

Interpretive Geotechnical Report

At:

Land Adjacent to Brandet House
Brenzett
Romney Marsh
TN29 9UG

For:

Graeme Smith

Private and Confidential

Ref: 3410 19 11 20 Rpt 01 Rev A NS GS

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Association of Geotechnical &
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Date: 20 November 2019
Your ref: 3410
Our Ref: NAS/wp/18065

For the attention of Mr D Jones

Dear Sirs

Re: Land adjacent to Brandet House, Brenzett, Kent TN29 9UG

We write in connection with the ground investigation work recently undertaken by you at the captioned site. As requested, this letter provides geotechnical interpretation of the information obtained in relation to the proposed development and should be read in conjunction with your report on the investigation.

The British Geological Survey (BGS) geological map of the area indicates that the site is underlain by the Hastings Beds, which are part of the Wealden Group of strata. Recent Tidal Flat Deposits are present above the Hastings Beds. The records of boreholes to the northeast and southwest of the site, available from the BGS archives, indicate that the Tidal Flat Deposits may be between 20m and 30m thick at the site. The BGS website includes the following description:

"Tidal flat deposits, including mud flat and sand flat deposits, are deposited on extensive nearly horizontal marshy land in the intertidal zone that is alternately covered and uncovered by the rise and fall of the tide. They consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit. Normally a consolidated soft silty clay, with layers of sand, gravel and peat. Characteristically low relief."

Much of the site area was previously taken up by a medieval canal that ran to the west of the Rhee Wall Road (now the B2080) (see the archaeological report¹ by Thames Valley Archaeological Services (TVA)). The canal fell into disuse in the 15th Century, but it is not known when it was backfilled. Figure 1 is a plan, taken from the TVA report, that shows the approximate extent of the canal.

It is proposed to construct six detached houses on the site. No foundation loadings were available at the time of writing this letter.

It was intended to drill six boreholes using a dynamic sampling rig, but only two (WS02 and WS03) were drilled. Hand-dug starter pits were excavated at WS01, WS04 and WS06 but the boreholes were not drilled owing to time constraints. The pits all terminated at 1.0m. Standpipes were installed in WS02 and WS03 to the base of the holes at 3.45m and 6.0m, respectively.

One cable percussion borehole was drilled to a depth of 20m. In situ testing included borehole vane tests and Standard Penetration Tests. A standpipe piezometer was installed with a response zone between 9m and 10m and a standpipe with a response zone between 1m and 5m.

Three trial trenches (TP01, TP02 and TP03) were excavated by machine on lines perpendicular to the road, to look for the western side of the former canal. Hand held vane tests were done within the trenches at several locations and depths. The maximum depth excavated was 3.0m.

Three trial pits were dug by hand to depths of 0.55m to collect samples for chemical testing relating to the gardens of the houses.

The comments made in this letter and the opinions expressed are based on the sources quoted and all the results of the intrusive investigation including laboratory tests. It should be noted that there may be conditions pertaining at the site which have not been disclosed by the investigation and which were not, therefore, revealed by the work. In particular it should be noted that groundwater conditions vary with seasonal and other effects.

Ground conditions

The exploratory holes revealed the expected sequence of strata. The near-surface soil was found to be clay of intermediate plasticity and low to medium volume change potential. At depths between 2m and 3m, most of the exploratory holes found pockets of peat within the clay. SPT N values and vane test results taken in this material confirmed the presence, across most of the site, of a medium to high strength upper crust of clay with a thickness of about 1m. This is typical of this type of deposit and reflects a reduced moisture content close to the ground surface. Vane test results from the trial trenches are plotted against depth in Figure 2, from which it can be seen that there is a sharp fall in strength below 1m. The SPT N values plotted in Figure 3 also show a fall in WS02 and WS03, though there does not appear to be a firmer crust in BH01.

In the three boreholes that penetrated below 3m, peat was found in all of them, from 3.0m to 3.45m in WS02, which was terminated in peat, and from 3.3m to 4.7m in WS03 and 3.3m to 3.9m in BH01. Moisture content values from the top 6m of ground are plotted in Figure 4 and show the extremely high moisture content of the peat. Hobbs² has provided a correlation between the moisture content of fen peat and its Compression Index (C_c):

$C_c = 0.008w$, where w is the moisture content

For the average peat moisture content of about 275%, this gives C_c of about 2.2. If this is compared with a typical value of C_c for a firm clay of the order of 0.05, it can be seen that the peat is extremely compressible. Figure 4 also shows the increase of moisture content with depth in the clay above the peat, consistent with the reducing soil strength.

Very low strength clay was again present below the peat. In WS03, at 5m, the N value was 4, while vane tests in BH01 at 5m and 6.5m recorded shear strengths of 14kPa and 13kPa, respectively. At 6.8m BH01 found medium dense clayey sand, with N values increasing from 10 at 8m. A maximum N value of 20 was recorded at 15.5m depth. Below this the N value reduced, probably as a result of increasing clay content.

Groundwater was encountered as seepages during the fieldwork in Trial Pits TP01N, TP02S and TP04 at depths of 2.7m, 3m and 3m, respectively, and in BH01 at 5.2m. At the time of writing, the installations had been monitored on a two occasions, on 6 and 20 November.

On 6 November, the levels were between 1.6m and 2.17m below ground level. On 20 November, the levels ranged from 1.50m to 1.98m below ground. Between the readings, all of the levels had risen, by between 6cm and 19cm. It should be noted that groundwater levels vary with time, for example as a result of seasonal effects. It is recommended that regular monitoring should continue until construction.

Foundations

Owing to the extreme compressibility of the peat, shallow foundations are not recommended. The most suitable foundation for the proposed buildings on this site is considered to be screw piles. These piles displace the soil penetrated and therefore produce no spoil for disposal. At surface, the pile heads are connected to pre-formed frames which support a suspended floor and the building superstructure.

A preliminary estimate of the working load of a pile 12m long with a 500mm diameter helical base is 150kN.

Excavations

Excavations for services may be stable with vertical sides for short periods. However, if personnel are required to enter excavations for any reason, the sides of the excavations must be supported. In view of the reduction in soil strength with depth, the depths of services should be kept to a minimum, with the objective of staying within the slightly firmer crust that extends to around 1m below ground. Drains should have flexible connections because of the very high compressibility of the ground.

Paved areas

It is recommended that permeable paving should be used, to limit any tendency for the subgrade to become wetter and softer over time. Based on the plasticity data, a design subgrade CBR of 2% may be used in design. However, great care will be needed during construction to prevent softening of the subgrade surface.

It would be prudent to include a reinforcing geogrid in the working platform for the site.

Buried concrete

Water samples were taken from each of the installations. All were tested for sulphate content and one for pH value. The pH value was 7.7 and the sulphate contents were 49mg/l^a (from the piezometer in BH01), 383mg/l (from the standpipe in BH01), 816mg/l (WS02) and 596mg/l (WS03). The pH values measured in six soil samples ranged from 7.5 to 8.3. Two water soluble sulphate concentrations on soil samples were 18mg/l and <10mg/l. Total sulphate concentrations in soil samples were also low. Based on the water samples, according to BRE Special Digest 1³, these results lie within Design Sulphate Class DS-2 and have an Aggressive Chemical Environment for Concrete class of AC-2. Table D1 of the Digest gives the Design Chemical Class as DC-2. Guidance on concrete mixes is provided in Table D-2 of the Digest.

^a This reading may have been affected (probably reduced) by the addition of water to the borehole during drilling.

We trust that the advice in this letter is sufficiently comprehensive for your current needs but, should you have any queries, please do not hesitate to contact us.

Yours faithfully

For Applied Geotechnical Engineering



Neil Smith
Senior Consultant

References

1. Wallis, S. (2019) Land adjoining Millside, Rhee Wall Road, Brenzett, Kent. An Archaeological Evaluation. Thames Valley Archaeological Services.
2. Hobbs, N. B. (1986) Mire morphology and the properties and behaviour of some British and foreign peats. Quarterly Journal of Engineering Geology Vol 19, pp7-80.
3. BRE Special Digest 1:2005 Concrete in aggressive ground. BRE Construction Division.

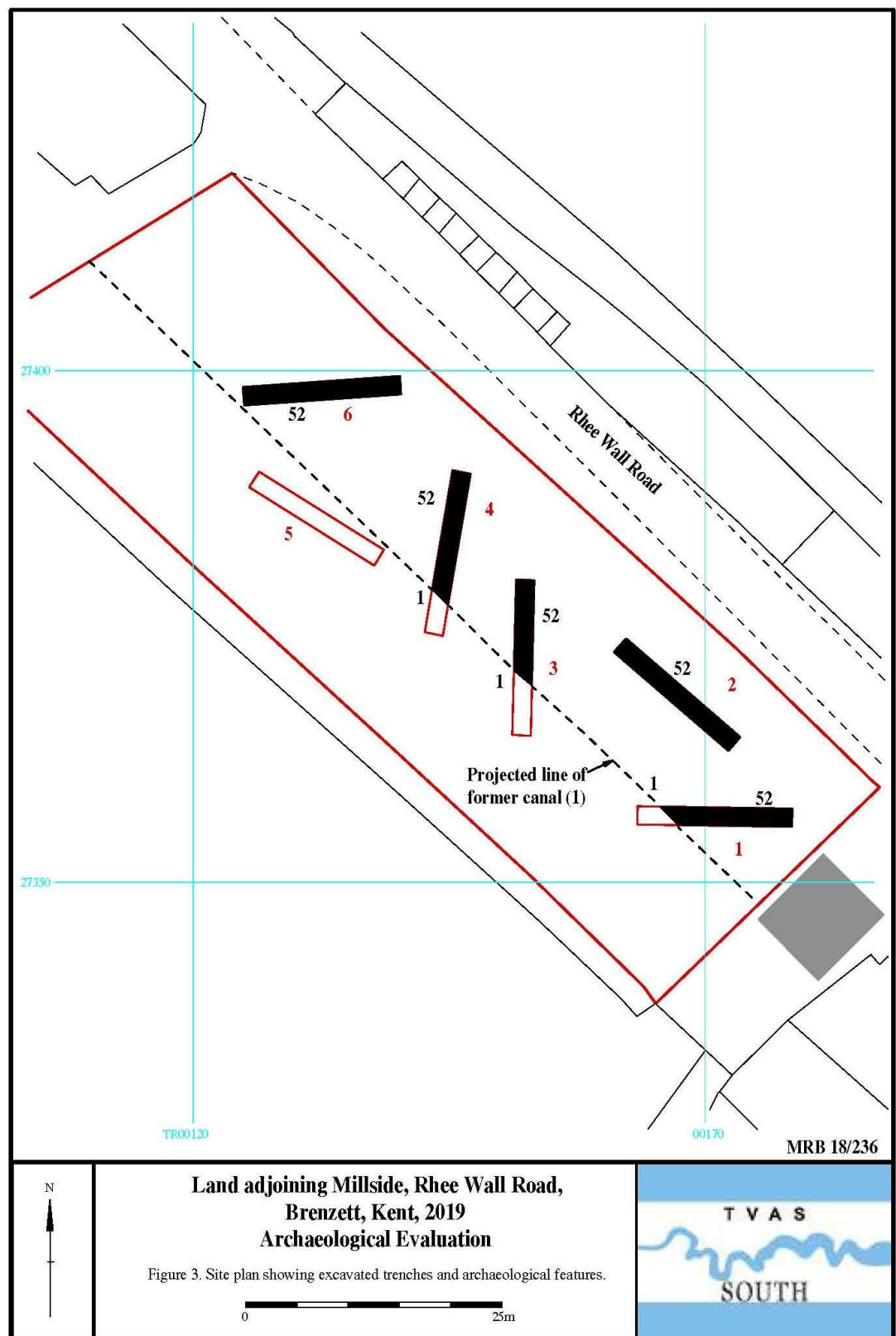


Figure 1. Plan from archaeological evaluation showing approximate extent of canal

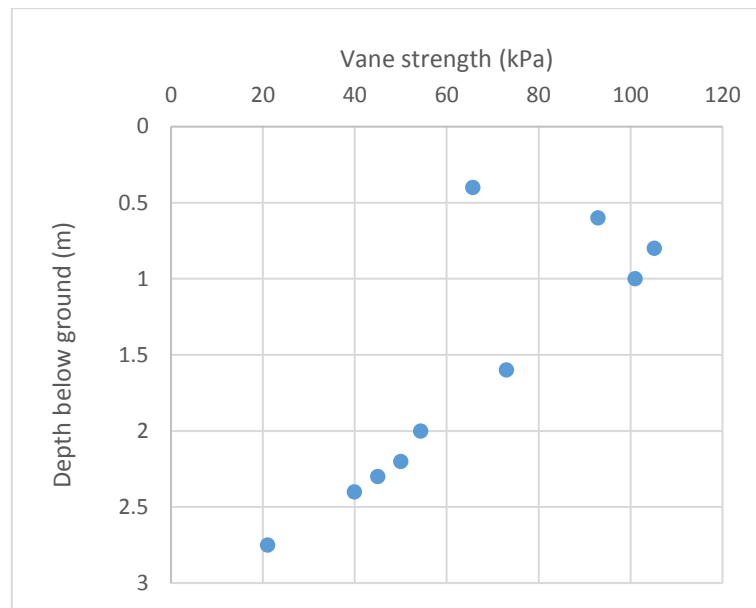


Figure 2. Hand held vane strength vs Depth from the trial trenches

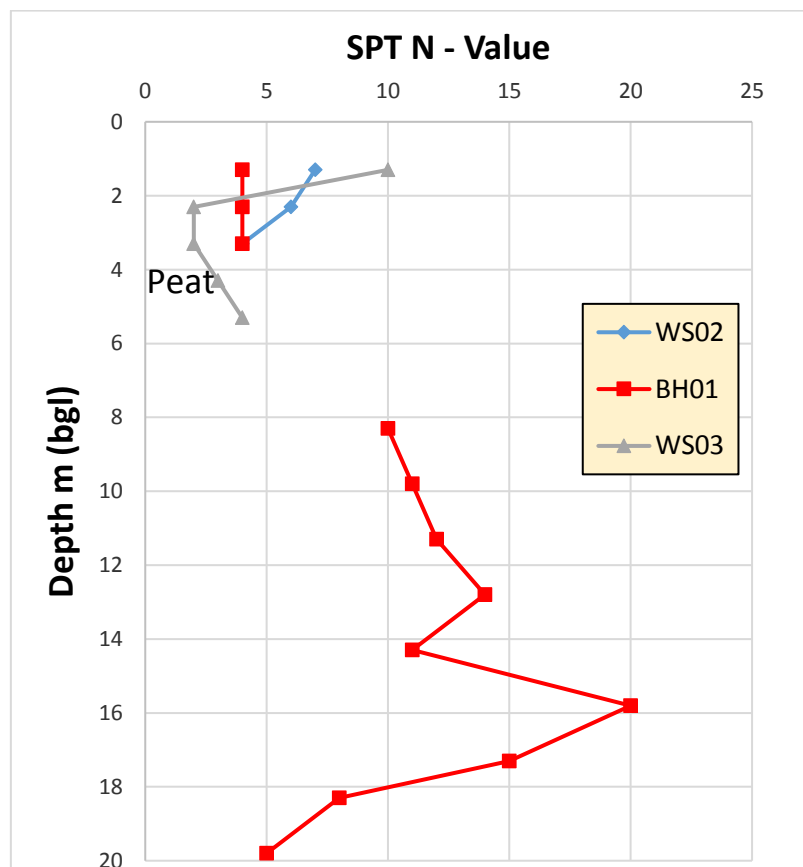


Figure 3, Standard Penetration Test N value vs Depth

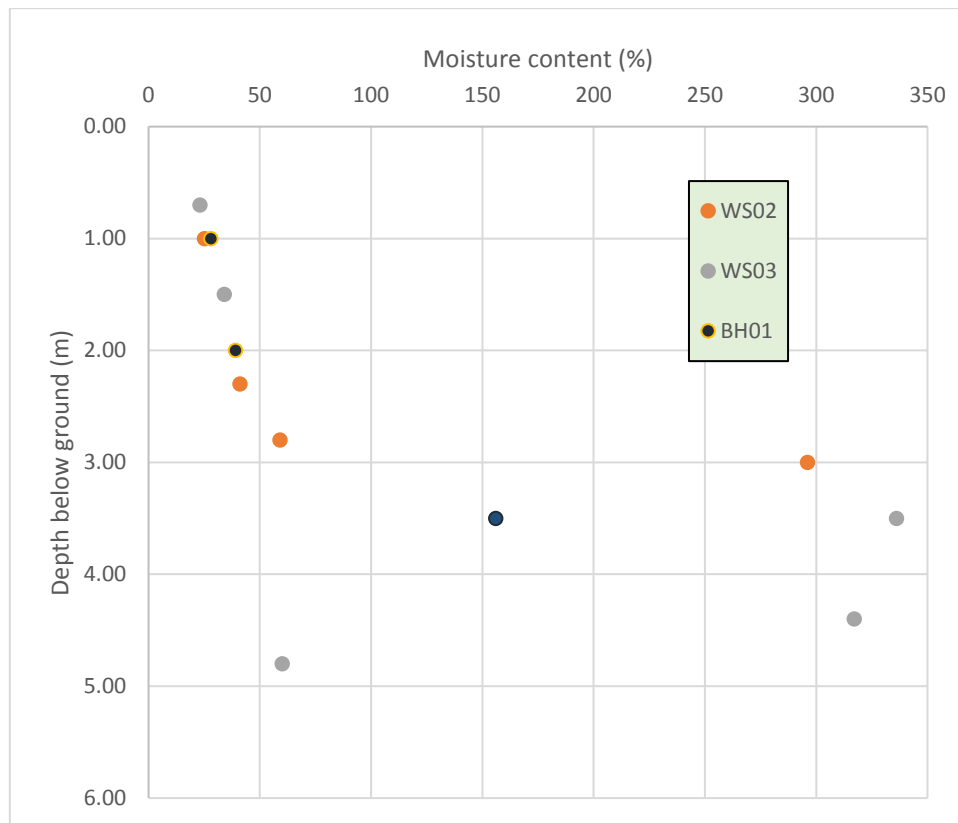


Figure 4. Moisture content vs Depth