G E O T E C H N I C S

UMSIZA PLANNING

RAILTON MIXED LAND-USE HUB INITIATIVE, SWELLENDAM

GEOTECHNICAL INVESTIGATION REPORT

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EXECUTIVE SUMMARY

The investigation of this almost 1,5ha piece of undeveloped municipal land in Railton, Swellendam, has been based on nine machine-excavated test pits and laboratory testing of selected samples.

Topographically the site lies within a subdued south-west draining depression with no discernible drainage features at the surface.

The general soil profile comprises a humified topsoil horizon, the upper part of which contains concentrated grass roots; it grades into a gravelly hillwash horizon in places. It is underlain in most parts of the site by a river-terrace gravel consisting of abundant sub-rounded to sub-angular sandstone gravel contained in a loose to medium dense intact silty sand matrix. The coarse fraction is tightly packed and well interlocked, and the matrix becomes ferrugined with depth. The TLB refused on the very strongly ferruginised river terrace gravel at 0,8m in TP5, 1,4m in TP7 and at 0,9m in TP9. In these areas the site falls into an 'R' Site Class Category.

The river-terrace gravel terminates in a pebble marker gravel that is markedly different in appearance but still dominated by the coarse fraction.

The underlying siltstone of the Bidouw Subgroup of the Bokkeveld Group is completely decomposed to a clay-silt mixture, the upper 0,2m to 1,3m of which has been reworked by biotic activity to a stiff and very stiff weakly shattered silty CLAY. This material falls into the low potential expansiveness category. Therefore, heave at the surface is expected to be less than 7,5mm, which places the site in an 'H' Site Class Category. The underlying residual siltstone comprises very stiff indistinctly striated in places weakly fissured clayey SILT.

Slight isolated to moderate seepages occurred mainly from the base of the river terrace gravel and pebble marker horizons. Subsurface water, evidently, that migrates down the subduel depression across the site, perches on top of the practically impervious hardpan ferricrete horizon and/or the reworked residual siltstone horizon. Stronger subsurface groundwater flows should be anticipated during future peak wet seasons.

Near surface seepage is likely to be encountered where the hardpan horizon is shallow.

The river-terrace gravel should be a suitable subgrade layer for the construction of the internal roads and parking areas, provided that all oversize particles larger than 100mm in diameter are removed. If the spoil from the services trenches contains more than 10% boulders larger than 50mm in diameter, it should be discarded. The river-terrace gravel horizons that are dominated by the coarse fraction with little matrix material should be blended with a suitable material to improve its grading and compaction characteristics.

The river-terrace gravel will also provide a suitable founding stratum for conventional single and double storey foundations stressed up to 100kPa. Strip and pad foundations stressed up to 200kPa should be placed on the underlying very dense and very soft rock ferruginised river-terrace gravel. Where this ferruginised gravel horizon is either absent or thin, the footings should be placed on the very stiff reworked residual and residual siltstone horizons.

1.0 INTRODUCTION

In June 2019, Geotechnics Africa Western Cape (GAWC), was requested by Ms Anna-Christa Redelinghuys of Umsiza Planning to submit proposals and related cost structure for a geotechnical investigation required for the zoning and subdivision of a piece of municipal land for the Mixed Land-use Hub Initiative in Railton, Swellendam.

The project was approved by the Swellendam Municipality on 6 August 2019; however, on 14 October, GAWC received instruction from Umsiza Planning to undertake the investigation in November 2019.

The main objectives of the investigation are as follows:-

(i) Establish the depths to a suitable founding stratum and identify any potential founding problems.
(ii) Assess potential groundwater problems and sub-surface drainage conditions.
(iii) Determine the excavatability of the strata within a depth of 2,5m below ground level.
(iv) Assess the short term stability of open excavations and services trenches.
(v) Designate site class categories, and provide detailed soil profiles and descriptions of the dominant soil types.
(vi) Determine the suitability of the near surface soils as potential subgrade materials for the construction of the internal roads and parking areas.

This report is aimed at satisfying the above objectives and presents the finding of the investigation. It also discusses potential geotechnical constraints that need to be taken into consideration during the planning of the project and at the design and construction stages of the development.

2.0 INFORMATION USED

For the submission of the site investigation proposals, planning of the fieldwork and compilation of this report, Ms Redelinghuys provided the following information:-

(i) Concept Plan, including Land Use Table and Legend – see Figure 3.
(ii) Plan A: Subdivision, including Locality Plan (Remaining Extent) and Legend.
(iii) Plan B: Consolidation, including Locality Plan (Remaining Extent) and Legend.
(iv) Plan C: Sub-divisional Area, including Locality Plan (Remaining Extent) and Legend.
(v) Unnumbered Contour Plan showing proposed test pit positions – see Figure 4.
(vi) Unnumbered drawings: Railton Hub - Known Services super-imposed on:
    a) Layout Plan of Erven, see Figure 6a.
    b) Google Earth Image showing boundaries of erven, see Figure 6b.

3.0 PROPOSED DEVELOPMENT

The following Land Use Table is shown on the Concept Plan:-

Land Use	Zoning	No. of Erven	Extent (ha)	% of Total
Residential	Residential 1	22	0.30	15.63
Business	Neighbourhood Business Zone	2	0.54	28.13
Community Facilities	Community & Institutional Zone	2	0.46	23.96
Parking	Transport Zone	1	0.47	24.48
Roads	Transport Zone	1	0.15	7.8
TOTAL		**28**	**1.92**	**100**

At the planning stage of the field investigation, it was understood that the approximately 3565m² Erf 17 was being sold off and that it was to be excluded from the area to be investigated.

4.0 THE SITE

4.1 Site Location

The site is located on the south-east side of the N2 and is accessed via 'Reisiebaan' Street, see Figure 1.

It is bounded on the north-west by Bontebok Street, on the south-east by the Railton School premises on Erf 2065, on the south-west by Oak Street, on the north-east corner by a library on Erf 2064, on the north-western corner by a community hall on Erf 2063 and a clinic on Erf 7296, which separates the library and community hall premises.

4.2 Site Features

4.2.1 Existing Structures

The building on Erf 7436 is partially single and partially double storey with shops on the ground floor and flats above. There is a Vodacom tower in the courtyard at the back of the building, see Plate 2, photo P2.2, Plate 4, photo P4.1 and Plate 5, photo P5.1.

The north-western half of Erf 2723 is also occupied by a double storey building with shops at ground floor level and flats above. The south-eastern half comprises a brick-walled courtyard, see Plates 2 to 5.

Erf 2445 on the north-east side of the unpaved parking area that separates the commercial buildings on Bontebok Street, is occupied by the Sonstraal Superette, see Plate 5.

The remaining grass-covered parts of the site, which are reasonably well maintained, is crossed by a few footpaths.

4.3 Known Services

A layout of the known services was provided to enable the test pit positions to be surveyed away from the services to avoid damage. However, a water reticulation pipeline (blue line in Figures 6a and 6b) was ruptured at the surveyed position of TP1. This asbestos pipe was not at the location indicated in the above figures, see Plate 1.

The manholes on the sewer lines were used to position the pits away from these pipelines.

The parking area in front of the shops on Bontebok Street is covered with coarse gravel containing some boulders that project above the surface in places.

A pile of boulders and a tree stump were also noticing immediately south of TP7. The boulders were probably excavated from the trenches when the sewer and water reticulation pipelines were installed, see Plate 3.

4.4 Topography

The configuration of the contour lines on the topographical plan in Figure 4, shows that a subdued drainage depression extends from the north-east corner across the site to Oak Street at the opposite end where it exits the site.

5.0 FIELD INVESTIGATION

Following discussions with Ms Redelinghuys and Mr Brunings of the Swellendam Municipality, test pits TP2, TP3, TP6 and TP9 were to be relocated away from their surveyed positions shown in Figures 6a and 6b; test pit; TP10 was to be omitted.

The pits were dug to refusal or stopped near the maximum reach of a Hyundai H930 S tractor-mounted loader-backactor (TLB) supplied by TVM Konstruksie. The positions of the pits are shown in Figures 5a and 5b. The original surveyed position in relation to the known services, are shown in Figures 6a and 6b.

The pits were profiled in-situ and the strata identified described in accordance with standard terminology recommended by Jennings *et al* (Ref. 1). The detailed profiles are contained in Appendix B and the strata encountered, together with their descriptions, are depicted on Plates 6 to 19.

Dynamic Probe Light (DPL) tests, also known as Drop-weight Cone Penetrometer (DCP) tests, were attempted next to the test pits in which ferricrete was either thin or poorly developed; however, the results were erratic and misleading due to the presence of gravel and boulders (coarse fraction) that increased the penetration resistance dramatically.

Disturbed samples were taken of the clayey residual soils to perform grading analyses and to determine their Atterberg limits and natural moisture contents (nmc's) for classification purposes and an assessment of their potential expansiveness.

6.0 GEOLOGY, STRATA ENCOUNTERED & GROUNDWATER

6.1 General

The 1:250 000 geological map, Sheet 3420 Riversdale, shows the general area of the site to be underlain by conglomerate of the Enon Formation, which is fringed by river-terrace gravel, presumably derived from weathered products of the Enon conglomerate. These strata appear to have been deposited on siltstone of the Bidouw Subgroup of the Bokkeveld Group, which is completely decomposed to residual soils, as observed in the test pits.

6.2 Strata Encountered

The following generalised soil profile, compiled from the detailed descriptions of the strata encountered in the nine test pits, should be read in conjunction with Plates 6 to 19 and the summary of the test pit data in Table 1:-

Fill:- A 200mm thick layer of fill comprising firm clayey SILT was only encountered in TP1.

Humified Topsoil:- A 100mm to 300mm thick layer of dark brown loose to medium dense voided to intact organic silty SAND with some to numerous gravel and small boulders; it occurs at the surface in TP2 to TP4 and TP6 to TP9. The upper strongly humified layer contains abundant fine grass roots.

Hillwash/ Transition:- The humified topsoil in TP2 grades into a 200mm thick predominantly fine and medium with scattered coarse sub-angular gravel in a moist brown medium dense intact silty SAND matrix. This stratum, in turn, grades into the underlying river-terrace gravel horizon.

River-Terrace Gravel Deposit:- This stratum varies in thickness from 0,95 to 1,2m and could not be penetrated in TP5, TP7 and TP9 due to the advanced stage of ferruginisation that resulted in refusal.

It is composed of abundant predominantly medium and coarse sub-rounded to sub-angular GRAVEL and occasional mainly small boulders (but up to 0,5m diameter in places) contained in a brown predominantly medium dense intact ferruginous silty SAND matrix. The matrix becomes more ferruginised and very dense with depth, and changes to strongly ferruginised hardpan

ferricrete on which the TLB refused at 0,8m in TP5, 1,3m in TP7 and 0,9m in TP9.

Pebble Marker:-

The gravel horizon at the interface of the topsoil, hillwash or river terrace-gravel horizons, and the in-situ weathered and biotically reworked residual siltstone, is considered to be the pebble marker.

It occurs between 0,2m and 0,4m in TP1, 1,6m and 1,8m in TP2, 1,2m and 1,4m in TP3, 0,2m and 0,5m in TP4 and 1,2m and 1,7m in TP8.

The matrix is slightly different to that of the river-terrace gravel and is made up of predominantly fine and medium GRAVEL contained in a loose to medium dense and dense silty SAND matrix.

It may also contain some clay, which, in TP3 is described as stiff in consistency.

River-channel Gravel-Deposit:-

In TP6, a 0,9m thick old gravel-filled river-channel deposit was exposed beneath the river-terrace gravel horizon, see Plates 14 and 15. It comprises abundant sub-rounded to angular coarse alluvial GRAVEL in a moist light grey to off-white very stiff intact sandy CLAY-SILT matrix.

Reworked Residual Siltstone:-

This biotically reworked residual stratum is between 0,5m and 1,3m thick and was intersected at depths of 0,4m in TP1, 1,8m in TP2, 1,4m in TP3, 0,5m in TP4, 1,2m in TP6 and 1,7m in TP8.

It comprises moist to very moist predominantly orange-brown very stiff weakly fissured and indistinctly shattered slightly sandy silty CLAY.

It is only partially reworked between 1,7m and 2,3m in TP1.

Residual Siltstone:- This stratum occurs from a depth of 2,3m in TP1, 2,2m in TP2, 1,9m in TP3, 1,5m in TP4, 1,7m in TP6 and 2,0m in TP8, and extends to depths greater to those attained in the pits.

It is composed of light yellow-brown blotched red- and orange-brown or pale grey mottled and blotched red-brown stiff to very stiff weakly fissured to intact slightly sandy clayey SILT and slightly sandy silty CLAY.

6.3 Groundwater

The base of TP1 was wet 30min after it was dug. Slight localised seepages were intersected at the base of the pebble marker between 1,6m and 1,8m in TP2. Approximately 200mm of seepage water had collected at the base of the pit within 35 minutes. Slight isolated seepage occurred from the base of TP4.

Slight isolated seepages were also noted at the base of TP7. The water seeped from leached pockets of sand at 1,3m in the strongly ferruginised very soft rock river-terrace gravel (hardpan) horizon.

The strongest seepages were intersected at the base of the pebble marker in TP8. Sub-surface water migrating down the subdued depression across the site perches on top of the practically impervious reworked residual siltstone horizon, see Plate 18. There was also an isolated wet zone in the coarse river-terrace gravel between 0,6m and 1,2m in this pit.

7.0 LABORATORY TESTING & GEOTECHNICAL EVALUATION

7.1 Engineering and Material Characteristics

7.1.1 General

Foundation indicator and natural moisture content tests were undertaken on disturbed samples of the clayey reworked residual and residual siltstone materials to categorise the soils and determine whether they are potentially expansive. The detailed results, which are contained in Appendix C, are summarised in Table 2. The characteristics and engineering properties of the residual soils, based on the test results, and the remaining soil horizons, which are assessed on a visual bases, are briefly discussed below:

7.1.2 Fill

The thin layer of fine-grained fill encountered at the surface in TP1, has poor engineering characteristics and should preferably be stripped to spoil.

7.1.3 Humified Topsoil and Hillwash

If carefully selected to exclude the portion containing the strongly organic topsoil in which most of the grass roots are concentrated, this material could be mixed in with the river-terrace gravel for use as an in-situ subgrade layer to support the pavement structures of the access roads and parking areas.

The organic material removed should either be carted off the site or be stockpiled for later use in the land-scaping of the public open spaces.

7.1.4 River-terrace Gravel/Pebble Marker

Where the coarse fraction is dominant with very little matrix material, it could be blended with an imported G6 or G7 material as a binder to improve its grading and

compaction characteristics so that it can be used as an in-situ sub-grade or general backfill material. All particles larger than 100mm in diameter must be removed to avoid compaction problems, particularly if it is to be used as a backfill beneath surface beds.

7.1.5 Reworked Residual Siltstone

7.1.5.1 Composition and Atterberg Limits

The samples taken at 1,0m in TP1 and 1,3m in TP4 consist of 64% and 71% clay, 32% and 14% silt, 12% and 14% sand, and 1% gravel, respectively.

Their liquid limits (LL) are 42 and 45, plasticity indices (PI) 19 and 20, (18 for the whole sample) and linear shrinkage (LS) of 9,0 and 11,0. The grading moduli (GM) are 0,21 and 0,26, and their natural moisture contents 22,7% and 24,7%, respectively.

7.1.5.2 Classification

The reworked residual siltstone classifies in the Unified Classification System as an inorganic clay of low plasticity, CL.

In the United States Public Roads Administration (USPRA) Classification System, it falls into the A-7-6 group.

7.1.5.3 Potential Expansiveness

Both samples fall into the low potential expansive category on Van der Merwe's Activity and Plasticity Chart in Figure 7.

7.1.6 Residual Siltstone

7.1.6.1 Composition and Atterberg limits

The particle size distribution of the residual siltstone sampled at 2,0m in TP1 and TP4, differ substantially. The sample in TP1 consists of 29% clay, 56% silt, 11% sand and 4% gravel, while the one in TP4 consists of 68% clay, 22% silt and 9% sand with no gravel. Their grading moduli are 0,32 and 0,15 and their natural moisture contents 16% and 23,5%, respectively.

7.1.6.2 Classification

The residual shale also classifies as 'CL' in the Unified System and falls into the A-4 and A-6 groups of the USPRA System.

7.1.6.3 Potential Expansiveness

As in the case of the reworked residual siltstone, both samples fall into the low potential expansive category, see Figure 7.

7.2 Potential Expansiveness and Heave

Based on a visual assessment and interpretation of the laboratory test results the reworked residual and residual siltstone horizons are relatively high in plastic fines; however, since these soils fall into the low potentially expansive category, Van der Merwe (Ref2) predicts that total heave at the surface is unlikely to exceed 7,5mm.

In order to confirm Van der Merwe's prediction, Weston's method has been applied to the same laboratory test results (Ref 3). This method is used in road pavement designs and is based on the liquid limit, natural moisture content and applied load. None of the profiles assessed, based on these results, indicate total heave at the surface of more than 7,5mm.

7.3 Foundations

7.3.1 Existing Structures

The external walls of the buildings on and around the site were assessed from their boundaries. With the exception of a few minor cracks, these buildings all appear to be sound.

However, a close and detailed inspection of the interior and exterior walls of the buildings should be undertaken by a structural engineer to establish whether there are any cracks that can be ascribed to foundation related movements.

7.3.2 Founding Strata

The type and nature of structures that are envisaged and their foundation loads, are unknown at this stage; however, if it is assumed that buildings similar to those occupying the developed premises will be constructed, contact stresses are unlikely to exceed 200kPa.

The coarse fraction of the river-terrace gravel deposit is generally tightly packed and well interlocked. Even if the matrix is loose or medium dense in consistency the loads that will be imposed on this stratum will be rapidly distributed through inter-granular contact and resultant spreading of the stresses.

The strongly ferruginised river-terrace gravel possesses more than adequate bearing capacity to support the anticipated foundation loads.

The stiff to very stiff reworked residual and residual siltstone horizons also possess satisfactory bearing capacity for single and double storey foundations with contact stresses of up to 200kPa.

7.4 Site Class Designation

Based on the test pit exposures and laboratory test results the following site class categories will apply:

(i) 'R' in areas of shallow hardpan ferricrete.

(ii) 'H' based on the underlying reworked residual and residual siltstone horizons that are low in potential expansiveness.

It is important to note that, although the reworked residual siltstone and residual siltstone horizons are low in potential expansiveness at the current moisture content, potential heave could increase if these soils are permitted to dry out during periods of prolonged drought; however, the ferruginised (hardpan) river-terrace gravel horizon, provides a barrier that protects the underlying clayey horizons from drying out to below their critical moisture level.

7.5 Excavation

The digging of services trenches will be possible to the depths attained in the test pits using conventional earth-moving plant; however, more powerful track-mounted excavators will be required to penetrate the strongly ferruginised river-terrace gravel on which the TLB refused at 0,8m in TP5, 1,4m in TP7 and 0,9m in TP9. This material would classify as "soft to intermediate excavation" in terms of the SABS 1200 D Earthworks Specification, Ref 5.

Trenching through the hardpan ferricrete horizon can be expedited if the excavator is equipped with a rock bucket.

The sidewalls of temporary trenches will be stable in the short term due to the presence of the ferruginised capping layer, provided that the underlying residual soil horizons are not subjected to standing water or persistent wet weather conditions. Nevertheless, regular inspections of the trenches by a competent person prior to and during the laying of services is essential.

7.6 Backfill Materials

7.6.1 Humified Topsoil

Once the top organic portion in which most of the grass roots are concentrated has been removed, this material could be used as general backfill.

7.6.2 River-terrace Gravel & Pebble Marker

The spoil from the river terrace and pebble marker gravel horizons may be used as general backfill in the services trenches, provided that all particles larger than 100mm diameter are removed. Spoil containing an appreciable number of small boulders, i.e. >10% exceeding 50mm in diameter, should be discarded.

7.6.3 Reworked Residual and Residual Siltstone

These soils are dominated by plastic fines and are considered to be worse than G10 in terms of the TRH14 Classification, Ref 4; they will be very difficult to compact as the optimum moisture content required to achieve any meaningful compaction will be difficult to control and the clay will also stick to the compaction equipment. These clay-silt mixtures should therefore not be used, especially where the trenches pass beneath the access roads, in which case a well graded imported material must be used.

7.7 Bedding Material

None of the materials encountered on the site will be suitable for use as a bedding sand.

8.0 FOUNDATION RECOMMENDATIONS & OPTIONS

Based on the test pit exposures and laboratory test results, the following foundation options can be considered:-

(i) Standard strip footings founded conventionally at a shallow depth on the river-terrace gravel deposit at contact stresses of 100kPa.

(ii) Pad footings also at a conventional depth, unless contact stresses of up to 200kPa will be imposed in which case they must be placed on the very dense ferruginised to very soft rock hardpan ferricrete horizons.

(iii) Where the river-terrace gravel is either absent or thin, foundations 200kPa should be taken down to the very stiff reworked residual or residual siltstone horizons upon which contact stresses of 200kPa will be acceptable.

It is essential that any significant change in soil conditions that do not resemble those described in this report, must be brought to the attention of the appointed project engineer and/or competent person, so that appropriate intervention action can be taken.

9.0 SPECIAL PRECAUTIONARY MEASURES

Besides the precautionary measures stipulated above nominal reinforcement of the foundations and stiffening of the foundation brickwork is recommended. The structures should also be articulated in structurally sensitive areas. Surface bed should also be freed from the walls to enable them to 'float'. No other special precautions will be required, unless inspection of the foundation excavations by a suitably qualified geotechnical person reveals problematic conditions that do not match those described in this document.

10.0 CONCLUSION

This investigation indicates that, in general, the site is suitable for the intended development provided that the aspects that require attention as set out above, are addressed.

It is also important that site preparation and construction procedures comply with the NHBRC requirements and that its guidelines are strictly adhered to.

11.0 REFERENCES

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TABLE 1: SUMMARY OF TEST PIT PROFILES

Test Pits	Fill / Humified Topsoil / Hillwash	River-terrace Gravel	Pebble Marker	Reworked Residual Siltstone	Residual Siltstone
TP1	0,0 – 0,2 (0,2): Moist light pinkish brown firm intact clayey SILT. Fill	-	0,2 – 0,4 (0,2): Abundant fine and medium GRAVEL in a moist dark brown loose to medium dense intact to slightly voided organic silty SAND.	0,4 – 1,7 (1,3): Moist orange-brown indistinctly blotched darker orange-brown stiff weakly shattered slightly sandy SILT-CLAY. Reworked Residual Siltstone. 1,7 – 2,3 (0,6): Moist yellowish-brown very stiff weakly fissured slightly sandy clayey SILT. Partially Reworked Residual Siltstone	2,3 – 3,0+ (>0,7): Moist light yellow-brown blotched red– and orange-brown very stiff indistinctly striated clayey SILT. Residual Siltstone. Note: (i) Inclusions of highly weathered very soft rock sandstone/siltstone near base. (ii) Base of hole wet after 30min.
TP2	0,0 – 0,2 (0,2): Moist dark brown loose voided organic silty SAND containing abundant fine grass roots. Humified Topsoil. 0,2 – 0,4 (0,2): Predominantly fine and medium with scattered coarse sub-angular gravel in a moist brown medium dense intact silty SAND matrix. Hillwash.	0,4 – 0,9 (0,5): Abundant predominantly medium and coarse sub-rounded to sub-angular GRAVEL and occasional small boulders in a little slightly moist brown medium dense intact silty SAND matrix. River-terrace GRAVEL. 0,9 – 1,6 (0,7): Fine medium and coarse angular to sub-angular GRAVEL and numerous to abundant sub-angular BOULDERS in an orange-brown very dense intact ferriginous-cemented silty SAND matrix. Ferruginised River-terrace Gravel.	1,6 – 1,8 (0,2): Abundant fine medium and coarse GRAVEL in a moist yellow-brown dense intact silty SAND matrix. Pebble Marker. Note: Slight localised seepages from base.	1,8 – 2,0 (0,2): Moist to very moist orange-brown streaked and blotched light yellow-brown very stiff slightly shattered sandy CLAY-SILT to clayey SILT. Reworked Residual Siltstone.	2,2 – 2,2+ (>0,2): Wet pale grey mottled red-brown very stiff weakly fissured sandy clayey SILT. Residual Siltstone. Note: Water level at 1,9m after 4,5hrs.
TP3	0,0 – 0,25 (0,25): Moist dark brown medium dense intact organic silty SAND with some medium and coarse sub-rounded gravel and abundant grass roots. Humified Topsoil.	0,0 – 0,2 (0,2): Abundant predominantly medium and coarse sub-rounded to sub-angular GRAVEL in a moist brown medium dense intact silty SAND matrix. Note: Contains some to numerous highly to completely weathered boulders from 0,6m; matrix also becomes very dense and partially ferruginised.	1,2 – 1,4 (0,2): Fine medium and coarse GRAVEL in a moist orange-brown stiff intact ferruginous clayey silty SAND matrix. Pebble Marker.	1,4 – 1,9 (0,5): Moist pale grey to off-white mottled red-brown very stiff weakly fissured indistinctly shattered slightly sandy SILT-CLAY. Reworked Residual Siltstone.	1,9 – 2,8+ (0,9): As above but sparsely mottled clayey SILT. Residual Siltstone.

Test Pits	Fill / Humified Topsoil / Hillwash	River–terrace Gravel	Pebble Marker	Reworked Residual Siltstone	Residual Siltstone
TP4	0,0 – 0,2 (0,2): Moist dark brown loose to medium dense intact organic silty SAND with some gravel and abundant grass roots. (Humified Topsoil)	-	0,2 – 0,5 (0,3): Numerous to abundant fine medium and coarse angular to sub-rounded GRAVEL and some small boulders in a moist brown medium dense humified silty SAND matrix. Note: Slight isolated seepage at base of pebble marker.	0,5 – 1,5 (1,0): Moist (locally very moist to wet) orange-brown very stiff weakly shattered sandy silty CLAY. Note: Sample taken at 1,3m.	1,5 – 2,5 (1,0): Moist light yellow-brown stiff to very stiff weakly fissured slightly sandy silty CLAY. Residual Siltstone. 2,5 – 3,1+ (>0,6): Wet yellowish-brown very stiff intact clayey SILT with some weathered quartzite boulders.
TP5	-	0,0 – 0,45 (0,45): Abundant fine medium and coarse sub-angular to sub-rounded GRAVEL and BOULDERS (up to 0,5m in diameter) in a slightly moist brown medium dense intact ferruginous silty SAND matrix. 0,45 – 0,8+(>0,35) Abundant fine medium and coarse GRAVEL and some small boulders tightly packed in an orange-brown very dense ferruginised silty SAND matrix. Ferruginised River-terrace Gravel. Note: Matrix strongly ferruginised to hardpan ferricrete towards base. Refusal at 0,8m.	- Not exposed	- Not exposed	- Not exposed
TP6	0,0 – 0,2 (0,2): Moist dark brown loose to medium dense intact silty SAND with some gravel and abundant roots. Humified Topsoil.	0,2 – 1,2 (1,0): Abundant predominantly medium and coarse sub-angular to sub-rounded GRAVEL in a reddish-brown loose to medium dense intact silty SAND matrix with abundant fine grass roots. River-terrace GRAVEL.	-	1,2 – 1,7 (0,5): Moist orange-brown stiff to very stiff weakly shattered slightly sandy silty CLAY.	1,7/2,1 – 3,1 (1,0/1,4): Moist pale grey to off-white with occasional red-brown streaks and blotches very stiff weakly fissured clayey SILT. Residual Siltstone.

Test pits	Fill/ Humified Topsoil / Hillwash	River-terrace Gravel	Pebble Marker	Reworked Residual Siltstone	Residual Siltstone
TP7	0,0 – 0,1 (0,1): Moist dark brown loose to medium dense voided organic silty SAND with some gravel and abundant grass roots. Humified Topsoil.	0,1 – 0,3 (0,2): Abundant predominantly medium and coarse sub-rounded to sub-angular GRAVEL in a moist dark brown medium dense silty SAND matrix. River-terrace GRAVEL. 0,3 – 0,9 (0,6): As above but with numerous to abundant sub-rounded boulders up to 300mm in diameter. 0,9 – 1,3 (0,4): Highly weathered sandstone GRAVEL and BOULDERS contained in an orange-brown very soft rock strongly ferruginised silty SAND matrix. Ferriginised River-terrace GRAVEL. Note: (i) Coarse fraction tightly packed and well interlocked. (ii) Refusal at 1,4m on soft rock ferruginised river-terrace gravel. (iii) Slight isolated seepages from 1,2m. (iv) Water stagnated at 1,3m.	Not exposed	Not exposed	Not exposed
TP8	0,0 – 0,2 (0,2): Moist dark brown loose to medium dense voided silty SAND with numerous gravel and abundant fine grass roots. Humified Topsoil.	0,2 – 0,6 (0,4): Abundant fine medium and coarse sub-rounded to sub-angular GRAVEL in a brown medium dense intact silty SAND matrix with fine roots. River-terrace Gravel. 0,6 – 1,2 (0,6): As above but with larger sandstone boulders.	1,2 – 1,7 (0,5): As between 0,6m and 1,2m but with numerous large BOULDERS (up to 0,5m in diameter) in a wet brown medium dense intact silty clayey SAND matrix. Pebble Marker. Note: Strong isolated seepages below 1,5m, see Plate 18.	1,7 – 2,0 (0,3): Wet pale grey to off-white blotched red-brown stiff intact to weakly shattered sandy silty CLAY. Reworked Residual Siltstone.	2,0 – 2,5+ (>0,5): Moist light yellow-brown blotched and streaked red-brown stiff to very stiff weakly fissured to intact clayey SILT. Residual Siltstone.

Test Pits	Fill/ Humified Topsoil / Hillwash	River-terrace Gravel	Pebble Marker	Reworked Residual Siltstone	Residual Siltstone
TP9	0,0 – 0,3 (0,3): Moist dark brown medium dense intact to slightly voided organic silty SAND with numerous to abundant predominantly fine and medium GRAVEL and some highly to completely weathered gravel and boulders. Humified Topsoil.	0,3 – 0,9+ (>0,6): Abundant fine medium and coarse GRAVEL in an orange-brown very dense intact ferruginised silty SAND matrix. Ferruginised River-terrace Gravel. At 0,9m: Refusal on very soft rock HARDPAN FERRICRETE. Strongly Ferruginised River-terrace Gravel.	Not exposed	Not exposed	Not exposed

TABLE 2 : SUMMARY OF LABORATORY TEST RESULTS

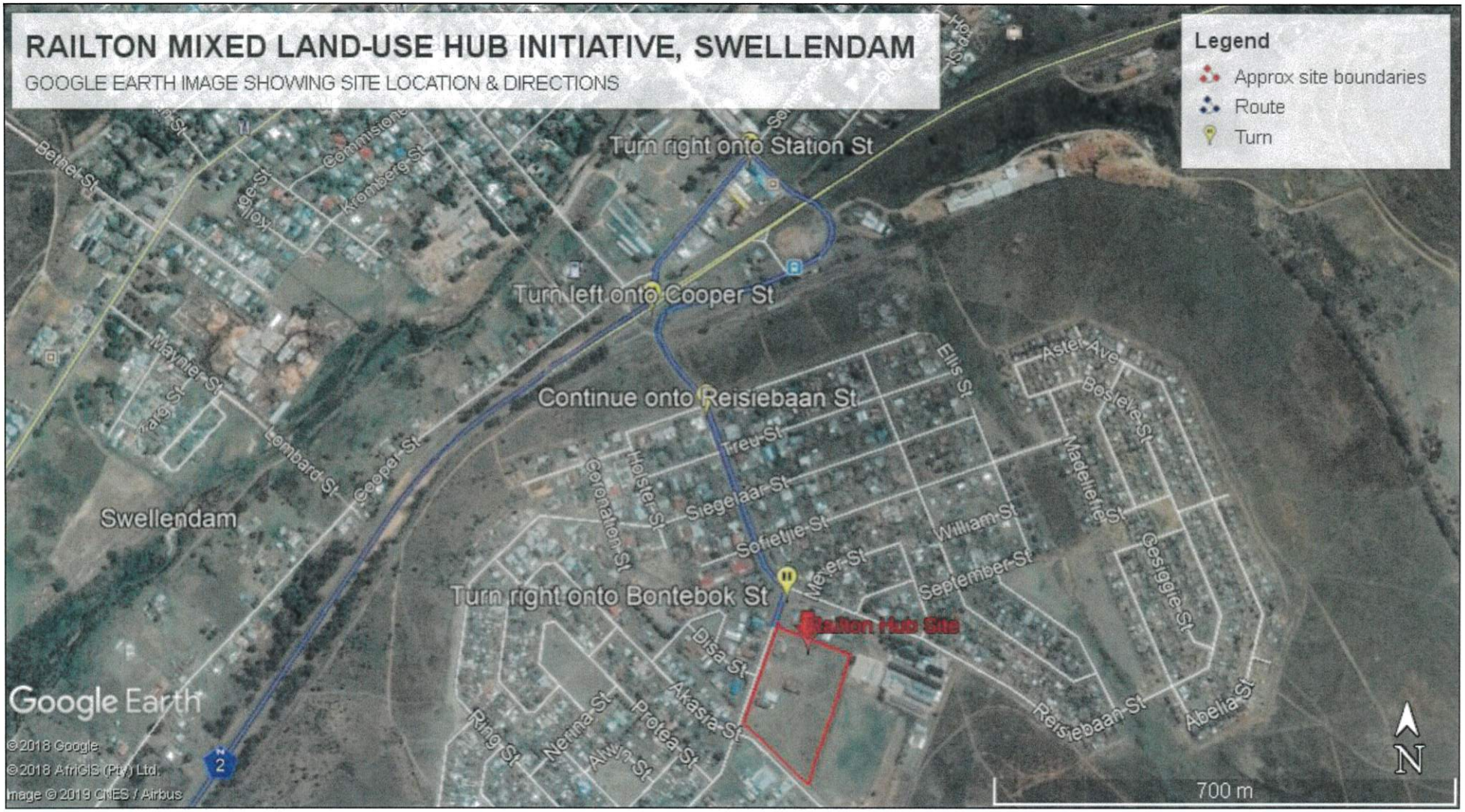
LOCATION	DEPTH	MATERIAL	ATTERBERG LIMITS			GRADING				PERCENTAGE FINER THAN (mm)			GM	CBR AT % MOD AASHTO				MDD	OMC	MAX. SWELL @ 100% Mod	NMC	CLASSIFICATION		
	(m)	DESCRIPTION	LL	PI (*)	LS	CLAY (%)	SILT (%)	SAND (%)	GRAVEL (%)	0,075	0,425	2,0		90	93	95	98	(*) kg/m³	(*) (%)	AASHTO	(%)	USPRA	UNIFIED	TRH14
TP1	1,0m	Reworked Residual Siltstone	42	19(18)	9,0	64	32	12	1	87	95	97	0,21	-	-	-	-	-	-	-	22,7	A-7-6	CL	-
TP1	2,0m	Residual Siltstone	23	10(9)	5,0	29	56	11	4	85	89	94	0,32	-	-	-	-	-	-	-	16	A-4	CL	-
TP4	1,3m	Reworked Residual Siltstone	45	20(18)	11,0	71	14	14	1	85	92	97	0,26	-	-	-	-	-	-	-	24,7	A-7-6	CL	-
TP4	2,0m	Residual Siltstone	32	15(14)	7,0	68	22	9	0	90	96	99	0,15	-	-	-	-	-	-	-	23,5	A-6	CL	-

NOTE:

LL - LIQUID LIMIT
PI (*)- PLASTICITY INDEX (PI OF WHOLE SAMPLE)
LS - LINEAR SHRINKAGE
GM - GRADING MODULUS

OMC - OPTIMUM MOISTURE CONTENT
USPRA- UNITED STATES PUBLIC ROAD ADMINISTRATION
NMC - NATURAL MOISTURE CONTENT
MDD- MAXIMUM DRY DENSITY

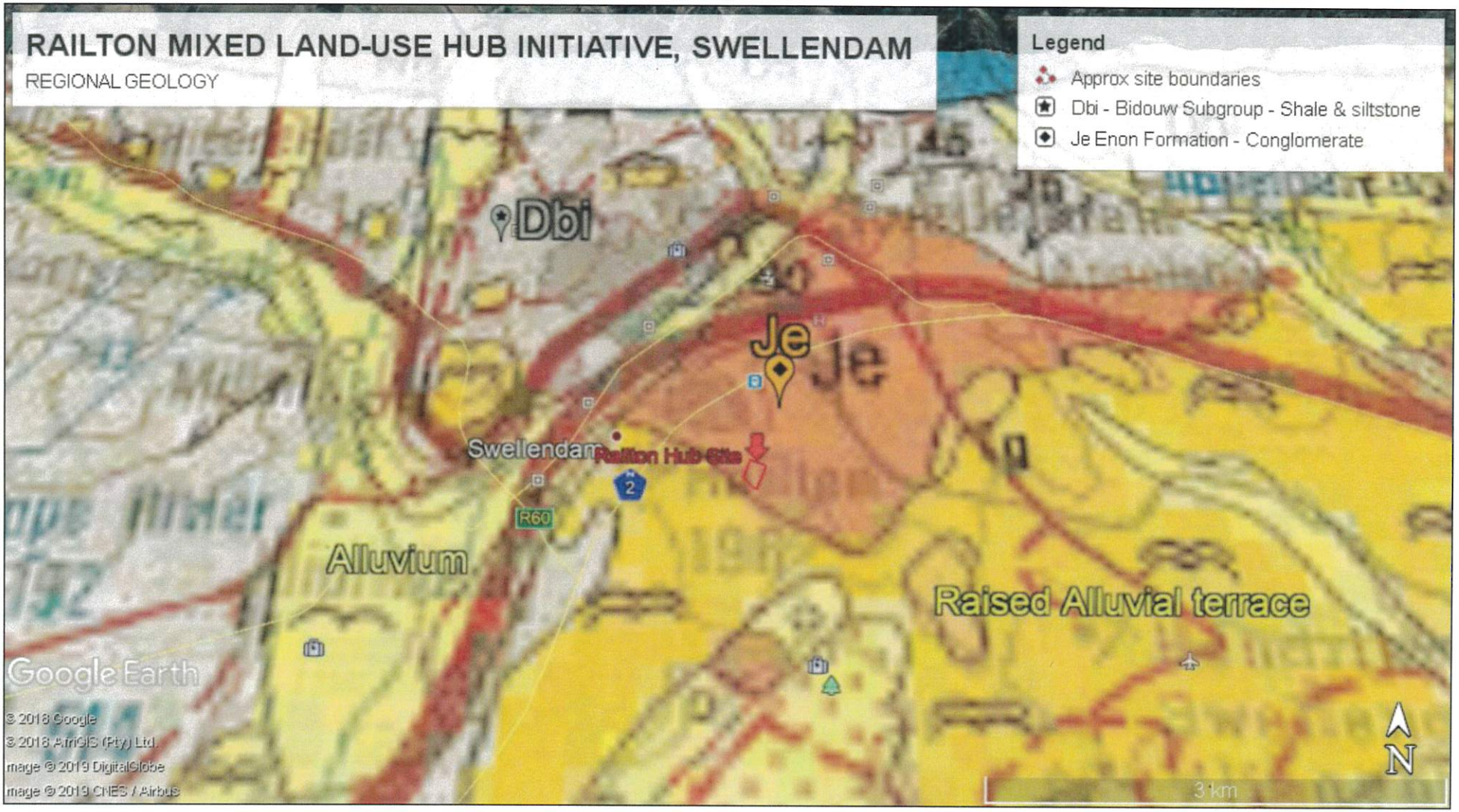
SP - SLIGHTLY PLASTIC
NP - NON-PLASTIC



RAILTON MIXED LAND-USE HUB INITIATIVE, SWELLENDAM

GOOGLE EARTH IMAGE SHOWING SITE LOCATION & DIRECTIONS

J2059 **FIGURE 1**

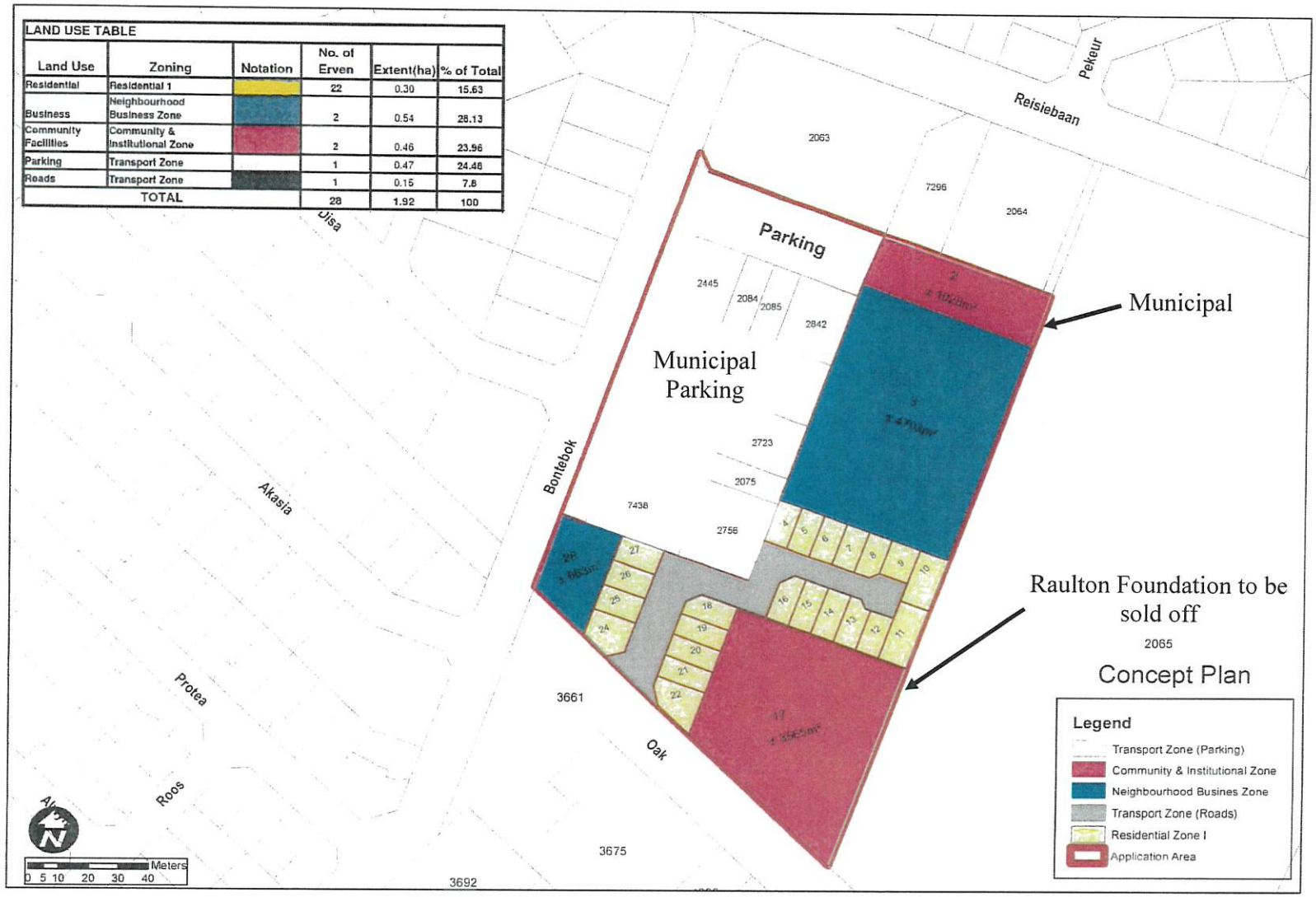


RAILTON MIXED LAND-USE HUB INITIATIVE, SWELLENDAM

REGIONAL GEOLOGY

J2059

FIGURE 2

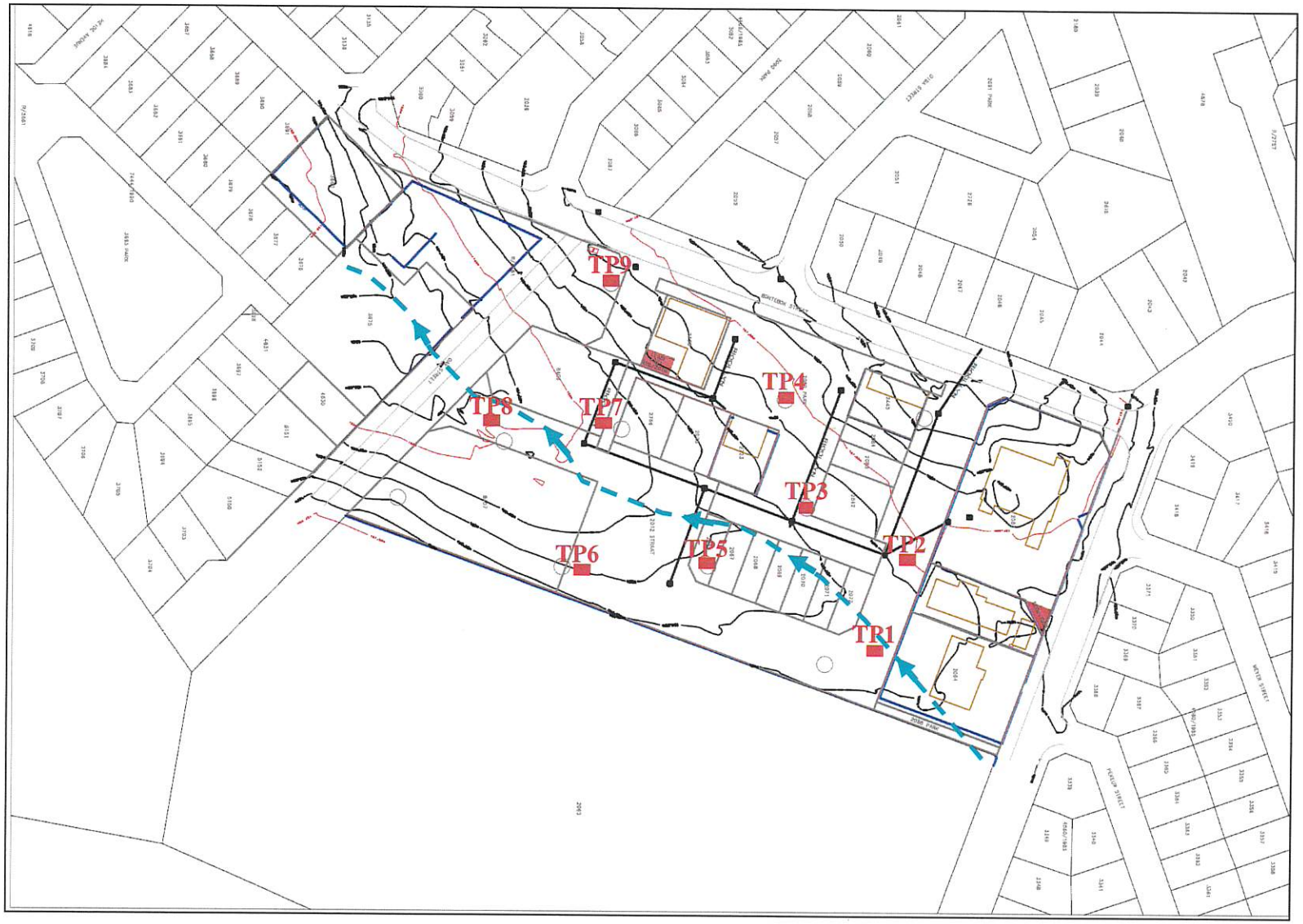


RAILTON MIXED LAND-USE HUB INITIATIVE, SWELLENDAM

CONCEPT PLAN

J2059

FIGURE 3

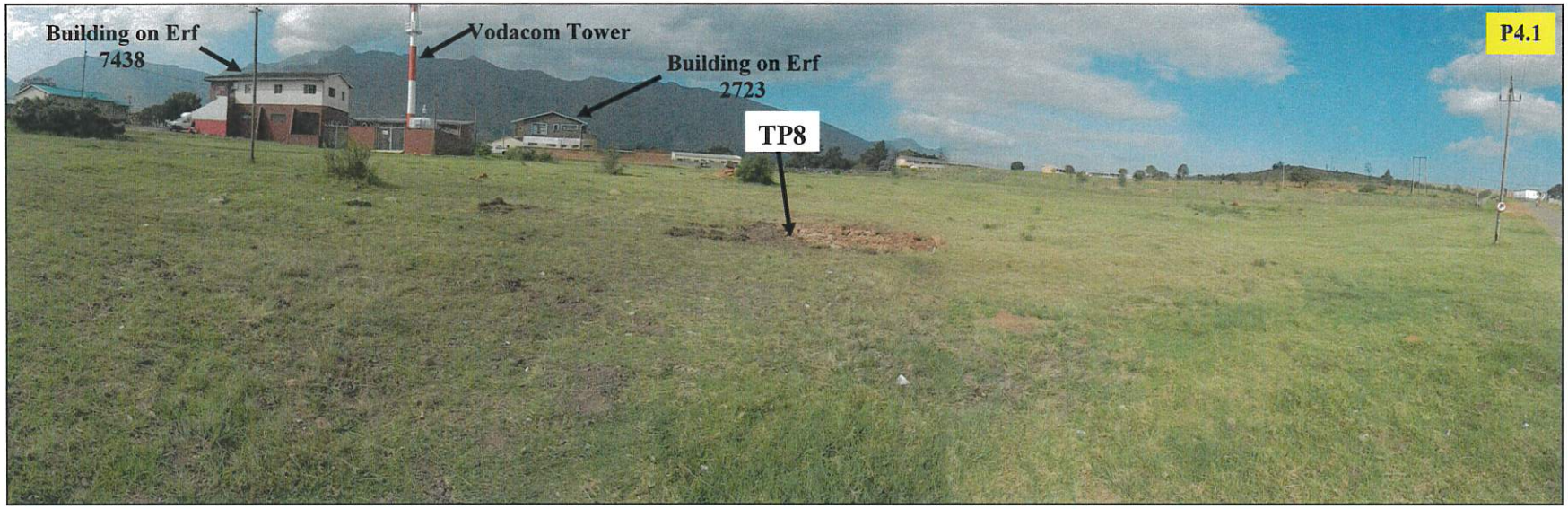


RAILTON MIXED LAND-USE HUB INITIATIVE, SWELLENDAM

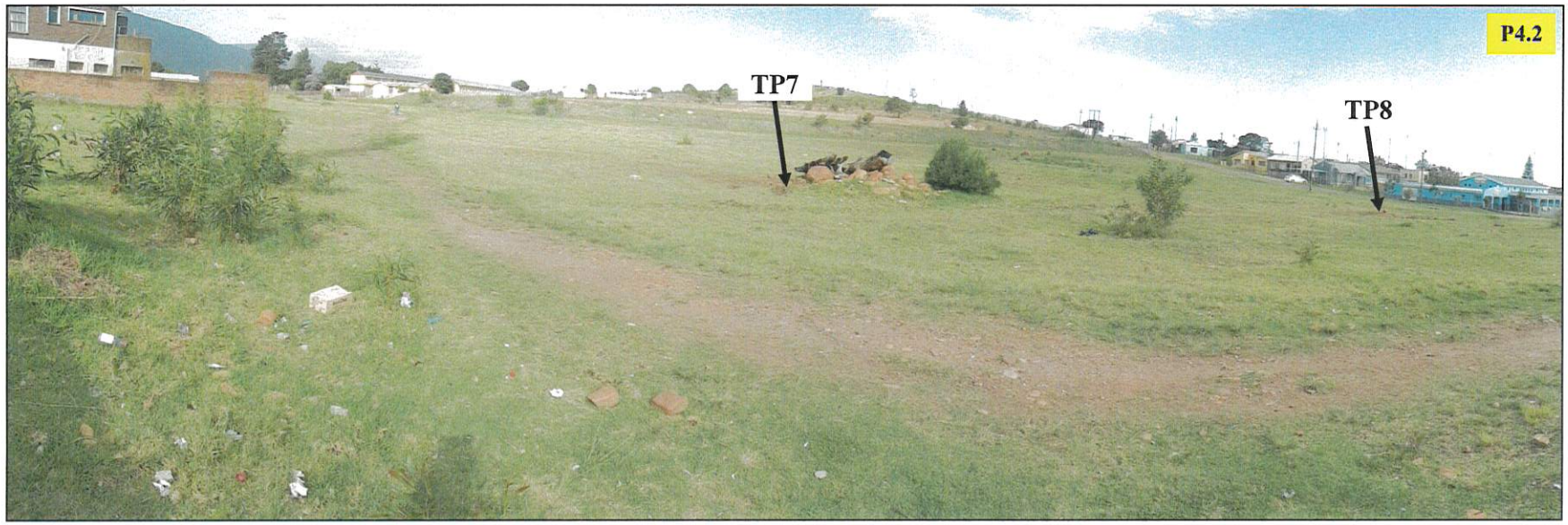
CONTOUR MAP SHOWING DRAINAGE PATH IN RELATION TO TEST PIT POSITIONS

J2059

FIGURE 4



Panoramic view of the site viewed from the south-western boundary on Oaks Street, see position of photo on P4.1 in Figure 4.

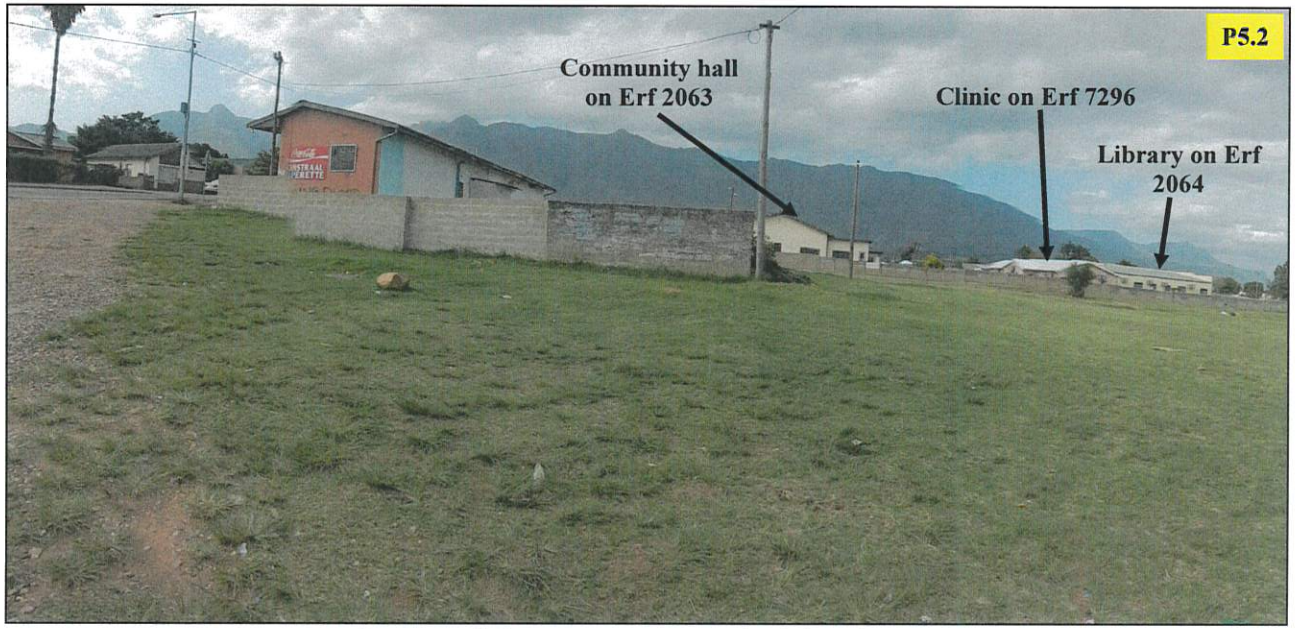


Panoramic view of site viewed from footpath passing between Vodacom tower and TP7, see position of photo on P4.2 in Figure 4.

PLATE 4



Test pit, TP5 excavated in centre of proposed parking area, which will be accessed from Bontebok Street on north-west side of the site.



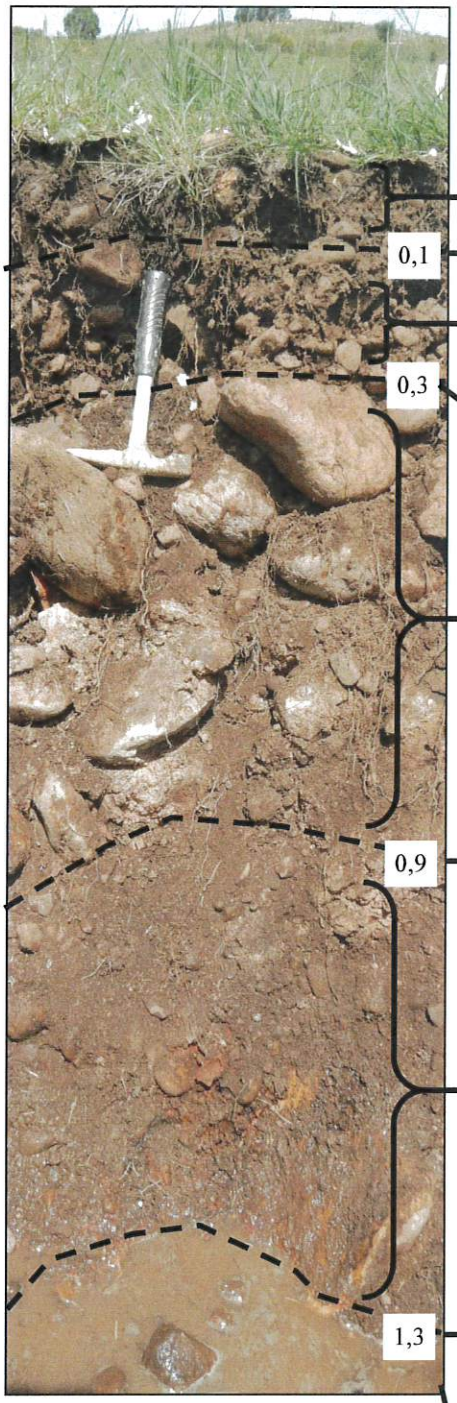
Sonstraal Superette on north side of TP5.

PLATE 5

APPENDIX B

PLATES 6 to 19

(Soil Profiles & Related Photos)



Profile recorded in TP7

Moist dark brown loose to medium dense voided organic silty SAND with some gravel and abundant grass roots. Humified Topsoil.

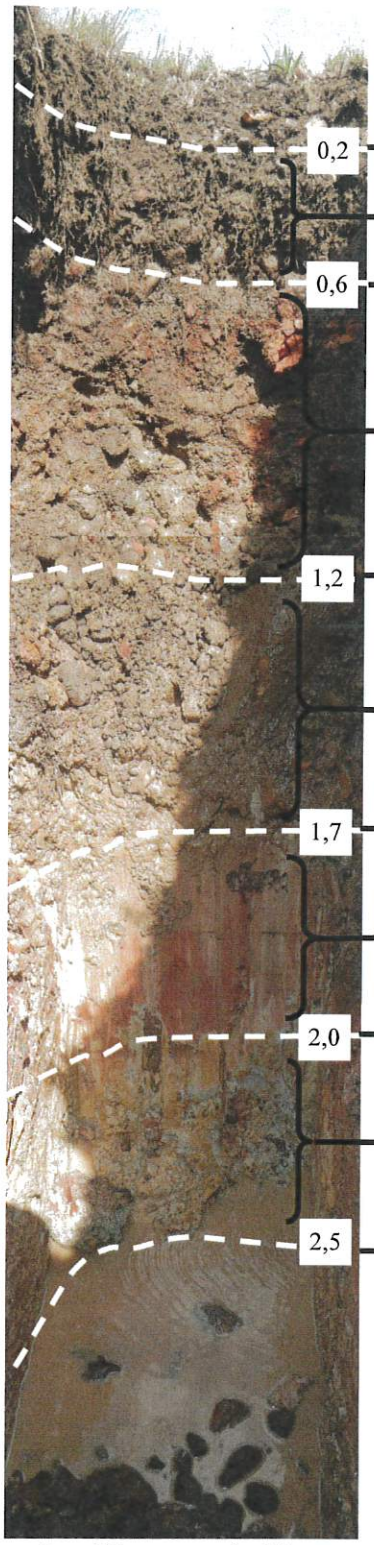
Abundant predominantly medium and coarse sub -rounded to sub-angular GRAVEL in a moist dark brown medium dense silty SAND matrix. River-terrace GRAVEL.

As above but with numerous to abundant sub-rounded boulders up to 300mm in diameter.

Highly weathered sandstone GRAVEL and BOULDERS contained in an orange-brown very soft rock strongly ferruginised silty SAND matrix. Ferruginised River-terrace GRAVEL.
Note: (i) Coarse fraction tightly packed and well interlocked.
(ii) Slight isolated seepages.
(iii) Water stagnated at 1,3m.

At 1,4m: Refusal on soft rock ferruginised River-terrace GRAVEL as above.

PLATE 16



Profile recorded in TP8

Moist dark brown loose to medium dense voided silty SAND with numerous gravel and abundant fine grass roots. Humified Topsoil.

Abundant fine medium and coarse sub-rounded to sub-angular GRAVEL in a brown medium dense intact silty SAND matrix with fine roots. River-terrace GRAVEL.

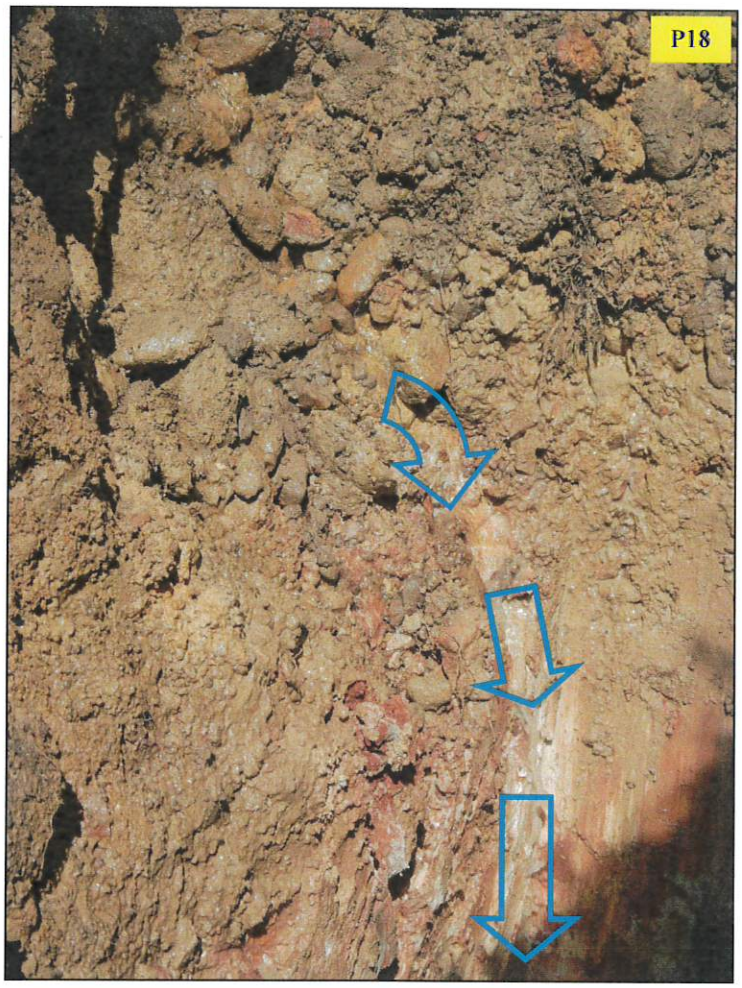
As above but with numerous highly to completely weathered sandstone BOULDERS.
Note: Isolated wet zones.

As above but with numerous large BOULDERS (up to 0,5m in diameter) in a wet brown medium dense intact silty clayey SAND matrix. Pebble Marker.
Note: Strong isolated seepages below 1,5m, see Plate 18.

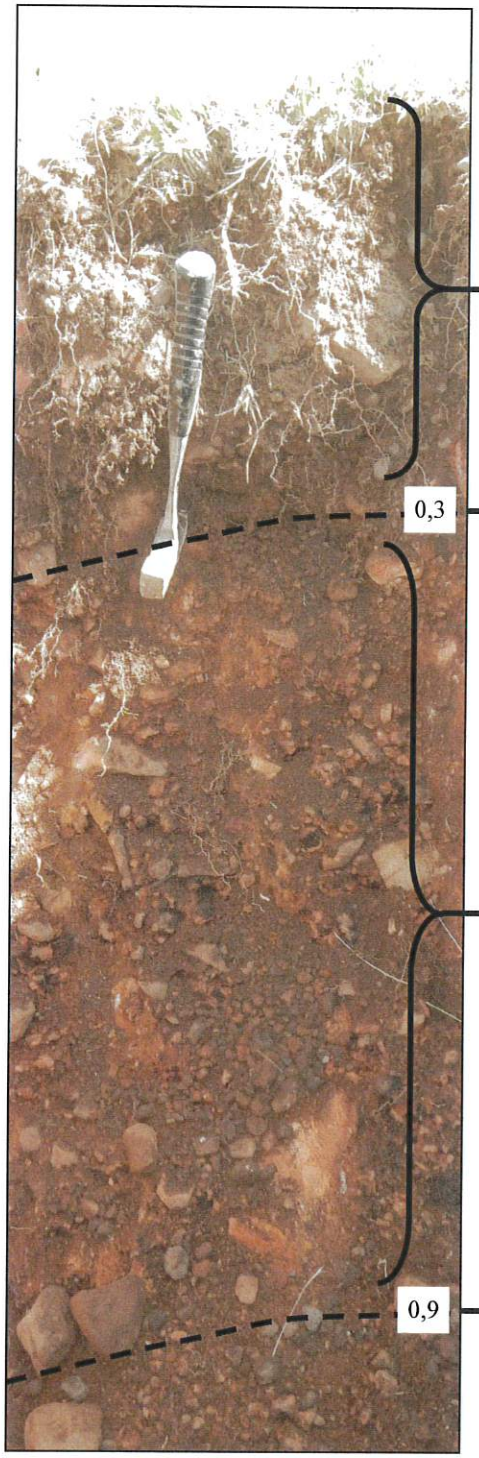
Wet pale grey to off-white blotched red-brown stiff intact to weakly shattered sandy CLAY-SILT. Reworked Residual Siltstone.

Moist light yellow-brown blotched and streaked red-brown stiff to very stiff clayey SILT. Residual Siltstone.

At 2,5m: Excavation stopped on stratum as above.



TP8: Strong isolated seepage from perched water table on top of reworked residual siltstone horizon at 1,7m.



Moist dark brown medium dense intact to slightly voided organic silty SAND with numerous to abundant predominantly fine and medium GRAVEL and some highly to completely weathered boulders.
Humified Topsoil.

Abundant fine medium and coarse GRAVEL in an orange-brown very dense intact ferruginised silty SAND matrix.
Ferruginised River-terrace GRAVEL

At 0,9m: Refusal on very soft rock HARDPAN FERRICRETE. Strongly Ferruginised River-terrace GRAVEL.

Profile recorded in TP9

PLATE 19

APPENDIX C

Laboratory Test Results

CONTROL GEOSCIENCES (PTY) LTD

CIVIL ENGINEERING MATERIAL AND GEOTECHNICAL LABORATORY,
GEOTECHNICAL AND ENVIRONMENTAL SERVICES

CLIENT:	Geotechnics Africa PO Box 1321 Hermanus 7200	**PROJECT:**	Railton Hub
		DATE:	04-12-2019
ATT:	Dirk van Rooyen	**REF:**	L191145

ASTM D422 SIEVE ANALYSIS

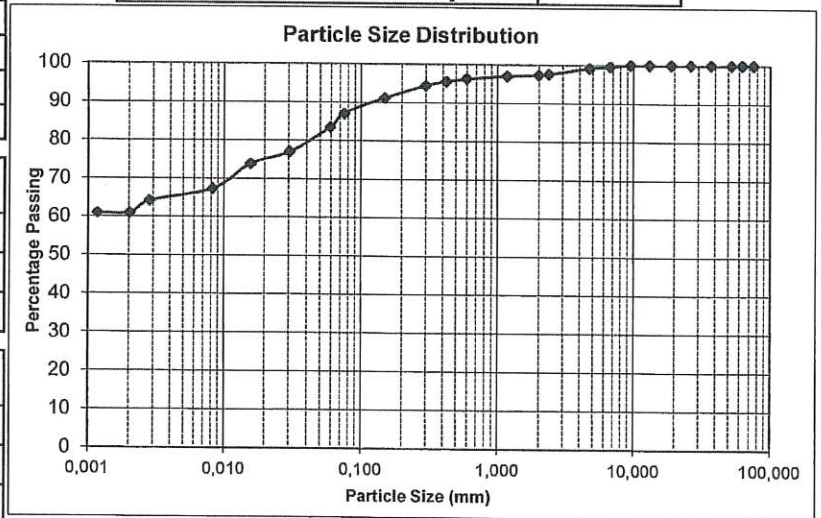
DESCRIPTION :	yellow olive clay	**SAMPLE NO. :**	32235
POSITION :	TP 1 @ 1.0m	**CLIENT SAMPLE NO. :**	

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	
	13,20	
	9,50	
	6,70	100
	4,75	99
	2,36	98
	2,00	97
	1,18	97
	0,600	96
	0,425	95
	0,300	94
	0,150	91
	0,0750	87

Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0592	83
0,0305	77
0,0158	74
0,0083	67
0,0028	64
0,0020	61
0,0012	61

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	22,7
pH:	
Conductivity mS/m:	



Atterberg Limits (SANS3001-GR10)	
Liquid Limit	42
Plastic Index	19
Linear Shrinkage	9,0

MOD (SANS3001- GR30) & CBR (SANS3001-GR40)	
MOD AASHTO (Kg/m³)	
O.M.C. (%)	
C.B.R. @ 100% Comp.	
C.B.R. @ 98 % Comp.	
C.B.R. @ 95 % Comp.	
C.B.R. @ 93 % Comp.	
C.B.R. @ 90 % Comp.	
Swell (max) %	

Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	1
Sand : Percentage - 4.75mm and + 0.075mm	12
Silt : Percentage - 0.075mm and + 0.005mm	23
Clay : Percentage - 0.005mm	64

The above test results are pertinent to the samples received and tested only.

CONTROL GEOSCIENCES (PTY) LTD

CIVIL ENGINEERING MATERIAL AND GEOTECHNICAL LABORATORY,
GEOTECHNICAL AND ENVIRONMENTAL SERVICES

CLIENT: Geotechnics Africa
PO Box 1321
Hermanus
7200

ATT: Dirk van Rooyen

PROJECT: Railton Hub

DATE: 04-12-2019

REF: L191145

ASTM D422 SIEVE ANALYSIS

DESCRIPTION : yellow clayey silt
POSITION : TP 1 @ 2.0m

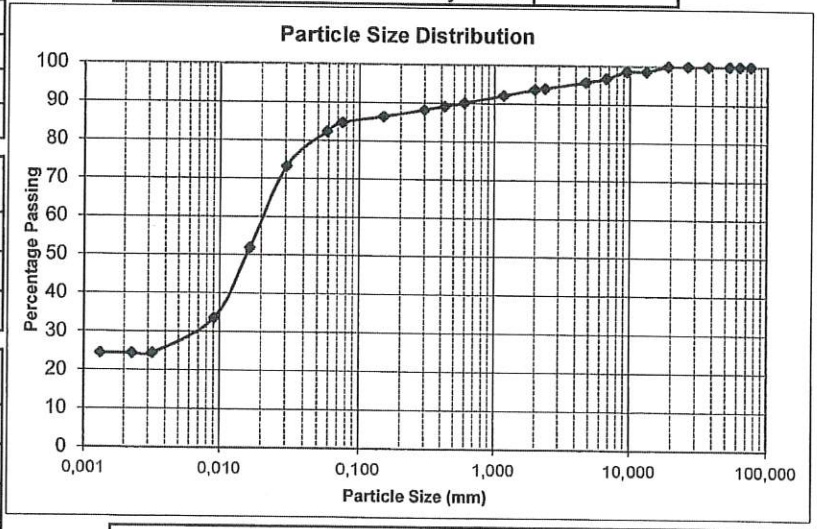
SAMPLE NO. : 32236
CLIENT SAMPLE NO. :

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	100
	13,20	99
	9,50	99
	6,70	97
	4,75	96
	2,36	94
	2,00	94
	1,18	92
	0,600	90
	0,425	89
	0,300	88
	0,150	86
	0,0750	85

Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0586	82
0,0305	73
0,0166	52
0,0091	34
0,0032	24
0,0023	24
0,0013	24

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	16
pH:	
Conductivity mS/m:	



Atterberg Limits (SANS3001-GR10)	
Liquid Limit	23
Plastic Index	10
Linear Shrinkage	5,0

MOD (SANS3001- GR30) & CBR (SANS3001-GR40)	
MOD AASHTO (Kg/m³)	
O.M.C. (%)	
C.B.R. @ 100% Comp.	
C.B.R. @ 98 % Comp.	
C.B.R. @ 95 % Comp.	
C.B.R. @ 93 % Comp.	
C.B.R. @ 90 % Comp.	
Swell (max) %	

Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	4
Sand : Percentage - 4.75mm and + 0.075mm	11
Silt : Percentage - 0.075mm and + 0.005mm	56
Clay : Percentage - 0.005mm	29

The above test results are pertinent to the samples received and tested only

CONTROL GEOSCIENCES (PTY) LTD

CIVIL ENGINEERING MATERIAL AND GEOTECHNICAL LABORATORY,
GEOTECHNICAL AND ENVIRONMENTAL SERVICES

CLIENT:	Geotechnics Africa PO Box 1321 Hermanus 7200	**PROJECT:**	Railton Hub
		DATE:	04-12-2019
ATT:	Dirk van Rooyen	**REF:**	L191145

ASTM D422 SIEVE ANALYSIS

DESCRIPTION :	red orange clay	**SAMPLE NO. :**	32237
POSITION :	TP 4 @ 1.3m	**CLIENT SAMPLE NO. :**	

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	
	13,20	
	9,50	100
	6,70	99
	4,75	99
	2,36	97
	2,00	97
	1,18	95
	0,600	94
	0,425	92
	0,300	91
	0,150	88
	0,0750	85

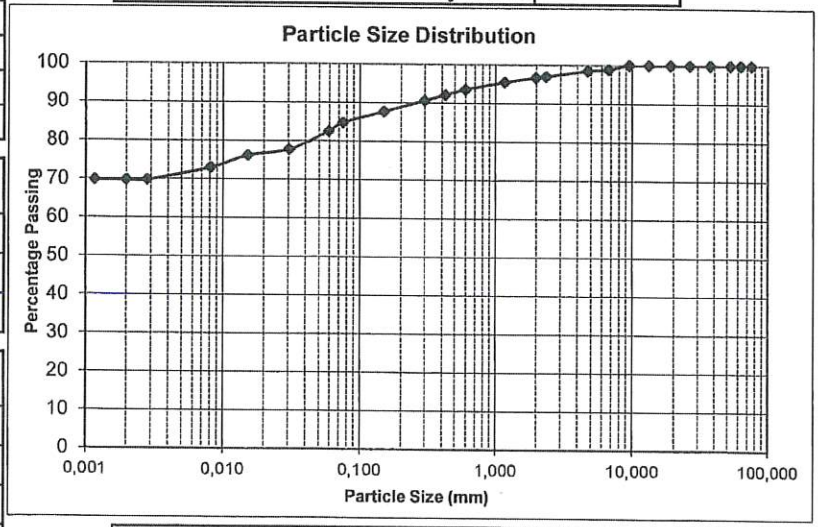
Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0592	82
0,0305	78
0,0153	76
0,0082	73
0,0028	70
0,0020	70
0,0012	70

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	24,7
pH:	
Conductivity mS/m:	

Atterberg Limits (SANS3001-GR10)	
Liquid Limit	45
Plastic Index	20
Linear Shrinkage	11,0

MOD (SANS3001- GR30) & CBR (SANS3001-GR40)	
MOD AASHTO (Kg/m³)	
O.M.C. (%)	
C.B.R. @ 100% Comp.	
C.B.R. @ 98 % Comp.	
C.B.R. @ 95 % Comp.	
C.B.R. @ 93 % Comp.	
C.B.R. @ 90 % Comp.	
Swell (max) %	



Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	1
Sand : Percentage - 4.75mm and + 0.075mm	14
Silt : Percentage - 0.075mm and + 0.005mm	14
Clay : Percentage - 0.005mm	71

The above test results are pertinent to the samples received and tested only

CONTROL GEOSCIENCES (PTY) LTD

CIVIL ENGINEERING MATERIAL AND GEOTECHNICAL LABORATORY,
GEOTECHNICAL AND ENVIRONMENTAL SERVICES

CLIENT: Geotechnics Africa
PO Box 1321
Hermanus
7200

ATT: Dirk van Rooyen

PROJECT: Railton Hub

DATE: 04-12-2019

REF: L191145

ASTM D422 SIEVE ANALYSIS

DESCRIPTION : yellow clay
POSITION : TP 4 @ 2.0m

SAMPLE NO. : 32238
CLIENT SAMPLE NO. :

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	
	13,20	
	9,50	
	6,70	
	4,75	100
	2,36	99
	2,00	99
	1,18	98
	0,600	97
	0,425	96
	0,300	95
	0,150	94
	0,0750	90

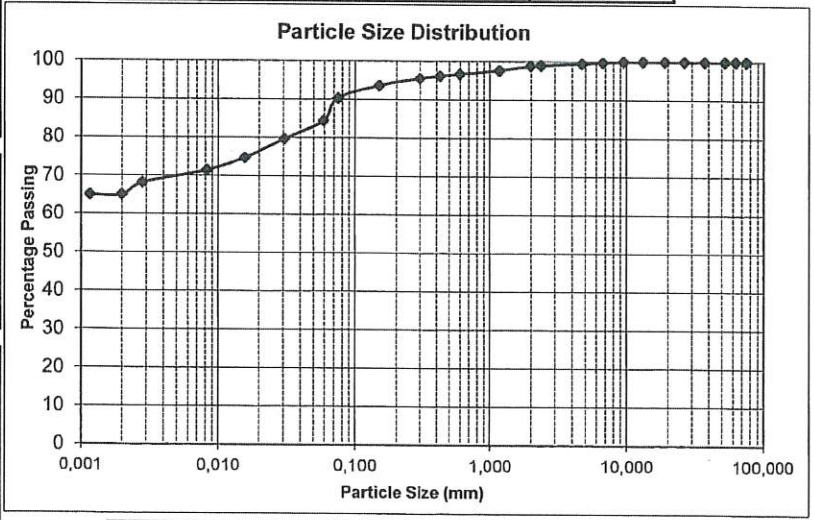
Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0592	84
0,0305	80
0,0158	75
0,0083	71
0,0028	68
0,0020	65
0,0012	65

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	23,5
pH:	
Conductivity mS/m:	

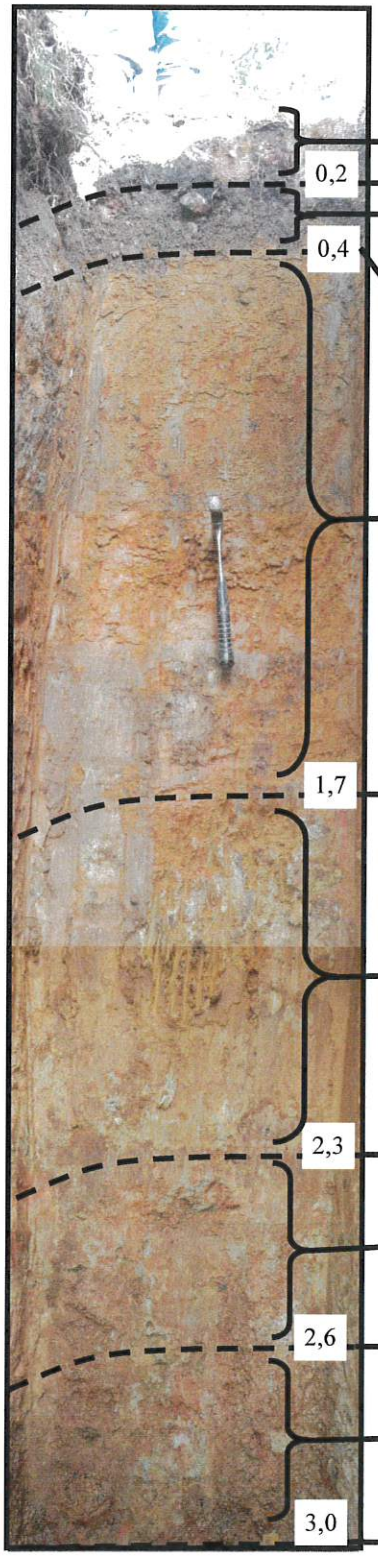
Atterberg Limits (SANS3001-GR10)	
Liquid Limit	32
Plastic Index	15
Linear Shrinkage	7,0

MOD (SANS3001- GR30) & CBR (SANS3001-GR40)	
MOD AASHTO (Kg/m³)	
O.M.C. (%)	
C.B.R. @ 100% Comp.	
C.B.R. @ 98 % Comp.	
C.B.R. @ 95 % Comp.	
C.B.R. @ 93 % Comp.	
C.B.R. @ 90 % Comp.	
Swell (max) %	



Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	0
Sand : Percentage - 4.75mm and + 0.075mm	9
Silt : Percentage - 0.075mm and + 0.005mm	22
Clay : Percentage - 0.005mm	68

The above test results are pertinent to the samples received and tested only



Profile recorded in TP1

Moist light pinkish brown firm intact clayey SILT. Fill.

0,2

Abundant fine and medium GRAVEL in a moist dark brown loose to medium dense intact to slightly voided organic silty SAND with some fine roots. Pebble Marker.

0,4

Moist orange-brown indistinctly blotched darker orange-brown stiff weakly shattered slightly sandy SILT-CLAY. Reworked Residual Siltstone.
Note: Sample taken at 1,0m.

1,7

Moist yellowish-brown very stiff weakly fissured slightly sandy clayey SILT.
Partially Reworked Residual Siltstone.
Note: (i) Zones of light grey stiff weakly shattered clay -silt with traces of sub-rounded pebbles, see P7.1.
(ii) Sample taken at 2,0m.

2,3

Moist light yellow-brown blotched red– and orange-brown very stiff indistinctly striated clayey SILT.
Residual Siltstone.

2,6

As above but very stiff with inclusions of highly weathered very soft rock argillaceous sandstone.
At 3,0m: Refusal on brown highly weathered very soft rock argillaceous SANDSTONE or arenaceous SILTSTONE.

3,0

Note: Base of pit wet.



Moist orange-brown stiff slightly sandy CLAY-SILT encountered between 0,4m and 1,7m. Reworked Residual Siltstone.

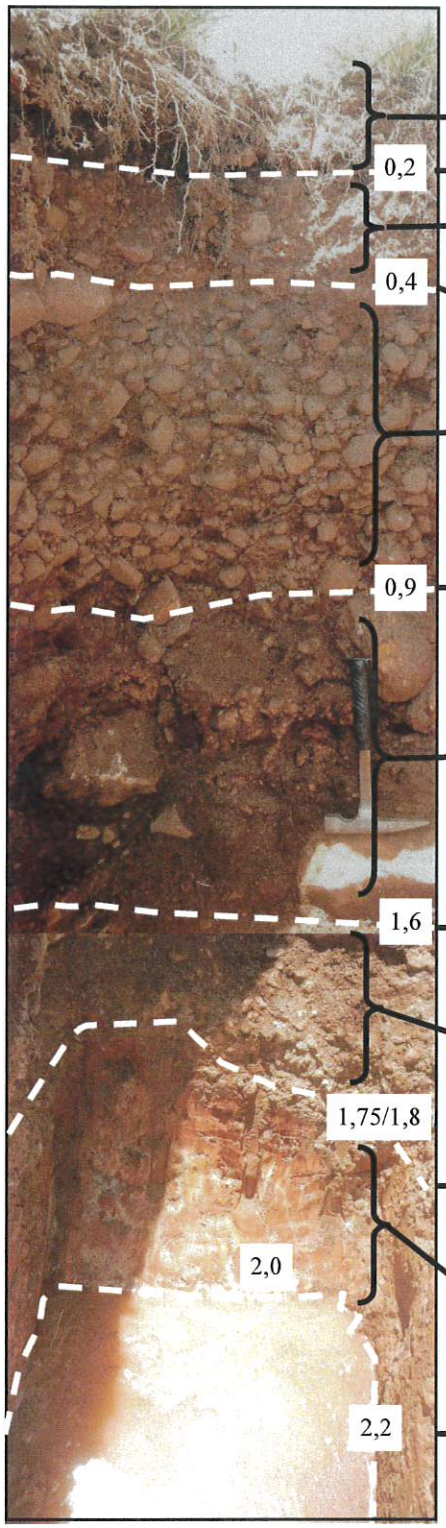


Pockets of grey-green stiff shattered sandy SILT-CLAY encountered between 1,7m and 2,0m.



Highly weathered soft rock arenaceous SILT-STONE or argillaceous SANDSTONE exposed at base of TP1 (3,0m).

PLATE 7



Profile recorded in TP2

Moist dark brown loose voided organic silty SAND containing abundant fine grass roots.
Humified Topsoil.

Predominantly fine and medium with scattered coarse sub-angular gravel in a moist brown medium dense intact silty SAND matrix. Hillwash.

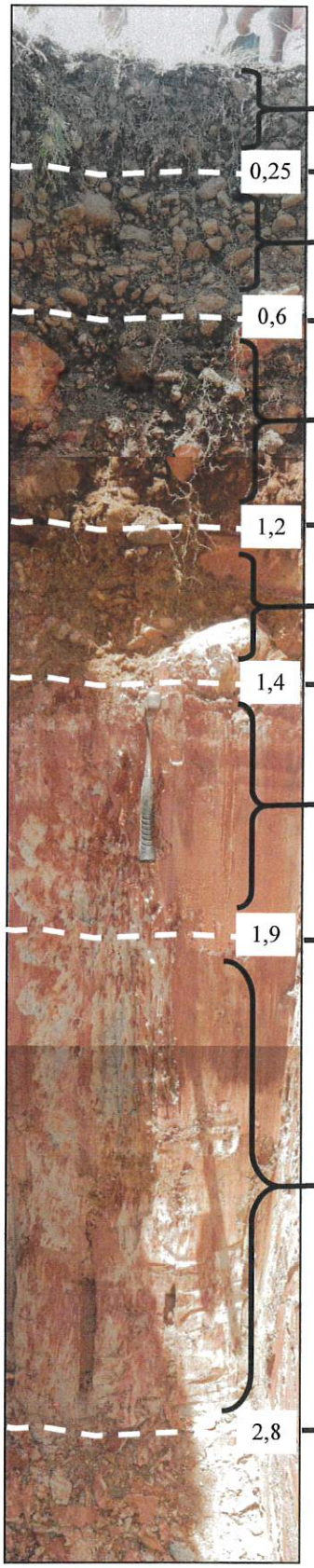
Abundant predominantly medium and coarse sub-rounded to sub-angular GRAVEL and occasional small boulders in a little slightly moist brown medium dense intact silty SAND matrix.
River-terrace GRAVEL.

Fine medium and coarse angular to sub-angular GRAVEL and numerous to abundant sub-angular BOULDERS in an orange-brown very dense intact ferruginous-cemented silty SAND matrix.
Ferruginised River-terrace GRAVEL.

Abundant fine medium and coarse GRAVEL in a moist yellow-brown dense intact silty SAND matrix. Pebble marker.

Moist to very moist orange-brown streaked and blotched light yellow-brown very stiff slightly shattered sandy CLAY-SILT to clayey SILT.
Reworked Residual Shale.
Note: Water level at 1,9m after 4,5hrs.

Below water level at base of pit: Wet pale grey mottled red-brown very stiff weakly fissured clayey SILT. Residual Siltstone.



Profile recorded in TP3

Moist dark brown medium dense intact organic silty SAND with some medium and coarse sub-rounded gravel and abundant grass roots. Humified Topsoil.

Abundant predominantly medium and coarse sub-rounded to sub-angular GRAVEL in a moist brown medium dense intact silty SAND matrix. River-terrace GRAVEL.

As above but with abundant GRAVEL and some to numerous highly to completely weathered boulders up to 300mm in diameter in a very dense partially ferruginised silty SAND matrix.

Fine medium and coarse GRAVEL in a moist orange-brown stiff intact ferruginous clayey silty SAND matrix. Pebble Marker.

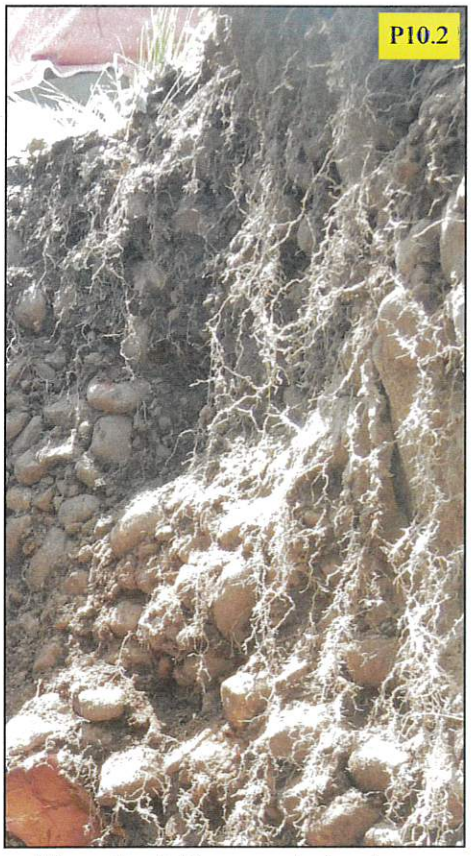
Moist pale grey to off-white mottled red-brown very stiff weakly fissured indistinctly shattered slightly sandy CLAY -SILT. Reworked Residual Siltstone.

As above but sparsely mottled clayey SILT. Residual Siltstone.
Note: Sand lens between 0,6m and 0,9m, see Plate 10.

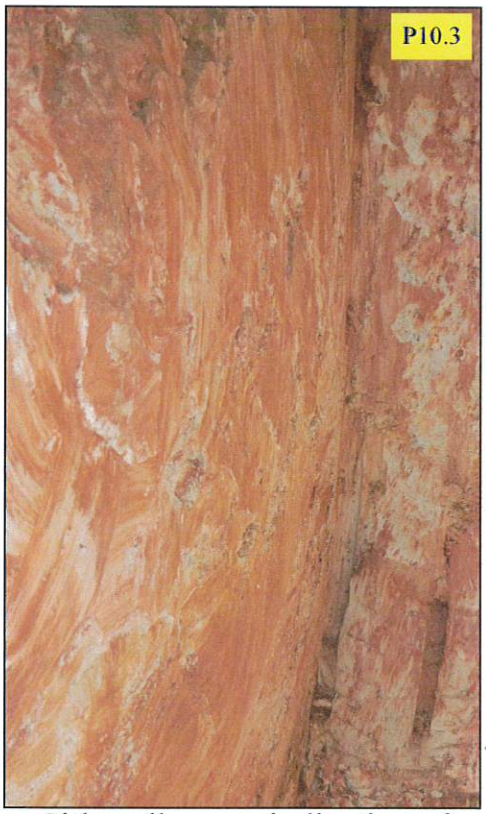
PLATE 9



TP3: Localised sand lens between 0,6m and 0,9m.



Abundant fine roots in river-terrace gravel horizon.



Sidewall smear indicative of clay fraction in residual silt-stone horizon.

PLATE 10



Moist dark brown loose to medium dense intact organic silty SAND with some gravel and abundant grass roots. Humified Topsoil.

Numerous to abundant fine medium and coarse angular to sub-rounded GRAVEL and some small boulders in a moist brown medium dense matrix as above. Pebble Marker. Note: Slight isolated seepages from base.

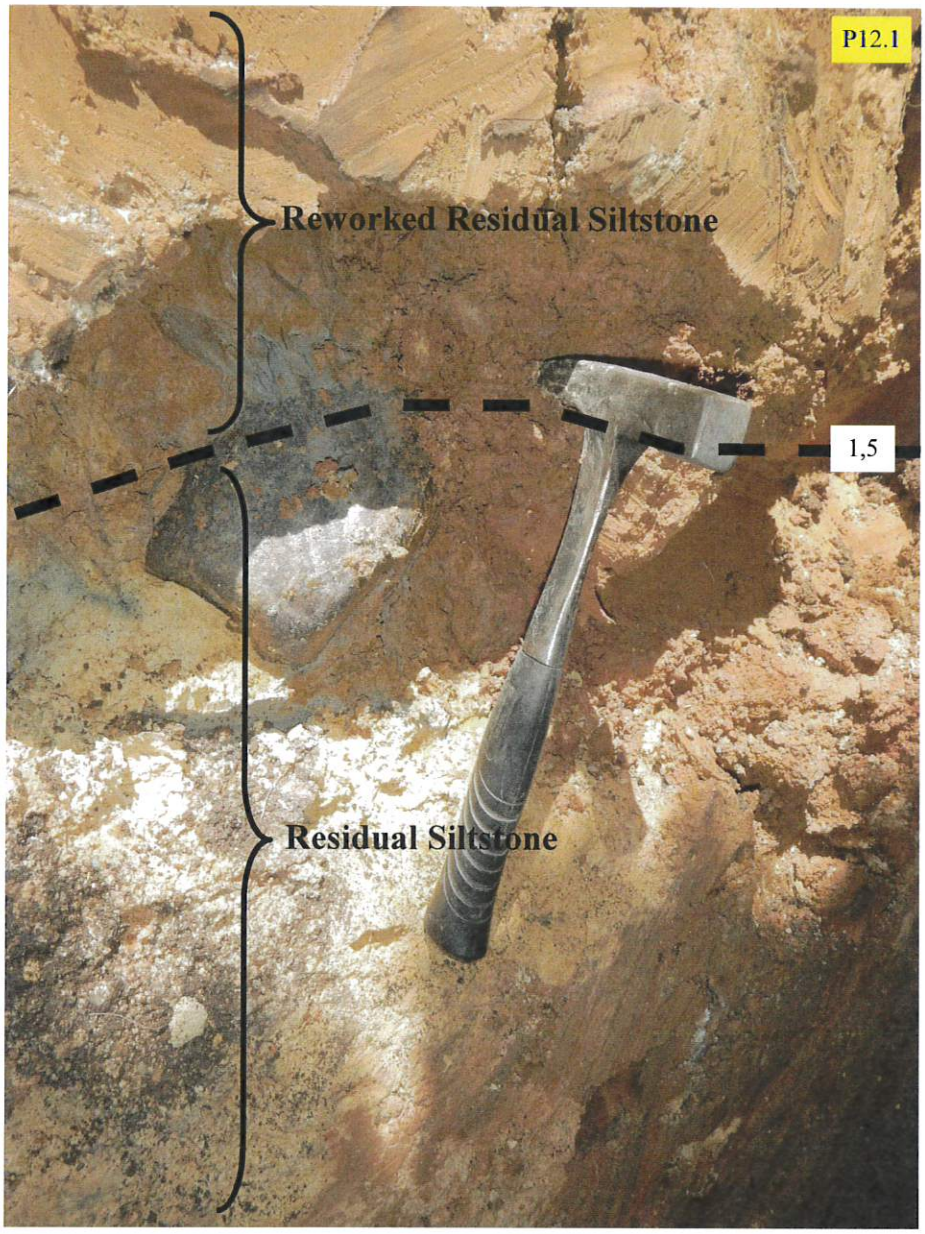
Moist (locally very moist to wet) orange-brown very stiff weakly shattered sandy silty CLAY.
Reworked Residual Siltstone.
Note: Sample taken at 1,3m.

Moist light yellow-brown stiff to very stiff weakly fissured slightly sandy silty CLAY. Residual Siltstone.
Note: (i) Sub-rounded boulder at 1,9m, see photo on Plate 12.
(ii) Sample taken at 2,0m.

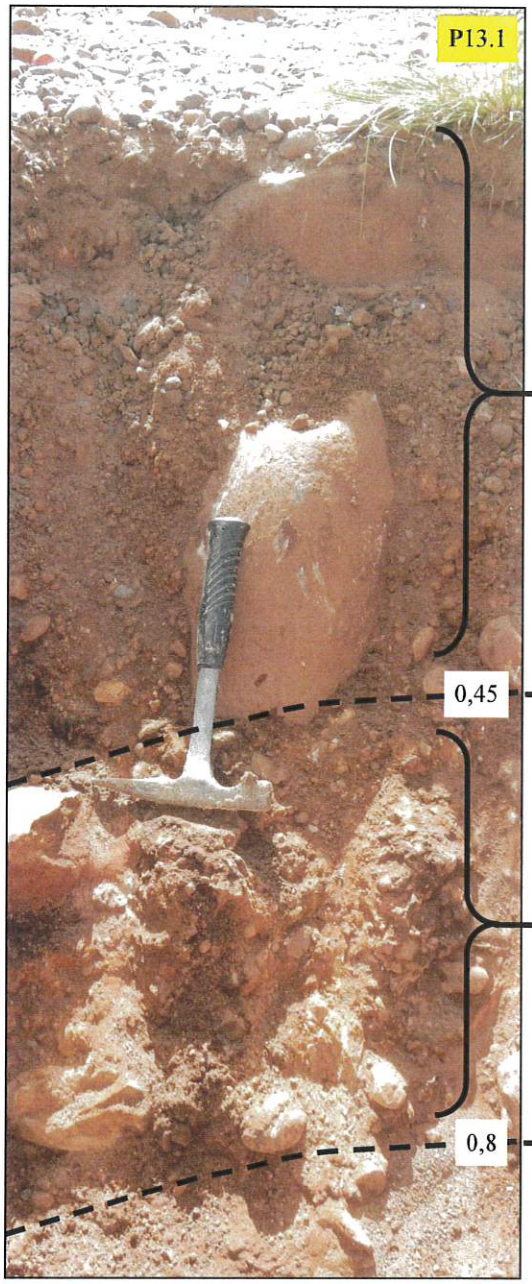
Wet yellowish-brown very stiff intact clayey SILT with some completely weathered relics of siltstone.
Residual Siltstone.

At 3,1m: Excavation stopped at maximum reach of TLB on stratum as above.

Profile recorded in TP4



TP4: Sub-rounded boulder exposed at 1,9m below ground level. Similar smaller boulders exposed in isolated places within residual siltstone horizon.



Profile recorded in TP5

Abundant fine medium and coarse sub-angular to sub-rounded GRAVEL and BOULDERS (up to 0,5m in diameter) in a slightly moist brown <u>medium dense</u> intact ferruginous silty SAND matrix.
River-terrace GRAVEL.

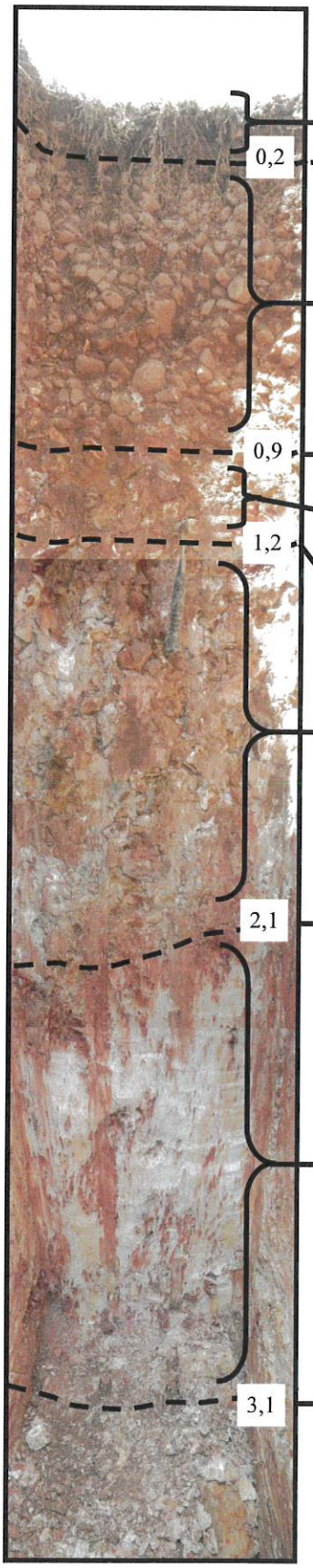
Abundant fine medium and coarse GRAVEL and some small boulders tightly packed in an orange-brown <u>very dense</u> ferruginised silty SAND matrix.
Ferruginised River-terrace Gravel.
Note: Matrix strongly ferruginised to hardpan ferricrete towards base.

At 0,8m: Refusal on <u>very soft rock</u>
Ferruginised River-terrace Gravel as above.



Several large boulders that project above ground level.

PLATE 13



Profile recorded in TP6

Moist dark brown loose to medium dense intact silty SAND with some gravel and abundant roots. Humified Topsoil.

Abundant predominantly medium and coarse sub-angular to sub-rounded GRAVEL in a reddish-brown loose to medium dense intact silty SAND matrix with abundant fine grass roots. River-terrace GRAVEL.

As above but slightly less gravel.

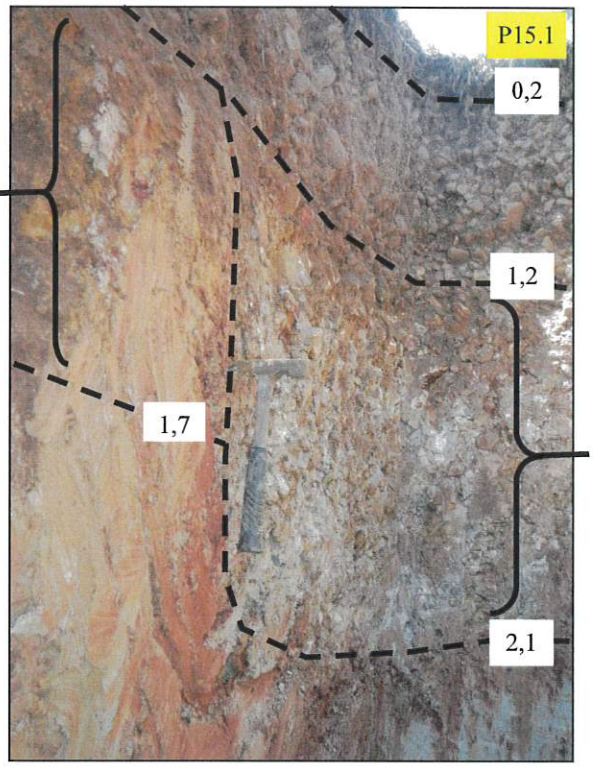
Abundant sub-rounded to angular coarse alluvial GRAVEL in a moist light grey to off-white very stiff intact sandy CLAY-SILT matrix. Localise River-channel Deposit.
Note: Becomes coarser with depth and matrix more moist, clayey and stiff.

Moist pale grey to off-white with occasional red-brown streaks and blotches very stiff weakly fissured clayey SILT. Residual Siltstone.

At 3,1m: Excavation stopped at maximum reach of TLB in stratum as above.

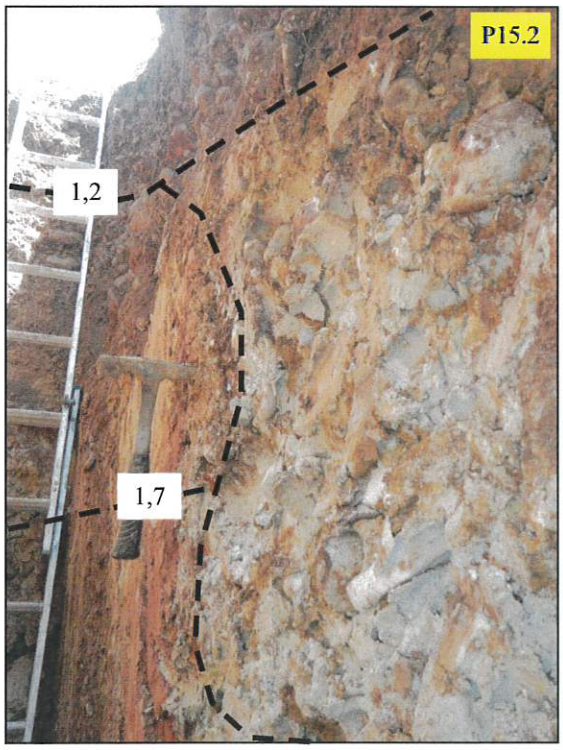
PLATE 14

Moist light yellow-brown to pale grey and off -white with occasional red-brown streaks and blotches very stiff weakly fissured clayey SILT. Residual Siltstone.



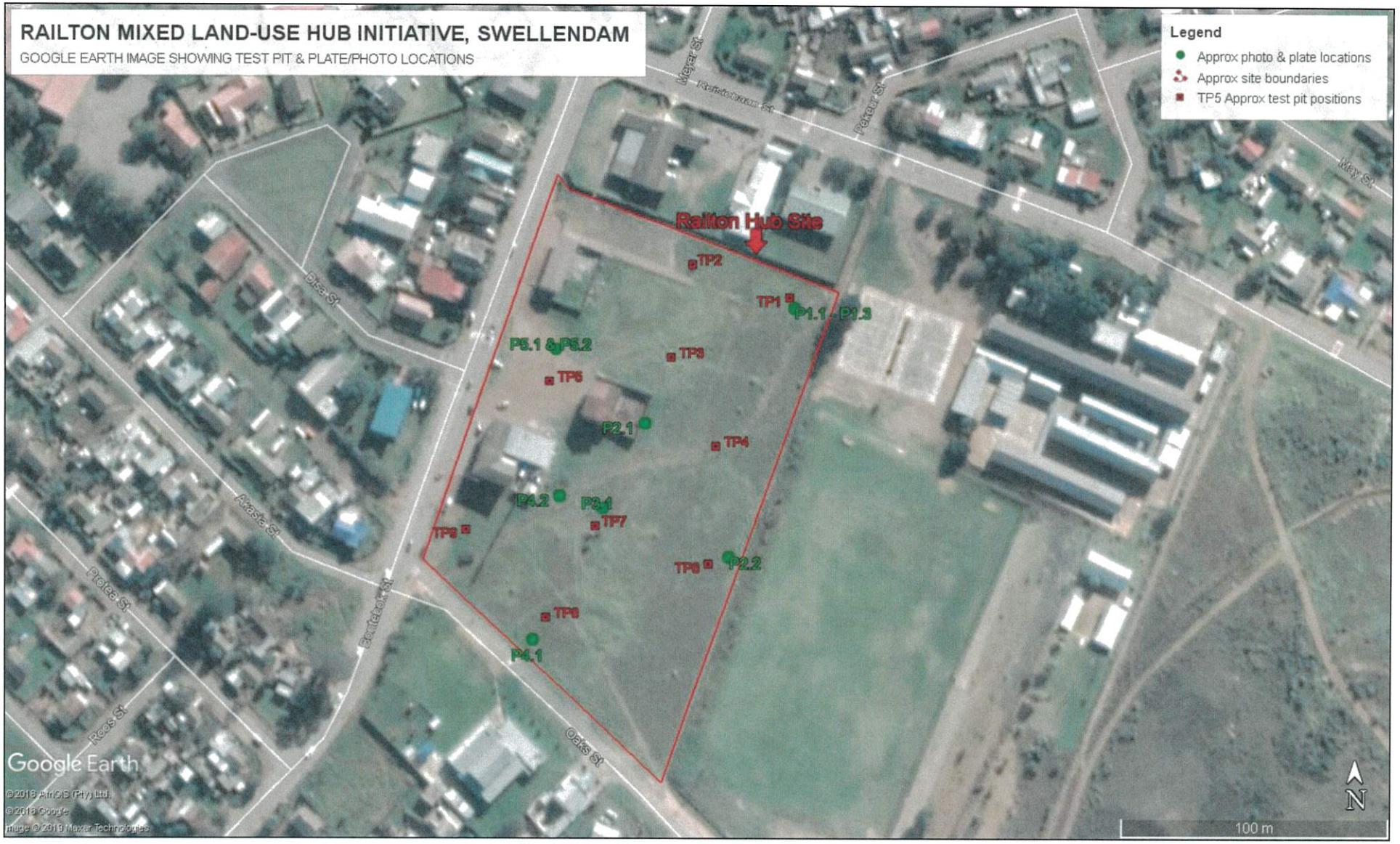
Moist orange-brown stiff to very stiff weak-ly shattered slightly sandy silty CLAY. Reworked Residual Siltstone.

Localised river-channel deposit viewed from south end of TP6.



River channel-deposit viewed from north end of TP6.

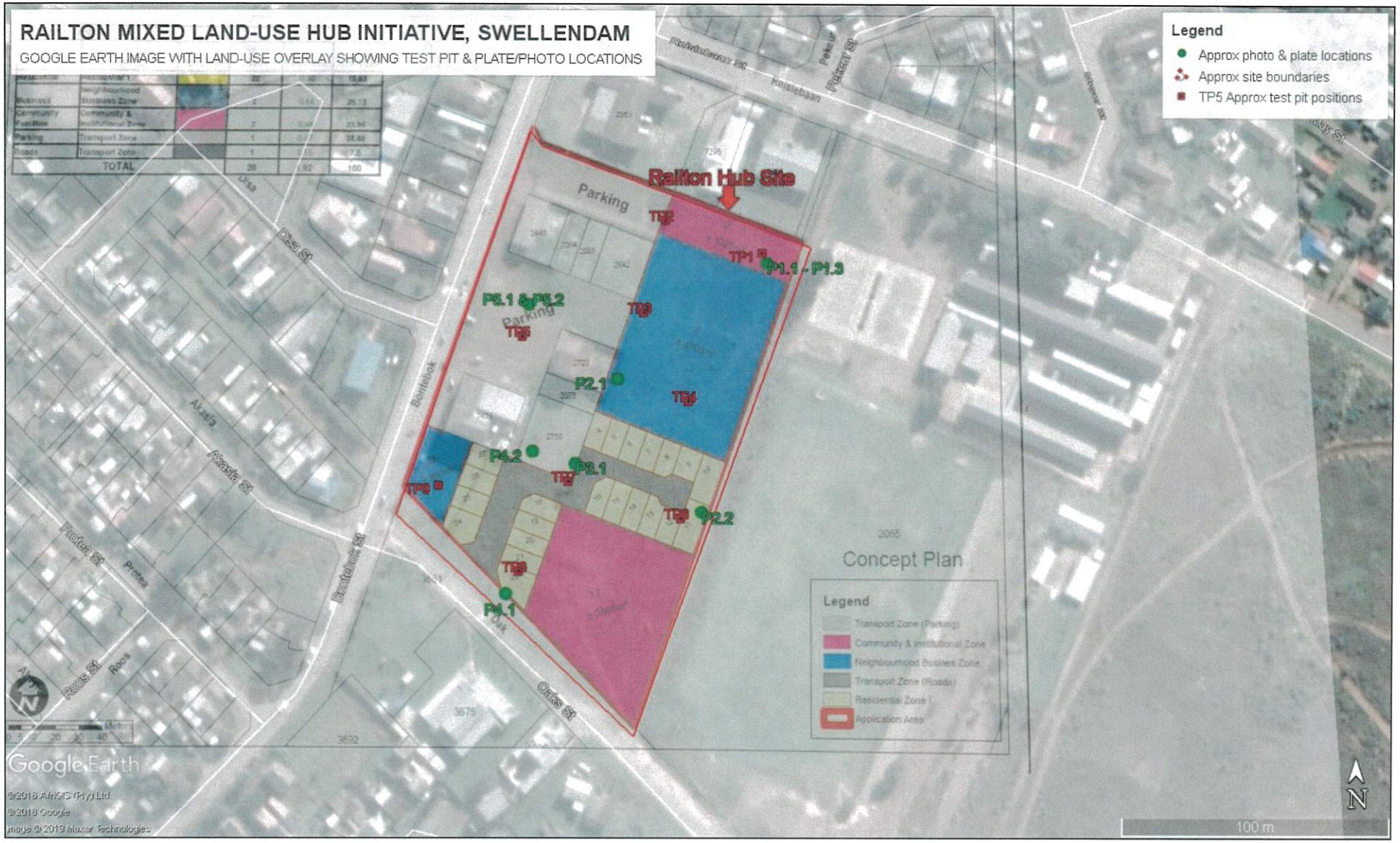
PLATE 15



RAILTON MIXED LAND-USE HUB INITIATIVE, SWELLENDAM

GOOGLE EARTH IMAGE SHOWING TEST PIT & PLATE/PHOTO LOCATIONS

J2059 **FIGURE 5a**



RAILTON MIXED LAND-USE HUB INITIATIVE, SWELLENDAM

GOOGLE EARTH IMAGE WITH LAND-USE OVERLAY SHOWING TEST PIT & PLATE/PHOTO LOCATIONS

J2059 **FIGURE 5b**



RAILTON MIXED LAND-USE HUB INITIATIVE, SWELLENDAM

GOOGLE EARTH OF KNOWN SERVICES IN RELATION TO SURVEYED ORIGINALY TEST PIT POSITIONS

J2059

FIGURE 6a

APPENDIX A

PLATES 1 to 5

(Panoramic Perspectives)



Backfilling of trench excavated to repair pipe that was ruptured when TP1 was excavated at its surveyed position.

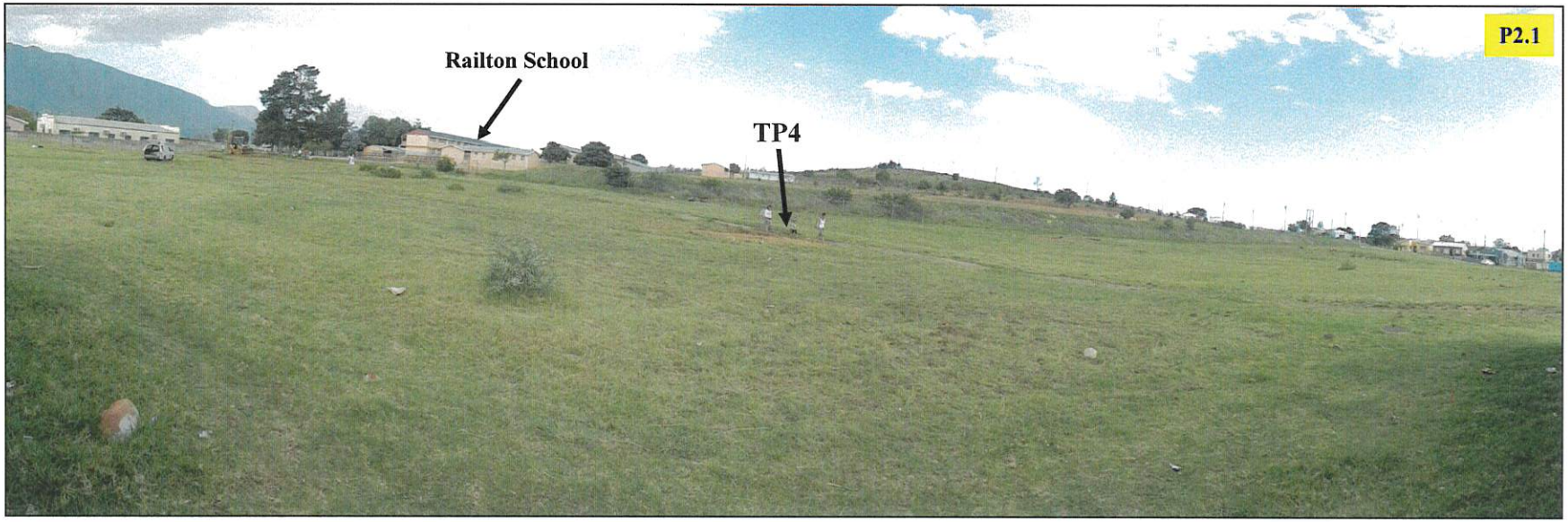


Dewatering of trench to expose ruptured pipe.

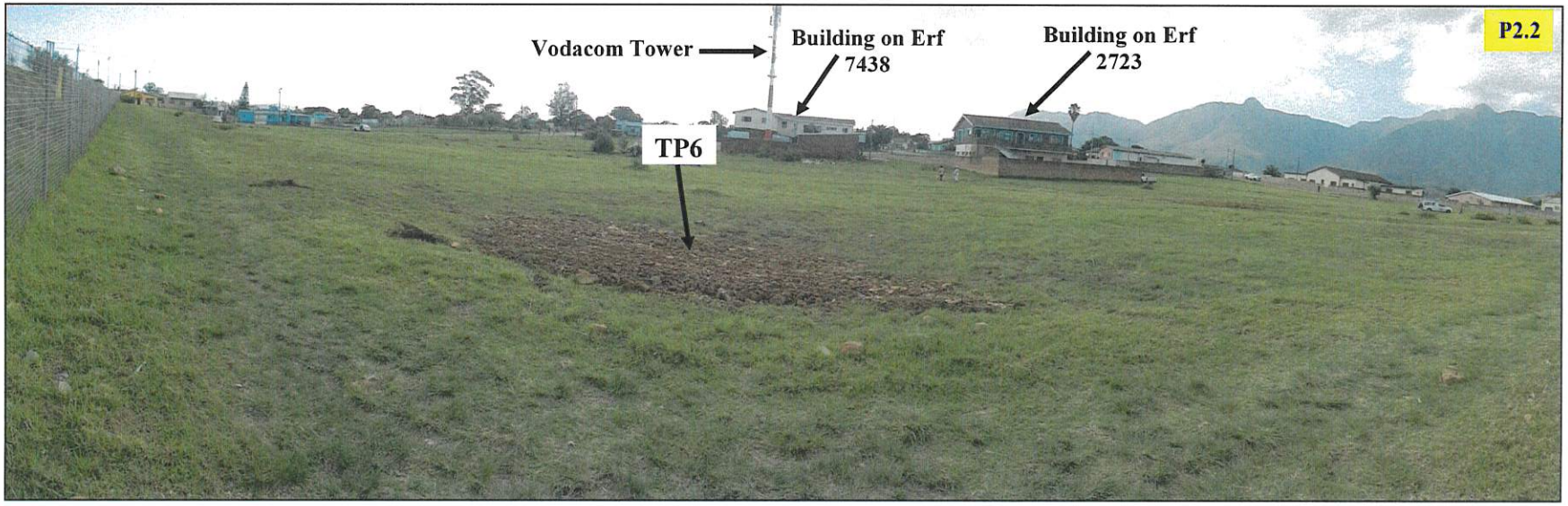


Piece of broken asbestos pipe that was replaced with a PVC pipe.

PLATE 1



Panoramic view of the site taken from back wall of courtyard on east side of shops in the centre of the block, see P2.1 in Figure 4.



Panoramic view of the site taken from the school's boundary fence on the east side of the site, see P2.2 in Figure 4.

PLATE 2



Panoramic view of the south-western part of the site taken from north side of TP7 that was excavated next to a pile of boulders and tree stump, see P3.1 in Figure 4.

PLATE 3