATORY TESTING

Two representative samples of the material occurring on the site were selected and taken for laboratory testing. The following tests were carried out for classification purposes, to determine the suitability of materials for use in bulk fills and road construction and to determine the swell potential of the materials:

- Particle size distribution and Atterberg Limits
- Mod AASHTO Moisture Density Relationship
- CBR Determination

The results of these tests are given in Appendix 3 and are summarized in the table overleaf. It should be noted, that these tests are not necessarily representative of the whole site, and additional testing will need to be undertaken by a qualified person on specific areas that are considered by the expert to be of concern.

Table 5 Laboratory Test Results

Barberton Crossings - Laboratory Test Results						
Laboratory and Field Data	Lab No.	E1	E2	E3	E4	E5
	Field ID	BX2	BX3	BX4	BX8	BX9
	Description	Sandy Clay	Clayey Sand	Sandy Clay	Clay Sand	Sandy Clay
Gradin Grading Analysis % Passing	38,0	100	100	100	100	100
	12,7	100	100	100	100	100
	4,76	100	100	100	100	100
	2,40	100	99	100	94	97
	1,20	100	88	96	75	75
	0,420	89	60	66	46	48
	0,250	60	55	60	40	46
	0,150	18	45	58	36	38
	0,075	6	35	46	30	33
	0,050	-	30	40	26	28
	0,005	-	26	38	23	24
	0,002	-	23	33	21	21
Soil Mortar	Gravel > 2.40mm	-	1	0	6	3
	C' Sand 0,025mm	70	44	39	54	51
	F' Sand 0,075mm	19	20	14	10	13
	Silt > 0.002mm	10	12	14	9	12
	Clay < 0.002mm	-	23	33	21	21
Atterberg Limits	Liquid Limit	-	31	38	38	43
	Plasticity Index	-	15	18	18	22
	Linear Shrinkage	-	7.3	10	9.3	10.7
	PI Whole Sample	-	9	12.1	8.3	10.6
	N. M. C	-	8.5	26.9	18.2	22.7
Grading Modulus		2.17	1.09	0.87	1.36	1.29
Heave – vd Merwe		Low	Low	Low	Low	Low

6. GEOLOGICAL AND SOIL CONDITIONS AFFECTING PROPOSED DEVELOPMENT

6.1 Slope Stability

In general, the granite bedrock occurring in the area investigated comprises a normal weathered sequence with firm to hard granite gneiss occurring at moderately deep depths (0.70 - 2.50m) on the gently undulating to flat terrain, with deeply weathered and damp (mottled) soils in the valley bottoms. The site specific conditions are moderately uniform across the site, with little to no areas of wetness that are of significance, other than the quaternary waterway that occurs in the central portion of the site, and which has been identified and planned as parklands.

The orientation of the topographic slope relative to the dip angle of the underlying strata should be checked for each structure to be erected, and all foundations will need to be mapped by a qualified person before construction commences. In general, the reconnaissance mapping, and logging of the inspection pits returned positive results, with no apparent lithological changes or problems with the orientation of the hard rock contact associated with the granites gneiss. However, the porous nature of the weathered material makes these soils potentially collapsible.

The potentially unstable areas (NHBRC Manual (February 1999) - Rating 3) (wet/damp soils) are to be considered for development then earthworks should be carefully controlled and supervised to prevent the creation of an unstable situation. Materials exposed in foundation excavations should be carefully examined with a view to identifying localized zones of weakness and implementing appropriate stabilizing measures.

Wherever possible, over-steep cut and fill banks (borrow pit areas) should be battered back to a more suitable grade (filled), as discussed below. In general, however, the stability of the existing constructions near by (Private Hospital and Private homesteads) appears to be sound.

6.2 Site Earthworks

In general, due to the moderate depth of the soils in much of the area, normal earthworks for the installation of services and building platforms will require only limited use of jackhammers to excavate below 0,90m. A TLB or hand excavation will suffice for the majority of the excavations required. Limited areas may require the use of jackhammers and in very limited areas possible blasting may be required (These areas will need to be mapped out using a DCP (Dynamic Cone Penetrometer) if the extent is to be measured.

6.2.1 Cuts

In general, the need for earth work “cuts” on this site will be limited to the areas where excavation for borrow pits and/or deep foundations (multi story buildings) is planned. It is suggested, that where these occur, they should be excluded from the total area proposed for development, as they will require the importation of material to fill the excavations, as well as a good deal of compaction before they could be used for building purposes. It is suggested that the pits could be used as a collection point for building rubble, covered over on completion of the works and possibly used as a recreation centres (playing fields etc).

Where cut slopes are needed in either the colluvial or the residual soils derived from granite (and/or dolerite where it occurs), the slopes should be battered back to a grade not exceeding 1:1,75 (30°). Cuts in moderately hard weathered bedrock may be slightly steeper, and should be battered back to a grade of 1:1,5 (34°). However, these should be inspected and approved by a Geotechnical Engineer or Engineering Geologist during development. Wherever possible, the maximum height of any cut bank required for platform creation should not exceed 2m, and for any road - 3m.

6.2.2 Fills

Again, the amount of filling to be carried out will be restricted to the areas of disturbance. However, where the need arises, the placement of fills should be preceded by the removal of all natural vegetation. The fill should then be constructed in layers not exceeding 300mm loose thickness, each layer being compacted prior to the placement of the subsequent layer.

On any natural slope steeper than 1:6 (10°) the fills should be placed on surfaces benched into the underlying weathered bedrock. The slope of any fill should not exceed a batter of 1:1,75 and the maximum height of any fill required for a platform should not exceed 2m, and for any road 3m.

Any existing fill banks should be battered back and compacted as much as possible to improve their stability. They should be grassed to aid in erosion prevention and drainage must be in place around the rehabilitated sites.

6.3 Site Drainage

No soak pits may be used in the area for storm-water disposal. It is essential that all storm-water be carried off the slopes in a controlled manner, in either surface drains or storm-water pipes. Sites should be designed such that storm-water from one site does not cascade downslope over a number of other sites, and storm-water down pipes on structures should not discharge directly onto platform surfaces, but rather storm-water should be carried away from structures in a controlled manner.

Ideally, no development should take place in the wetland/seepage areas. These areas are excluded as part of the conditions of the EIA.

As waterborne sewage is to be installed in the area, inhabitants must be encouraged to dispose of all waste and washing water into the system, rather than discarding water outside onto platforms or over fill banks. In addition, a concrete paving strip at least 1m wide should be placed around the perimeter of all structures, to prevent the ingress of excess water below foundations.

6.4 Founding

6.4.1 Shallow Materials <0.50m

Only a small portion of the area occurs on very shallow materials. Founding conditions in these areas are such that normal strip footings can be used. However, all footings should be taken through the colluvial and residual soils to bear into weathered granite or dolerite bedrock. In this regard, the optimum location of the structure on the platform in the cut portion will reduce the required depth of founding below final ground level.

In general, the local materials are not highly active, and can therefore be used as fill material below floors etc.

6.4.2 Moderately Deep Materials - Between 0.50 – 1.5m

The majority of the area is comprised of soils in this depth range. In these areas, the deeper colluvial and residual soils preclude the use of normal strip footings. In this regard, spread footings should be used. The spread footings should be founded into bedrock or firm weathered granite.

6.4.3 Deep Materials >1.5m

In only a few places do the soils exceed 1.5m in depth. However, where a platform is uniformly underlain by deep, colluvial and residual soils, piles founded into bedrock may be used to support reinforced ground beams. Alternatively, raft foundations may be used. Where a raft spans across a cut/fill platform, the portion of the raft underlain by fill must be supported by mass concrete pads taken through the fill to bear into the same material which underlies the raft on the cut portion of the platform.

No structures should be constructed on existing fills that have not been adequately formed. In these areas, all foundations must be taken down into weathered bedrock.

All foundations must be inspected and signed off by a qualified person before the construction is undertaken.

6.5 Materials Classification

The results of the laboratory testing indicate that all the materials occurring on site are of moderate quality. They can be classified as A-2-6 in terms of the AASHO classification. These materials qualify as Unified Class "Sc" material, their swell factor being moderate to low but their in-situ density being moderate and the plasticity index, moderate.

This material is generally suitable for use in bulk fills and would be adequate for use as sub-grade material.

6.6 Erosion Potential

The erosion potential of the soils occurring on the site is moderate to low. The clay content is sufficiently high to provide cohesion, and the clays are not generally depressive. However, erosion is always a possibility if storm-water is not adequately controlled, and where surfaces have been disturbed and exposed to the elements.

7. CONCLUSIONS

Generally, the site assessment investigation has revealed that, apart from a few areas along the stream and riverine environment where the soils are slightly wet/damp, there are no major constraints to development of the area, other than the need for spread footings to the foundations due to the depth of soil cover and the clay contents of the soils.

In the wet/damp areas there are a number of materials constraints which will require consideration during planning and development if these areas are to be considered.

Where the steepness of the terrain is too great (borrow pit excavations), minimum plot sizes will need to be increased to enable earthworks to be satisfactorily carried out.

Strict drainage control must be carried out both during and after development of the area, to ensure storm-water runoff onto the roads in the area and to prevent pounding of storm-water. Drainage measures must be installed in the seepage/wet areas if they are to be developed. In addition, the storm-water drains under the main road that runs to the south of the proposed area of development will need to be enlarged and kept clean in order to cope with the additional runoff that will occur once development is completed.

Founding conditions in the area show some variation from normal shallow founding to moderately deep founding, and may vary within one site due to a change in parent materials.

Strict control and supervision should be implemented during the development of the area to confirm any variations of materials and give recommendations where this may become necessary.

APPENDIX 1

TEST PIT LOGS

BX 2 (E1)

Depth (m)	Description
0,00 - 0,30	Topsoil – Slightly moist to dry, red brown, firm, apedal sandy clay loam.
0,30 - 1,40	Subsoil - Moist, dark red brown to red, firm, weakly structured sandy clay loam.
1,40 – 2.20	Saprolite – moderate to hard, red to dark red, firm, weathered granite gneiss.
2.20	Refusal

BX 3 (E2)

Depth (m)	Description
0,00 - 0,35	Topsoil – Dry to slightly moist, red brown to brown apedal, firm, sandy loam.
0,35 - 0,80	Subsoil - Moist, orange red to brown weakly structured, slight indications of mottling at base of profile, sandy clay loam.
0,80 - 2,30	Saprolite/Soft Plinthic – Damp, poorly mottled reddish brown, firm and moderately structured sandy clay.
2.30	Refusal.

BX 4 (E3)

Depth (m)	Description
0,00 - 0,25	Topsoil - Moist, dark red brown to orange red, firm, apedal sandy clay loam.
0,25 - 1,60	Subsoil - Moist, dark red, firm, apedel sandy clay to sandy clay loam.
1,60 – 2.10+	Saprolite – dark red to yellow red, firm to hard weathered gneiss.
2.10	Refusal.

BX 8 (E4)

Depth (m)	Description
0,00 - 0,30	Topsoil - Moist, brown to dark red/brown, firm, apedal, sandy loam.
0,30 - 1,70	Subsoil - Moist, dark brown to red, weakly structured, firm, sandy clay loam.
1,70 - 2,20	Saprolite - Slightly moist, dark red to brown, firm to hard, sandy clay.
2.20	Semi-refusal of excavator.

BX 9 (E5)

Depth (m)	Description
0,00 - 0,30	Topsoil – Dry, red to dark red, firm, apedel, structure - sandy clay loam.
0,30 - 1,80	Subsoil - Dry, dark red, poorly structured (weak crumby) sandy clay loam.
1,80 – 2.40+	Saprolite – dark red/brown, firm weathered gneiss.
2.40	Refusal.