Geotechnical Interpretation

At:

Culls Farm,
Dean Street,
Maidstone,
ME15 0PS

For:

Culls Development Ltd

Private and Confidential

Ref: 5750 24 03 22 Rpt 02 Rev B RC NS

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Introduction

This note presents interpretation of the data obtained from the intrusive ground investigation carried out at the above site during February 2024 by SEC. This work followed an earlier intrusive investigation by SEC in 2019 (job ref: 3199). The factual reports from the current and previous investigations should be read in conjunction with this interpretation, which supersedes the previous interpretation.

It is understood that the proposed development involves the demolition and clearance from site of the existing buildings to make way for the construction of residential dwellings with associated access, landscaping and infrastructure. The proposed site layout is shown in Figure 1, below.

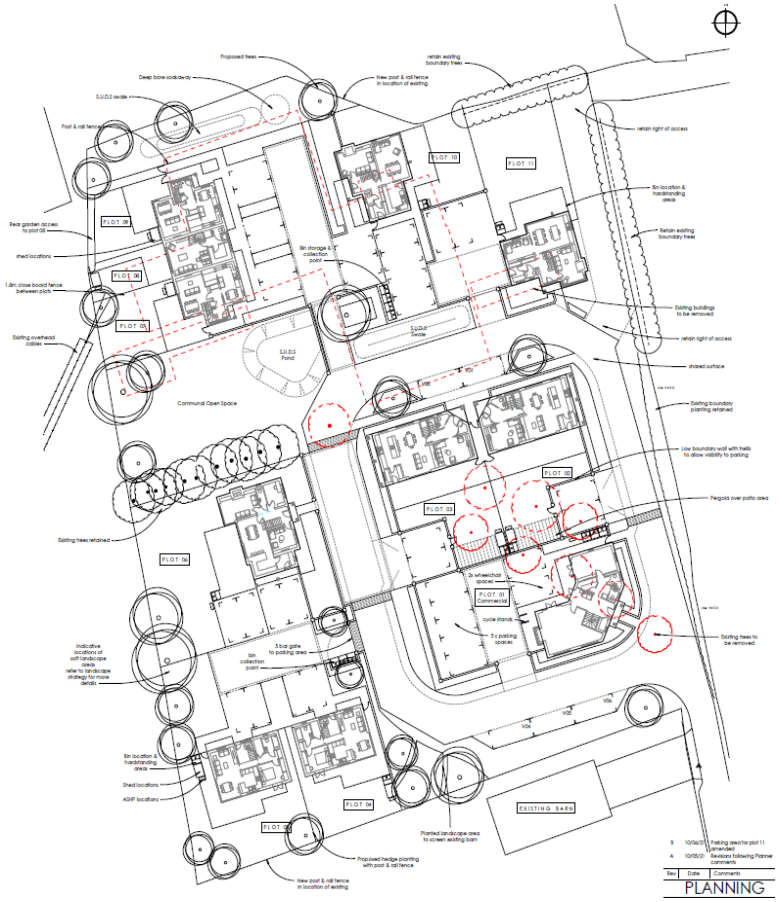

Figure 1. Proposed site layout

Ground conditions

Geology

Information from the British Geological Survey (BGS) website shows the whole of the site to be underlain by the Hythe Formation, which was laid down approximately 120m years ago. The materials that are now exposed at, and near to, the surface are the weathering products of those deposits. The parent material is indicated to comprise alternating sandy limestones ("Ragstone") and glauconitic sandy mudstones (Hassock). The weathering process is likely to have created predominantly clayey soil.

The topography of the area surrounding the site is important to an understanding of the nature of the ground. Figure 2 is an extract from a topographical map of the area.

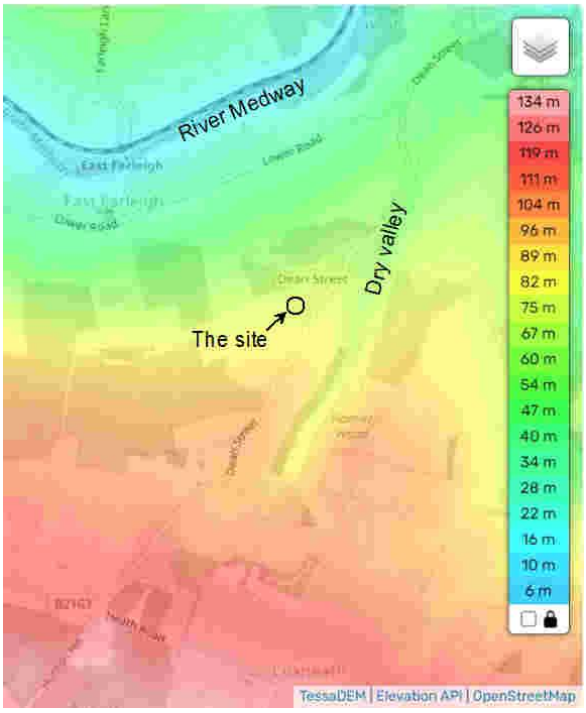

Figure 2. Topography of the area surrounding the site
(Based on an image extracted from https://en-gb.topographic-map.com/)

The image shows that the site lies close to the crest of a ridge which runs down from south-southwest to north-northeast, with a narrow dry valley to the east and the valley of the River Medway to the northwest. An effect of the erosion of these valleys over geological time was to cause the relatively brittle sandy limestone and mudstone layers to bend and break (cambering). The fractures were infilled with soil from above, but not always completely, such that voids remained in places. The result of the genetic process has been to create ground which varies between 'blocks' of rock covered by quite shallow layers of weathered material and infilled fissures containing less competent soil and some voids.

Results of the Investigations

The two stages of intrusive investigation have included 24 dynamically sampled (WS) boreholes. Thirteen boreholes met refusal on hard strata, at depths between 0.80m and 4.00m. The other boreholes reached their intended depth of 5.00m, except WS101, which continued to 6.00m, all without reaching refusal.

Standard Penetration Tests were undertaken in nearly all the WS boreholes. The results (N values) have been corrected from the field measurements to account for the energy efficiency of the equipment used compared with the standard efficiency of 60%. The resulting values are termed N_{60}. The results are plotted as N_{60} against the mid-point of the test drive in Figure 3, below.

The wide range of N60 v Depth profiles illustrates the nature of the ground as described above, with refusals occurring in many holes between about 1.00m and 5.00m, but some holes not finding refusal to the termination depth. The data from WS9 within the previous site investigation has been highlighted, because zero N60 values were recorded from 3.00m to the base of the hole, suggesting the presence of a void. Another zero N60 value was reported in WS103 of the current site investigation at 2.00m.

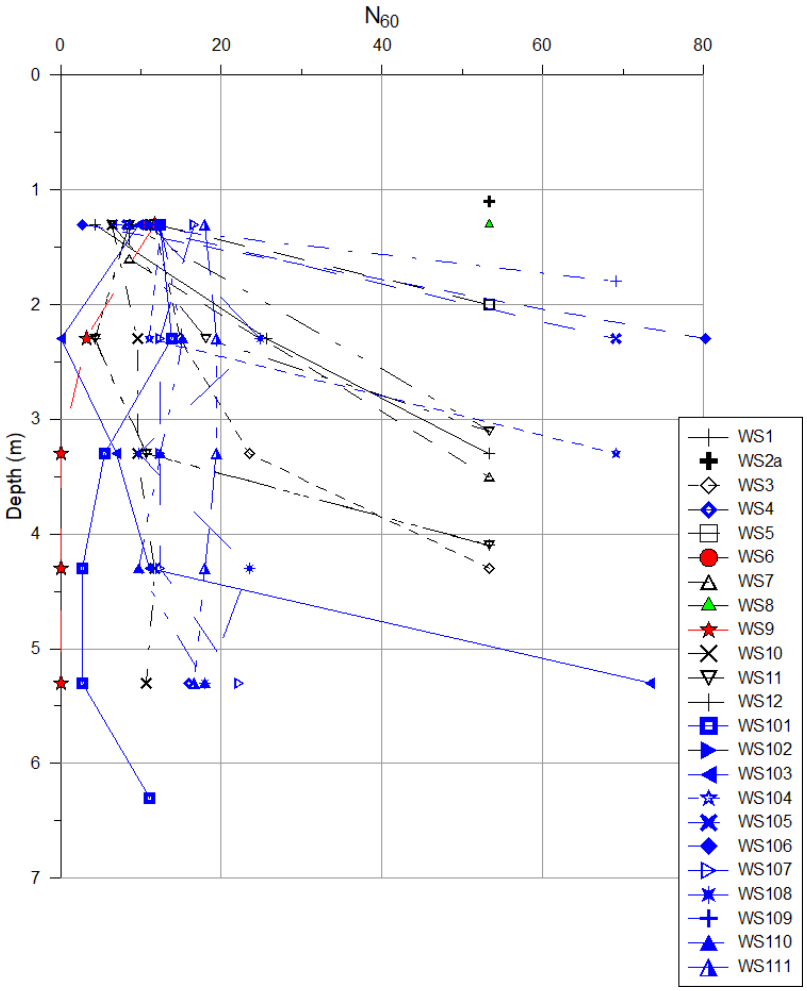

Figure 3. SPT N_{60} v Depth below ground

Liquid and Plastic Limit tests on samples from both investigations showed the soil to comprise predominantly Clay of intermediate plasticity (CI), with a low to medium volume change potential.

Groundwater was not encountered in any of the boreholes during the drilling. A total of 17 standpipes were installed in the two stages of investigation. Thirteen of these were monitored a number of times and no groundwater has been found.

Discussion of results

Foundations

The variable ground is obviously a risk that the development must address. In the majority of the boreholes, the N_{60} value from the test started at 1.00m exceeded 10. In only two of twenty-two holes, N_{60} was less than 5. It is therefore suggested that that preliminary foundation design may be based on shallow strip foundations with a net bearing pressure limited to 100kPa. Ground floor slabs should be suspended. The foundation depths should be chosen to comply with the NHBC requirements[1] for soil of medium volume change potential.

The following measures are proposed to mitigate the risk associated with the ground variability:

1. After demolition of the existing buildings, carry out a geophysical survey of the site to look for evidence of fractures and/or voids.
2. Carry out dynamic probing along the lines of the new building foundations. It is noted that the existing buildings prevented the drilling of boreholes in some of these locations.
3. Provide reinforcement to the strip foundations. This should be designed to span a void of, say, 3.00m to ensure the building will cope with a loss of support over that length. The geophysical survey may provide evidence to review the span distance. It must be noted that the foundation strips should be continued beyond the corners of the buildings to cater for the possibility of loss of support at the corners.

A raft foundation may provide a viable alternative to shallow strips, but the NHBC requirements[1] call for the raft to be founded on compacted granular fill, which would involve the excavation and removal of significant quantities of soil and the import and compaction of the fill. The above measures also apply if raft foundations are used.

The sides of shallow excavations may stand vertically for short periods, but if personnel are required to work within the excavation, the sides should either be battered back to a safe angle or provided with support.

Foundation excavations should be inspected and approved by a competent person prior to concrete being placed. Foundation concrete should be placed as soon as possible after approval of the base of the excavation and certainly on the same day. It should be noted that the near-surface low to intermediate plasticity clay will soften rapidly if exposed to free water. Excavations should therefore be kept dry at all times.

Site roads

The proposed levels of the site roads are not available at the time of writing this report. However, it is likely that the subgrade will be mainly clay – silty and gravelly in places. It is recommended that preliminary design of the roads could be based on a subgrade CBR of 3%, provided the surface is kept dry and proof-rolled between the site strip and construction of the pavement. Any soft or loose spots revealed during site preparation should be removed and replaced with well-compacted granular fill. When the levels have been established, further ground investigation would be appropriate to inform the pavement design. The TfL penetrometer would be a convenient tool for this.

Site drainage

If soakaways are used for storm drainage, there will be a risk that the concentration of water infiltration to the ground will cause settlement of the material in the fractures in the rock or the collapse of voids. They should certainly be kept well away from the buildings, if possible more than 10.00m.

Buried concrete

In the two investigations, 17 samples of soil from depths ranging from 0.15m to 1.50m below ground were tested for the pH value and the concentration of water-soluble sulphate. The pH values ranged from 6.8 to 12.2. Eleven samples were tested for water-soluble sulphate and the results ranged from <10mg/l to 230mg/l. According to BRE Special Digest 1[2], these results lie within Design Sulphate Class DS-1 and have an Aggressive Chemical Environment for Concrete class of AC-1. Table D1 of the Digest gives the Design Chemical Class as DC-1, for which no special concrete mix is required.

References

1. National House Building Council (NHBC) Standards, Chapter 4.2 Building near trees. Available online from https://www.nhbc.co.uk/builders/products-and-services/techzone/nhbc-standards
2. BRE Special Digest 1 (2005) Concrete in aggressive ground. Building Research Establishment, Watford. ISBN 1 86081 754 8