



Geo-Environmental

SUPPLEMENTARY GROUND INVESTIGATION REPORT

for the site at

READING GOLF CLUB,

KIDMORE END ROAD,

READING, RG4 8SQ

on behalf of

VISTRY THAMES VALLEY



Report:	SUPPLEMENTARY GROUND INVESTIGATION REPORT
Site:	READING GOLF CLUB, KIDMORE END ROAD, READING, RG4 8SQ
Client:	VISTRY THAMES VALLEY
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EXECUTIVE SUMMARY		
Site Details	Site Address	Reading Golf Club, Kidmore End Road, Reading, RG4 8SQ
	National Grid Reference	471657, 176771
	Site Area	Total site c. 12ha, area covered in this report c. 7ha
	Form of Development	Proposed to be developed for a residential end use with private gardens, areas of soft landscaping, car parks, access roads, storm water attenuation basins and associated infrastructure.
Encountered Conditions	Scope of works	A supplementary investigation incorporating remote sensing and intrusive ground investigation to clarify and update geotechnical assessments in relation to potential solution feature geohazards, drainage and foundation strategies for the proposed development
	Ground Conditions	The ground conditions encountered comprised Topsoil or Made Ground overlying sand, gravel and clay soils of the Black Park Gravel Member, clayey soils of Lambeth Group and Chalk of the Seaford Chalk Formation. The ground conditions varied within exploratory holes across the site, with Chalk only encountered in some exploratory holes. The depth to, and level of, the upper surface of the Chalk was variable. In addition, strata characteristic of Lambeth Group, were not always encountered between the Black Park Gravel Member and the Chalk, where Chalk was proven in exploratory holes.
	Groundwater	Water was encountered in BH01, TP307, TP309 and TP312 at depths of 3.6m bgl, 2.40m bgl, 1.57m bgl and 1.40m bgl, respectively. In each case, the water ingress appeared to be associated with more granular strata overlying clay or structureless Chalk and given the limited to sporadic presence, it was considered likely to be discontinuous perched water and not indicative of a single site wide groundwater body.
Geotechnical Considerations	Foundations	A net allowable bearing capacity of 90kPa is recommended to account for the presence of firm clay at varying depths in some exploratory holes. Total settlement should remain within tolerable limits for this bearing capacity assuming that foundations terminate in a uniform soil type. Geotechnical laboratory testing has shown the more clayey soils of the Black Park Gravel Member and the Lambeth Group to be of high volume change potential. As such, a minimum founding depth of 1.0m bgl is recommended for conventional foundations on this site remote from trees. Heave precautions may be required for foundations in excess of 1.5m deep. Foundation design should take account of lower strength soils at depth in some of the exploratory holes and this may result in shallow foundations being unsuitable due to overstressing or settlement issues. Foundations spanning multiple soil types should be avoided and the foundation deepened to terminate on a single soil type where possible. It is understood that an existing Thames Water sewer crosses beneath part of the northern limb (Zone 2) of the site at c. 1.7m bgl. No foundations are likely to be permitted over or within a set easement of this asset. For the purposes of foundation assessment, the site was divided into two zones, with Zone 1 located on the south-eastern limb of the site and Zone 2 located on the north-western limb of the site (see Figure 3).



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	Foundations (continued)	<i>Zone 1</i> Based on the ground and groundwater conditions encountered within the exploratory holes in Zone 1, it is considered that conventional foundations could be suitable albeit with some deepening of foundations within the zone of influence of trees and hedgerows. Foundations should be taken below any Made Ground or disturbed ground, root zones, desiccated clay soils or the like and terminate wholly within the Black Park Gravel Member, or the Lambeth Group. <i>Zone 2</i> On the basis of the ground and groundwater conditions encountered in the exploratory holes within Zone 2, it is considered that conventional shallow foundations may be suitable within some areas on the northern portion of Zone 2, albeit with inclusion of sufficient reinforcement to be capable of spanning a void of c. 2-3m diameter in plan, should it form in due course. Conventional foundations as per Zone 1 may be suitable in the south-westernmost portion of Zone 2 (in the vicinity of trial pits TP309-312). Whilst it may be possible to consider the use of conventional foundations in the Medium and High risk areas of Zone 2, this would be anticipated to require plot specific probing at c. 2-5m linear intervals along foundation lines, inclusion of sufficient reinforcement to be capable of spanning a 2-3m void and construction phase inspection. It would also remain possible ultimately that, a piled foundation solution could be required for some or all of the plots in these areas. As such, it is recommended that a piled foundation solution is adopted for the Medium and High risk areas and plots in the vicinity of DP326. Further intrusive investigation will be required in due course to support the design of piled foundations.
	Floor Slabs	Given the presence of shrinkable soils, it is recommended that suspended floor slabs are constructed throughout the site. Preliminary modelling indicates a minimum void height of 300mm due to the presence of high volume change potential soils.
	Excavations	Shallow excavations within the Topsoil, and clay soils of the Black Park Gravel Member and the Lambeth Group are likely to be stable in the short to medium term assuming the excavations remain dry. Excavations within the more sandy and gravelly Black Park Gravel Member are unlikely to be stable in the short term and some collapse was observed within trial pits during the intrusive investigation. Excavations taken below any water ingress are likely to collapse and will require shoring and dewatering to maintain stability.
	Buried Concrete	Buried concrete should be designed to Class DS-1 (AC-1s).
	Buried Services	Zone 2 has been identified as extending across areas of High and Medium risk for the presence of solution features and also known features have been identified on or close to the north-western portion of Zone 2. Whilst further geophysical surveys have not clearly identified the presence of solution features in this portion of the site, it is recommended that simple butt jointed services are not used in this portion of the site due to the potential for leakages to occur at connections. A flexible pipework and connection should be included. If water was to leak from mains supply, storm or foul water systems the leak could induce reactivation of any dormant solution features, creation of new dissolution features or saturate the overlying soils any of which could result in catastrophic collapse of the ground.

**EXECUTIVE SUMMARY****Storm water drainage**

On the basis of the results of soakage testing, it is considered that the rate of infiltration is unlikely to be sufficient for conventional soakaways to function satisfactorily and thus storage and attenuation is likely to be required.

The drainage strategy will need to minimise the risk of any infiltration solution exacerbating the status of existing solution features, causing dormant features to become active, or creation of new dissolution features. No infiltration device (basin/pond, swale, soakaway or the like) should be located within 20m of any structure due to the potential for infiltrating water to induce instability and ground collapse. In addition, wherever possible, drainage runs should be diverted away from any such feature.

Currently infiltration basins are shown in the medium and high risk solution feature zone as well as in the vicinity of the known solution feature on site and these would not be acceptable unless measures were included to prevent infiltration, e.g. inclusion of a permanent liner and discharge elsewhere.

It is understood that the existing Thames Water sewer which crosses the site is located beneath or close to one of the proposed storm water basins (based on the layout prepared for Fairfax). Consultation with Thames Water is recommended at the earliest opportunity to determine whether this is acceptable and what mitigation measures could be required.

An alternative development layout has been generated by the Client and includes a central basin and swales to store and transfer storm water, with a second basin located in the north-eastern corner of Zone 2. These basins were located outside of the Medium and High risk areas. Infiltration testing for the central basin was unsuccessful, suggesting that infiltration to the ground in this area might not be feasible and thus the basin would act as a shallow 'detention, storage and peak flow attenuation' device. Testing in the vicinity of the north-eastern basin indicated that storm water infiltration could be feasible. Deeper testing in cable percussion boreholes in both basin locations indicated the possibility of discharging storm water to the ground at depth, albeit subject to relevant regulatory consultation and approval. Discharge of storm water into the Chalk via borehole soakaways is likely to require a multiphase filtering and sediment capture process even if regulatory approval is granted.

Earthworks

Site won soils (clay, sand and gravel) and Chalk may be suitable for re-use as earthworks fill subject to testing in due course and may require treatment to bring them within acceptability limits for placement and compaction.

Further Action:

- Further ground investigation will be required on both Zone 1 and Zone 2. In Zone 1, it is likely to comprise investigation to inform design to account for tree influence on clay soils and the like. In Zone 2, the further investigation is likely to comprise some pitting/trenching through anomalies, albeit that this level of investigation might result in a need to pile due to causing significant ground disturbance, plot specific probing and provide information for pile design. If abnormal conditions are encountered, Geotechnical/Geo-Environmental advice should be sought to determine a suitable source of action.
- Further investigation and infiltration testing may be required to inform the design of any SUDS elements such as revised locations of basins, attenuation crates, permeable paving or the like.
- If earthworks are proposed then further testing would be required to inform an earthworks specification, with compliance testing undertaken during any such earthworks construction. In addition, an Earthworks Specification should be prepared which correlates with the earthworks strategy and

**EXECUTIVE SUMMARY**

construction strategy.

- A discovery strategy must be maintained during development such that any abnormal conditions (geotechnical or potential contamination) are identified and their potential impact on the proposed development assessed prior to determining any potential mitigation measures.

This Executive Summary is intended to provide a brief summary of the main findings and conclusions of the investigation. For detailed information, the reader is referred to the main report ref. GE20079-SGIR-OCT21.



1.0 INTRODUCTION

Geo-Environmental Services Limited, "Geo-Environmental", was instructed by Vistry Thames Valley, "the Client", to undertake a supplementary investigation of the geotechnical factors pertaining to Reading Golf Club, Kidmore End Road, Reading, RG4 8SQ, herein referred to as 'the site' (National Grid Reference at centre: 471120, 176760). The site's location is presented in Figure 1.

1.1 Form of Development

It is understood that the site is proposed to be developed for a residential usage comprising houses, private gardens, access roads and associated infrastructure. In addition, it is likely that public areas of soft landscaping would be proposed.

At the time of writing, a provisional development layout has been formulated and issued to Geo-Environmental. However, it is considered possible that this layout might change, or be refined in due course due to development constraints, planning/design requirements and to account for ground conditions and ground hazards.

1.2 Objectives

The data from the remote sensing and intrusive investigation was to form the basis of an interpretation with respect to foundation and drainage strategies for the proposed development. This assessment relates to the western portion of the wider development site.

1.3 Standards and References

Where practicable, the investigation was undertaken in accordance with the following documents and guidance:

- BS10175:2011+A2:2017 - Investigation of Potentially Contaminated Sites - Code of Practice, BSI 2017;
- BS5930:2015+A1:2020 - Code of Practice for Site Investigations, BSI 2020;
- EN ISO 14688 Geotechnical Investigation and Testing Part 1-2002 and Part 2-2004;
- BS1377: 1990 - Soils for Civil Engineering Purposes, BSI1990;
- NHBC Standards Chapter 4.1 Land Quality - Managing Ground Conditions;
- NHBC Standards Chapter 4.2 Building Near Trees;
- CIRIA C574 - Engineering in Chalk.

In addition to the above, the scope of investigation was discussed with representatives of the NHBC's Engineering Division to agree a strategy which would serve to provide a pragmatic approach to the ground investigation and address possible NHBC concerns at an early stage.

1.4 Conditions

This report does not purport to be a "Geotechnical Design Report" as defined in Clause 2.8 of Eurocode 7 (Geotechnical Design BS EN 1997-1:2004) and some of the data used to support this preliminary geotechnical assessment may not be fully compliant with that design code. It is considered possible that further detailed ground investigations could be required to facilitate the detailed geotechnical design process and should be carried out on a structure specific basis if necessary.

The data collected from the investigations have been used to provide an interpretation of the geotechnical and/or environmental conditions pertaining to the site. The recommendations and opinions expressed in this report are based on the data obtained. Geo-Environmental takes no responsibility for conditions that either have not been



revealed in the available records, or that occur between or under points of physical investigation. Whilst every effort has been made to interpret the conditions, such information is only indicative and liability cannot be accepted for its accuracy.

It should be noted that the engineering performance of the ground can change over time due to factors such as changes in soil moisture content, disturbance, reworking and the like. The assessment presented herein is based on the conditions as observed and/or measured at the time of the investigation. No liability can be accepted for changes in engineering performance of the ground due to factors outside of Geo-Environmental's control.

Information contained in this report is intended for the use of the Client and Geo-Environmental can take no responsibility for the use of this information by any party for uses other than that described in this report. Geo-Environmental makes no warranty or representation whatsoever express or implied with respect to the use of this information by any third party. Geo-Environmental does not indemnify the Client or any third parties against any dispute or claim arising from any finding or other result of this investigation report or any consequential losses.

This report remains the property of Geo-Environmental and the Client has no rights to, or reliance upon this document or supporting documents until such time as payment has been received in full for all invoices for works undertaken in connection with this report.



2.0 SITE CONTEXT

2.1 Site Description

At the time of the intrusive investigation, July 2021, the site comprised an approximately 'L' shaped parcel of land which had formerly been used as a golf course and included a clubhouse, tarmac surfaced car park and several holes (comprising tee-off, fairway, rough, bunkers and greens). The ground surface was variable with flat and undulating ground surfaces and a number of depressions and mounded surface features, some of which may be attributed to golf course landscaping, but also some features understood to be associated with natural topography and sub-surface features, including possible solution features.

A number of mature to semi mature trees were located across the site and along the site boundaries. Tracts and stands of trees were also present separating the holes and fairways on the golf course.

The site was accessed by an open driveway off Kidmore End Road, east of the site. The former golf course was accessed by a service track running along the north-eastern site boundary.

The site was bounded by residential land use to the east, south and west. Housing was also located to the north and east, i.e. beyond the inner quadrant to the 'L' shape. The golf course continued to the north of the western limb of the subject site. The site boundaries to adjacent land (excluding the continuation of the golf course) comprised wooden fences, wire fences, trees and hedges.

2.2 Anticipated Geology

With reference to British Geological Survey (BGS) mapping, the geology of the site was anticipated to comprise a succession of Black Park Gravel (generally anticipated to comprise sand and gravel with possible sub-ordinate clay content), Lambeth Group (interbedded sand and clay) and Seaford Chalk Formation. In addition, given the developed nature of the site it was considered likely that a thickness of Made Ground could be present at locations within the site.

BS5930:2015 defines **Made Ground** as anthropogenic ground in which the material has been placed without engineering control and/or manufactured by man in some way, such as through crushing or washing, or arising from an industrial process. Great variations in material type, thickness and degree of compaction invariably occur and there can be deleterious or harmful matter, as well as potentially methanogenic organic material. In addition, on sites which have undergone several phases of historic development it is not uncommon for asbestos to be present within Made Ground soils.

The **Black Park Gravel** is part of the **Thames Valley Formation** and generally comprises sand and gravel, with possible lenses of silt, clay or peat. The deposits are characterised as horizontally stratified, matrix-supported gravel with thin tabular cross-bedded sand channels.

The **Lambeth Group** comprises a mixture of stiff to hard red, blue/grey and brown mottled clays with basal beds of sand and gravel which vary greatly both laterally and vertically. Locally, these sediments are cemented with calcium carbonate, iron oxides and silica to form materials with relatively high strength. The Lambeth Group sits unconformably over the Chalk, i.e. the junction comprises a geological weathering/erosion boundary and the Lambeth Group soils close to the boundary are often green due to the presence of the mineral glauconite.

The **Seaford Chalk Formation** is part of the **White Chalk Subgroup** and comprises white chalk with conspicuous semi-continuous nodular and tabular flint seams. Hardgrounds and thin marls are known from the lowest beds. Some flint nodules are large to very large.

Geological hazards were identified on the wider golf course and comprised 4No. sinkholes and 43No. solution pipes. In addition, a further 33No. natural cavities were identified within 1km of the site. Whilst the hazard mapping did not indicate any of the solution features (sinkholes and solution pipes) to be within the extent of the proposed



development site, several were located close to the east, north and west, and hazard mapping also indicated a higher risk zone for solution features where the Black Park Gravel and/or Lambeth Group was anticipated, by the BGS, to thin out over the Chalk, such that a higher risk zone crossed the north-western portion of the site, see Section 2.3 for further information.

2.3 Third Party Information

The following documents have been provided for review and to assist in formulating a scope of works for a preliminary investigation. It should be noted that further investigation is likely to be required to support design in due course.

- Phase 1 Contamination Risk Assessment, prepared by Ground and Environmental Services Limited, ref. 12112 dated February 2019.
- Geophysical Survey Report, prepared by Magnitude Surveys, ref. MSSU661 dated May 2020.
- Flood Risk Assessment and Sustainable Drainage Systems (SuDS) Strategy, prepared by Stantec, ref 67058R1Rev1 dated 02/06/2020.
- Indicative Site Layout, prepared by Paul Hewitt, ref. 2036/PL.04 Rev. N dated July 2020.

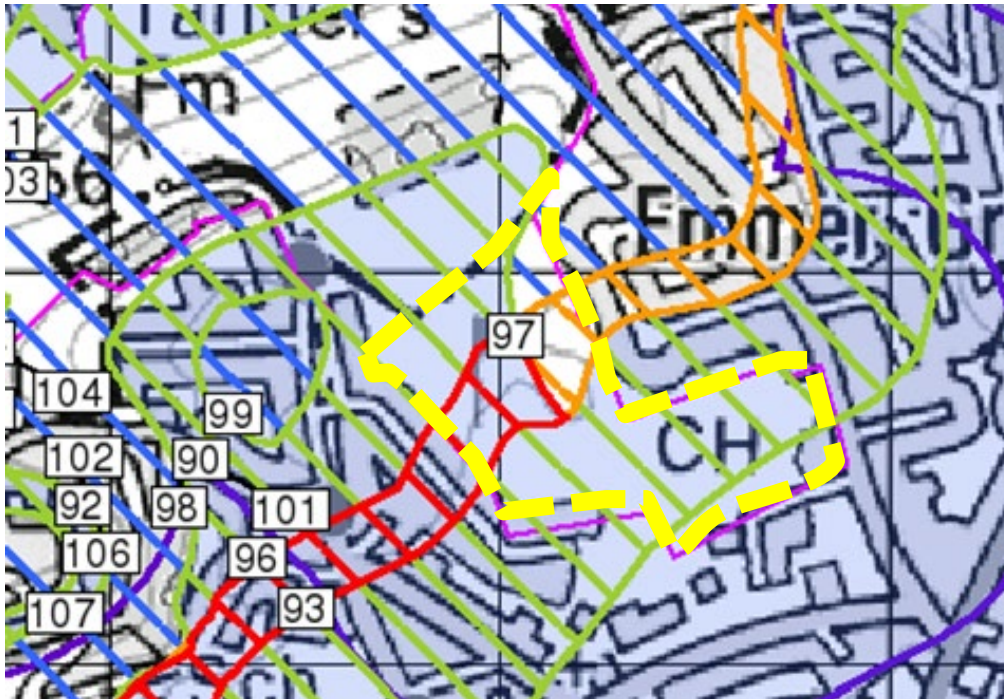
All of these documents were prepared for Fairfax Properties, the landowner, and thus it is assumed that Vistry Thames Valley would have formal reliance on these documents in due course. The factual correctness of third party information is assumed and no liability is accepted for errors or omissions in such information, or subsequent errors where assessment is based on this third party information.

Comments are presented in relation to these documents and where relevant, the Geophysical survey and Indicative Site Layout have been referred to under the review of the Phase 1 Contamination assessment and/or the Flood Risk Assessment.

Phase 1 Contamination Risk Assessment

This report identified the ground conditions underlying to site to comprise a mixture of Black Park Gravel (generally anticipated to comprise sand and gravel with possible sub-ordinate clay content) and Lambeth Group (interbedded sand and clay) and Seaford Chalk.

Geological hazards were identified on the wider golf course and comprised 4No. sinkholes and 43No. solution pipes. In addition, a further 33No. natural cavities were identified within 1km of the site. Whilst the hazard mapping did not indicate any of the solution features (sinkholes and solution pipes) to be within the extent of the proposed development site, several were located close to the east, north and west, and hazard mapping also indicated a higher risk zone for solution features where the Black Park Gravel and/or Lambeth Group thinned out over the Chalk, such that a higher risk zone crossed the north-western portion of the site.



Extract from Phase 1 Report showing ground stability risk associated with chalk dissolution (red hatching is high risk, orange- medium risk, green – low risk; yellow line is approximate site boundary)

The geophysical survey, whilst principally undertaken for archaeological purposes, also identified numerous anomalies within the site. Many of these were recorded as ‘ferrous spikes’ and thus may be metal fragments in the soil mass, but some anomalies could represent natural hazards and this should be considered further.

The assessment identified a risk of solution features being present beneath the site and set out proposals for an initial investigation to assess ground conditions further. In addition, the assessment recommended incorporation of reinforcement in conventional foundations (assuming they are a suitable option), and siting soakaways at a minimum offset of 20m from any structure. This latter point should be extended to attenuation basins which are designed to drain to the ground and thus have a similar potential to induce collapse of existing sub-surface features and potentially initiate new features. The Indicative Site Layout shows attenuation basins close to or straddling the high-risk solution feature zone (see extract map above).

The report identified potential contamination sources including the grounds keepers’ sheds/yard (not within the development site), a former chalk quarry (not within the development site), landfill which included deposition of domestic and trade wastes (off-site) and Made Ground (considered as a ground gas source but also a possible source of soil contamination). Whilst most of these potential sources were outside of the proposed development site, it is possible that they might impact the development site, e.g. gas from the off-site landfill, and thus should be considered as part of any investigation and further assessment. In addition to these sources, tarmac and hardstanding areas may be underlain by Made Ground soils and/or aggregates which have the potential to be contaminated by Asbestos.

Flood Risk Assessment (FRA)

The FRA sets out an initial drainage strategy whereby storm water is proposed to be discharged to the ground via a series of attenuation basins. Infiltration rates were estimated from small scale testing in boreholes, or based on reference to published values. Further testing in accordance with BRE DG365 will be required.

As noted above, the current drainage strategy and development layout show attenuation basins close to, or straddling zones where there is a high risk of solution features and associated ground stability hazards, as well as siting basins adjacent to or close to housing. A minimum offset of 20m should be used when refining the



development layout and the basin areas will need to be investigated to assess the potential for and actual presence and condition of solution features and implications this may have for infiltration.

2.4 Previous Investigations

Geo-Environmental has undertaken two phases of ground investigation prior to the July 2021 reported herein, where relevant, the findings of the previous investigations have been incorporated into this report. The two previous investigations were reported under the following three references:

- GE19428-GIR-DEC20 - A ground investigation report presenting the findings of a preliminary investigation comprising trial pitting (8No.), trial pit soakage testing (4No.), dynamic sampler boreholes (14No.), super heavy dynamic probing (10No.), monitoring well installation (5No.), laboratory testing and gas/groundwater monitoring (6No. from early November 2020 to late January 2021). The findings of the intrusive investigation and geotechnical test results from the 2020 investigation are incorporated into this report.
- GE19873-RG01-210428 – A letter report presenting the findings of investigation and testing to inform the emerging drainage and road design strategies. Whilst the investigation included the excavation of 31No. trial pits, these were primarily excavated to shallow depth for infiltration testing, sampling or plate load testing. The maximum depth of excavation was 1.8m bgl and all pits terminated in superficial strata. Soakage testing outcomes were variable, with infiltration rates generally in the range 10^{-5} to 10^{-7} m/s where infiltration occurred. Testing indicated that shallow infiltration might be possible, albeit with more favourable outcomes in some areas of the site. Winter groundwater monitoring results were presented in the report and showed the presence of water at relatively shallow depth in some of the monitoring wells. Whilst it is possible that this comprised perched water rather than a continuous groundwater body, the presence of water at relatively shallow depth could impair to effective operation of shallow infiltration systems. In-situ CBR values of 4.5-13% were reported from the Plate Load Tests and recommendations were presented for consideration of including geogrid reinforcement in road construction in areas of heightened risk of ground dissolution.
- GE19873-GR02-210507 - A letter report presenting updated findings in relation to soil contamination assessment of near surface soils in the car park at the eastern end of the site.

These reports should be referred to for greater detail.



3.0 REMOTE SENSING

3.1 Aerial Survey

An aerial survey was commissioned as part of the agreed scope of works and comprised a drone based survey incorporating aerial photogrammetry and LIDAR techniques to create site specific aerial imagery and a point cloud dataset. The survey focussed on the western limb of the site, i.e. where the potential for presence of solution features was identified from previous studies of the site.

The results of the drone surveys are incorporated into Figures 3-7 presented within this report. It should be noted that for presentation purposes, vertical scaling may be exaggerated to show variation in ground surface levels across the site on 3D schematics.

3.2 Geophysical Survey

In addition to the drone survey, a supplementary geophysical survey was commissioned from Magnitude Surveys as part of the agreed scope of works. The key objective of the geophysical survey was to assess the potential for the presence of potential geohazards, i.e. solution features, in the shallow subsurface strata, i.e. c. upper 6m of ground. The survey utilised an Electromagnetic (EM) survey method deployed across the accessible areas of the western limb followed by a Ground Penetrating Radar (GPR) survey targeted to areas where anomalies were identified from the EM survey. Magnitude Surveys also utilised the findings from their previous, archaeological focussed, geophysical surveys where relevant to this exercise. The findings of the geohazard geophysical survey are presented in Magnitude Survey's report, ref. MSSU986v1.0 FINAL dated 29th September 2021 and a copy of the report is presented in Appendix A herein.

Interpretation, by Magnitude Surveys, of the geophysical survey results identified several anomalies across the survey area and whilst the majority of these were considered to represent landscaping works associated with the site's former use as a golf course, buried services and the like, some anomalies were identified as possible dissolution features as discussed in Section 6 of the Magnitude report and summarised below:

- SU 71430 76905 – the feature is reported as c. 20m wide at 0.67m bgl and reduces in diameter to c. 6m at 1.07m bgl. A sloping, likely natural, profile was identified and was considered probably to comprise a shallow depression with natural infill. Further investigation of this area was recommended.
- SU 71565 76898 & SU71542 76928 – anomalies larger than others 'discussed as natural background' were detected at c.0.95m bgl and 1.56m bgl. Both exhibit bowl shaped profiles in the survey plots. They are reported not to exhibit morphology typical of large dissolution features, but their size was considered to indicate 'a larger variation in the bedrock or overlying deposits than others identified'. Further investigation was recommended.

The locations of these specific anomalies are transposed on Figure 7 presented herein. The Magnitude Surveys report should be referred to directly for further information.



4.0 INTRUSIVE INVESTIGATION

The intrusive investigation works were undertaken shortly after completion of the remote sensing surveys and where possible incorporated initial feedback for targeting of areas.

4.1 Scope of Works

The investigation strategy comprised construction of exploratory holes across the site to assess ground and groundwater conditions and to support the geotechnical assessment. The investigation included:

- Undertake a basic photographic drone survey to identify and record key visible features.
- Undertake specialist drone survey including high resolution photogrammetry and LiDAR techniques to develop a detailed surface terrain model of the site.
- Attendance of a specialist Geophysical Surveyor to undertake surface geophysical surveys comprising Electromagnetic (EM) surveying of the western portion of the site with a second phase of Ground Penetrating Radar (GPR) used to survey any anomalies identified from the EM survey. Provision, by the Specialist, of geophysical assessment report in relation to potential solution features.
- The construction of c. 10No. machine dug trial pits to provisional depths of 3m bgl. Approximately 6No. pits were to be located in the basin area and 4No. on the swale footprint. The aim of the pitting was to determine the presence of and depth to Chalk or other potentially permeable strata and undertake soakage testing in these strata.
- Construction of 2No. cable percussion boreholes to a provisional depth of 15m bgl together with in-situ testing and sampling at regular intervals. One borehole was to be located within the basin and the other in the swale location.
- Undertake infiltration tests within the cable percussion boreholes on completion of drilling.
- Super heavy dynamic probing at 16No. locations across the basin and swale footprints to inform the geotechnical assessment.
- Super heavy dynamic probing at c. 30No. locations in areas where solution feature anomalies were anticipated from initial geophysical survey feedback and targeting higher occurrence risk zones (from published mapping).
- Installation of a groundwater monitoring well within each cable percussion borehole to facilitate monitoring if required in due course. Winter monitoring may be required to support and inform the drainage strategy.
- Provision of a Ground Investigation Report.

4.2 Investigation Strategy

Table 4.1 sets out the investigation strategy adopted.

Area of Concern	Investigation	Positions
General ground conditions	Exploratory holes located across the site.	All
Northern basin	Trial pitting, soakage testing, cable percussion borehole, dynamic sampler borehole and super heavy dynamic probing.	WS01*, SHDP1*, TP201-TP206, TP301, BH01, DP01-DP06
Central swale	Trial pitting, soakage testing, cable percussion borehole and super heavy dynamic probing	TP07*, TP102*, TP207-TP210, TP308, BH02, DP07-DP15
Geophysical anomaly in Area 1	Trial pitting and super heavy dynamic probing in the vicinity of the anomaly. ⁺	TP322, TP320, DP317, DP321-DP323
Geophysical anomaly in Area 3	Trial pitting and super heavy dynamic probing in the vicinity of the anomaly. ⁺	TP03*, TP303, DP301
Geophysical anomaly in Area 4	Trial pitting and super heavy dynamic probing in the vicinity of the anomaly. ⁺	WS05*, TP305-TP306, DP303-DP306



Area of Concern	Investigation	Positions
Vicinity of solution feature close to the northern site boundary	Super heavy dynamic probing	DP320
Potential risk of solution features	Exploratory holes located to target the north-western limb of site, including area of higher hazard rating identified from the desk study and possible anomalies identified from geophysical surveys.	TP01 – TP07*, WS01 – WS10*, WS14*, SHDP01 – SHDP10*, DP1-DP15, DP301-DP330, BH01, BH02, TP201-TP210, TP301-TP324

NOTE: * none of the positions targeted the specific grid references in the Magnitude Survey's report as these were confirmed after the planned intrusive investigation had been completed; * exploratory holes from the previous phase of investigation.

Table 4.1 Summary of the investigation strategy



5.0 ENCOUNTERED CONDITIONS

A factual record of the conditions encountered during the physical investigation of the site is presented in the following sections. For further details of the ground conditions, reference should be made to the exploratory hole logs and in-situ testing presented in Appendix B and soakage test results in Appendix C.

The physical ground investigation works were undertaken in July 2021. Exploratory hole locations are shown on Figure 2, site zones on Figure 3, a two dimensional terrain model in Figure 4, a three dimensional terrain model (exaggerated vertical scale for illustrative purposes) in Figure 5 and an illustrative chalk contour plan in Figure 6.

Unless stated otherwise, all depths are reported as metres below ground level (m bgl).

5.1 Soils

The ground conditions encountered within the exploratory holes were broadly consistent with those anticipated, i.e. a succession of Topsoil or Made Ground, over sand, gravel and clay of Black Park Gravel Member, clay and sand strata of the Lambeth Group and Chalk encountered at depth in a number of exploratory holes. A generalised summary of the encountered conditions is presented in Table 5.1.

Top (m bgl)	Base (m bgl)	Description	Positions
0.00	0.20 – 0.50	Topsoil: Dark brown SILT with varying proportions of gravel, rootlets and roots (1-50mm); Brown fine SAND with varying proportions of gravel, rootlets and roots (1-20mm).	All except WS05, WS07, WS09, WS14, C1-C8.
0.00	0.20 – 0.40	Made Ground: Dark brown CLAY with varying proportions of brick fragments, sand, gravel and rootlets; Brown SAND/SILT with varying proportions of clay, gravel, brick, clinker, rootlets and roots; Tarmacadam and Type 1 Subbase (C1-C8), Greyish brown/yellowish brown SAND and GRAVEL with brick fragments, concrete rubble and tarmacadam fragments (C1, C7); Dark brown gravelly SILT/SAND with a mild organic malodour and brick fragments (C2, C3)	WS05, WS07, WS09, WS14 & C1-C8
0.20 – 0.40	0.90 – 5.00 (base of hole)	Black Park Gravel Member: Brown, dark brown, orangish brown and yellowish brown fine to medium SAND with varying proportions of gravel, cobbles, boulders, rootlets and roots; Orangish brown SAND and GRAVEL with varying proportions of clay, cobbles, boulders, black flecking, rootlets and roots; Soft to stiff orangish brown/pale grey and occasionally reddish brown mottled CLAY with varying proportions of sand, gravel, roots and rootlets and rotting roots and rootlets; Orangish brown/brown GRAVEL with varying proportions of clay, sand and cobbles.	All
0.40 – 2.90	2.30 (base of hole) – 5.80	Lambeth Group: Stiff to very stiff thinly bedded (WS06) bluish grey/orangish brown/yellowish brown/greenish grey/reddish brown CLAY with varying proportions of silt, sand, black flecking, sand lenses (1-2mm thick) and rotting roots and rootlets; Orangish brown and grey fine to medium SAND with varying proportions of gravel; Firm or stiff brown sandy CLAY; Stiff brown and grey mottled CLAY with reddish staining; soft to firm brown and grey mottled sandy CLAY with occasional to frequent rootlets; Firm grey and orange sandy CLAY; Firm to stiff bluish grey and brown thinly bedded CLAY; Soft to firm-stiff greenish grey and occasionally reddish brown mottled sandy gravelly CLAY; loose yellowish brown clayey fine to medium SAND.	TP04, TP05, TP07, TP08, WS04, WS06, WS07, WS14, BH02, TP207, TP210, TP302-TP309, TP311-TP316, TP319



Top (m bgl)	Base (m bgl)	Description	Positions
1.80 - 1.90	0.90 – 5.80 (base of hole)	Seaford Chalk Formation: Recovered as off white to cream weathered CHALK composed of silty gravel sized clasts with flints of fine to coarse gravel size and brown clayey sandy chalk matrix. Where encountered in trial pits, the chalk was estimated to be CIRIA Grade Dm/Dc, the method of drilling for WS03 and WS04, and in the cable percussion boreholes BH01 and BH02, could destroy any structure and thus a CIRIA grading has not been estimated at this stage.	TP05, WS03, WS04, BH01, BH02, TP201- TP204, TP206, TP31, TP303- TP307, TP315, TP320, TP323, TP324

Table 5.1 Summary of encountered ground conditions

Pocket penetrometer testing was undertaken on samples of clay soils recovered from the dynamic sampler boreholes. Zones of lower results were recorded in the sandy clay in WS01 at 2.5m bgl; around the junction between clay and wet sandy clay at 3.0m bgl in WS08; and silty clay in WS13 at 2.0-4.0m bgl. In addition, possible high result outliers were evident in the clay in WS08 at 2.5m bgl and silty clay in WS09 at 2.5-3.0m bgl.

As noted in Table 5.1, Chalk was only encountered within twenty exploratory holes, TP05, WS03 and WS04 (as part of the previous investigation) and BH01, BH02, TP201-204, TP206, TP301, TP303-307, TP315, TP320, TP323 and TP324 (as part of the July 2021 investigation). With reference to the respective exploratory hole logs, the chalk was encountered at varying elevations and this suggests a non-uniform depth to the Chalk where it was encountered. This is further supported by the fact that the Black Park Gravel Member and Lambeth Group strata were encountered elsewhere to elevations below where Chalk was encountered in these exploratory holes. Whilst Figure 6 presents an estimated contour plot for the upper surface of the Chalk, this is based on the conditions encountered within the exploratory holes referred to above and the modelling makes various assumptions to interpolate levels between these positions. As such, Figure 6 should be considered as a schematic representation and not an absolute contour profile. Extreme caution should be adopted wherever any estimate or interpolation of Chalk depth or level is attempted between exploratory hole positions and any such estimate or interpolation would require further investigation to verify/clarify conditions. It is anticipated that whilst the weathering profile for the upper surface of the Chalk is likely to be uneven, changes would be highly variable. If, or where any solution features are present, changes in depth to the Chalk are likely to be sudden and can vary from bowl shaped surfaces such as associated with suffusion to vertical or near-vertical 'plunging' surface associated with conical to cylindrical solution features and solution pipes. To date, non-intrusive and intrusive investigation have identified various anomalies, most of which were non-cylindrical and more bowl-shaped in profile.

Investigation was undertaken in the vicinity of the reported (by others) solution feature close to the north-western site boundary and recorded the presence of strata considered to be of the Black Park Gravel Member to the full depth of excavation at 2.6m bgl. Whilst the nearest dynamic probe position (DP319) indicated that presence of strata of medium dense relative density, TP321 was terminated due to instability of pit sides.

Geophysical Anomalies

The geophysical anomaly identified in 'Area 1' (refer to the geophysical survey report) being reported by the Geophysical Specialist as being c. 20m in diameter at c. 0.67m bgl reducing to c. 6m diameter at c. 1.07m bgl. The nearest exploratory hole to this location (TP320) encountered soils considered representative of the Black Park Gravel Member at this depth range, with Chalk not encountered until a depth of 2.95m bgl. As such, it is possible that this geophysical anomaly might be due to composition variations and erosion surfaces within superficial strata. It would be prudent to excavate a trench in due course through the co-ordinate position of this anomaly.

The two geophysical anomalies identified in Areas 3 and 4 were considered by the Geophysical Specialist not to be typical of large scale solution features and may be indicative of a relatively large variation in the bedrock, or overlying deposits. The strata encountered in the nearest exploratory holes comprised Black Park Gravel Member over Lambeth Group (clay and a basal sand bed) with chalk at a relatively consistent level (where encountered). The encountered conditions correlate with a thinning out (feather edge) of Lambeth Group strata, including the basal



bed of glauconitic clayey sand, over weathered Chalk. Variations in the Chalk surface profile could be associated with the erosion surface at the time the Lambeth Group strata were deposited as well as periglacial and post glacial weathering. It would be prudent to excavate a trench in due course through the co-ordinate positions of these anomalies.

The ground conditions encountered in the exploratory holes did not provide clear evidence of the presence of solution features. However, such features are known to exist in proximity to the north-western corner of the site and a High and Medium hazard rating was identified by the BGS across the north-western limb and thus the presence of solution features below or away from exploratory hole locations could not be ruled out. Geophysical surveying has identified three particular anomalies which might be associated with dissolution of the Chalk, albeit that the anomalies also appeared to reflect observed variations in composition of the Black Park Gravel Member and Lambeth Group, based on nearest exploratory hole findings. Nonetheless, the foundation strategy accounts these specific anomalies as well as the mapped geohazard zones.

It is noted that the LiDAR and photogrammetry surveys did not reveal obvious topographic features at the locations of the geophysical anomalies. Nonetheless, it is possible that landscaping undertaken as part of golf course construction and maintenance could mask naturally occurring topographic indicators.

For more detailed descriptions at specific locations, reference should be made to the exploratory hole logs presented in Appendix A.

5.2 Groundwater

Water was encountered during the intrusive investigation works within eight of the exploratory hole positions on site, details of which are presented in Table 5.2.

Location	Depth of strike (m bgl)	Strike level (m AOD)	Water rose to (m bgl)	Standing level (m AOD)	Time elapsed (min)
TP07*	2.70	79.55	2.90	-	Seepage
TP08*	2.90	79.78	3.00	-	Seepage
WS06*	3.00	77.40	3.00	77.40	20
WS13*	3.00	78.19	3.00	78.19	20
BH01*	3.60	74.24	3.40	74.44	20
TP307*	2.40	77.92	2.40	-	Seepage
TP309*	1.57	80.19	1.57	-	Seepage
TP312*	1.40	80.21	1.40	-	Seepage

NOTE: * anticipated to be perched/discontinuous water within Black Park Gravel Member or Lambeth Group

Table 5.2 Water strikes within exploratory hole positions

In addition to encountering water strikes as summarised in Table 5.2, some soil layers were recorded to have had a notable water content, i.e. visibly wet, details of which are outlined in Table 5.3. Each of these observations relate to soils inferred to comprise Black Park Gravel Member. It is noted that all of the observations listed in Table 5.3 relate to the initial phase of investigation undertaken in late October 2020 and that the observations from the more recent investigation, July 2021, might indicate some seasonal or weather dependent variations in the presence of water within the soils beneath this site.

Location	Water content	Depth range (m bgl)	Geology
TP04	'slightly wet'	0.40 – 0.90	Gravelly sandy CLAY
TP08	'wet'	1.80 – 2.90	SAND and GRAVEL
WS06	'slightly wet'	2.00 – 2.60	Medium SAND
WS08	'wet'	3.10 – 3.70	Gravelly sandy CLAY
WS12	'slightly wet'	2.60 – 4.00	Gravelly SAND
WS13	'wet'	3.60 – 4.00	Sandy CLAY

Table 5.3 Details of visible water content in encountered soils



Combined ground gas and groundwater monitoring wells were installed within WS01, WS03, WS07, WS12 and WS13 on site. These locations were chosen to provide general coverage of the site. Details of water encountered within the monitoring wells are presented in Table 5.4. A plot of groundwater depths is also presented below as Chart 1, albeit where wells were dry these are not shown on the plot.

Location	Date	GWL (m bgl)
WS01 [3.85]	06/11/20	Dry
	17/11/20	Dry
	01/12/20	Dry
	21/12/20	Dry
	04/01/21	Dry
	26/01/21	Dry
WS03 [3.70]	06/11/20	Dry
	17/11/20	Dry
	01/12/20	Dry
	21/12/20	3.70
	04/01/21	3.70
	26/01/21	3.69
WS07 [3.60]	06/11/20	1.95
	17/11/20	0.75
	01/12/20	1.65
	21/12/20	1.00
	04/01/21	1.45
	26/01/21	1.20
WS12 [3.70]	06/11/20	0.90
	17/11/20	0.75
	01/12/20	1.20
	21/12/20	0.90
	04/01/21	1.90
	26/01/21	0.60
WS13 [3.90]	06/11/20	0.70
	17/11/20	0.60
	01/12/20	2.25
	21/12/20	0.55
	04/01/21	0.85
	26/01/21	1.90

NOTE: The value in brackets is the depth to which the monitoring well was installed

Table 5.4 Summary of groundwater monitoring records

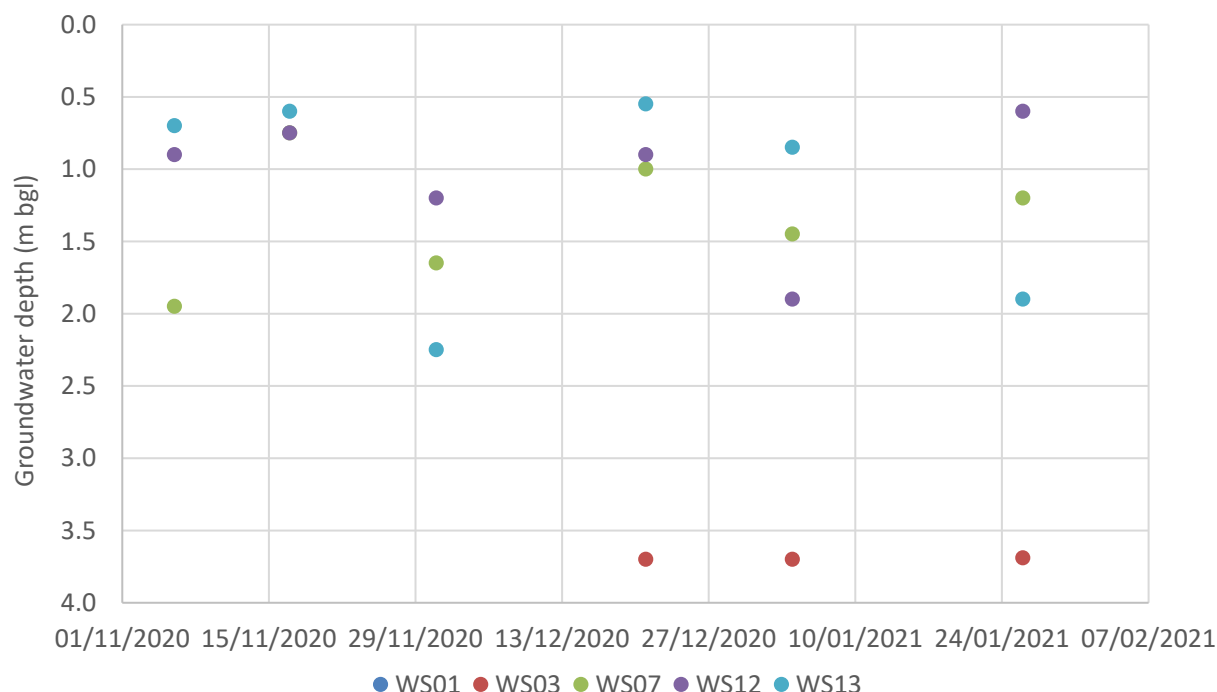


Chart 1 Plot of groundwater depths recorded in monitoring wells from November 2020 to end of January 2021

Given the varying ground conditions encountered across the exploratory holes on site, the absence of water within the majority of exploratory holes during the intrusive investigation and also within two of the five monitoring wells for at least some of the monitored period, it is considered likely that the water encountered on site is a perched or discontinuous body of water. Nonetheless the potential to encounter water during construction and possible requirement for mitigation/control measures to be required is considered likely. With reference to Table 5.3, several of the 'wet' records relate to granular soil layers which could be prone to running sand, slumping or the like if exposed in excavations.

The groundwater monitoring data indicates that, in some areas of the site, there could be limited unsaturated zone during wetter periods into which any soakaway, or similar infiltration device could drain and this could limit the operability of infiltration solutions within the site.

It should also be noted that changes in groundwater levels do occur for a number of reasons including seasonal effects and variations in drainage. Such fluctuations may only be recorded by the measurement of the groundwater level within a series of standpipes or piezometers installed with appropriate response zones.

5.3 Obstructions

With the exception of refusal on naturally occurring hard layers within the soil (likely flint gravel, dense sands or stiff clays), no natural or artificial obstructions were encountered during the intrusive investigation works undertaken. The presence of natural and/or manmade obstructions elsewhere on site cannot be discounted and any ground works could encounter hard bands or rock layers.

It is understood that a Thames Water sewer crosses beneath the site, the location (depth and alignment) of which will need to be confirmed. This will represent an obstruction for any intrusive investigation, construction or similar activities and must be accounted for, and mitigated, as part of any planning and execution of such works.

5.4 Geotechnical Testing

10No. dynamic probe (DP) tests were undertaken, as a super heavy 'SHDP' method, at depths of up to 8m bgl across the site as part of the initial phase of investigation, with a further 45No. undertaken as part of the more recent (July



2021) phase of investigation. The initial 10No. DPs were conducted in order to investigate potential 'soft', loose or voided zones which could be indicative of suspected solution features across the site, as highlighted within a previous third party report. The additional 45No. DPs were undertaken to target locations for potential infiltration/attenuation basins for storm water (15No. DPs) and to target areas at higher risk potential for chalk dissolution, target areas of geophysical anomalies and to support the description of superficial strata.

Recordings of no (zero) blows per 100mm increment were recorded in a number of locations, details of which are outlined in Table 5.5. Given the presence of water seemingly sporadically across the site, it is considered possible that zones of lower penetration resistance encountered within the Black Park Gravel could represent soft clays and/or loose wet sands.

Location	Depth of 'soft' zones recorded (m bgl)	Geology (estimated based on nearby exploratory holes)
SHDP03	0.2 – 0.3	Black Park Gravel Member
	0.4 – 0.6	Black Park Gravel Member
	0.7 – 0.8	Black Park Gravel Member
SHDP04	1.2 – 1.3	Black Park Gravel Member
SHDP09	0.1 – 0.3	Black Park Gravel Member
	0.4 – 0.6	Black Park Gravel Member
DP1	0.3 – 0.7	Black Park Gravel Member
DP4	0.6 – 0.8	Black Park Gravel Member
DP8	4.4	Possibly Lambeth Group or Chalk
DP9	1.1 – 1.3	Black Park Gravel Member
DP10	0.6 – 0.8	Lambeth Group (soft to firm sandy CLAY – TP210)
DP303	0.4 – 0.6	Black Park Gravel Member
DP304	0.4 – 0.6	Black Park Gravel Member
	1.2 – 1.6	Lambeth Group (firm or stiff sandy CLAY – TP304/305)
DP305	0.6	Black Park Gravel Member
DP309	0.6	Black Park Gravel Member
DP315	0.3 – 0.6	Black Park Gravel Member
DP316	0.3 – 0.6	Lambeth Group (stiff slightly gravelly CLAY – TP319)
	1.4	
DP323	0.6	Black Park Gravel Member
DP324	0.5 – 0.7	Black Park Gravel Member (assumed)
DP325	0.4 – 0.6	Black Park Gravel Member (assumed)
DP326	0.6 – 0.7	Black Park Gravel Member
	1.0	Black Park Gravel Member
	1.8	Lambeth Group
	3.2 – 3.6	Chalk
	3.9 – 4.0	Chalk
	4.2 – 4.6	Chalk
	5.0	Chalk
	5.2 – 5.6	Chalk
DP328	0.3 – 0.5	Black Park Gravel Member
DP329	0.5 – 0.6	Black Park Gravel Member
	1.5	

Table 5.5 Summary of 'soft/loose' zones recorded within dynamic probes

The majority of the 'soft/loose' zones encountered were located within the Black Park Gravel Member (clay, sand and gravel) or Lambeth Group (soft to stiff sandy clay) and for limited depth ranges. It is considered unlikely that they represent solution features, i.e. for which zero or low blows over a greater depth range would be anticipated. These 'soft/loose' depth zones were underlain by strata of the Black Park Gravel, Lambeth Group and/or Chalk to the base of the nearest exploratory holes and no clear evidence of possible solution features was identified within these exploratory holes. These pockets or zones of weak strata may be more susceptible to internal erosion or wash out of fine soil particles if water infiltrates through these soils and this could cause subsidence in these soils.



Whilst soft/loose zones were identified from shallow probe results at DP326, a series of zero blows were recorded between 3.2m and 5.6m bgl, these being within Chalk based on the ground conditions encountered in the closest trial pit (TP315). These zero blow counts might reflect the presence of a zone of highly weathered, very weak Chalk, but could also possibly indicate the presence of a weak zone populated by open fractured rock, voids, or possible dissolution within the Chalk. Probe DP327 was also located in proximity to DP326 and TP315 but did not record any zero blows within any strata. In addition, DP326 was located outside of any area where the geophysical survey identified any anomalies. Thus, the information available is not considered to indicate the presence of large scale dissolution, but does indicate the presence of variable ground conditions, including seemingly localised weak ground. DP326 was located within the BGS High risk area for solution feature hazards.

Soakage testing in accordance with BRE DG365 was attempted within four trial pits (TP01, TP02, TP04 and TP05) as part of the initial investigation. The results are presented in Table 5.6 below. In addition, soakage testing was undertaken in nine trial pits (TP201-204 and TP206-210) along with falling head tests in both cable percussion boreholes (BH01 & BH02) as part of the July 2021 investigation as summarised in Tables 5.7 and 5.8. Results sheets are presented in Appendix C. Trial pits TP201-204 and TP206 together with borehole BH01 were located in the proposed basin area located at the northern end of the site and TP207-210 and BH02 were located in the vicinity of the central swale (as indicated on the Client's development layout at the time of investigation).

Trial pit	Infiltration rate (m/s)			Notes
	Test cycle 1	Test cycle 2	Test cycle 3	
TP01	1.1×10^{-5}	5.7×10^{-6}	7.4×10^{-6}	-
TP02	2.1×10^{-6}	1.9×10^{-6}	1.9×10^{-6}	-
TP04	-	-	-	Testing aborted due to collapsing pit
TP05	4.7×10^{-6}	3.4×10^{-5}	3.2×10^{-5}	Partial collapse during test

Table 5.6 Summary of soakage test results

Trial pit	Infiltration rate (m/s)			Notes
	Test cycle 1	Test cycle 2	Test cycle 3	
TP201	5.0×10^{-5}	5.2×10^{-5}	3.3×10^{-5}	-
TP202	2.4×10^{-4}	1.8×10^{-4}	1.8×10^{-4}	-
TP203	1.4×10^{-4}	2.6×10^{-4}	4.2×10^{-4}	-
TP204	2.3×10^{-5}	2.4×10^{-5}	2.1×10^{-5}	-
TP206	2.8×10^{-6}	2.8×10^{-6}	-	Third test cycle not completed due to time constraints
TP207	-	-	-	Insufficient fall in water in Test 1 to determine an infiltration rate
TP208	-	-	-	Insufficient fall in water in Test 1 to determine an infiltration rate
TP209	-	-	-	Insufficient fall in water in Test 1 to determine an infiltration rate
TP210	-	-	-	Insufficient fall in water in Test 1 to determine an infiltration rate

Table 5.7 Summary of soakage test results

Borehole	Infiltration rate (m/s)	Notes
BH01	6.2×10^{-5}	Test undertaken at 15m bgl. Cased GL to 6m bgl. Test undertaken in Chalk.
BH02	4.1×10^{-5}	Test undertaken at 15m bgl. Cased GL to 6m bgl. Test undertaken in Chalk.

Table 5.8 Infiltration rates from falling head tests in boreholes

Geotechnical laboratory tests were undertaken on selected samples of the key strata encountered from the initial



phase of investigation. The results are summarised in Table 5.9.

Parameter		Black Park Gravel Member	Lambeth Group	Seaford Chalk Formation
Natural Water content (%)		8 – 40	19 – 34	26 – 29
Liquid Limit (%)		23 – 74	40 – 80	-
Plastic Limit (%)		12 – 28	21 – 29	-
Plasticity Index Ip (%)		9 – 46	19 – 58	-
Modified Plasticity Index Ip' (%)		4.4 – 46	19 – 57	-
Classification (A-Line Plot)		CL – CV	CI – CV	-
Soil grading		Silty CLAY; sandy silty CLAY; sandy silty gravelly CLAY, clayey gravelly SAND, clayey sandy GRAVEL.	CLAY; silty CLAY; sandy silty CLAY; gravelly silty CLAY.	'Putty' CHALK with chalk fragments
Particle Size Distribution	Very coarse (%)	0.0	-	-
	Gravel (%)	6.0 - 49.7	-	-
	Sand (%)	32.3 – 69.9	-	-
	Fines (%)	18.0 – 24.1	-	-
pH		6.3 – 7.4	6.8	-
Water soluble sulphate (g/l)		<0.02	<0.02	-
Total Sulphur (%)		<0.01 – 0.01	0.01	-
Acid Soluble Sulphate (SO ₄ , %)		<0.02 – 0.03	<0.02	-
Saturation Moisture Content (%)		-	-	26 – 28
Bulk Density (Mg/m ³)		-	-	1.94 – 2.04
Dry Density (Mg/m ³)		-	-	1.54 – 1.58

Table 5.9 Summary of geotechnical laboratory test results (from GE19428)

Variation in moisture content and possible tree influence was considered within report GE19428-GIR-DEC20, to which the reader is referred for further information.

Standard Penetration Tests (SPTs) were undertaken in the cable percussion boreholes, the results of which are presented on the respective borehole logs presented in Appendix B.



6.0 ENGINEERING CONSIDERATIONS

Subsequent to intrusive investigation of the site and receipt of the laboratory test results, the following geotechnical assessments have been made.

6.1 Foundations

Given the risk of solution features on site, foundation recommendations are presented based on zones as outlined within Figure 3. Zone 1 comprises the south-east portion of the site and is located outside of any known or encountered evidence of solution features. Zone 2 is in the north, central and south-western area of the site, and includes an area of high and medium hazard rating (rating by BGS) in relation to solution features as presented in the third party Phase 1 report, the area of known solution features and surrounding areas of this limb of the site.

Zone 1

On the basis of the ground and groundwater conditions encountered in the exploratory holes within Zone 1, it is considered that conventional foundations may be suitable for the proposed development within Zone 1, albeit with some deepening of foundations within the zone of influence of trees and hedgerows.

It is considered that the soils of the Black Park Gravel Member and the Lambeth Group should be classified 'en-masse' as high volume change potential. In line with NHBC Standards Chapter 4.2 a minimum founding depth of 1.0m bgl is recommended. Heave protection should be installed for any foundations extending deeper than 1.5m bgl, as required in NHBC Standards.

Foundations should pass through any desiccated soils, root zones, Topsoil, Made Ground, disturbed ground, loose ground, fill material, soft and weathered ground and terminate wholly within the firm or stiff clay, or sand and gravel of the Black Park Gravel Member or the Lambeth Group. Due consideration is required during plot specific foundation design in relation to the reported presence of lower strength soils at depth in some of the exploratory holes, e.g. WS13, as this could have an adverse impact on bearing capacity and subsequent settlement.

A net allowable bearing capacity of 90kPa is recommended for the firm to stiff clay and sand/gravel soils of the Black Park Gravel and stiff clay soils of the Lambeth Group. This value has been limited to account for the reported presence of firm clay in some exploratory holes and thus could be conservative where higher strength soils are present. Total settlement should remain within tolerable limits for this bearing capacity.

Where foundations are proposed to be constructed within the zone of influence of trees, it is possible that foundations would need to be deepened to account for the presence and influence of trees. It is possible that foundation bases would require to be stepped and as such, it is recommended that steps do not exceed 0.50m in height at any point and are at least 1.0m (lateral distance) away from any corner or node point on the foundations, unless otherwise specified by an approved plot specific detailed foundation design. Where this cannot be accommodated, the foundation should be formed at the greater depth. Where the depth of foundations requires deepening beyond 2.50m bgl on account of trees, the use of a piled foundation solution on site may be more appropriate. Further investigation would be required to inform the pile design and would be likely to require the construction of a number of boreholes to 20-25m bgl.

Foundations which are proposed in proximity to trees and hedgerows (remaining, removed or proposed) should be designed in accordance with NHBC Standards Chapter 4.2, and relevant design approaches such as 4.2B and 4.2C, which incorporate the water demand of trees and the distance of the tree from the nearest portion of foundation.

It is recommended that foundation excavations be concreted or blinded as soon after excavation as possible. Where concreting could take place the following day it is recommended that excavations are not taken to full depth overnight and that the final 0.5m of cover is only removed immediately prior to concreting. Long, deep excavations should be avoided in order to mitigate the risk of trench side collapse prior to concrete pour.



The foundation designer should also take account of constructability of conventional foundations and additional measures which may be required to support excavations and/or control groundwater ingress into foundation excavations during construction.

Zone 2

On the basis of the ground and groundwater conditions encountered in the exploratory holes within Zone 2, it is considered that a mixture of conventional and piled foundations may be a feasible solution for plots located within Zone 2. The requirement for piled foundations is anticipated to be driven by the risk of solution features being present beneath specific plots, tree influence and the like.

The geophysical survey identified numerous in-ground anomalies, most of which were considered by the Geophysical Specialist to relate to golf course features, services and the like; historic features; and natural variation in the composition of the ground. Three anomalies were identified by the Geophysical Specialist as potential indicators of chalk related geohazards. Each was described as a bowl-shaped feature or possible variation in the weathering of, and depth to the Chalk, but not indicative of localised cylindrical anomalies commonly associated with chalk dissolution, e.g. solution features, solution pipes and the like. Co-ordinated positions were provided for each of these three anomalies as discussed in Section 5.1 and shown in Figure 7. 'Area' references discussed below are as defined in the geophysical survey report.

The ground conditions encountered in exploratory holes located in proximity to the geophysical anomaly in 'Area 1' (NGR SU 71430 76905) comprised soils of the Black Park Gravel Member to depths in excess of the bowl-shaped feature described and it would appear, at this stage, that the anomaly is within the Black Park Gravel Member and thus not a solution feature within the Chalk. This anomaly was located close to the northern fringe of the 'High Risk' area as mapped by BGS. Whilst trenching and possibly further probing across this feature is recommended in due course, at this stage it is considered that conventional foundations terminating in the soils of the Black Park Gravel Member could be suitable, albeit that allowance should be included for reinforcement within the foundation to enable it to span a void of c. 2-3m diameter. This should be included for any plots in the immediate vicinity of this anomaly. It is possible that further intrusive investigation and/or construction inspection may be required depending on the final foundation solution adopted.

The geophysical anomalies identified in 'Area 3' and 'Area 4' (NGR 71542 76928 & SU 71565 76898) were located within the 'Medium Risk' area as mapped by BGS. The Geophysical Specialist's assessment of these anomalies was that they were not indicative of cylindrical anomalies typically associated with solution features, but that they were suggestive of variable weathering of, and depth to the Chalk coupled with possible variation in composition of overlying strata. Reference to the exploratory holes in the vicinity of these anomalies indicates that the Chalk was overlain by strata typical of the basal beds of the Lambeth Group, e.g. glauconitic sandy clay and clayey sand with variable gravel content. In addition, the erosion surface on which these basal beds were deposited is often uneven, this irregularity being contemporaneous with the depositional environment, i.e. not necessarily associated with geologically more recent chalk dissolution activity. If plots in this portion of the site were to be constructed using conventional foundations terminating in the soils of the Black Park Gravel Member, or Lambeth Group, these foundations must include sufficient reinforcement to be capable of spanning a void of c. 2-3m diameter and it is possible that plot specific investigation and construction phase geotechnical inspection might be required. It is possible that reinforcement and inspection might be required for foundations terminating wholly within Chalk. Thus on balance, given the presence of these anomalies, the BGS Medium Risk rating and potential complexities and costs associated with enhanced conventional foundations, it is considered that a piled foundation solution would serve to mitigate potential geotechnical risks for plots located within this portion of the site.

Whilst not identified as a geophysical anomaly, dynamic probing at DP326 encountered numerous depth zones where zero blow counts were recorded. These zero blow count zones were present within Black Park Gravel Member, Lambeth Ground and Chalk, based on correlation with encountered conditions in trial pit TP315. DP326 was located within the 'High Risk' area mapped by BGS. The remainder of the zero blow counts in other probe locations (see Table 5.5) were at shallow depth within the Black Park Gravel Member where gravel might have caused the probe to 'jump' as it penetrated through and around gravel; within firm to stiff clay of the Lambeth



Group (based on strata encountered in pits adjacent to probes), or in Chalk. Critically, these zero blow zones were all generally of limited thickness and were considered unlikely to influence foundation performance due to their shallow depth, assuming that ground levels remain relatively similar to the current levels and that ground and groundwater regimes do not change significantly. With respect to the multiple zero blow count zones identified in DP326, it is considered that these could present a geotechnical risk to long term foundation performance for any plots in proximity to this location and thus a piled foundation solution would be recommended at this stage. It must also be noted that storm water infiltration to the ground must be avoided in this area in order to mitigate a potential risk of inundation collapse settlement, internal erosion or the like within the extant soil profile.

It remains possible that some plots where conventional foundations might be possible will require plot specific probing and foundations should be designed to span a cavity of 2-3m diameter (sub-circular in plan beneath any part of the foundation). In addition, where conventional foundations are deemed suitable, deepening of foundations within the zone of influence of trees and hedgerows may be required.

It is understood from initial discussions and consideration of the development layout that reinforced cruciform foundations would not be suitable due to constraints of the layout, proximity of structures to each other, requirement for services routing and the like.

It is recommended that plots located within the 'High' and 'Medium' risk areas (BGS assessment) are assumed to require piling. As discussed above, this would serve to mitigate likely requirements for plot specific investigation, reinforced foundations (akin to reinforced beams), construction phase inspection and the associated risk that a piled foundation may ultimately be recommended.

Further investigation would be required to inform the pile design and would be likely to require the construction of a number of boreholes to depths of at least 25m bgl. In addition, probing may be required on some plots spanning the edge, or close to the higher risk zone boundaries which are approximations and not absolute or defined boundaries. It may also be necessary to construct boreholes using rotary drilling techniques to enable detailed logging of the Chalk (condition, strength, fractures and the like), if required. Piled foundations are considered further in Section 6.2.

Irrespective of final foundation solution for any given plot, it is considered that the soils of the Black Park Gravel Member and the Lambeth Group should be classified 'en-masse' as high volume change potential. In line with NHBC Standards Chapter 4.2 a minimum founding depth of 1.0m bgl is recommended. Heave protection should be installed for any foundations extending deeper than 1.5m bgl, as required in NHBC Standards.

Foundations should pass through any desiccated soils, root zones, Topsoil, Made Ground, disturbed ground, loose ground, fill material, soft and weathered ground and terminate wholly within the natural soils of the Black Park Gravel Member, Lambeth Group or Chalk. Founding across multiple strata should be avoided in Zone 2 and thus foundations should be deepened where feasible.

A net allowable bearing capacity of 90kPa is recommended for the firm to stiff clay and sand/gravel soils of the Black Park Gravel, stiff clay soils of the Lambeth Group and Chalk. This value has been limited to account for the reported presence of firm clay in some exploratory holes and thus could be conservative where higher strength soils are present. Total settlement should remain within tolerable limits for this bearing capacity.

Where foundations are proposed to be constructed within the zone of influence of trees, it is possible that foundations would need to be deepened to account for the presence and influence of trees. It is possible that foundation bases would require to be stepped and as such, it is recommended that steps do not exceed 0.50m in height at any point and are at least 1.0m (lateral distance) away from any corner or node point on the foundations, unless otherwise specified by an approved plot specific detailed foundation design. Where this cannot be accommodated, the foundation should be formed at the greater depth. Where the depth of foundations requires deepening beyond 2.50m bgl on account of trees, the use of a piled foundation solution on site may be more appropriate. Further investigation would be required to inform the pile design and would be likely to require the construction of a number of boreholes to 20-25m bgl.



Foundations which are proposed in proximity to trees and hedgerows (remaining, removed or proposed) should be designed in accordance with NHBC Standards Chapter 4.2, and relevant design approaches such as 4.2B and 4.2C, which incorporate the water demand of trees and the distance of the tree from the nearest portion of foundation.

It is recommended that excavations for any conventional foundations be concreted or blinded as soon after excavation as possible. Where concreting could take place the following day it is recommended that excavations are not taken to full depth overnight and that the final 0.5m of cover is only removed immediately prior to concreting. Long, deep excavations should be avoided in order to mitigate the risk of trench side collapse prior to concrete pour.

The foundation designer should also take account of constructability of conventional foundations and additional measures which may be required to support excavations and/or control groundwater ingress into foundation excavations during construction.

6.2 Preliminary Pile Assessment

As discussed above, it is recommended that piled foundations are used for plots located within the Medium and High risk areas (including around DP326) in relation to mitigating potential geotechnical risks associated with chalk dissolution. In addition, piled foundations may also be required for plots located with the zone of influence of trees (existing, removed or proposed) and this should be assessed further as part of the foundation strategy with the structural engineering package of works.

The construction of a piled foundation is a specialist job and the advice of a reputable local contractor familiar with the type of ground and groundwater conditions encountered on this site should be sought prior to finalising the design.

Preliminary load capacities calculated for varying depths of CFA piles taken through any Made Ground/disturbed ground, Black Park Gravel Member, Lambeth Group and into the Chalk are given in Table 6.1. The information should be used for preliminary purposes only as the actual working load is dependent on the type of pile and method of installation. It must also be noted that the values presented in Table 6.1 are based on boreholes which were constructed in potential infiltration basin areas and thus are not specific to the areas of the site where piled foundations are likely to be required. These values are for preliminary purposes only and further investigation will be required in due course to target plots/areas of the site where piled foundations are required. Pile working loads are therefore likely to change depending on the ground conditions encountered at specific locations yet to be investigated.

Pile Type	Diameter (mm)	Depth (m bgl)	Working Load (kN)
CFA	0.30	8.0	140
		10.0	200
		12.0	240

Table 6.1 Preliminary Pile Working Loads

For pile depths of c.13m or greater, the preliminary load capacity calculations indicate that the overburden pressure exceeds the recommended maximum of 150kN/m², and therefore CIRIA recommends pile testing to establish skin friction.

These working loads have been calculated on the basis of the ground and groundwater conditions encountered within the borehole, SPT results and assume the following parameters:

- The contribution to the working load on the upper 3m has been ignored.
- A groundwater depth of 3.60m bgl has been assumed.
- A factor of safety of 5 and 3 was used on end bearing and skin friction working loads respectively.



- No allowance has been made for additional forces acting on the pile shaft, such as negative skin friction, loading due to desiccation, heave forces or raising of ground levels.

The bearing values given are applicable to single vertically loaded piles. Where groups of piles are to be constructed, the bearing value of each individual pile should be reduced by a factor of 0.8 and a calculation made to check for the factor of safety against block failure.

Where required, heave protection measures for ground beams and pile caps should be designed in accordance with the NHBC Standards, Chapter 4.2 and should assume clay rich soils to be of High Volume Change Potential.

6.3 Floor Slabs

Given the presence of shrinkable soils encountered at shallow depth across the site within the Black Park Gravel Member and the Lambeth Group, it is recommended that suspended floor slabs are constructed throughout the site. Preliminary modelling indicates a minimum void height of 300mm due to the presence of high volume change potential soils. Consideration should also be given to heave associated with the presence of any seasonal desiccation and ongoing influence of trees.

6.4 Excavations

Shallow excavations within the Topsoil and clay soils of the Black Park Gravel Member and Lambeth Group are likely be stable in the short to medium term above any water ingress. Excavations within the sands and gravels of the Black Park Gravel Member are likely to become unstable in the short term. Large scale excavations and those taken below any water ingress are likely to collapse and will require shoring and dewatering to maintain stability. Where Chalk is encountered in excavations, it may be possible for the excavation to remain stable at relatively steep angle, subject to Chalk condition, fracturing and the like, albeit that some overbreak and spalling should be expected. Excavations in structureless Chalk are unlikely to remain stable in the medium to long term.

Ground works should be designed in such a manner to avoid any requirement for construction or maintenance personnel to enter into or work within excavations. If such work cannot be avoided, then it should only be permitted once a safe system of work, supported by a robust risk assessment, has been determined and implemented.

6.5 Sulphates

The results of the water soluble sulphate and pH analyses of soil and groundwater samples indicate that buried concrete, i.e. shallow foundations within the Black Park Gravel Member or Lambeth Group, should be designed in accordance with Class DS-1 of BRE Special Digest 1, with an ACEC class of AC-1s. Whilst this might also be applicable to foundations cast into the Chalk, further testing to verify this would be recommended.

6.6 Soakaways

Soakage test and infiltration test results are presented in Tables 5.6, 5.7 and 5.8. On the basis of the results of soakage testing, it is considered that whilst infiltration of storm water into the ground may be achievable, the rate of infiltration is unlikely to be sufficient for conventional soakaways to function satisfactorily and thus storage and attenuation is likely to be required. It is understood that the emerging drainage strategy includes infiltration basins. Additional measures such as swales, reed beds and the like may also be required to provide sufficient filtration to protect underlying groundwater resources.

As mentioned above, the third party desk study identified the presence of solution features on the wider golf course, a high risk zone crossing through the subject site and also that there are active solution features within the subject site which require infilling by the site maintenance staff periodically. The drainage strategy will need to minimise the risk of any infiltration system adversely impacting the status of existing solution features, causing dormant features to become active, or creation of new dissolution features.



At the time of writing, the development layout is not fixed and options seen to date have included basins within, or close to the High and Medium risk areas (for potential solution features and chalk dissolution), and an option for permeable paving, swales a central basin and basin in the north-west of the site (basins located outside of the Medium and High risk areas). It is imperative that infiltration to the ground in proximity (within 20m) to house plots is avoided in Zone 2 and any basins located in Zone 2 must be lined and would thus serve as detention basins and not allow storm water to infiltrate the ground. The requirement for including an impermeable liner is to prevent concentration infiltration of storm water from causing internal erosion of shallow strata, inundation collapse settlement of loose/voided ground and activation/creation of solution features in the Chalk. Discharge from these basins to an alternative discharge point or medium would be required. Positioning of basins outside the Medium and High risk areas would help to mitigate the risk of damage to property.

In accordance with guidance in CIRIA C574 Engineering in Chalk, for all dissolution features, whether backfilled or infilled, and for deneholes (none suspected on this site), all possible steps should be taken to prevent the ingress of surface water that might destabilise any void and/or cause further dissolution. No infiltration device (pond, swale, soakaway or the like) should be located within 20m of any structure due to the potential for infiltrating water to induce instability and ground collapse. In addition, wherever possible, drainage runs should be diverted away from any known feature (known from investigation or discovered during development). If this is not feasible, it is preferable for drains to be sealed flexible jointed pipes or to be provided with concrete bedding and haunching.

Care will also be required during construction ensure that drainage connections are robust and resilient to slight movement, otherwise leakage from drains could result in washing out of shallow soils, activation of solution features and collapse back to ground surface.

6.7 Earthworks

It is anticipated that any development on this site could include the reprofiling of site levels to accommodate the proposed development.

On the basis of the ground conditions encountered, it is anticipated that site won clay soils might be suitable for retention and re-use as earthworks fill, subject to meeting likely acceptability requirements. At this stage, it is anticipated that the sand and gravel soils might comprises Class 1 granular fill for use as general bulk fill, clay soils could be classified as Class 2A wet cohesive soil and/or Class 2C stony cohesive soils for use as general bulk fill, i.e. not specialist fill to structures or the like, and any Chalk would comprise Class 3 fill. The suitability of clay fill is often governed by factors such as moisture content and shear strength. BS6031 Code of Practice for Earthworks states that a Moisture Condition Value (MCV) range of 8-12 is common for wet cohesive fill and 8-16 for stony cohesive fill such as may be generated from this site.

Many clay soils have moisture contents which are outside of the acceptability range for immediate use as earthworks fill, i.e. based on MCV, or optimum moisture content (OMC) as derived from compaction tests. As such, if site won clay soils are proposed to be re-used for earthworks fill on this site, further testing for classification, acceptability and compliance would be required in due course. In addition, treatment may be required to bring clay fill into the required acceptability range, e.g. setting aside to dry out, wetting if dry, additional of lime:cement to dry out or stabilise the fill, or the like.

Any earthworks should be undertaken in accordance with an earthworks specification and accompanying earthworks strategy prepared for the proposed development and to reflect the required end use of the earthworks construction.



7.0 DISCOVERY STRATEGY

Whilst several phases of intrusive investigation have been undertaken on the site, it remains possible that unexpected soil conditions may be encountered during the process of construction.

Geotechnical

Solution features are known to be present on the site and mapping indicates a high and medium hazard rating for solution features across part of the site. Geophysical surveying has detected several anomalies, albeit that these might relate to natural variations in composition rather than irrefutable evidence of chalk dissolution. As such, it is possible that abnormal ground conditions, loose/voided ground, sudden changes or the like could be encountered during construction activities on the site. Therefore, a discovery strategy should be maintained in relation to potential geotechnical hazards. Any such discovery should be reported to the Geotechnical Engineer and wider design team, e.g. Structural Engineer and Civil Engineer, at the earliest opportunity such that the discovery can be investigated and possible remedial solutions be determined.

Contamination

Should previously undiscovered contamination or unforeseen ground conditions be encountered during construction by the ground workers, this must be reported to the Site Manager immediately in order that the Consultant is notified. Where deemed necessary, the Consultant shall attend the site to inspect the discovery and provide recommendations on the further actions required, if any. Where necessary the regulatory authority shall be informed. Post any additional investigation or laboratory testing the results and any proposed remedial measures shall be reported to the regulatory authority or other appropriate organisation for consent, before proceeding or implementing the remedial measures.

A copy of the discovery strategy must be lodged on site, and provisions made to ensure that all workers are made aware of their responsibility to observe, report, and act on any potentially suspicious, abnormal, unforeseen or contaminated ground and/or groundwater conditions they may encounter.

Depending on the type, nature and extent of any such 'discovery', it may be necessary to halt works in that location until such time as the assessment has been completed. This shall be reviewed on a 'discovery' specific basis and in conjunction with consultation with the client, other technical personnel and/or regulatory/approval organisations.

As a general guide, where such unexpected conditions are encountered the following approach is required as a minimum:

- All discoveries are to be reported to the Site Manager immediately and works at that location are to halt until further notice;
- The Site Manager is to report any such discoveries to the Client and the Consultant;
- Following notification from the Site Manager, the Consultant shall discuss the discovery with the Local Authority and/or other relevant parties and if considered necessary, arrange to meet on site to view the discovery;
- The Consultant shall attend the site to record the location, extent and nature of the discovery and implement an appropriate sampling and analysis regime, taking due account of the type and nature of the discovery, known and probable land uses in that area of the site;
- Where remedial action is required, regulatory consultation and approval will be sought;
- A record will be produced by the Consultant and held on site (with copies held by the Consultant, Client and Local Authority/other relevant organisation), detailing the discovery, assessment works undertaken, findings thereof, confirmation either of no action required or detailing the remedial action taken and validation thereof.

The process is shown below.

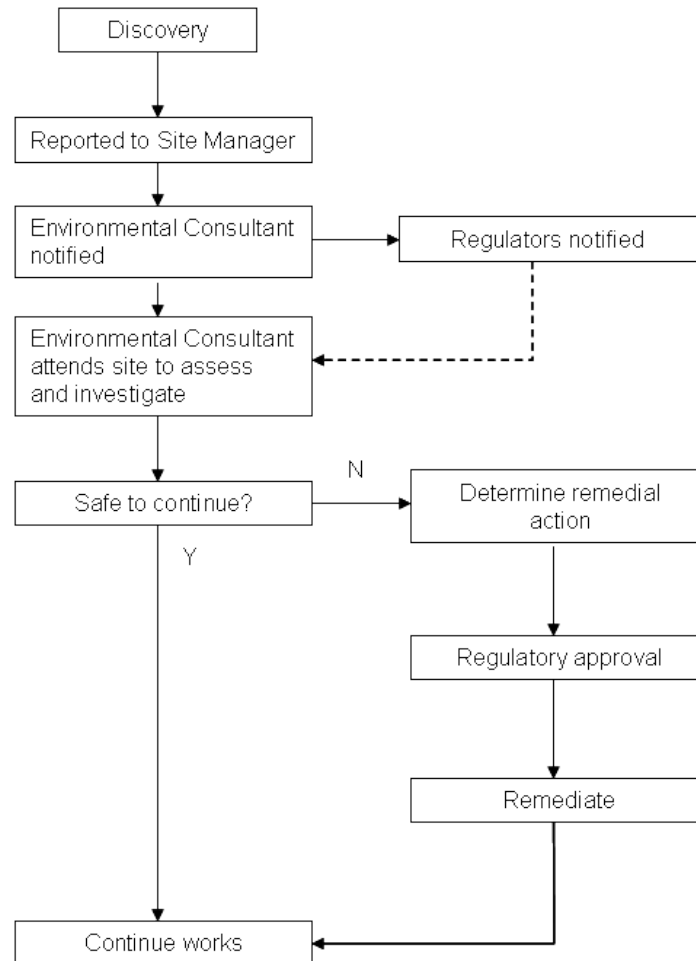


Chart 1: Discovery Strategy Process

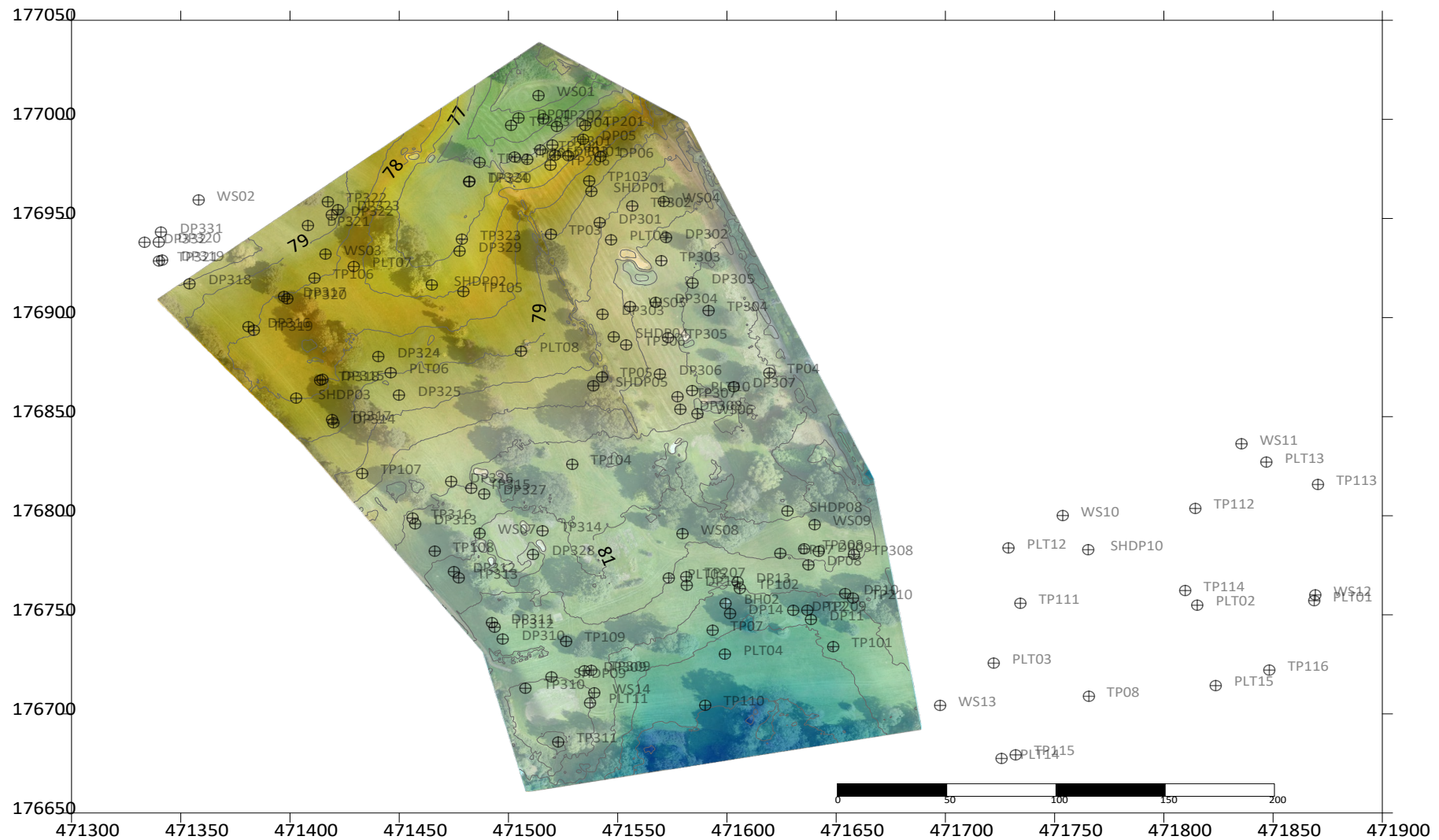


FIGURES

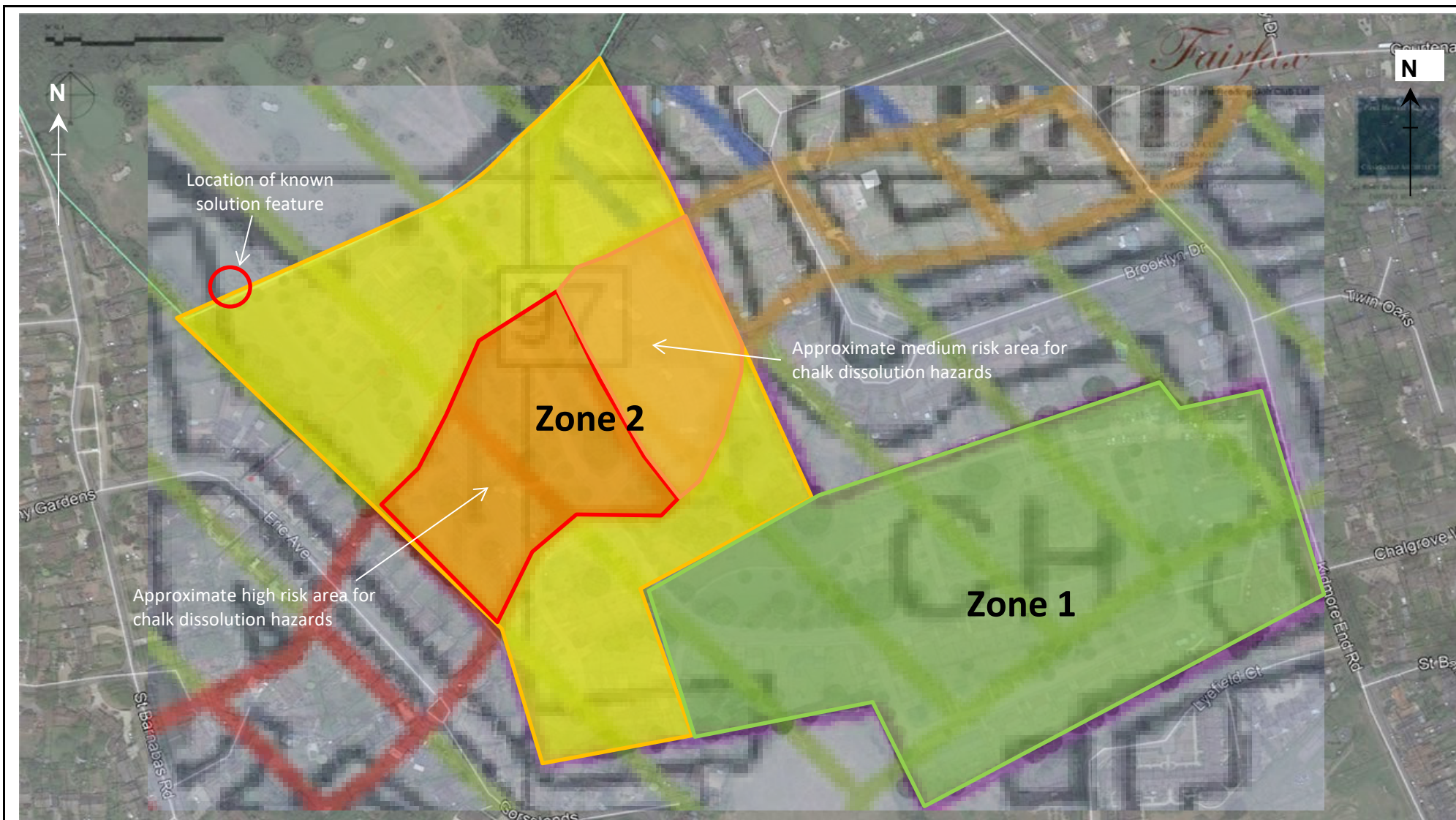




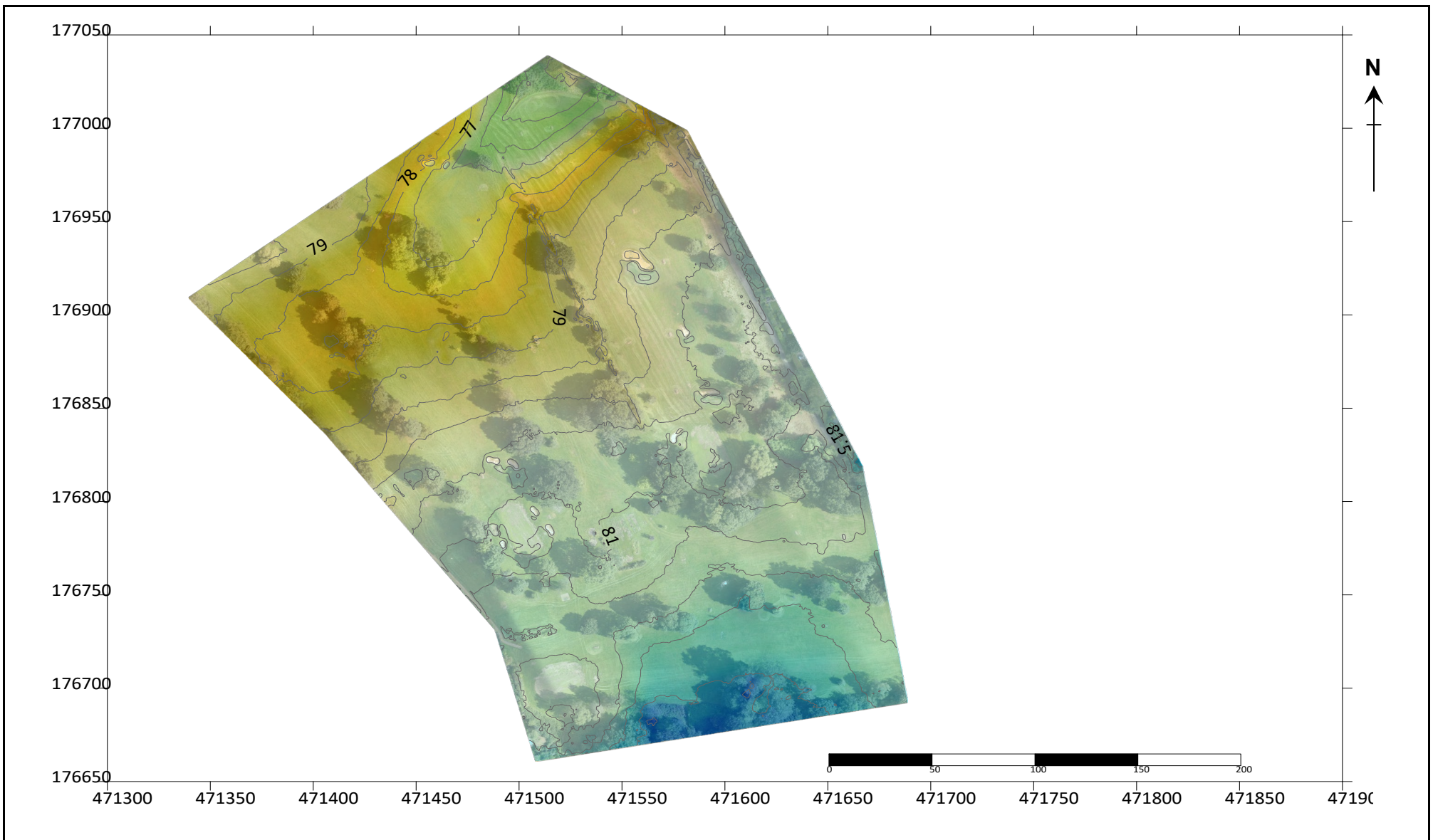
Project:	Reading Golf Course			Title	Site Location Plan	
Client:	Vistry Thames Valley			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net	 Geo-Environmental	
Ref No:	GE20079	Revision:	1.0			
Drawn:	GR	Date:	28/09/2021			
Figure:	1	Scale:	Not To Scale			



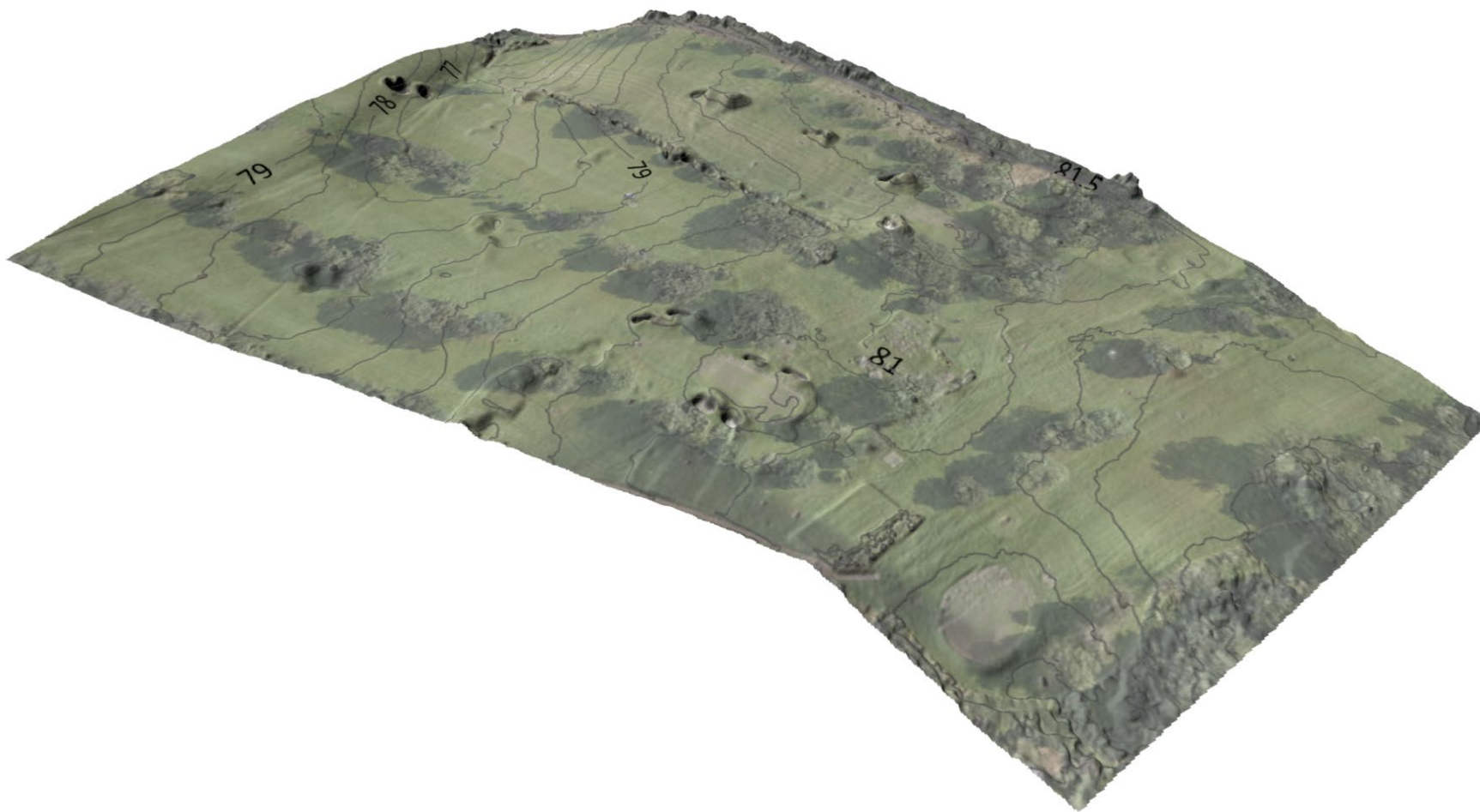
Project:	Reading Golf Course			Title	Exploratory Hole Location Plan		
Client:	Vistry Thames Valley			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net		 Geo-Environmental	
Ref No:	GE20079	Revision:	1.0				
Drawn:	GR	Date:	28/09/2021				
Figure:	2	Scale:	Not To Scale				



Project:	Reading Golf Course			Title	Site Zoning Plan	
Client:	Vistry Thames Valley			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net	 Geo-Environmental	
Ref No:	GE20079	Revision:	1.0			
Drawn:	GR	Date:	28/09/2021			
Figure:	3	Scale:	Not To Scale			

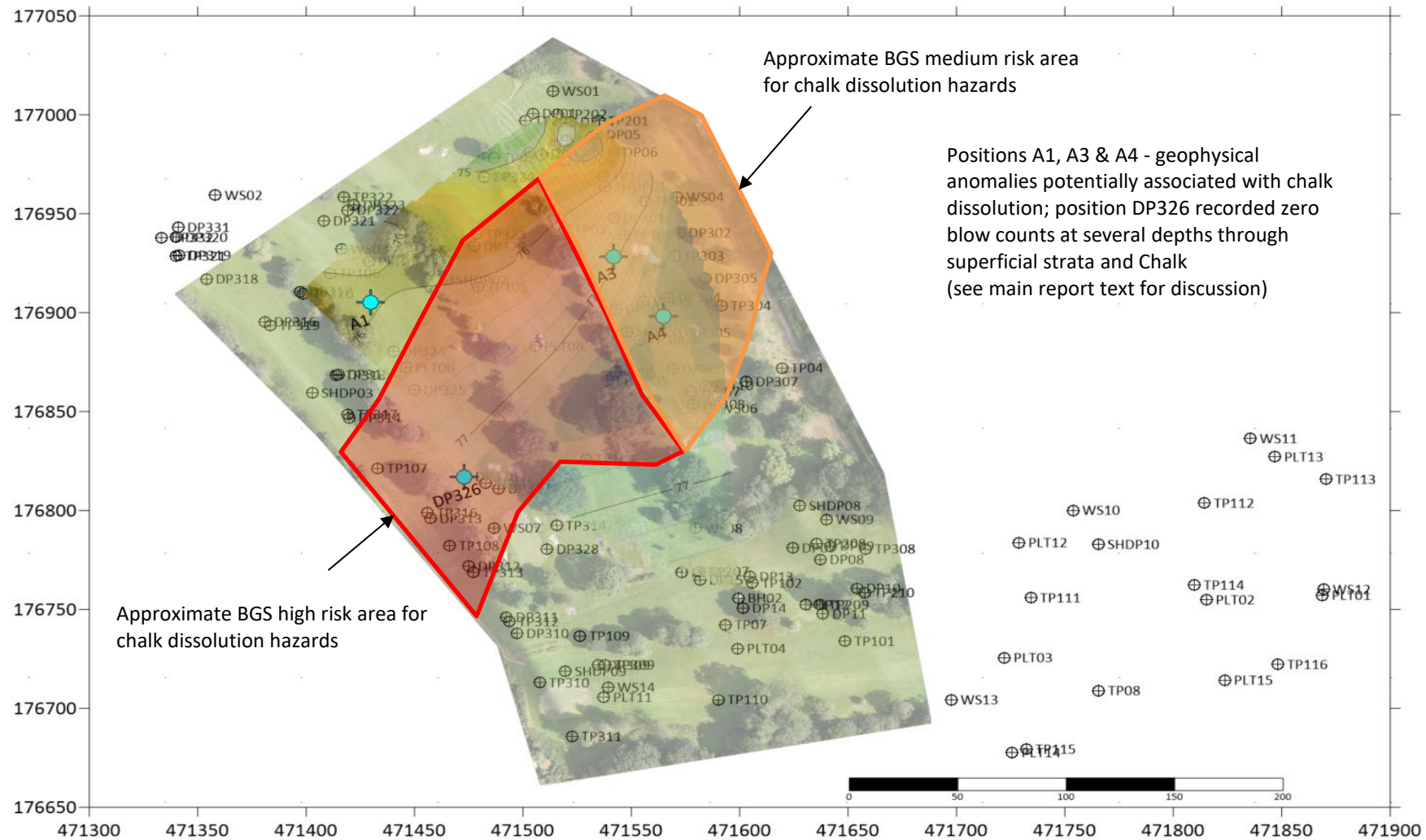


Project:	Reading Golf Course			Title	Digital Terrain Model (2D)	
Client:	Vistry Thames Valley			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net  Geo-Environmental		
Ref No:	GE20079	Revision:	1.0			
Drawn:	GR	Date:	28/09/2021			
Figure:	4	Scale:	Not To Scale			



NOTE: This 3D model surface is for illustrative purposes and includes a 5x vertical exaggeration

Project:	Reading Golf Course			Title	Digital Terrain Model (3D)	
Client:	Vistry Thames Valley			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net  Geo-Environmental		
Ref No:	GE20079	Revision:	1.0			
Drawn:	GR	Date:	28/09/2021			
Figure:	5	Scale:	Not To Scale			



Project:	Reading Golf Course			Title	Geotechnical Hazard Plan	
Client:	Vistry Thames Valley			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net  Geo-Environmental		
Ref No:	GE20079	Revision:	1.0			
Drawn:	GR	Date:	28/09/2021			
Figure:	7	Scale:	Not To Scale			



APPENDIX A

Geophysical Survey Report





**magnitude
surveys**

**Geophysical Survey Report
Former Reading Golf Club
Berkshire**

**For
Geo-Environmental Services Ltd
On behalf of
Vistry Thames Valley**

Magnitude Surveys Ref: MSSU986

September 2021



magnitude surveys

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Issue Date:

29 September 2021

Abstract

Magnitude surveys was commissioned to identify areas of high risk of solution features within a 6.8ha area of land at Reading Golf Club, Reading. An initial electromagnetic induction (EM) survey of 4.9ha was completed, with 1.28ha not surveyed due to the presence of trees, dense vegetation and golf course features. The EM data shows clear contrast between areas recorded to be underlain by chalk bedrock and those on clay, silt and sand. Targeted Ground Penetrating Radar (GPR) survey was then carried out over specific areas based on the EM (and previous magnetic) results. The GPR supports the results of the EM interpretation suggesting that the highest likelihood for solution features is the zone of transition between the different geologies, in the northeast quadrant of the survey area. Other anomalies detected by these techniques include golf course features, drainage, and disturbed ground.

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1. Introduction

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by Geo-Environmental Services Limited on behalf of Vistry Thames Valley to undertake a geophysical survey over a c. 6.8ha area of land at the former Reading Golf Club, Berkshire (SU 7148 7692).
- 1.2. The geophysical survey comprised quad-towed, cart-mounted GNSS-positioned electromagnetic (EM) induction and hand-pushed, cart-/sled-mounted ground penetrating radar (GPR) survey. EM survey provides data related to both soil electrical conductivity and magnetic susceptibility. It provides multiple datasets corresponding to properties of bulk soil volumes at various depths of investigation, and is particularly suited for detecting palaeolandscape features, such as palaeochannels and superficial deposits, and deeper conductive targets. MS' Ofcom Ground Probing Radar licence number is 1200059/1.
- 1.3. The survey commenced on 28/06/21 and took 8 days to complete.

2. Quality Assurance

- 2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society for Archaeological Prospection).
- 2.2. The directors of MS are involved in cutting edge research and the development of guidance/policy. Specifically, Dr Chrys Harris has a PhD in archaeological geophysics from the University of Bradford, is a Member of CIfA and is the Vice-Chair of the International Society for Archaeological Prospection (ISAP); Finnegan Pope-Carter has an MSc in archaeological geophysics and is a Fellow of the London Geological Society, as well as a member of GeoSIG (CIfA Geophysics Special Interest Group); Dr Kayt Armstrong has a PhD in archaeological geophysics from Bournemouth University, is a Member of CIfA, the Editor of ISAP News, and is the UK Management Committee representative for the COST Action SAGA; Dr Paul Johnson has a PhD in archaeology from the University of Southampton, is a Fellow of the Society of Antiquaries of London, has been a member of the ISAP Management Committee since 2015, and is currently the nominated representative for the EAA Archaeological Prospection Community to the board of the European Archaeological Association.
- 2.3. All MS managers, field and office staff have degree qualifications relevant to archaeology or geophysics and/or field experience.

3. Objectives

- 3.1. The objective of the geophysical survey was to assess the survey area for possible ground dissolution features in advance of future intrusive investigations.

4. Geographic Background

- 4.1. The survey area was located c. 3.4km north of the centre of Reading (Figure 1). Survey was undertaken across part of a golf course. The EM survey area is bordered by housing off Brooklyn Drive to the east, Emmer Green Primary School to the south and housing off Eric Avenue to the west. The golf course continues to the north and southeast of the survey area (Figure 2).

Approximately 1.28ha were unable to be surveyed due to trees and golf course features. There are also 6 areas of GPR survey in-between the trees and bunkers on the golf course.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
EM	The area consisted of mostly flat, golf course green, with some areas of sand for bunkers.	The survey area had trees on the eastern, western, and southern boundaries as well as throughout the area. Some areas were unsurveyable due to golf course features.
1 (GPR)	The area consisted of golf course with a gentle slope to the south-east.	A line of small trees marked the eastern and western boundaries. The north and south had no physical boundaries.
2 (GPR)	The area consisted of mostly flat, golf course green.	There were no physical boundaries to the north, west, and south of the area. The boundary to the east consisted of trees and a ditch, some of which was unsurveyable.
3 (GPR)	The area consisted of mostly golf course green.	The survey area had small trees and a ditch as a boundary to the west and no physical boundaries to the north, east, and south. A small area in the north-east was unsurveyable due to a steep bunker.
4 (GPR)	The area consisted of mostly flat, golf course green.	The survey area had trees as a boundary to the west and no physical boundaries to the north, east, and south. Two areas in the north-east and south-east were unsurveyable due to bunkers.
5 (GPR)	The area consisted of mostly flat, golf course green.	The survey area had trees as a boundary to the east and west, and no physical boundary to the north and south. Areas along the eastern boundary were unsurveyable due to overhanging trees interfering with GPS signal and due to a steeply-sided dip in the ground.
6 (GPR)	The area consisted of mostly flat, golf course green.	The survey area had trees as a boundary to the east and west, and no physical boundary to the north and south. Areas along the eastern and western boundaries were unsurveyable due to overhanging trees interfering with GPS signal
7 (GPR)	The area consisted of golf course green with a gentle slope to the south-west.	The survey area is bounded to the north-east by trees. The golf course continued to the northwest, south, east and west. An area to the west is unsurveyable due to a steeply-sided dip in the ground. A small area to the south-west consists of gravel.

- 4.3. The underlying geology comprises chalk of the Seaford and Newhaven Chalk Formations in the north and clay, silt and sand of the Lambeth Group in the south. The superficial deposits across the majority of the survey area consist of sands and gravels of the Black Park Gravel Member. No superficial deposits are recorded across a small portion of the eastern extent of the survey area (British Geological Survey, 2021).

- 4.4. Slightly acid loamy and clayey soils with impeded drainage are present across the entire survey area (Soilscapes, 2021).

5. Methodology

5.1. Data Collection

- 5.1.1. Geophysical prospection comprised the complementary Electromagnetic Induction (EM) and Ground Penetrating Radar (GPR) methods as described in the following table.

- 5.1.2. Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Electromagnetic Induction – Conductivity and Magnetic Susceptibility	GF Instruments CMD Explorer in Vertical Coplaner (VCP) orientation	4m	5Hz reprojected to 0.25m
Ground Penetrating Radar	MALÅ Mira with a 400MHz Antenna	0.5m	0.05m

- 5.1.3. The EM data were collected using MS' bespoke quad-towed cart system.

- 5.1.4. MS' cart system comprised GF Instruments CMD Explorer in VCP orientation to facilitate greater depth penetration. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

- 5.1.5. Electromagnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing and visualisation to be monitored in real-time as fieldwork was ongoing.

- 5.1.6. A navigation system was integrated with the RTK GPS, which was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing.

- 5.1.7. The GPR data were collected along traverses separated by 0.5m and set out within a grid established using a Carlson BRx6 GNSS Smart Antenna RTK GPS, which is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical. The radar equipment was set to sample every 0.05m along each traverse, controlled by the odometer wheel attached to the system. The odometer was distance calibrated at the start of the survey.

5.2.Data Processing

5.2.1. EM data

- 5.2.1.1. Electromagnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to the EAC and Historic England guidelines for 'minimally enhanced data' (see Section 3.8 in Schmidt et al., 2015: 33 and Section IV.2 in David et al., 2008: 11).

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

5.2.2. GPR data

- 5.2.2.1. GPR data were processed in the standard commercial software package RSlicer. GPR Processing steps were limited to:

DC Shift – The waveform response for each traverse was centred to correct for striping effects caused by small variations in sensor electronics and orientation.

Bandpass Filter – Frequencies outside the normal range of the measuring antennas were filtered out to remove errors from external sources.

Background Removal – Background 'noise' was filtered out of the data to improve clarity and aid in the detection of weak anomalies.

Gain Adjust – A gain curve was manually calculated to account for signal attenuation with depth. The gain adjust allows features at depth with a weaker signal to be resolved at the same plotting scale as near surface features.

Hyperbola fitting – Manual fitting of hyperbola curves was conducted to calculate the velocity of the wave. This allows the calculation of response depth from response time.

Hilbert Transform – An envelope of the GPR trace was created where the positive and negative polarity amplitude responses of a reflection event were transformed into the total amplitude for each reflection response. This creates absolute values for each response so that the total amplitudes are comparable.

5.3.Data Visualisation and Interpretation

- 5.3.1. The electromagnetic (quadrature-phase and in-phase) results are presented as greyscale images. Multiple greyscale images at different plotting ranges have been used for data interpretation. The EM interpretation is partly derived from the quadrature-phase, which is a proxy for apparent electrical conductivity. These datasets are referred to as C1, C2 and C3 and roughly correspond to bulk soil volumes equated to c. 1.1m, 2.1m and 3.5m below ground level, respectively. However, as the EM is measuring a bulk soil volume, it will be sensitive to features above and below these theoretical exploration depths. The EM interpretation is also derived from the in-phase component of the EM response, which relates to the soil's magnetic susceptibility. The in-phase roughly corresponds with a bulk soil volume of half that of the quadrature-phase. The different receiving coil responses are referred to as I1, I2, and I3 for the magnetic susceptibility. The various investigation depths are described comparatively here as shallow, middle, and deep soil volumes. From this point onward, the respective quadrature-phase and in-phase datasets will be referred to as EM conductivity and EM magnetic susceptibility, respectively. The geophysical results have been interpreted in a layered environment, overlaid against open street mapping, satellite imagery, historical maps, LiDAR data, and soil and geology mapping. Google Earth (2021) was also consulted, to compare the results with recent land use.
- 5.3.2. The individual GPR radargrams were stacked to form a three-dimensional cube of measurements. Greyscales were created by horizontally slicing the cube to produce plan-view 'timeslices'. These timeslices were initially considered in an animated GIF form, to analyse the three-dimensional extent of reflections. For print purposes, three gross soil volumes were considered: shallow, middle, and deep. The mean of the timeslices within each gross soil volume was taken and used as a representative time slice for the interpretation figures. The timeslices were also interpreted in combination with the radargrams, which visualise the form of the geophysical response, aiding anomaly interpretation
- 5.3.3. The Geophysical results have been interpreted using greyscale images in a layered environment, overlaid against open street maps, satellite imagery, historical maps, LiDAR data, and soil and geology mapping. Google Earth (2021) was also consulted, to compare the results with recent land use
- 5.3.4. The Geodetic position of results – All vector and raster data have been projected into OSGB36 (ESPG27700) and can be provided upon request in ESRI Shapefile (.SHP) and Geotiff (.TIF) respectively. Figures are provided with raster and vector data projected against OS Open Data.

6. Results

6.1. Qualification

6.1.1. Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified reflections is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all reflection sources. Where possible, a reflection source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports, as well as reports from further work, in order to constantly improve our knowledge and service.

6.2. Discussion

6.2.1. EM survey was conducted over 4.9ha, with GPR undertaken across smaller, targeted areas within the footprint of the EM survey. Areas for targeted GPR survey were chosen across a range of high to low conductivity areas to provide comparative datasets and help substantiate their respective interpretations. The GPR technique has achieved effective signal penetration to a depth of up to c. 4m; any targets that may exist beyond this depth will not have been identified. The EM survey has detected good contrasts across the survey area and provided bulk volume measurements at nominal depths up to c. 3.5m BGL. Zones of highest risk of potential dissolution features have been identified within Areas 3 and 4.

6.2.2. The EM data are characterised by broad contrasts (Figures 3-5), considered likely to reflect the differences in mineral content and hydrological conductivity of the contrasting bedrock formations, although numerous variables influence the EM conductivity. The bands of lower conductivity measured in the northern portion of the survey area correspond well with the extent of the mapped chalk bedrock, while the higher conductivity measured across the central and southern parts are likely to reflect the transition to the recorded clays, silts and sands. The strongest conductivity values across the central zone may be the result of factors such as greater ground saturation or a greater proportion of clay (the mineral content of which typically facilitates greater electrical conductivity), perhaps with slightly better-drained river terrace gravels distributed towards the southern boundary (BGS borehole data indicates such deposits immediately outside the survey area (BGS 2021)). There is minimal lateral variation in the EM anomalies between the three depths of investigation (Figures 3, 4 & 5).

6.2.3. The survey results show several amorphous low amplitude features in the GPR data (Figure 8), positioned within an area of high conductivity detected by the EM survey, GPR Areas 3 and 4 (Figures 2, 3-5). This area was previously identified as having a higher risk of dissolution features. The low amplitude features possibly represent dissolution channel and depressions containing a non-homogenous fill given the nature of their reflections, morphology and location. A wider and shallower feature was detected

within GPR Area 1, this has been highlighted as another potential solution feature; however, given the minimal variation indicated in the EM dataset it is possible that this is a variation on the surface of the chalk bedrock itself. None of the other GPR areas appear to contain high risk features within the GPR data.

6.2.4. Reflectors corresponding with the extant golf course feature have also been identified throughout the GPR dataset. These are consistent with with buried surfaces, compacted layers, disturbed ground, rubble backfill and drainage features. This interpretation is supported by the close correlation of many of these with features visible on recent satellite imagery (Google Earth, 2021).

6.3. Interpretation

6.3.1. General Statements

6.3.1.1. Geophysical results will be discussed broadly as classification types across the survey area. Only reflections that are distinctive or unusual will be discussed individually.

6.3.1.2. **‘Ringing’ or ‘Shadows’** – Ringing in GPR data is an effect whereby a specific material (usually metal objects, but not always) causes the radar energy to behave in an unusual way, producing strong amplitude responses within the radargram well below the object in question. These can make it appear as though there are deeper reflectors present, when in fact this is a data artefact caused by an object higher up in the soil or sediment.

6.3.1.3. **Undetermined** – Reflections are classified as Undetermined when the source of the reflection is ambiguous and there is no supporting or contextual evidence to warrant a more certain classification. These reflections are typically likely to be the result of either geological or soil processes, or recent anthropogenic activities, although an archaeological origin cannot be entirely ruled out.

6.3.2. Specific Results and Reflections

Area 1

6.3.2.1. **EM** – Area 1 is located in an area of low conductivity identified by the EM survey (Figs 3-6). The low conductivity is likely to represent the areas recorded chalk geology and a low water content.

6.3.2.2. **GPR Natural (Background)** – Reflectors were detected in Area 1 that could be identified as having their origin in natural variations in the underlying geology. Two parallel sinuous linear anomalies cross the south of Area 1 in a northeast-southwest direction. These anomalies are visible at 0.80m – 1.20m depth and appear natural in morphology. The north of Area 1 is therefore deemed to have a relatively homogenous geology and superficial deposits whilst the south shows more variation.

6.3.2.3. **GPR Natural (Possible Dissolution) (SU 71430 76905)** – In the south of Area 1 a depression has been detected. The reflections are at their widest c.20m diameter at a depth of 0.67, and they reduced to a diameter of c.6m at a depth of 1.07m. The

radargram of the area (Figure 14) shows a sloping, likely natural, surface. It is probable that this is a shallow depression with a natural fill in the underlying geology however further investigation is needed to fully determine its nature.

Areas 3 & 4

- 6.3.2.4. **EM** – Areas 3 & 4 are located within an area of high conductivity identified by the EM survey (Figs 3-6). The high conductivity is likely to relate to the areas' geology and the water content of the ground. The recorded bedrock in this area consists of Seaford and Newhaven chalk formation, however, is close to a change in recorded bedrock to clay, silt and sand (see Section 4.3). It is possible therefore that the areas of natural variation identified using GPR (sections 6.3.2.5-6) may be areas of chalk dissolution, or may be recording a change in geology to the recorded clays, silts and sands. It is worth noting that in the magnetic data (Langston, A., *et al.* 2020) drains were recorded in this area indicating a naturally wet environment needing management to ensure adequate drainage.
- 6.3.2.5. **GPR Natural (Background)** - In Areas 3 and 4 sinuous and amorphous reflections have been detected. These are visible as low and high amplitude responses in both the timeslices and radargrams (Figures 8, 13-14). The reflections appear between c.0.30m and 3m deep and exhibit slight changes in shape and position with increasing depth. It is possible that a reflector in the northeast of Area 3 is related to the edge of a former sandpit however given its morphology is considered more likely to be natural. These anomalies occur in an area of high conductivity (Figures 3-5) which coincides with the areas marked medium risk for chalk dissolution hazards (Geo-Environmental, 2020). The morphology and signal of these features is suggestive of a variable bedrock surface or changes in the overlying natural deposits rather than large dissolution hollows or channels.
- 6.3.2.6. **GPR Natural (Possible Dissolution) (SU 71565 76898 & SU 71542 76928)** - In the southeast of Area 3 an anomaly larger than those discussed as natural background (Section 6.3.2.5) have been detected at c.0.95m deep [3a] (Figure 8). In the north of Area 3 a reflector has been identified at 1.56m deep [3b] (Figure 8). Both 3a and 3b exhibit a curved 'bowl' shaped series of reflections in the radargrams (Figures 13-14). These do not exhibit a morphology in the timeslices typical of large dissolution features such as substantial infilled voids or channels in the underlying chalk, however their size means they are a larger variation in the bedrock or overlying deposits than the others identified. Further investigation would be needed to determine their full extent.

Areas 2 & 6

- 6.3.2.7. **EM** – Areas 2 and 6 are located within an area of low - medium conductivity identified by the EM survey. Both are however situated close to the band of high conductivity that is recorded running in the central and southern parts of the overall survey area. It is likely that the low conductivity recorded is the result of the underlying chalk geology with the increase in conductivity in the southeast of Area

2 and southwest of Area 6, due to a change in the underlying deposits and a potential increase in soil moisture.

- 6.3.2.8. **Natural (Background)** – In Areas 2 and 6 sinuous and amorphous reflections have been detected. These are visible as low and high amplitude responses in the timeslices (Figures 7 & 10). The reflections appear between c.0.30m and 2.5m deep and exhibit changes in shape and position at differing depths. Whilst some could be related to land management in the golf course, in morphology and response they look similar to the natural variations seen in Areas 3 and 4. The morphology and signal of these features is suggestive of variable underlying natural deposits rather than large dissolution hollows or channels.

Area 5

- 6.3.2.9. **EM** – Area 5 is located in an area of low conductivity identified by the EM survey (Figs 3-6). The low conductivity is likely to be caused by the areas chalk geology and a low water content.

- 6.3.2.10. **Natural** - No reflectors were detected in Area 5 that could be confidently identified as having their origin in natural variations in the underlying geology. There were some discrete reflectors identified that have been ascribed an undetermined origin and whilst these may have a natural origin and reflect small changes in the underlying soils, their origin could not be confidently determined from the data alone.

Area 7

- 6.3.2.11. **EM** – The majority of Area 7 is located within an area of high conductivity, with its eastern extent located within an area of medium conductivity. Manmade drains have been identified in the GPR and magnetic data (Langston, A., *et al.* 2020). It is likely that the high conductivity is caused by the underlying gravel bedrock with a high clay content, causing a wetter environment and the need for drainage.

- 6.3.2.12. **Natural** – In Area 7 no reflectors have been detected of a natural origin. The area on satellite imagery (Google, 2021) can be seen to have been heavily landscaped, and various reflectors considered likely to be disturbed and made ground and drainage pipes have been detected. It is therefore likely that any natural variations present are masked by these later additions.

7. Conclusions

- 7.1. EM survey was successfully completed across 4.9ha of the survey area, with GPR undertaken across smaller targeted areas within the footprint of the EM survey. GPR areas were targeted in a range of high to low conductivity zones of the EM data to provide comparison datasets, as well as to further inform interpretation. Both techniques have generally responded well to the environment of the survey area allowing the identification of three zones of increased risk for dissolution features, most notably within Areas 3 and 4. A further feature within Area 1 also warrants further investigation, though may be indicative of bedrock variation.
- 7.2. Areas 3 and 4 fall within a zone of high conductivity in the EM dataset, and in the transition zone between the chalk and the clay, silt, sand and gravel bedrock geologies. Most of the reflections identified with the GPR data in these areas are relatively small and may be considered shallow variations in the chalk bedrock that have then been infilled naturally, often not apparent in radargrams. Larger variations noted in these areas, while not conclusive, are considered of higher risk for dissolution features. These have a 'bowl' shape series of reflections in the radargrams.
- 7.3. A shallower, but morphologically similar, reflector was identified within Area 1. This is located in an area of lower conductivity with little variation, suggesting a more homogenous chalk bedrock geology. The shallow reflector may be a variation in the surface of the bedrock, however, warrants further investigation.
- 7.4. The majority of the remaining GPR areas are located within the low to mid-range of the conductivity dataset, none of which appear to contain reflectors suggesting high risks of dissolution features. Area 7, in the southwest, is in a zone of high conductivity but this is likely due to difference in the bedrock of this area, on gravels with a high clay content rather than as a dissolution or transitional zone.
- 7.5. Golf course features and drainage, visible as reflections in both timeslices and radargrams, have been identified in various areas, some of which correspond with extant features visible on satellite imagery.
- 7.6. Reflectors classified as "Undetermined" within the GPR data often have similar morphology and/or amplitude to those identified as golf course features or natural variations. None of these anomalies are indicative of dissolution features; however, it has not been possible to definitively classify them further.

8. Archiving

- 8.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.
- 8.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to the any dictated time embargoes.

9. Copyright

- 9.1. Copyright and intellectual property pertaining to all reports, figures, and datasets produced by Magnitude Services Ltd is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

10. References

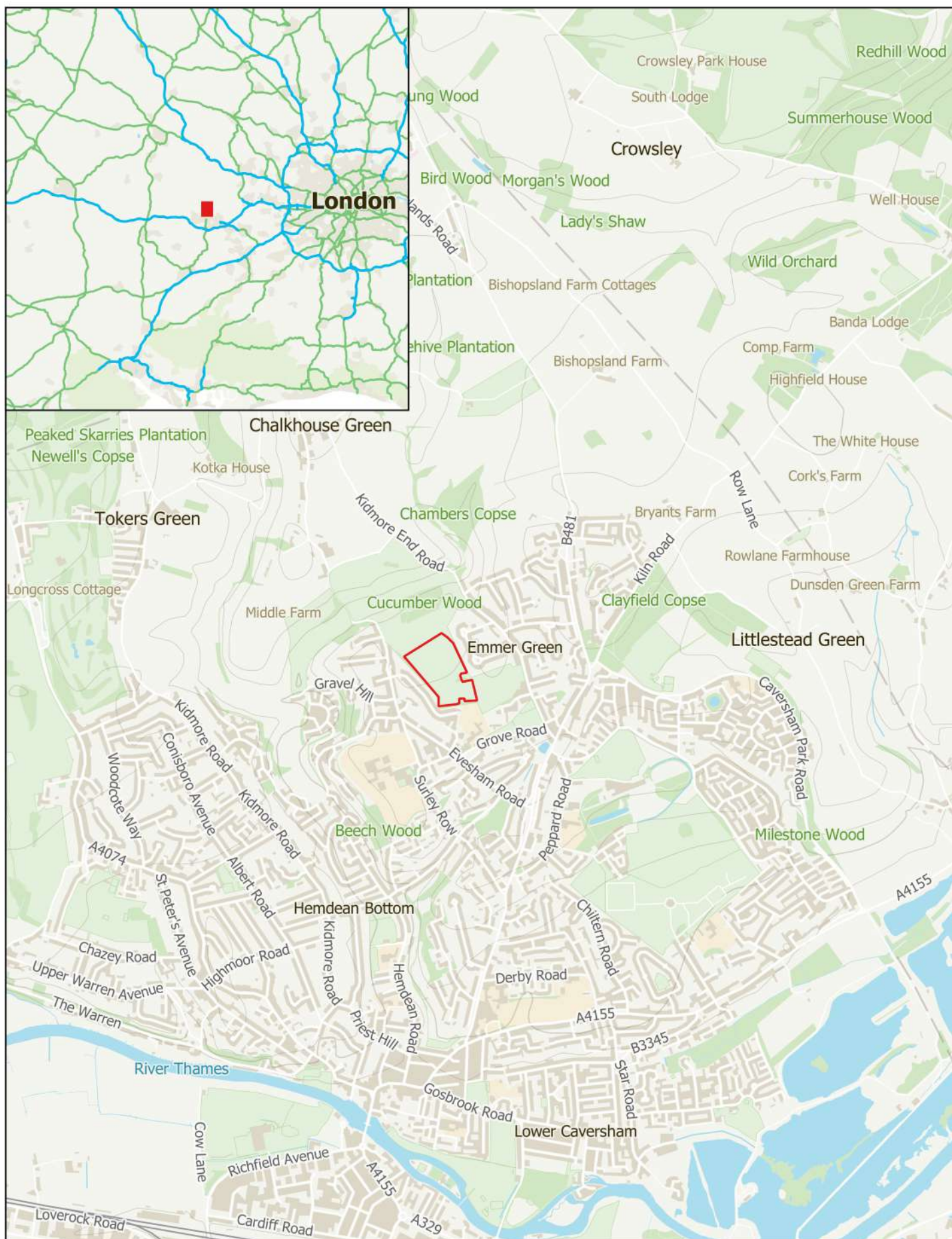
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11. Project Metadata

MS Job Code	MSSU986
Project Name	Reading Golf Club
Client	Geo-Environmental Services Limited
Grid Reference	SU 71483 76927
Survey Techniques	Electromagnetic Induction – Conductivity and Magnetic Susceptibility, Ground Penetrating Radar
Survey Size (ha)	c. 4.9ha (Electromagnetic Induction), c. 1.9ha (Ground Penetrating Radar)
Survey Dates	2021-06-29 to 2021-07-07
Project Lead	Christian Adams BA MSc ACIfA
HER Event No	N/A
OASIS No	N/A
S42 Licence No	N/A
Report Version	1.0

12. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Lead to Review	S.P & P.F.P	C.A.	23 July 2021
0.2	2 nd draft for Project Lead to Review	L.J	H.B	26 July 2021
0.3	3 rd draft for Project Lead to Review	L.J & L.S	F.P.C	02 August 2021
1.0	Report Issued as Final	C.A	C.A	29 September 2021



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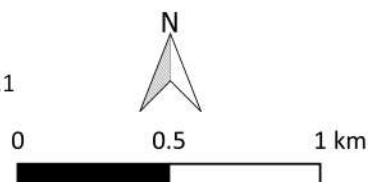
Figure 1 - Site Location

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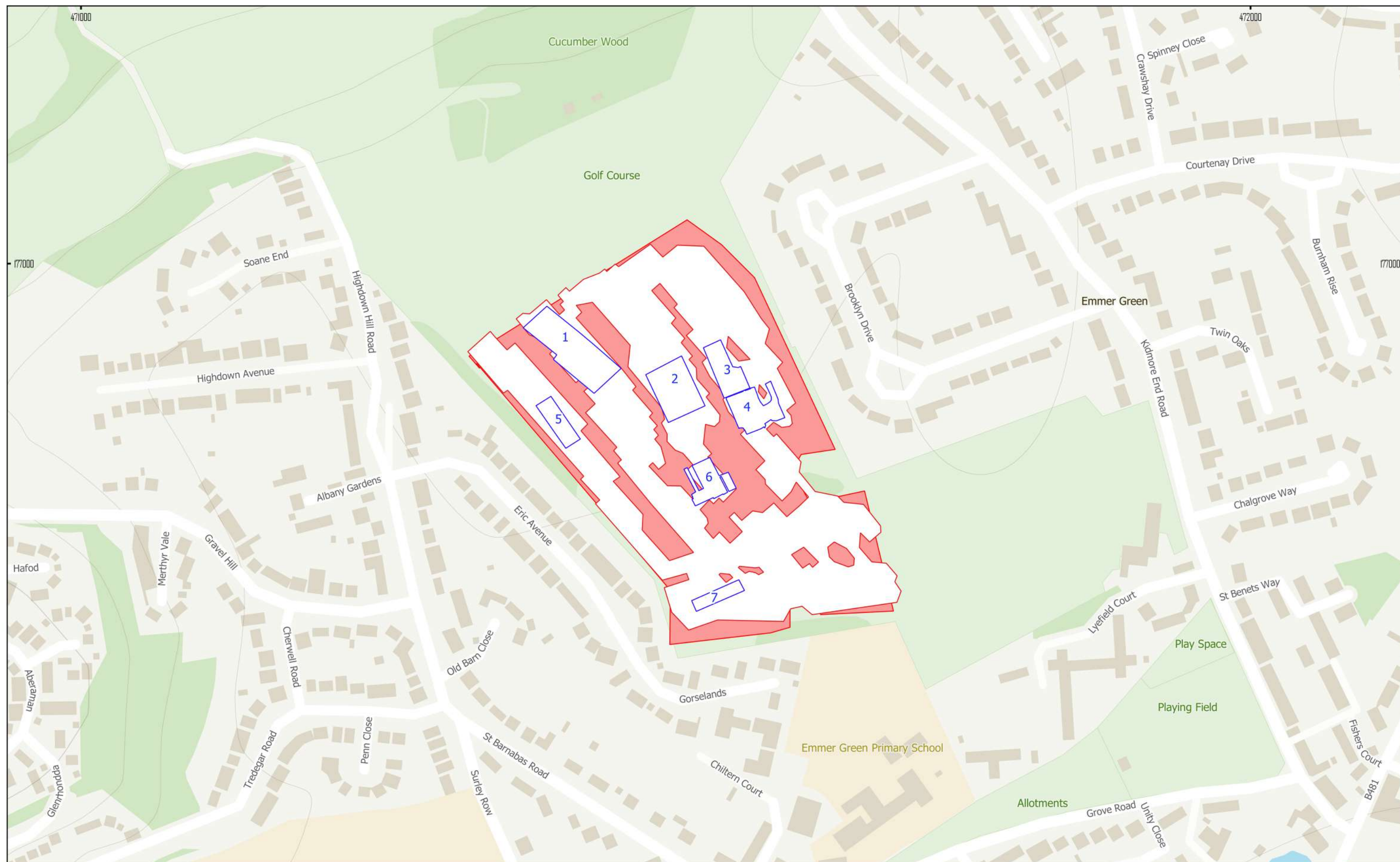
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 Survey Area



magnitude
surveys



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 Figure 2 - Location of Survey Areas
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EM Survey Area

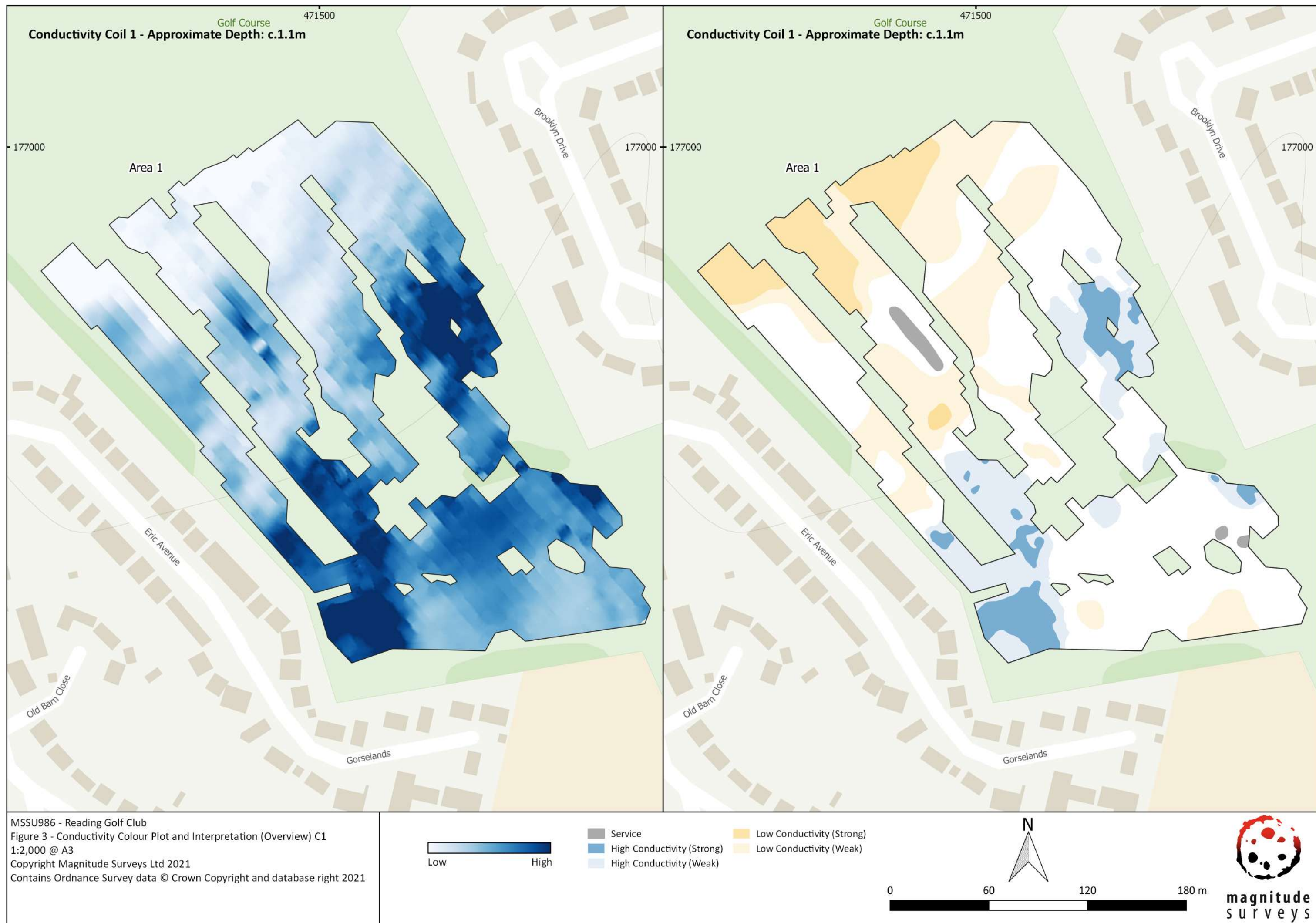
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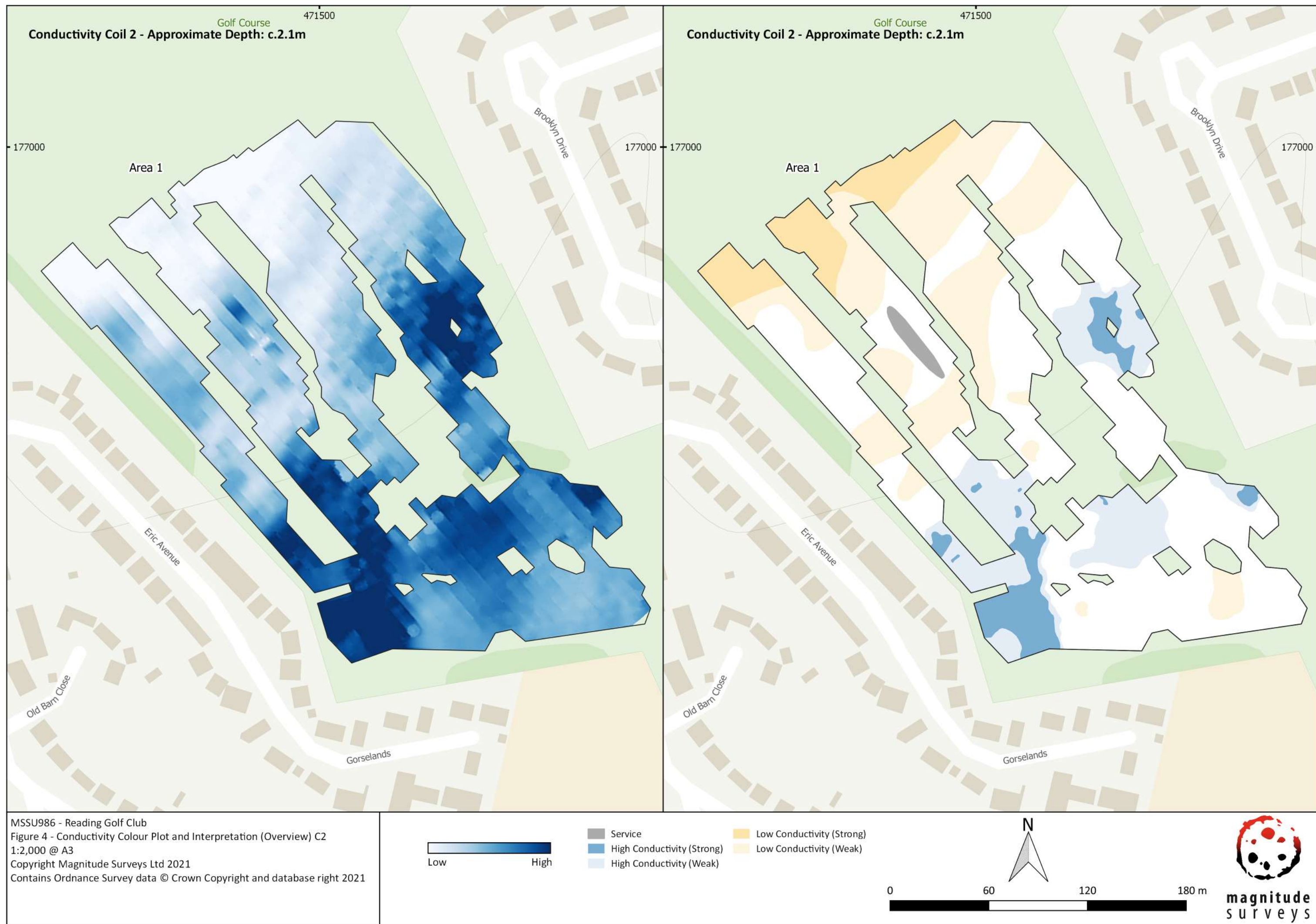
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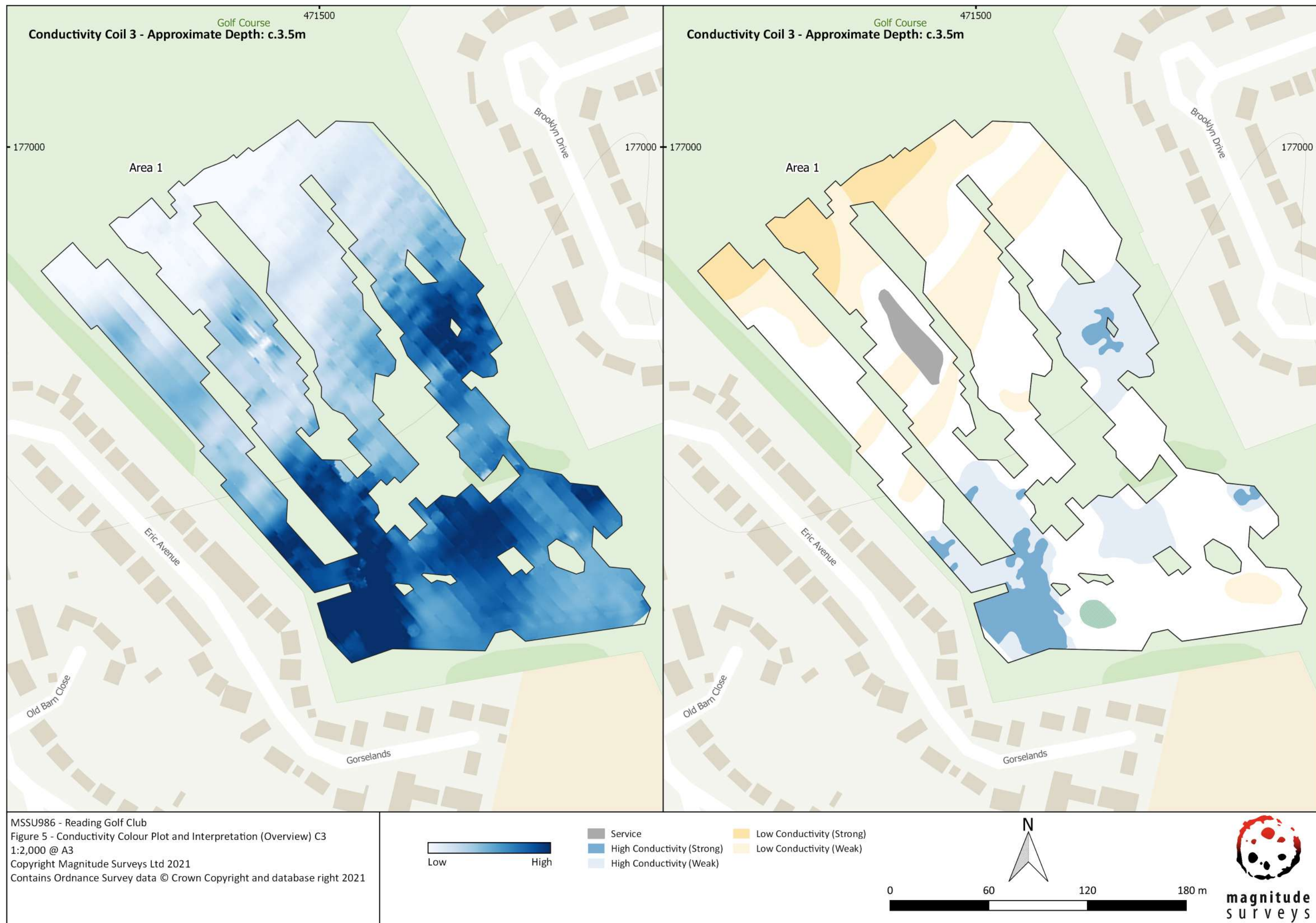
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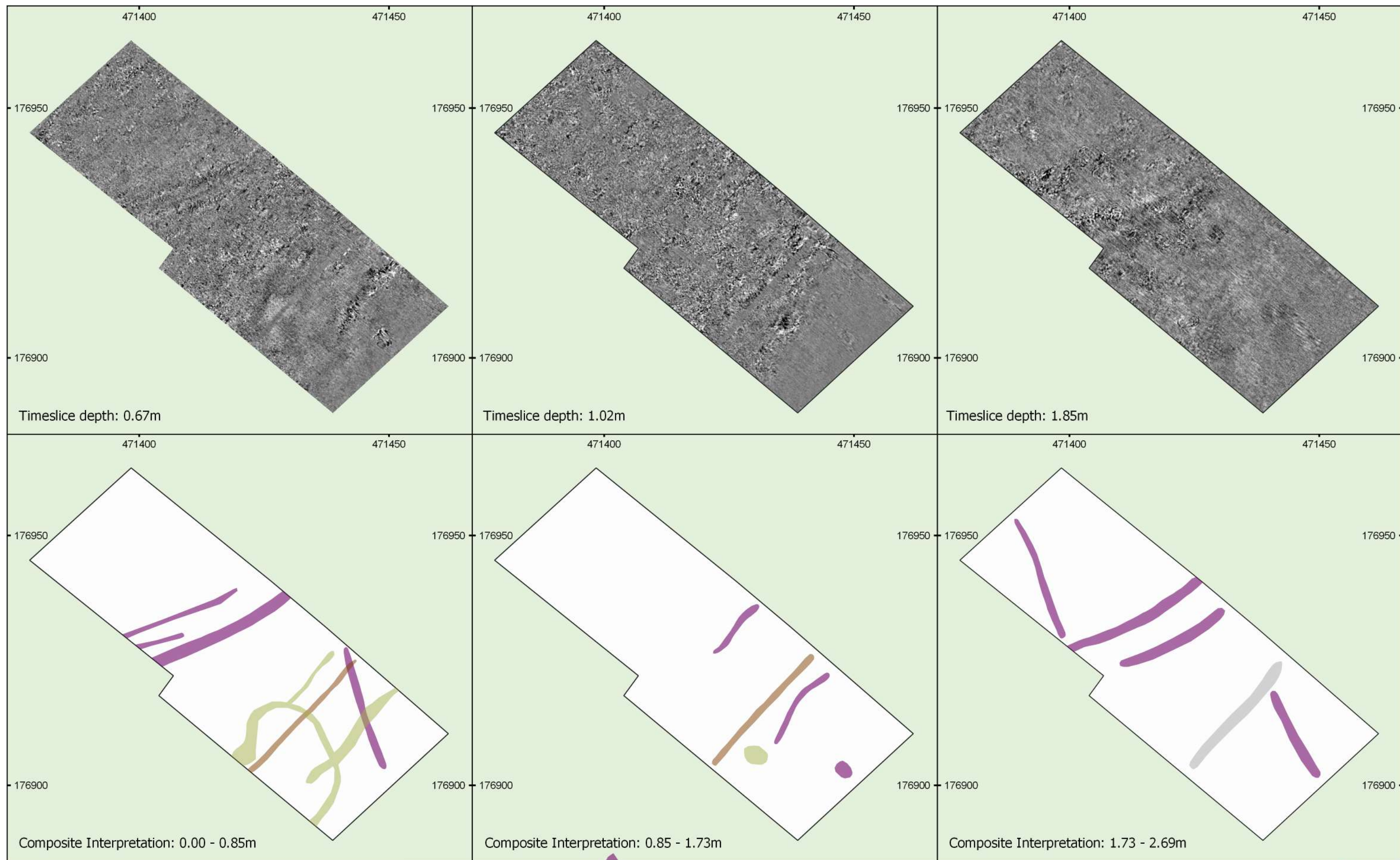
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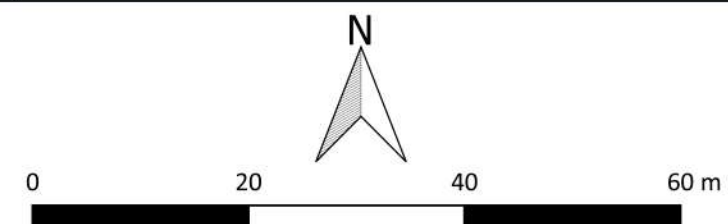


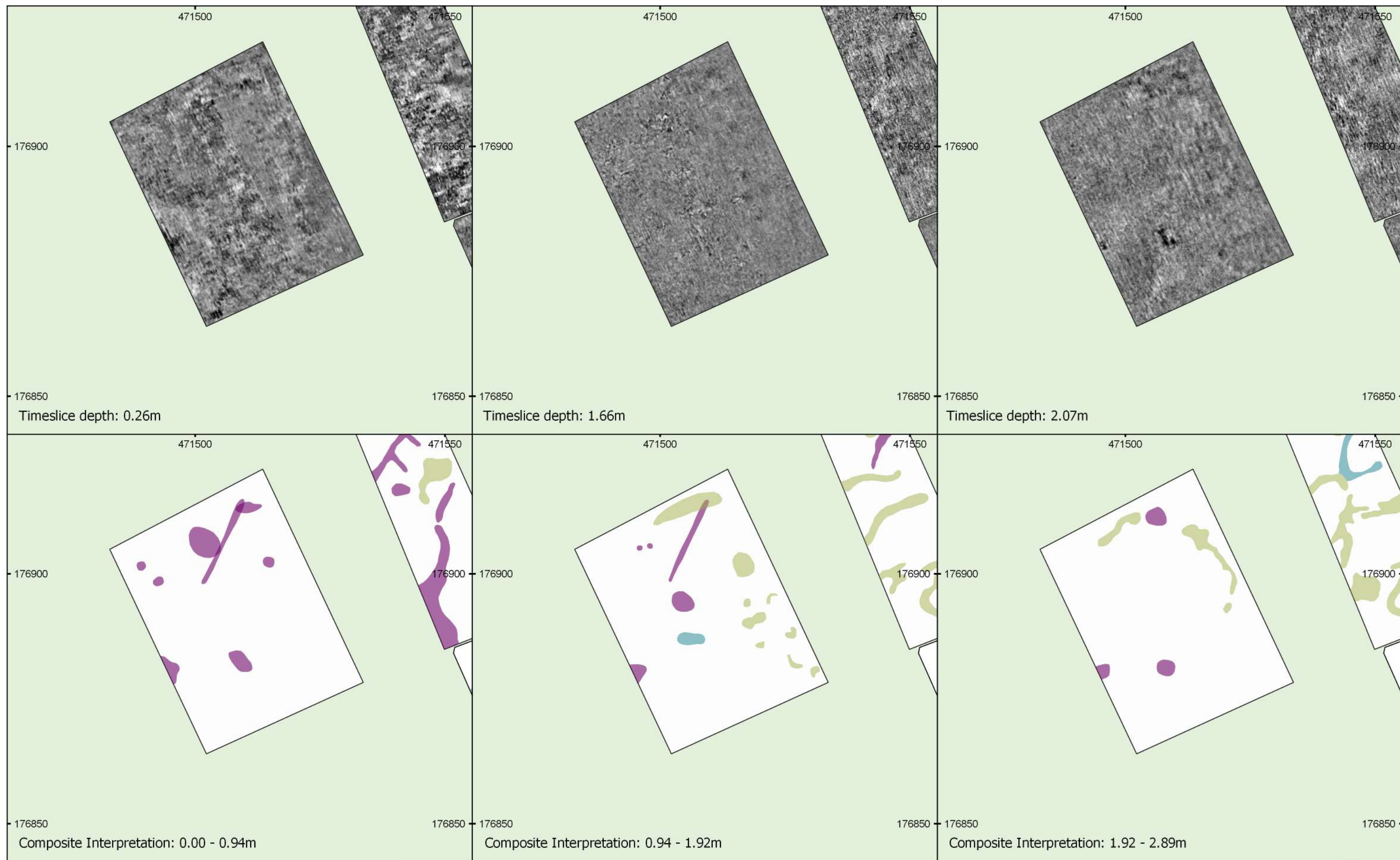


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 Figure 6 - Area 1 GPR Interpretation (Indicative Timeslices and Composite Interpretation at Given Depths: shallow, medium, deep)
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- Natural
- Golf Course/Disturbed Ground
- Possible Drain
- Undetermined
- Shadow

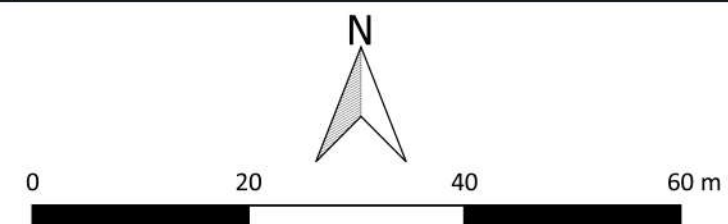


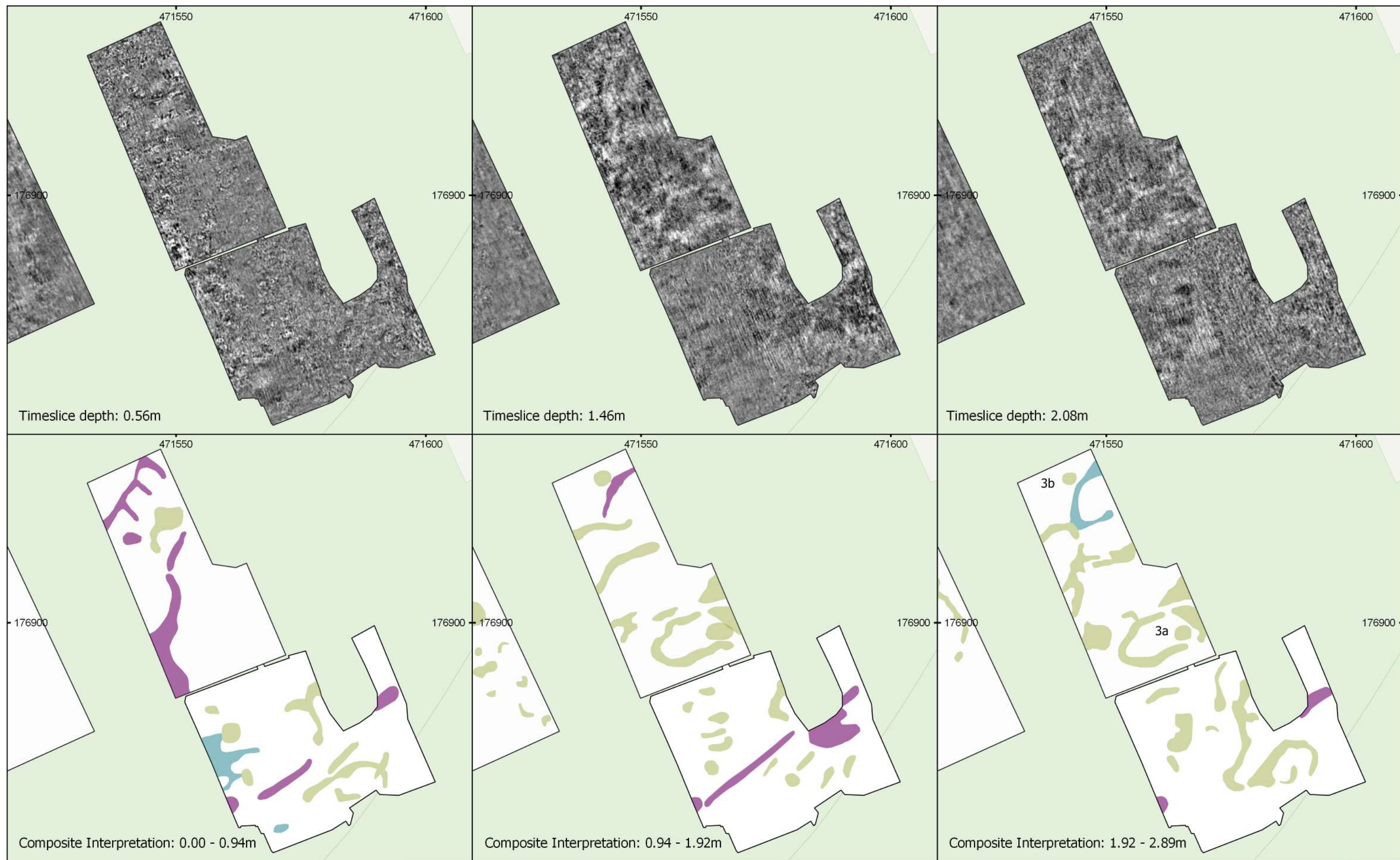


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 Figure 7 - Area 2 GPR Interpretation (Indicative Timeslices and Composite Interpretation at Given Depths: shallow, medium, deep)
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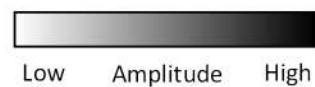


- Natural
- Golf Course/Disturbed Ground
- Undetermined
- Shadow

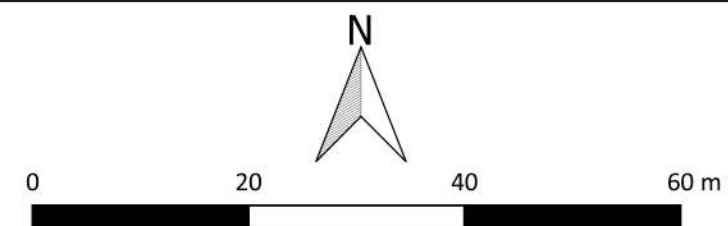


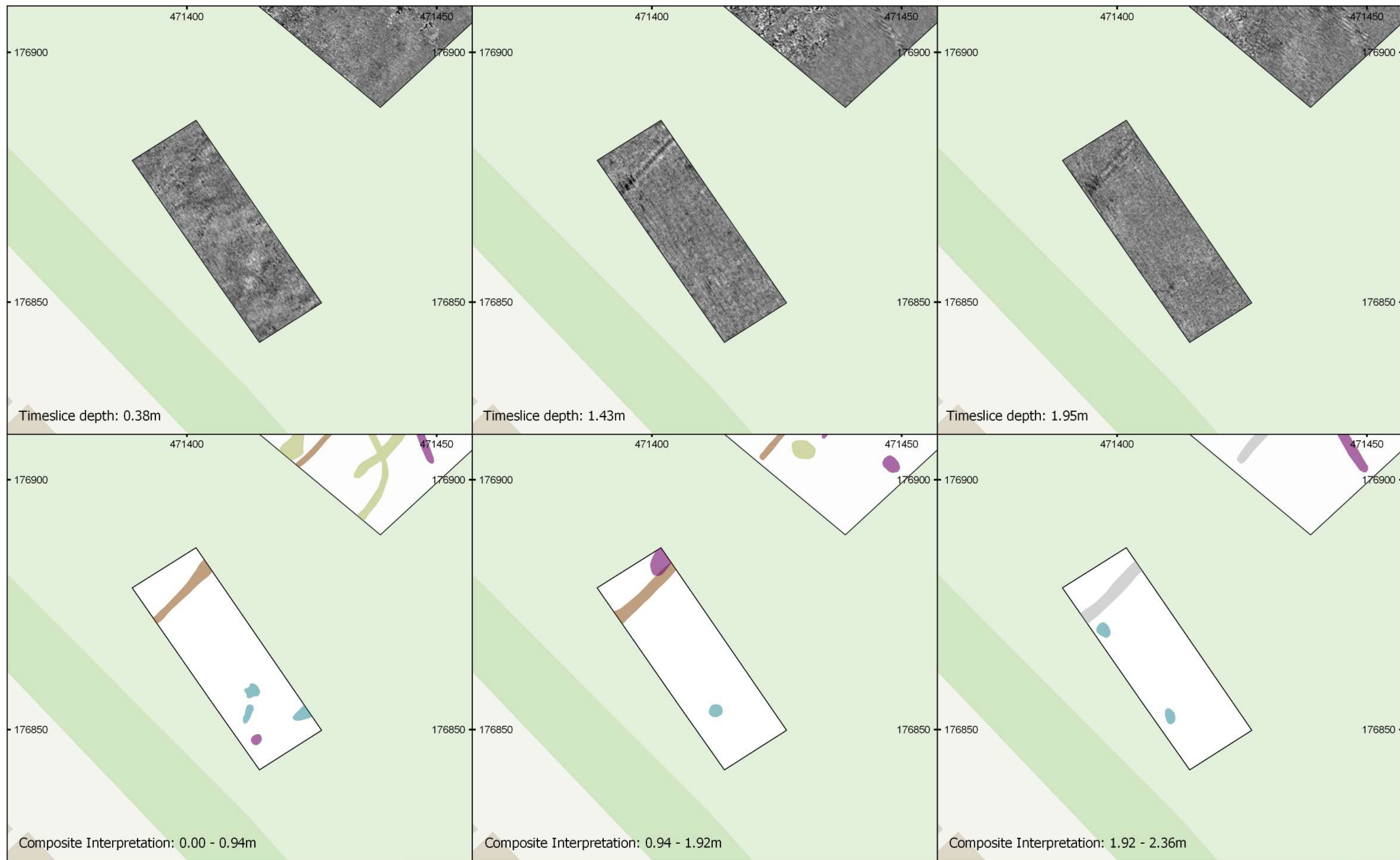


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 Figure 8 - Areas 3 & 4 GPR Interpretation (Indicative Timeslices and Composite Interpretation at Given Depths: shallow, medium, deep)
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■ Natural
■ Golf Course/Disturbed Ground
■ Undetermined

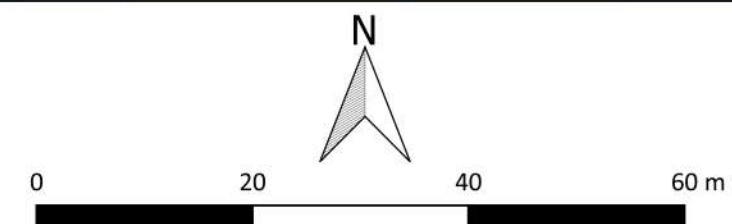


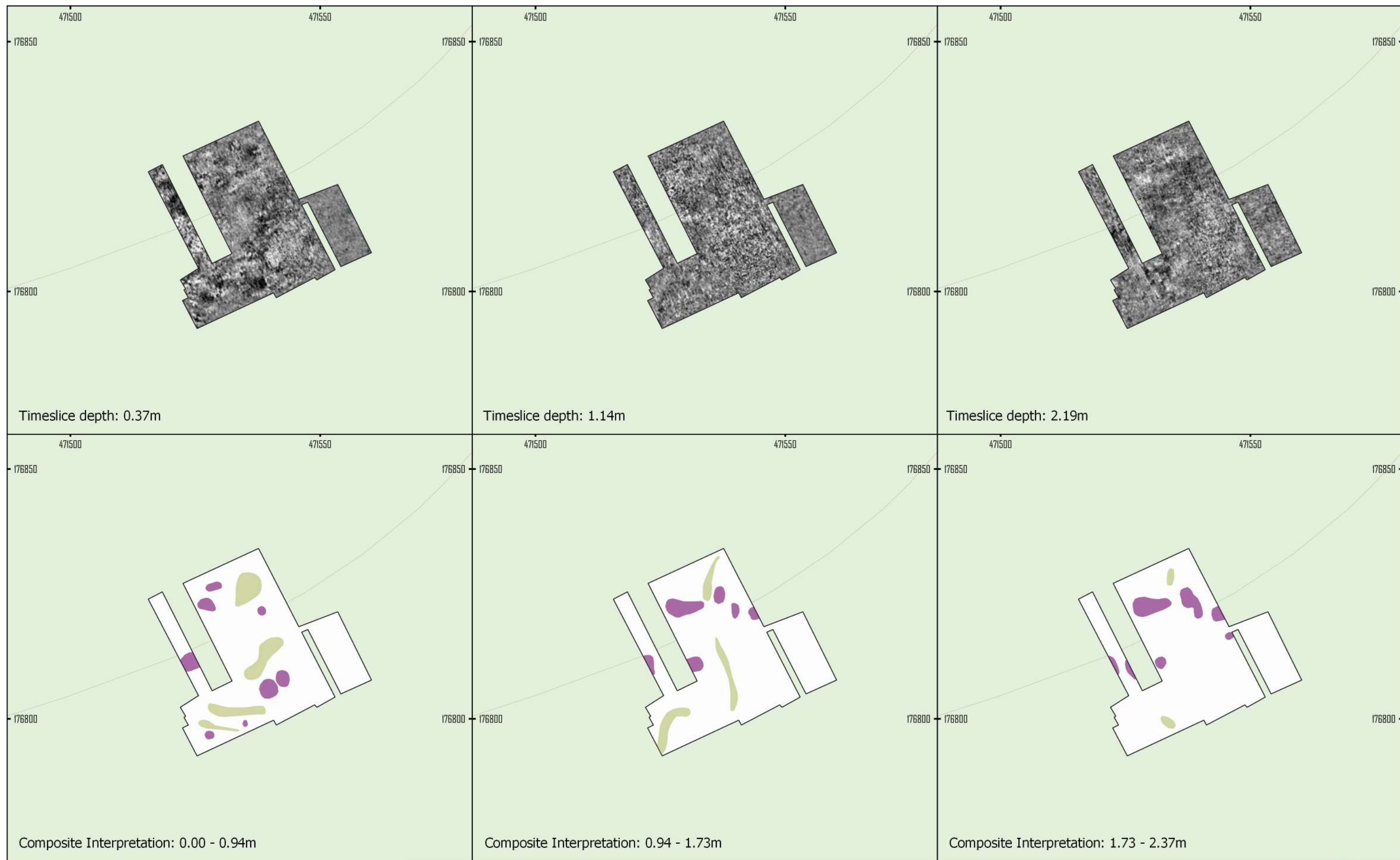


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 Figure 9 - Area 5 GPR Interpretation (Indicative Timeslices and Composite Interpretation at Given Depths: shallow, medium, deep)
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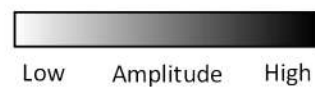


- Golf Course/Disturbed Ground
- Possible Drain
- Undetermined
- Shadow

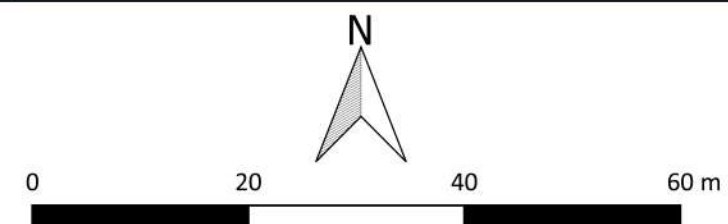


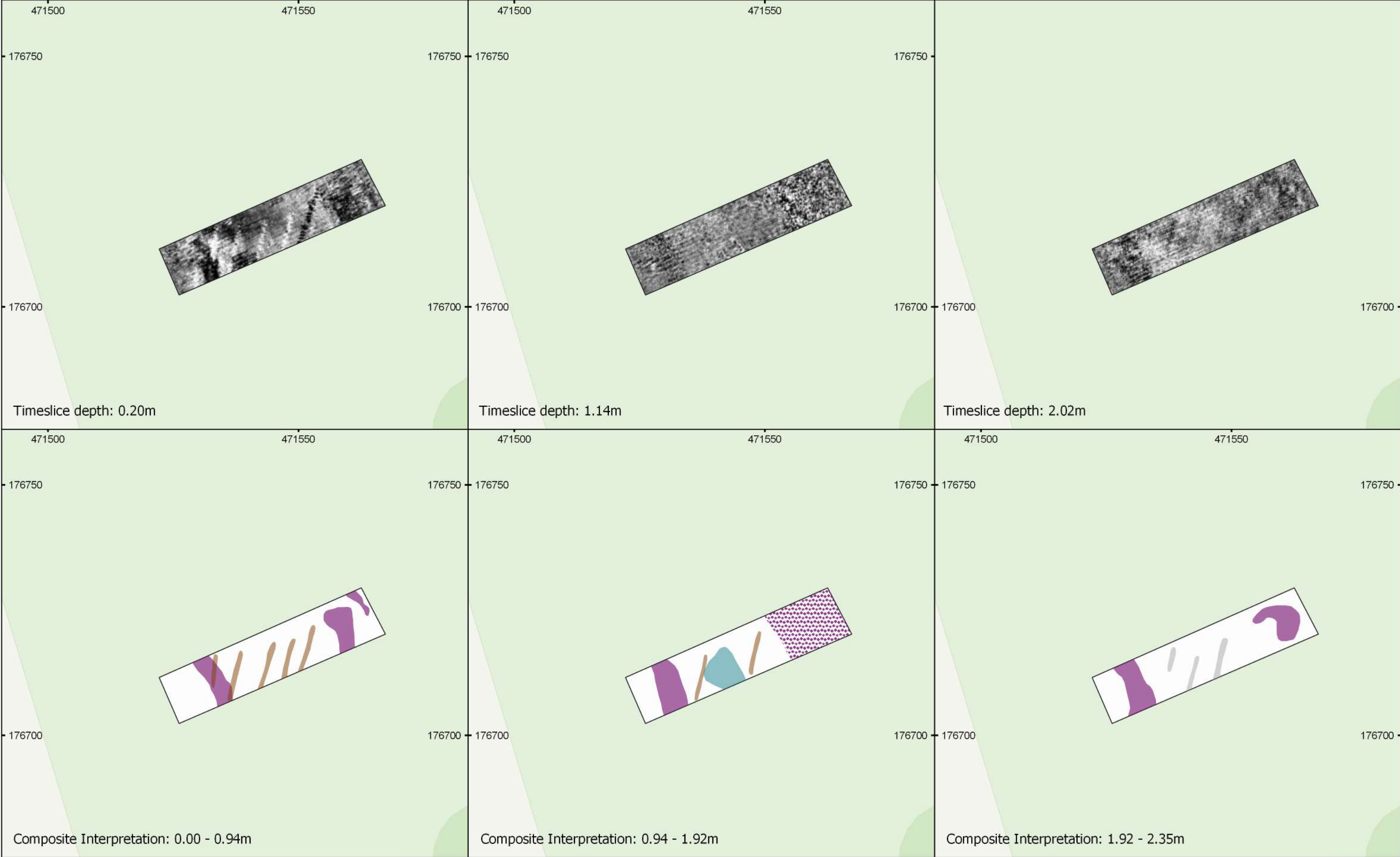


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 Figure 10 - Area 6 GPR Interpretation (Indicative Timeslices and Composite Interpretation at Given Depths: shallow, medium, deep)
 1:700 @ A3
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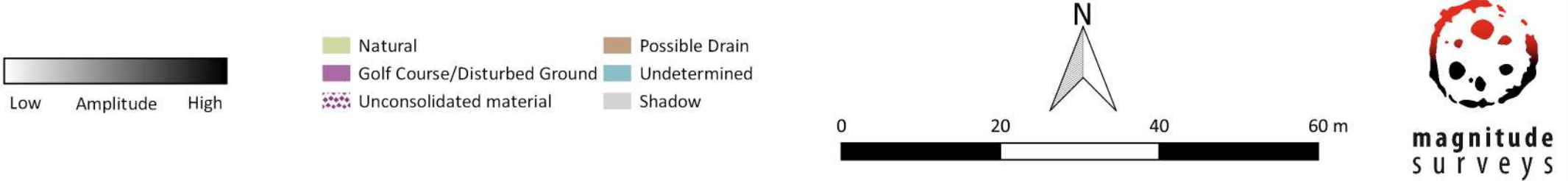


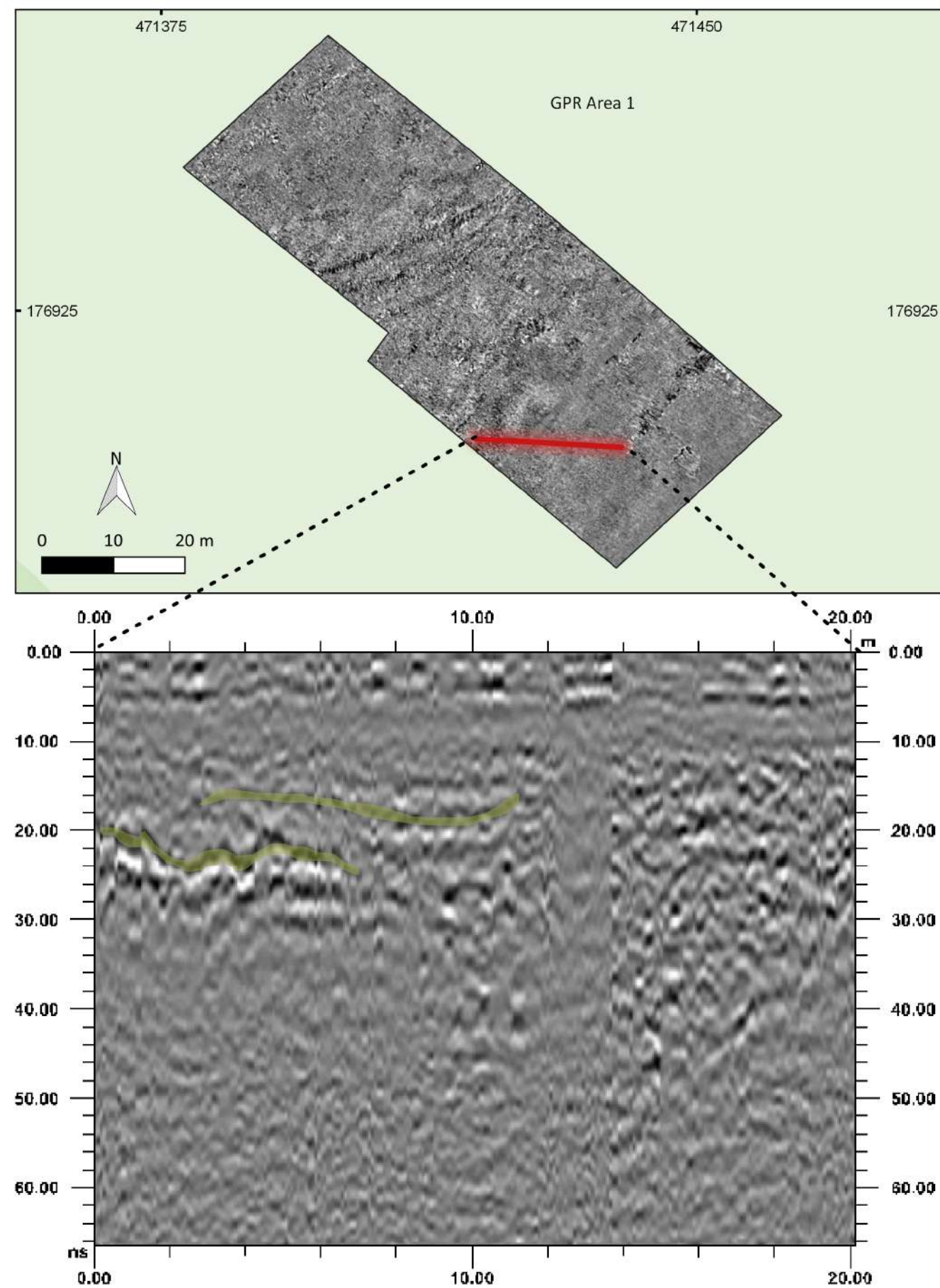
■ Natural
 ■ Golf Course/Disturbed Ground





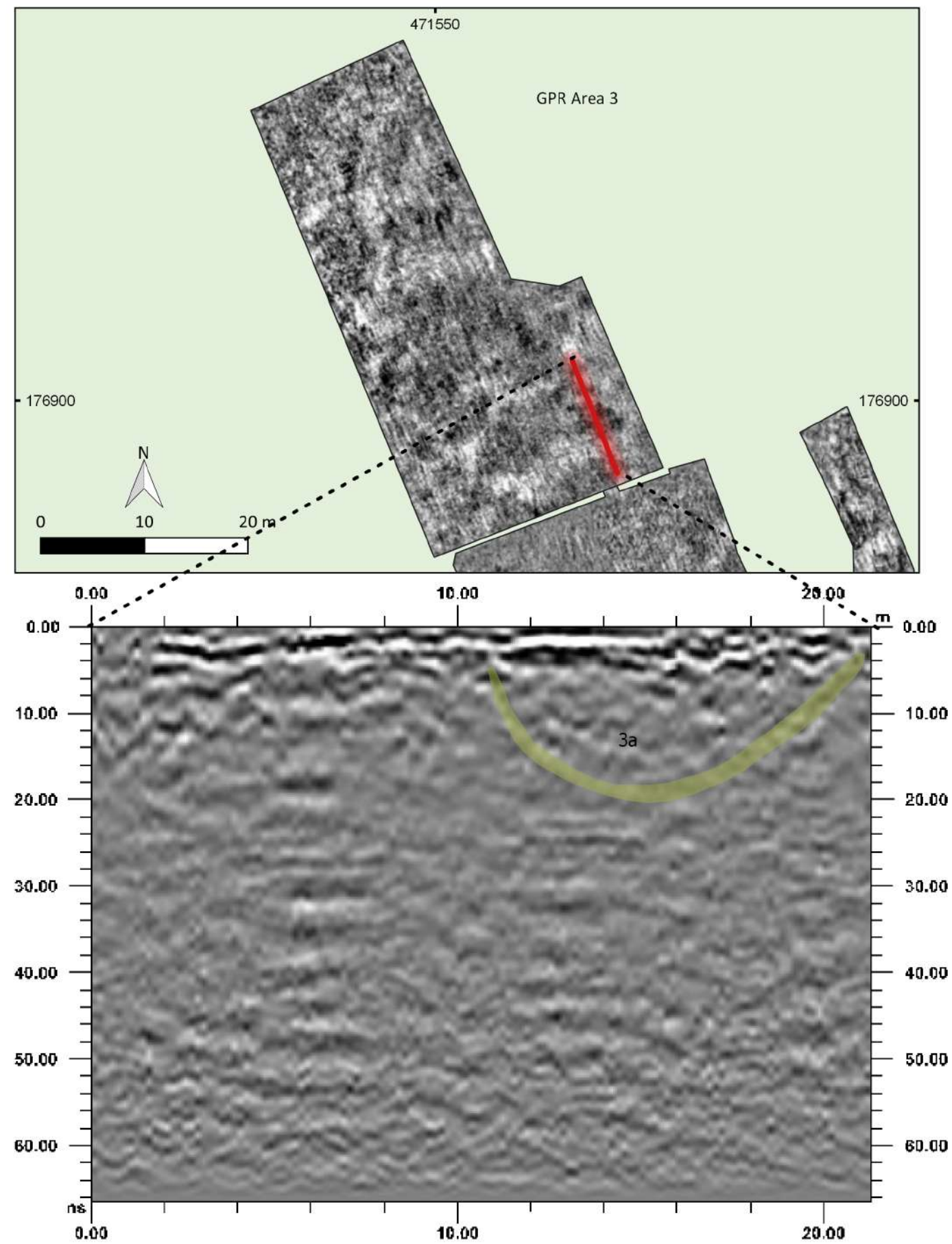
MSSU986 - Reading Golf Club
Figure 11 - Area 7 GPR Interpretation (Indicative Timeslices and Composite Interpretation at Given Depths: shallow, medium, deep)
1:700 @ A3
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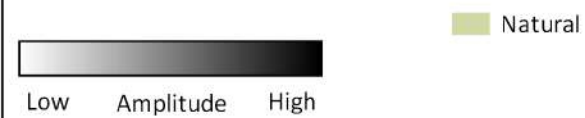


MSSU986 - Reading Golf Club
 Figure 12 - Area 1 Radargram with Interpretation
 $\text{Depth [cm]} = 9 \times \text{Time [ns]}/2$
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 Contains Ordnance Survey data © Crown Copyright and database right 2021

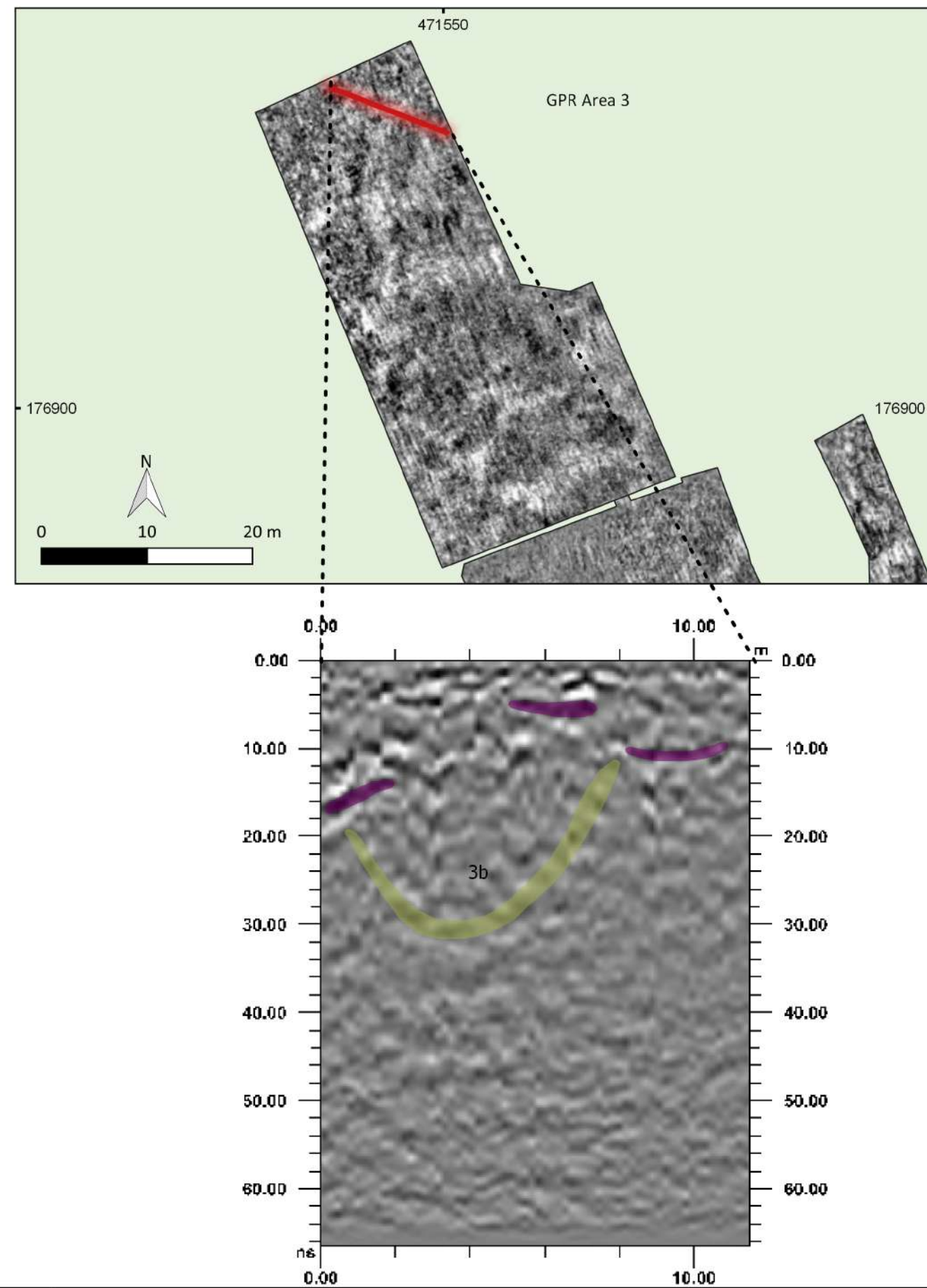




MSSU986 - Reading Golf Club
 Figure 13 - Area 3 Radargram with Interpretation [3a]
 Depth [cm] = $9 \times \text{Time [ns]} / 2$
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magnitude
surveys



MSSU986 - Reading Golf Club
 Figure 14 - Area 3 Radargram with Interpretation [3b]
 Depth [cm] = 9 x Time [ns]/2
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Low Amplitude High

Golf Course/Disturbed Ground
 Natural

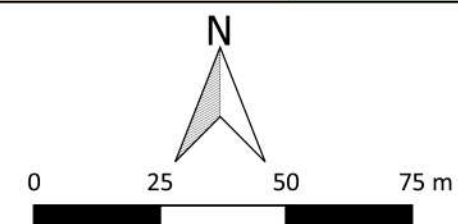


magnitude
surveys



MSSU986 - Reading Golf Club
 Figure 15 - Composite Interpretation EM & GPR
 1:1,500 @ A3
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 Contains Ordnance Survey data © Crown Copyright and database right 2021

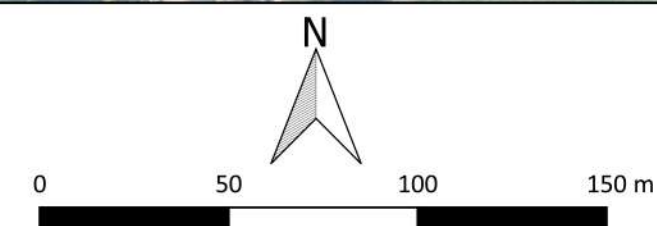
- | | |
|---|--|
| ■ High Conductivity (Strong) | ■ Natural |
| ■ High Conductivity (Weak) | ■ Possible Drain |
| ■ Low Conductivity (Strong) | ■ Golf Course/Disturbed Ground |
| ■ Low Conductivity (Weak) | ■ Unconsolidated material |
| ■ Service | ■ Undetermined |





MSSU986 - Reading Golf Club
 Figure 16 - GPR Composite Interpretation over Exploratory Hole Location Plan
 1:2,000 @ A3
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- Golf Course/Disturbed Ground
- Natural
- Shadow
- Undetermined



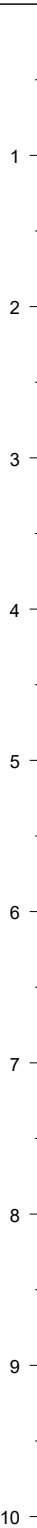


APPENDIX B

Exploratory Hole Logs & Dynamic Probe Results



 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. BH01 Sheet 1 of 2	
Project Name: Reading Golf Course		Project No. GE20079		Co-ords: 471527E - 176981N		Hole Type CP	
Location: Reading				Level: 77.84		Scale 1:50	
Client: Vistry Thames Valley				Dates: 15/07/2021		Logged By PL	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30	77.54		Grass over topsoil. TOPSOIL	
	0.50 - 1.00	B	N=23 (3,4/5,6,5,7)	0.70	77.14		Brown gravelly CLAY BLACK PARK GRAVEL MEMBER		
	1.00	S		1.10	76.74		Firm to stiff brown gravelly CLAY. BLACK PARK GRAVEL MEMBER		
	1.45 1.50 - 2.00	D B					Medium dense brown clayey flint GRAVEL BLACK PARK GRAVEL MEMBER		
	2.00	S	N=25 (4,4/6,7,7,5)						
	2.45 2.50 - 3.00	D B							
	3.00 3.00 - 3.45 3.00	D B C		N=26 (4,5/7,6,7,6)					
	4.00 - 4.45 4.00	B S	N=13 (2,3/3,3,3,4)		3.90	73.94		Recovered as off-white to white structureless CHALK composed of silt to gravel size chalk with some coarse gravel to cobble size flint. No CIRIA Grade assessed due to method of drilling. SEAFORD CHALK FORMATION	
	5.00 - 5.45 5.00	B C			N=14 (2,2/3,4,5,2)				
	6.50	S		N=19 (2,3/4,4,6,5)		6.70	71.14		
	6.95	D	N=28 (4,5/7,7,7,7)						
	7.50	D			N=35 (5,5/8,9,9,9)	8.50	69.34		
	8.00	S		N=35 (5,5/8,9,9,9)					
	8.45	D	N=35 (5,5/8,9,9,9)						
	9.00	D			N=35 (5,5/8,9,9,9)				
	9.50	S		N=35 (5,5/8,9,9,9)					
9.95	D	N=35 (5,5/8,9,9,9)							
Continued on Next Sheet									

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to		
150	6.00	3.60	3.40	4.50 8.50	5.00 9.00	1m Hand Pit Falling head test carried out at 15m bgl.	



Geo-Environmental

Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL
www.gesl.net

Borehole Log

Borehole No.

BH01

Sheet 2 of 2

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471527E - 176981N

Hole Type
CP

Location: Reading

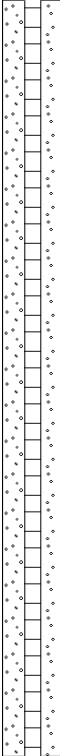
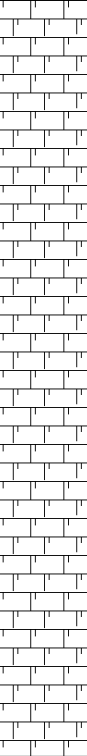
Level: 77.84

Scale
1:50

Client: Vistry Thames Valley

Dates: 15/07/2021

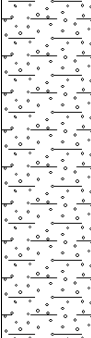
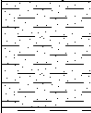
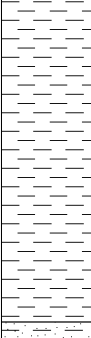
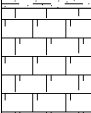
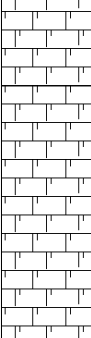
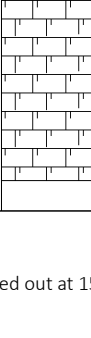
Logged By
PL

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50	D	N=55 (6,6/10,13,15,17)	15.00	62.84		Recovered as white CHALK composed of weak to moderately weak clasts and some flint of gravel and cobble size. No CIRIA Grade assessed due to method of drilling. SEAFORD CHALK FORMATION	11
		11.00	S						
		11.45	D						
		12.00	D	N=39 (6,6/9,9,10,11)					12
		12.50	S						
		12.95	D						13
		13.50	D	N=63 (7,8/12,14,17,20)					
		14.00	S						14
		14.45	D						
		15.00	D						15
End of Borehole at 15.00m									
								16	
								17	
								18	
								19	
								20	
Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks 1m Hand Pit Falling head test carried out at 15m bgl.			
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to				
150	6.00	3.60	3.40	4.50 8.50	5.00 9.00				

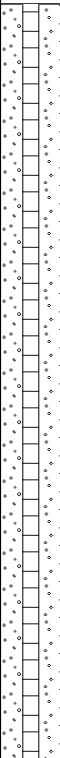
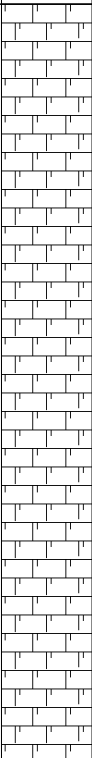




 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. BH02 Sheet 1 of 2	
Project Name: Reading Golf Course		Project No. GE20079		Co-ords: 471599E - 176756N		Hole Type CP	
Location: Reading				Level: 82.08		Scale 1:50	
Client: Vistry Thames Valley				Dates: 16/07/2021		Logged By PL	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.50 - 1.00	B	N=19 (4,5/1,1,8,9)	0.40	81.68		Grass over topsoil with tree roots. TOPSOIL	1	
		1.00 - 1.45	B		N=33 (4,4/2,9,10,12)	2.70	79.38			Medium dense to dense brown clayey flint GRAVEL BLACK PARK GRAVEL MEMBER
		1.00	C							
		1.50 - 2.00	B	N=16 (2,2/3,4,4,5)	3.40	78.68		Firm to stiff brown and grey sandy CLAY. LAMBETH GROUP	3	
		2.00 - 2.45	B							
		2.00	C							
		2.50 - 3.00	B	N=18 (2,3/4,4,5,5)	5.60	76.48		Stiff brown CLAY with bands of sand. LAMBETH GROUP	4	
		3.00	S							
		3.45	D							
		4.00	S	N=20 (2,3/4,5,5,6)	5.80	76.28		Stiff brown sandy CLAY. LAMBETH GROUP	6	
		4.45	D							
		4.80	D							
		5.00	S	N=105 (10,10/19,22,29,35)	7.10	74.98		White and off-white CHALK composed of silt to gravel sized clasts of very weak to weak chalk and some gravel to cobble size flint. No CIRIA Grade assessed due to method of drilling. SEAFORD CHALK FORMATION	7	
		5.45	D							
		5.80	D							
		6.00	D	86 (10,10/86 for 150mm)	9.00	15.00		Recovered as white CHALK composed of weak clasts and some gravel to cobble size flint. No CIRIA Grade assessed due to method of drilling. SEAFORD CHALK FORMATION	8	
		6.50	S							
		6.95	D							
7.50	D	87 (8,8/87 for 150mm)	9.00	15.00		Continued on Next Sheet	10			
8.00	S									
8.45	D									
9.00	D									
9.50	S									
9.95	D									

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to		
150	6.00			7.10 9.00	9.00 15.00	1m Hand Pit Falling head test carried out at 15m bgl.	

 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Borehole Log				Borehole No. BH02 Sheet 2 of 2				
Project Name: Reading Golf Course		Project No. GE20079		Co-ords: 471599E - 176756N		Hole Type CP				
Location: Reading				Level: 82.08		Scale 1:50				
Client: Vistry Thames Valley				Dates: 16/07/2021		Logged By PL				
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		10.50	D	86 (11,11/86 for 150mm)	15.00	67.08		Recovered as white CHALK composed of weak clasts and some gravel to cobble size flint. No CIRIA Grade assessed due to method of drilling. SEAFORD CHALK FORMATION	11	
		11.00	S							12
		11.45	D							
		12.00	D	82 (12,12/82 for 150mm)						13
		12.50	S							
		13.50	D							
		14.00	S	N=57 (7,7/8,13,17,19)						14
		14.45	D							
		15.00	D							15
End of Borehole at 15.00m								16		
								17		
								18		
								19		
								20		
Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks 1m Hand Pit Falling head test carried out at 15m bgl.				
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to					
150	6.00			7.10 9.00	9.00 15.00					



www.gesl.net

Trial Pit Log

Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471534.71 - 176995.88
Level: 77.38

Date
14/07/2021

Location: Reading

Dimensions
(m):

Depth 3.00

0.50 2.00

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20	77.18		Turf covered sandy gravelly CLAY with frequent rootlets. Sand is fine to coarse gravel is fine medium.
	0.50	D					TOPSOIL
	0.60	B					Soft to firm orangish brown very sandy gravelly CLAY with a low cobble content. Gravel is fine to coarse sand is fine to medium.
							BLACK PARK GRAVEL MEMBER
	1.00	D					Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc
	1.50	D					SEAFORD CHALK FORMATION
	2.00	D		2.10	75.28		End of Pit at 3.00m
	2.50	D					End of Pit at 3.00m
	3.00	D		3.00	74.38		End of Pit at 3.00m
							End of Pit at 3.00m

Water Strikes	
Depth Strike	Rose to (mbgf)

Remarks

Stability	Sides stable
-----------	--------------





Geo-Environmental www.gesl.net

Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL

Trial Pit Log

TrialPit No
TP202
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471515.44 - 176999.17
Level: 76.33

Date
14/07/2021

Location: Reading

Dimensions (m): 2.00
0.50
Depth 2.90

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20			0.20	76.13		Turf covered sandy gravelly CLAY with frequent rootlets. Sand is fine to coarse gravel is fine medium. TOPSOIL	
	0.50	D					Firm to stiff brown sandy gravelly CLAY with frequent rootlets and medium cobble content. BLACK PARK GRAVEL MEMBER	
	0.90	B		0.90	75.43		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	1
	1.00	D						
	1.20	PP	PP=2kg/cm2					
	1.50	D						
	2.00	B						2
	2.00	D						
	2.50	D						
	2.90	D		2.90	73.43		End of Pit at 2.90m	3
								4
								5

Water Strikes	
Depth Strike	Rose to (mlog)

Remarks

Stability Sides stable





Geo-Environmental www.gesl.net

Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL

Trial Pit Log

TrialPit No
TP203
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471500.67 - 176995.93
Level: 76.31

Date
14/07/2021

Location: Reading

Dimensions (m): 2.00
Depth 2.90

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20	76.11		Turf covered sandy gravelly CLAY with frequent rootlets. Sand is fine to coarse gravel is fine medium. TOPSOIL	
	0.50	D					Firm to stiff brown sandy gravelly CLAY with frequent rootlets.	
	0.60	B					BLACK PARK GRAVEL MEMBER	
	1.00	D					Firm to stiff brown sandy gravelly CLAY with frequent rootlets and medium cobble content. BLACK PARK GRAVEL MEMBER	1
	1.50	D					Firm to stiff brown sandy gravelly CLAY with frequent rootlets and medium cobble content. BLACK PARK GRAVEL MEMBER	
	1.50	PP	PP=0.75kg/cm2				Firm to stiff brown sandy gravelly CLAY with frequent rootlets and medium cobble content. BLACK PARK GRAVEL MEMBER	
	1.75	PP	PP=1.75kg/cm2	1.70	74.61		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	2
	2.00	D					Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	
	2.50	D		2.45	73.86		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	
	3.00	D		2.90	73.41		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	3
							End of Pit at 2.90m	

Remarks Spalling at clay chalk boundary

Stability Localised spalling



Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Trial Pit Log		TrialPit No TP204 Sheet 1 of 1		
Project Name: Reading Golf Course		Project No. GE20079	Co-ords: 471514.03 - 176983.61 Level: 77.10		Date 15/07/2021	
Location: Reading			Dimensions (m): 1.80 0.50		Scale 1:25	
Client: Vistry Thames Valley			Depth 3.00		Logged TM	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	Scale
	Depth	Type	Results					
				0.40	76.69		Turf covered brown sandy gravelly SILT with frequent rootlets gravel is medium and well rounded. TOPSOIL	
	0.50	D					Soft orangish brown sandy gravelly CLAY with a low cobble content. Gravel is fine to coarse angular to subangular. Sand is fine to coarse. BLACK PARK GRAVEL MEMBER	
	0.60	B						
	1.00	D						
	1.50	D		1.60	75.50			
	2.00	D					Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	
	2.50	D						
	3.00	D		3.00	74.10			
							End of Pit at 3.00m	

Water Strikes Depth Strike Notes to (m)ggl	Remarks Stability Sides stable
---	---

 Geo-Environmental		Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Trial Pit Log			TrialPit No TP205 Sheet 1 of 1		
Project Name: Reading Golf Course				Project No. GE20079		Co-ords: 471502.26 - 176980.02 Level: 77.00		Date 15/07/2021	
Location: Reading						Dimensions (m): 1.80 		Scale 1:25	
Client: Vistry Thames Valley						Depth 3.40		Logged TM	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
							Turf covered brown sandy gravelly SILT with frequent rootlets gravel is medium and well rounded. TOPSOIL	
	0.50	D		0.35 0.40 0.40	76.65 76.60 76.60		Dark brown sandy gravelly SILT. Sand is fine to coarse and gravel is fine to medium subangular to subrounded. BLACK PARK GRAVEL MEMBER Dark brown sandy gravelly SILT. Sand is fine to coarse and gravel is fine to medium subangular to subrounded. Soft to firm orangish brown sandy gravelly CLAY. Sand is fine to coarse and gravel is fine to coarse subangular to subrounded. BLACK PARK GRAVEL MEMBER	1
	0.70	B						
	1.00	D						
	1.50	D		1.40	75.60		Soft to firm orangish brown very sandy gravelly CLAY with a medium cobble content of rinded flint. Sand is fine to coarse gravel is fine to coarse angular rinded flint. BLACK PARK GRAVEL MEMBER	2
	2.00	D		2.10	74.90		Loose orange clayey gravelly fine to coarse SAND with a medium cobble content. Sand is fine to coarse gravel is fine to coarse angular flint. BLACK PARK GRAVEL MEMBER	3
	2.50	D						
	3.20	D		3.40	73.60		End of Pit at 3.40m	4
								5

Depth Strike 	Water Strikes 	Remarks Relative density assessed from DP2 Stability Sides stable
--	---	--





Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL
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Trial Pit Log

Trial Pit No
TP206
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471518.75 - 176975.95
Level: 77.64

Date
15/07/2021

Location: Reading

Dimensions (m): 1.80

Depth
3.01

0.55

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.25	77.39		Turf covered brown sandy gravelly SILT with frequent rootlets gravel is medium and well rounded. TOPSOIL	
	0.50	D					Firm to stiff brown sandy gravelly CLAY with frequent rootlets and medium cobble content. BLACK PARK GRAVEL MEMBER	
	0.60	B						
	1.00	D						1
	1.50	D					Firm to stiff brown sandy gravelly CLAY with frequent rootlets and medium to high cobble and boulder content. BLACK PARK GRAVEL MEMBER	
	2.00	D		1.80	75.84			2
	2.50	D		2.45	75.19		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	
	3.00	D		3.01	74.63		End of Pit at 3.01m	3
								4
								5

Depth Strike	Water Strikes	Remarks
	Rose to (mlog)	
		Stability Sides stable





Geo-Environmental www.gesl.net

Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL

Trial Pit Log

TrialPit No
TP207
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471581.01 - 176769.19
Level: 81.64

Date
14/07/2021

Location: Reading

Dimensions (m): 2.00

Depth
2.30

0.55

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	81.24		Turf covered brown sandy gravelly CLAY with frequent rootless. Sand is fine to coarse gravel is medium. TOPSOIL	
	0.50	D					Loose becoming medium dense orangish gravelly fine to coarse SAND with a medium cobble content. BLACK PARK GRAVEL MEMBER	
	0.60	B						
	1.00	D						1
	1.50	D						
	2.00	D					Stiff brown and grey mottled CLAY with occasional roots and slight Reddish staining. LAMBETH GROUP	2
	2.20	PP	PP=2.5kg/cm2	2.10	79.54			
	2.30	D		2.30	79.34			
							End of Pit at 2.30m	
								3
								4
								5

Depth Strike	Water Strikes	Remarks
		Relative density assessed from DP15
		Stability Sides stable

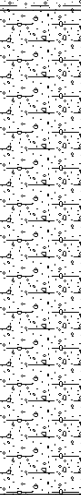


 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Trial Pit Log			TrialPit No TP208 Sheet 1 of 1	
Project Name: Reading Golf Course		Project No. GE20079		Co-ords: 471635.05 - 176783.21 Level: 81.30		Date 14/07/2021
Location: Reading				Dimensions (m): 2.00 Depth 2.10		Scale 1:25
Client: Vistry Thames Valley				Logged TM		

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	80.90		Turf covered sandy gravelly CLAY with frequent rootlets. Sand is fine to coarse gravel is fine medium. TOPSOIL	
	0.50	D					Firm to stiff orangish brown sandy gravelly CLAY with frequent rootlets sand is fine to coarse and gravel is fine to coarse subangular to subrounded. BLACK PARK GRAVEL MEMBER	
	0.60	B						
	0.80	PP	PP=1.5kg/cm2	0.80	80.50		Loose becoming medium dense orangish brown clayey gravelly fine to coarse SAND with a high cobble content. Gravel is fine to coarse subangular to rounded. NOTE: Very loose to 2.1m bgl in DP9 BLACK PARK GRAVEL MEMBER	1
	1.00	D						
	1.50	D						
	2.00	D		2.10	79.20			2
							End of Pit at 2.10m	
								3
								4
								5

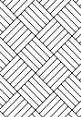
Depth Strike Water Strikes	Rosen to (mbgl)	Remarks Relative density assessed from DP7, DP8 & DP9
		Stability Sides stable



 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Trial Pit Log			TrialPit No TP209 Sheet 1 of 1			
Project Name: Reading Golf Course		Project No. GE20079		Co-ords: 471636.50 - 176752.37 Level: 82.31		Date 14/07/2021		
Location: Reading				Dimensions (m): 2.00 		Scale 1:25		
Client: Vistry Thames Valley				Depth 2.00		Logged TM		
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	82.01		Turf covered sandy gravelly SILT with frequent rootlets. TOPSOIL	
				0.40	81.91			Soft grey sandy gravelly CLAY sand is fine to medium. Gravel fine to medium subangular to subrounded. BLACK PARK GRAVEL MEMBER
	0.50	D				Loose becoming medium dense orange clayey gravelly fine to coarse SAND with a low cobble content and firm gravelly CLAY pockets. Dense at 2.0m in DP11. BLACK PARK GRAVEL MEMBER		
	0.60	B						
	1.00	D						
				1.30	PP	PP=1.5kg/cm2		
				1.50	D			
			2.00	D		2.00	80.31	End of Pit at 2.00m
Depth Strike		Remarks: Relative density assessed from DP11 and DP12. Some localised spalling.						
Water Strikes		Stability: Localised spalling						



 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Trial Pit Log		TrialPit No TP210 Sheet 1 of 1	
Project Name: Reading Golf Course		Project No. GE20079		Co-ords: 471657.44 - 176758.45 Level: 84.41	
Location: Reading		Dimensions (m): 2.00 0.55		Scale 1:25	
Client: Vistry Thames Valley		Depth 3.00		Logged TM	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	84.01		Turf covered brown slightly gravelly sandy CLAY with frequent rootlets gravelly is find to medium rounded. TOPSOIL	
	0.50	D					Soft to firm orangish brown and grey mottled sandy CLAY with occasional to frequent roots. LAMBETH GROUP <i>Tree root 30mm dia.</i>	
	0.60	B						
	1.00	D						1
	1.20	PP	PP=1kg/cm2					
	1.40	PP	PP=1.5kg/cm2					
	1.50	D						
	2.00	D						2
	2.50	D						
				2.70	81.71		Firm grey with slight orange staining slightly gravelly sandy CLAY. Sand is fine to coarse gravel is fine to medium sub rounded. LAMBETH GROUP	
	3.00	D		3.00	81.41		End of Pit at 3.00m	3
								4
								5

Depth Strike	Water Strikes (None to (m)g)	Remarks
		Stability Sides stable



Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net				Trial Pit Log				TrialPit No TP301 Sheet 1 of 1	
Project Name: Reading Golf Course				Project No. GE20079		Co-ords: 471519.61 - 176986.07 Level: 77.23		Date 16/07/2021	
Location: Reading						Dimensions (m): 1.70 0.50		Scale 1:25	
Client: Vistry Thames Valley						Depth 3.00		Logged TM	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.25	76.98		Turf over brown sandy gravelly SILT with frequent rootlets. Gravel is fine to medium. Sand is fine to medium. TOPSOIL	
	0.80	PP	PP=1.25kg/cm2				Firm orangish brown sandy gravelly CLAY. Sand is fine to coarse gravel is fine to medium subangular to subrounded see photo 0.7-1.3m bgl BLACK PARK GRAVEL MEMBER	1
	1.10	PP	PP=2kg/cm2				Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling and light brown staining on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	2
	2.50	B		1.30	75.93			
				3.00	74.23		End of Pit at 3.00m	3
								4
								5

Depth Strikes Water Strikes	Remarks Stability Sides stable
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Trial Pit Log

TrialPit No
TP302
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471556.23 - 176955.42
Level: 79.68

Date
16/07/2021

Location: Reading

Dimensions (m):

Depth 3.10

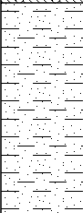
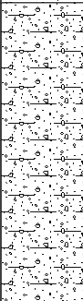
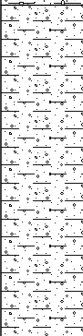
0.50

2.00

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	79.38		Turf over brown sandy gravelly SILT with frequent rootlets. Gravel is fine to medium subrounded. Sand is fine to medium. TOPSOIL
				1.00	78.68		Soft to firm orangish brown slightly sandy CLAY BLACK PARK GRAVEL MEMBER
	1.30	PP	PP=1kg/cm2				Medium dense orange brown clayey gravelly fine to coarse SAND. Gravel is fine to coarse subangular to rounded with a low to medium cobble content. BLACK PARK GRAVEL MEMBER
	1.50	PP	PP=1.5kg/cm2				Firm to stiff greenish grey and reddish brown mottled CLAY grading along the pit to orangish brown and green mottled sandy gravelly CLAY. Gravel is fine to coarse rounded to subrounded and occasional flint of cobble size LAMBETH GROUP
	3.00 3.00	PP PP	PP=3.5kg/cm2 PP=3kg/cm2	3.10	76.58		End of Pit at 3.10m

Remarks	Relative density assessed from DP301
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Stability	Sides stable
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Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL

Geo-Environmental www.gesl.net

Trial Pit Log

TrialPit No
TP303
Sheet 1 of 1

Project Name: Reading Golf Course	Project No. GE20079	Co-ords: 471569.56 - 176927.93 Level: 80.20	Date 16/07/2021
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Location: Reading	Dimensions (m): 1.80 0.50	Scale 1:25
Client: Vistry Thames Valley	Depth 3.20	Logged TM

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.40	PP	PP=2kg/cm2	0.30	79.90		Turf covered brown sandy gravelly SILT with frequent rootlets. Gravel is fine to medium subrounded. Sand is fine to coarse. TOPSOIL	
				0.50	79.70		Firm bluish grey mottled brown gravelly CLAY. Gravel is fine to coarse rounded to subrounded BLACK PARK GRAVEL MEMBER	
	1.20	PP	PP=2.15kg/cm2	1.17	79.03		Orangish brown clayey fine to coarse SAND and fine to coarse GRAVEL with a low cobble content. BLACK PARK GRAVEL MEMBER	1
				2.00	78.20		Firm to stiff bluish grey and brown thinly laminated sandy silty CLAY LAMBETH GROUP	
				2.40	77.80		Soft greenish grey sandy gravelly CLAY. Gravel is fine to coarse angular to subangular. Low cobble content. LAMBETH GROUP	2
	2.60	B		3.20	77.00		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling and light brown staining on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	3
							End of Pit at 3.20m	4
								5

Depth Strike	Water Strikes	Remarks
		Stability Sides stable



Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net				Trial Pit Log				TrialPit No TP304 Sheet 1 of 1	
Project Name: Reading Golf Course				Project No. GE20079		Co-ords: 471591.21 - 176902.89 Level: 80.74		Date 16/07/2021	
Location: Reading						Dimensions (m): 1.80 Depth 3.00		Scale 1:25 Logged TM	
Client: Vistry Thames Valley									

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.35	80.39		Turf over brown sandy gravelly SILT with frequent rootlets. Sand is fine to medium gravel is fine to medium subrounded to rounded. TOPSOIL	
							Very loose orangish brown clayey gravelly fine to coarse SAND with frequent rootless. Gravel is fine to medium subangular to subrounded. BLACK PARK GRAVEL MEMBER	1
	1.40	PP	PP=2kg/cm2	1.40	79.34		Stiff bluish grey mottled red with a high cobble content. Cobbles are very well rounded. LAMBETH GROUP	
	1.80	PP	PP=2kg/cm2					2
				2.40	78.34		Loose yellowish brown and black speckled clayey fine to medium SAND. LAMBETH GROUP	
	2.80	PP	PP=2kg/cm2	2.80	77.94		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling and light brown staining on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	3
				3.00	77.74		End of Pit at 3.00m	
								4
								5

Depth Strike Rose to (mdeg)	Remarks Stability	Relative density assessed from DP304 Sides stable
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Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL
Geo-Environmental www.gesl.net

Trial Pit Log

TrialPit No
TP305
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471572.64 - 176889.29
Level: 80.36

Date
16/07/2021

Location: Reading

Dimensions (m): 1.80
Depth 3.10

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

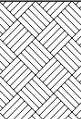
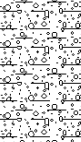
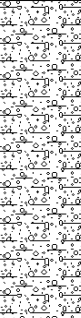
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	80.06		Turf over sandy gravelly SILT with frequent rootlets. Sand is fine to medium. Gravel is fine to medium subangular to subrounded. TOPSOIL
				1.00	79.36		Firm orangish brown sandy gravelly CLAY with frequent rootlets. Sand is fine to coarse. Gravel is fine to medium angular to subrounded. BLACK PARK GRAVEL MEMBER
	1.50	PP	PP=1.25kg/cm2	1.80	78.56		Firm bluish grey mottled brown and red sandy gravelly CLAY with a high cobble content. Cobbles are rounded. Sand is medium. Sand is in pockets. Gravel is fine medium subangular. LAMBETH GROUP
	2.00	PP	PP=1.75kg/cm2	2.30	78.06		Firm bluish grey and dark brown mottled sandy gravelly CLAY with a low cobble content. Cobbles are rounded. Sand is medium. Sand is in pockets. Gravel is fine medium subangular. LAMBETH GROUP
				2.50	77.86		Loose to medium dense yellowish brown and black speckled clayey fine to medium SAND. LAMBETH GROUP
				2.80	77.56		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling and light brown staining on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION
				3.10	77.26		End of Pit at 3.10m

Remarks Relative density assessed from DP304

Stability Sides stable

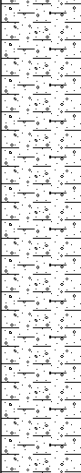
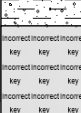


 Geo-Environmental		Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Trial Pit Log			TrialPit No TP306 Sheet 1 of 1		
Project Name: Reading Golf Course				Project No. GE20079		Co-ords: 471553.44 - 176885.64 Level: 79.81		Date 16/07/2021	
Location: Reading						Dimensions (m): 1.80 Depth 3.00		Scale 1:25	
Client: Vistry Thames Valley								Logged TM	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	79.41		Turf over brown sandy gravelly SILT with frequent rootlets. Sand is fine to coarse. Gravel is fine to medium subrounded to rounded. TOPSOIL	
	0.50	PP	PP=1.5kg/cm2				Firm orangish brown mottled reddish brown sandy gravelly CLAY with frequent rootlets. Sand is fine to coarse. Gravel is fine to coarse angular to subrounded. Coarse gravel is subrounded fine gravel is angular to subrounded. Low to medium cobble content. Cobbles are rounded. BLACK PARK GRAVEL MEMBER	
	1.00	PP	PP=1.5kg/cm2	0.90	78.91		Firm to stiff bluish grey mottled orangish brown sandy gravelly CLAY with frequent rootlets. Gravel is fine to coarse. Sand is fine to coarse in pockets. Low cobble content and rare boulders. LAMBETH GROUP	1
	1.50	PP	PP=2kg/cm2				Loose yellowish brown clayey fine to medium SAND. LAMBETH GROUP	2
				2.00	77.81		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling and light brown staining on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	
				2.20	77.61			
				3.00	76.81		End of Pit at 3.00m	3
								4
								5

Depth Strike 	Water Strikes 	Remarks	Relative density assessed from DP303	
		Stability	Sides stable	



 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Trial Pit Log		TrialPit No TP307 Sheet 1 of 1			
Project Name: Reading Golf Course		Project No. GE20079		Co-ords: 471576.98 - 176859.59 Level: 80.32			
Location: Reading		Dimensions (m): 1.80 Depth 3.00		Scale 1:25 Logged TM			
Client: Vistry Thames Valley							
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20	80.12		Turf over sandy gravelly SILT with frequent rootlets. Sand is fine to medium. Gravel is fine to medium subangular to subrounded. TOPSOIL
	0.50	PP	PP=1.25kg/cm2				Firm orangish brown sandy gravelly CLAY with frequent rootlets. Sand is fine to coarse. Gravel is fine to medium angular to subrounded. BLACK PARK GRAVEL MEMBER
	1.50	PP	PP=1.75kg/cm2				
				1.90	78.42		Firm bluish grey mottled brown and red sandy gravelly CLAY with a high cobble content. Cobbles are rounded. Sand is medium. Sand is in pockets. Gravel is fine medium subangular. LAMBETH GROUP
				2.15	78.17		
	2.30	PP	PP=2.5kg/cm2				Firm bluish grey mottled brown and red sandy gravelly CLAY with a high cobble content. Cobbles are rounded. Sand is medium. Sand is in pockets. Gravel is fine medium subangular. LAMBETH GROUP
				2.45	77.87		Loose to medium dense yellowish brown and black speckled clayey fine to medium SAND. LAMBETH GROUP
			2.80	77.52			
			3.00	77.32		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling and light brown staining on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION End of Pit at 3.00m	
Depth Strike 2.40 Rose to (m)ggl 2.40		Remarks Relative density assessed from DP306 & DP307					
		Stability Sides stable					



Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL

Geo-Environmental www.gesl.net

Trial Pit Log

Trial Pit No
TP308
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471657.89 - 176780.42
Level: 81.48

Date
20/07/2021

Location: Reading

Dimensions (m): 1.80
Depth 3.20

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	81.18		Grass over brown sandy gravelly SILT with frequent rootlets. Sand is fine to coarse. Gravel is fine to medium subangular to subrounded. TOPSOIL
	1.30	PP	PP=1.5kg/cm2	1.40	80.08		Firm brown and grey mottled sandy gravelly CLAY with frequent rootlets. Sand is fine to coarse. Gravel is fine to medium subangular to subrounded. BLACK PARK GRAVEL MEMBER
	2.00	PP	PP=2.25kg/cm2				Firm to stiff bluish grey mottled brown slightly sandy gravelly CLAY with a low cobble content. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded. Cobbles are rounded. LAMBETH GROUP
	2.70	PP	PP=3.5kg/cm2	2.60	78.88		Very stiff bluish grey slightly gravelly CLAY. Gravel is fine to medium subrounded to subangular. LAMBETH GROUP
	2.80	PP	PP=3.25kg/cm2				
	2.90	PP	PP=4kg/cm2				
	3.00	PP	PP=4kg/cm2	3.20	78.28		
							End of Pit at 3.20m

Remarks: Approx 20m from mature tree

Stability: Sides stable



Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Trial Pit Log			TrialPit No TP309 Sheet 1 of 1	
Project Name: Reading Golf Course		Project No. GE20079		Co-ords: 471537.45 - 176722.15 Level: 81.76		Date 20/07/2021
Location: Reading				Dimensions (m): 1.80 Depth 3.35 0.50		Scale 1:25 Logged TM
Client: Vistry Thames Valley						

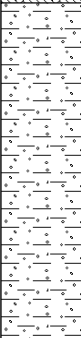
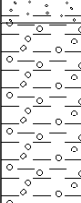
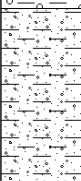
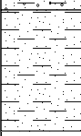
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	81.46		Turf over brown sandy gravelly SILT with frequent rootlets. Sand is fine to medium. Gravel is fine to medium subangular to subrounded. TOPSOIL	
				0.90	80.86		Soft brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse angular to subrounded. BLACK PARK GRAVEL MEMBER	1
				1.60	80.16		Medium dense brown clayey fine to coarse SAND and fine to coarse angular to subrounded GRAVEL with a medium cobble content of angular to subangular rounded flint. BLACK PARK GRAVEL MEMBER	
	1.90	PP	PP=3kg/cm2				Stiff grey mottled red slightly gravelly CLAY with occasional roots 3mm to 5mm. Gravel is fine to medium subangular to subrounded. LAMBETH GROUP	2
	2.70	PP	PP=3.75kg/cm2	2.80	78.96		Stiff to very stiff bluish grey slightly sandy CLAY with occasional roots 3mm to 5mm. Sand is fine to medium. LAMBETH GROUP	3
	2.90	PP	PP=2.25kg/cm2					
			3.20					
			3.35	78.41		End of Pit at 3.35m		4
								5

Depth Strike Water Strikes 1.57 1.57	Remarks	Relative density assessed from DP309	
	Stability	Sides unstable below water table	

 Geo-Environmental www.gesl.net				Unit 7, Danworth Farm Hurstpierpoint BN6 9GL				Trial Pit Log				TrialPit No TP310 Sheet 1 of 1	
Project Name: Reading Golf Course						Project No. GE20079		Co-ords: 471507.23 - 176713.17 Level: 81.36				Date 20/07/2021	
Location: Reading								Dimensions (m): 2.00 0.50				Scale 1:25	
Client: Vistry Thames Valley								Depth 0.35				Logged TM	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description						
	Depth	Type	Results										
				0.35	81.01		Turf over brown sandy gravelly SILT with frequent rootlets. Gravel is fine to medium subrounded to rounded. TOPSOIL End of Pit at 0.35m						
												1	
												2	
												3	
												4	
												5	
		Remarks Terminated due to live services x 2 one at each end of pit (water)											
		Stability Sides stable											



 Geo-Environmental		Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Trial Pit Log			TrialPit No TP311 Sheet 1 of 1		
Project Name: Reading Golf Course				Project No. GE20079		Co-ords: 471522.28 - 176686.15 Level: 80.97		Date 20/07/2021	
Location: Reading						Dimensions (m): 1.80 		Scale 1:25	
Client: Vistry Thames Valley						Depth 3.10		Logged TM	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	80.67		Grass over brown sandy gravelly SILT with frequent rootlets and roots up to 20mm. Sand is fine to coarse. Gravel is fine to medium subangular to subrounded. TOPSOIL	
	1.00	PP	PP=2.25kg/cm2				Firm to stiff brown slightly mottled grey slightly gravelly CLAY with frequent rootlets and roots up to 5mm. Gravel is fine to medium subangular. BLACK PARK GRAVEL MEMBER	1
	1.50	PP	PP=2.5kg/cm2	1.48	79.49		Firm to stiff brown slightly mottled grey slightly gravelly CLAY with frequent rootlets and roots up to 5mm and a low cobble content. Gravel is fine to coarse angular to subrounded. Cobbles are rounded. BLACK PARK GRAVEL MEMBER	2
	2.40	PP	PP=1.6kg/cm2	2.10	78.87		Firm to stiff brown slightly mottled grey sandy gravelly CLAY with frequent rootlets and roots up to 5mm. Sand is fine to coarse. Gravel is fine to medium angular to subangular. BLACK PARK GRAVEL MEMBER	
				2.70	78.27		Occasional to frequent iron staining within CLAY. Firm bluish grey mottled reddish brown sandy CLAY with frequent rootlets and roots 10mm. Sand is fine. LAMBETH GROUP	3
	3.00	PP	PP=1.6kg/cm2	3.10	77.87		End of Pit at 3.10m	
								4
								5

Depth Strike 	Water Strikes 	Remarks Stability Sides stable
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Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net		Trial Pit Log			TrialPit No TP312 Sheet 1 of 1	
Project Name: Reading Golf Course		Project No. GE20079		Co-ords: 471493.13 - 176743.82 Level: 81.61		Date 20/07/2021
Location: Reading				Dimensions (m): 1.80 Depth 3.35		Scale 1:25
Client: Vistry Thames Valley				Logged TM		

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	81.21		Turf over brown sandy gravelly SILT with frequent rootlets. Sand is fine to medium. Gravel is fine to medium subangular to rounded. TOPSOIL	1
							Loose becoming medium dense to dense yellow to orangish brown clayey gravelly fine to coarse SAND with pockets of fine to medium SAND. Gravel is fine to coarse angular to subrounded. BLACK PARK GRAVEL MEMBER	
	1.50	PP	PP=1.6kg/cm2	1.40	80.21		Firm to stiff bluish grey turning darker with depth slightly gravelly CLAY with occasional rootlets and roots up to 5mm. Gravel is fine to medium subangular to subrounded. LAMBETH GROUP	2
	1.80	PP	PP=2kg/cm2					
	2.50	PP	PP=2.25kg/cm2					
				2.90	78.71		Firm bluish dark grey slightly gravelly sandy 1 to 3mm laminated CLAY with occasional rootlets and roots up to 5mm. Sand is fine to medium. Gravel is fine to medium subangular to subrounded. LAMBETH GROUP	3
				3.00	78.61		Medium dense yellowish to light brown with dark orange staining slightly clayey fine to coarse SAND. LAMBETH GROUP	
				3.35	78.26		End of Pit at 3.35m	4
								5

Depth Strike Notes to (m) (g) 1.40 1.40	Remarks	Relative density assessed from DP310 & DP311	
	Stability	Sides unstable below water table	



Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL
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Trial Pit Log

TrialPit No
TP313
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471476.67 - 176768.61
Level: 81.36

Date
20/07/2021

Location: Reading

Dimensions (m): 1.80

Scale
1:25

Client: Vistry Thames Valley

Depth
3.35

0.50

Logged
TM

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.50	80.86		Turf over brown sandy gravelly SILT with frequent rootlets, roots up to 20mm and golf tees. TOPSOIL	
							Loose to medium dense brown clayey fine to coarse SAND and fine to coarse angular to subrounded GRAVEL. BLACK PARK GRAVEL MEMBER	1
	2.10	PP	PP=2kg/cm2	2.00	79.36		Firm to stiff bluish grey slightly sandy CLAY. Sand is fine. LAMBETH GROUP	2
	2.40	PP	PP=2.5kg/cm2	2.50	78.86		Medium dense grey and yellow fine to coarse SAND becoming clayey SAND. LAMBETH GROUP	
	3.00 3.00 3.10	PP PP PP	PP=1.5kg/cm2 PP=1.8kg/cm2 PP=1.75kg/cm2	3.10 3.30	78.26 78.06		Stiff greyish brown mottled reddish brown slightly sandy thinly laminated CLAY with black sandy inclusions. LAMBETH GROUP	3
							End of Pit at 3.35m	4
								5

Remarks Relative density assessed from DP312

Stability Sides stable





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www.gesl.net

Trial Pit Log

TrialPit No
TP314
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471515.07 - 176792.24
Level: 81.20

Date
20/07/2021

Location: Reading

Dimensions (m): 1.80

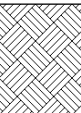
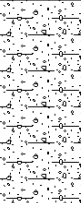
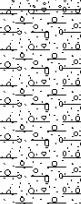
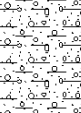
Depth
3.15

0.50

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.37	80.83		Grass over brown sandy gravelly SILT with frequent rootlets. Sand is fine to medium. Gravel is fine to medium subangular to subrounded.	
				1.10	80.10		Very loose to medium dense brown to orangish brown clayey fine to coarse SAND and fine to coarse angular to subrounded GRAVEL. BLACK PARK GRAVEL MEMBER	1
				1.80	79.40		Orangish brown clayey gravelly fine to coarse SAND with a low to medium cobble content. Gravel is fine to coarse angular to subrounded rinded flint. Cobbles are rounded rinded flint. BLACK PARK GRAVEL MEMBER	
	2.00	PP	PP=2.25kg/cm2				Firm to stiff bluish grey mottled brown slightly sandy CLAY with a medium cobble. Sand is fine to medium in pockets. Cobbles are well rounded. LAMBETH GROUP	2
	2.50	PP	PP=2.75kg/cm2					
	2.75	PP	PP=3kg/cm2					
				2.85	78.35			
				3.15	78.05		Medium dense yellow and orange slightly gravelly fine to medium SAND. Gravel is fine subangular. LAMBETH GROUP	3
							End of Pit at 3.15m	
								4
								5

Remarks Spalling in the sand towards the pit base. Relative density assessed from DP328

Stability Localised spalling





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Trial Pit Log

TrialPit No
TP315
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471482.40 - 176813.61
Level: 80.53

Date
19/07/2021

Location: Reading

Dimensions (m): 2.00
Depth 3.50

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.35	80.18		
				1.40	79.13		
	2.00	PP	PP=1.25kg/cm2				
	2.50	PP	PP=2.75kg/cm2				
	3.30	B		3.20	77.33		
				3.50	77.03		

Remarks Relative density assessed from DP326 & DP327. NOTE zero N values at depth in DP326.

Stability Sides stable





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Trial Pit Log

TrialPit No
TP316
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471455.50 - 176798.67
Level: 80.55

Date
19/07/2021

Location: Reading

Dimensions (m): 2.00
0.50
Depth 3.25

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	80.15		Turf over brown sandy gravelly SILT with frequent rootlets. Sand is fine to medium. Gravel is fine to medium subrounded to rounded. TOPSOIL	
							Loose becoming dense orangish brown slightly clayey fine to coarse SAND and fine to coarse angular to subrounded GRAVEL. BLACK PARK GRAVEL MEMBER	1
	2.65	PP	PP=1.75kg/cm2	2.65	77.90		Stiff bluish grey slightly gravelly CLAY. Gravel is fine subrounded. LAMBETH GROUP	2
	3.00	PP	PP=2.25kg/cm2					3
				3.25	77.30		End of Pit at 3.25m	4
								5

Remarks Relative density assessed from DP313

Stability Sides stable





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Trial Pit Log

Trial Pit No
TP317
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471418.58 - 176848.12
Level: 78.77

Date
19/07/2021

Location: Reading

Dimensions (m): 2.00

Depth
3.20

0.50

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.35	78.42		Turf over brown sandy gravelly SILT with frequent rootlets and roots up to 3mm. Sand is fine to coarse. Gravel is fine to medium subangular to subrounded. TOPSOIL
	1.50	PP	PP=2kg/cm2				Firm to stiff orangish brown sandy CLAY with occasional to frequent roots and rootlets. Sand is fine to medium becoming more prominent with depth. BLACK PARK GRAVEL MEMBER
	2.00	PP	PP=1.75kg/cm2				
				3.20	75.57		End of Pit at 3.20m

Depth Strike	Water Strikes	Remarks
	Rosen to (m)	
		Stability Sides stable



 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net				Trial Pit Log				TrialPit No TP318 Sheet 1 of 1	
Project Name: Reading Golf Course				Project No. GE20079		Co-ords: 471413.13 - 176867.85 Level: 78.39		Date 19/07/2021	
Location: Reading						Dimensions (m): 2.00 0.50		Scale 1:25	
Client: Vistry Thames Valley						Depth 3.20		Logged TM	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.30	78.09		Turf over brown sandy gravelly SILT with frequent rootlets. Sand is fine to medium. Gravel is fine to medium subrounded to rounded. TOPSOIL		
	0.80	PP	PP=2kg/cm2				Firm to stiff sandy CLAY with rare angular fine to medium gravel. Sand is fine to coarse. Gravel is fine to medium subangular. BLACK PARK GRAVEL MEMBER		
	1.20	PP	PP=2kg/cm2						
	2.40	PP	PP=2kg/cm2						
	2.60	PP	PP=2.25kg/cm2						
	2.80	PP	PP=2.5kg/cm2						
				3.20	75.19		End of Pit at 3.20m		
Depth Strike Rosen to (mkg) Remarks Stability Sides stable									





Unit 7, Danworth Farm
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Trial Pit Log

Trial Pit No
TP319
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471382.73 - 176893.00
Level: 78.49

Date
19/07/2021

Location: Reading

Dimensions (m): 2.00
Depth 3.25

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.40	78.08		Turf over brown sandy gravelly SILT with frequent rootlets. Sand is fine to coarse. Gravel is fine to medium subrounded to rounded. TOPSOIL
	0.60	PP	PP=1.75kg/cm2				Stiff brown slightly gravelly CLAY. Gravel is fine rounded to subrounded. LAMBETH GROUP
	0.80	PP	PP=2kg/cm2				
	1.20	PP	PP=2kg/cm2				
	2.00	PP	PP=2kg/cm2				
	2.50	PP	PP=1.6kg/cm2	2.50	75.98		Firm yellowish brown sandy CLAY. Sand is fine. LAMBETH GROUP
				3.25	75.24		End of Pit at 3.25m

Water Strikes	
Depth Strike	Rose to (mlog)

Remarks

Stability Sides stable





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Geo-Environmental www.gesl.net

Trial Pit Log

TrialPit No
TP320
Sheet 1 of 1

Project Name: Reading Golf Course Project No. GE20079 Co-ords: 471398.09 - 176908.81 Level: 78.40 Date 19/07/2021

Location: Reading Dimensions (m): 2.00 0.50 Depth 3.20 Client: Vistry Thames Valley Scale 1:25 Logged TM

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	78.00		Turf over sandy gravelly SILT with frequent rootlets and roots upto10mm. Gravel is fine to medium subrounded to rounded. Sand is fine to coarse. TOPSOIL	
				1.90	76.50		Firm to stiff orangish brown sandy gravelly CLAY with frequent rootlets and a low cobble content. Gravel is fine to coarse angular to subangular rinded flint. Cobbles are angular rinded flint. BLACK PARK GRAVEL MEMBER	1
				2.95	75.45		Medium dense becoming loose yellowish to orangish brown slightly clayey gravelly fine to medium SAND with a very low cobble content. Gravel is fine to coarse angular to subrounded rinded flint. Cobbles are subangular to subrounded rinded flint. BLACK PARK GRAVEL MEMBER	2
				3.20	75.20		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION End of Pit at 3.20m	3
								4
								5

Depth Strike	Water Strikes	Remarks	Localised spalling in the sand. Relative density assessed from DP317
		Stability	Localised spalling



 Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net				Trial Pit Log				TrialPit No TP321 Sheet 1 of 1	
Project Name: Reading Golf Course				Project No. GE20079		Co-ords: 471339.23 - 176927.80 Level: 79.79		Date 19/07/2021	
Location: Reading						Dimensions (m): 2.00 		Scale 1:25	
Client: Vistry Thames Valley						Depth 2.60		Logged TM	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.50	79.29		Turf over brown sandy gravelly SILT with frequent rootlets and roots up to 4mm. Gravel is fine to medium subrounded to rounded. TOPSOIL		
							Medium dense orangish brown gravelly fine to coarse SAND with a low cobble content. Gravel is fine to coarse subangular to rounded rinded flints. Cobbles are rounded rinded flint. BLACK PARK GRAVEL MEMBER		
				2.60	77.19		End of Pit at 2.60m		
1 2 3 4 5									
Depth Strike		Water Strakes (None to (m) to (m))		Remarks: Unstable in sand below 0.5m Terminated at 2.6m bgl. Relative density assessed from DP319					
				Stability: Sides unstable					





Unit 7, Danworth Farm
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Geo-Environmental www.gesl.net

Trial Pit Log

Trial Pit No
TP322
Sheet 1 of 1

Project Name: Reading Golf Course	Project No. GE20079	Co-ords: 471416.67 - 176957.52 Level: 79.14	Date 19/07/2021
Location: Reading	Dimensions (m): Depth 3.30		Scale 1:25
Client: Vistry Thames Valley	2.00		Logged TM

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.50	78.64		Grass over brown sandy gravelly SILT with frequent rootlets and roots 30mm. Sand is fine to medium. Gravel is fine to medium subrounded to rounded. TOPSOIL
				2.40	76.74		Loose orangish brown slightly gravelly fine to coarse SAND with occasional roots 5mm. Gravel is medium subangular. Medium dense from 1.4m to 2.2m bgl. BLACK PARK GRAVEL MEMBER
				2.90	76.24		Loose yellowish brown slightly clayey slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded. BLACK PARK GRAVEL MEMBER
				3.30	75.83		Medium dense orangish brown slightly clayey fine to coarse SAND and fine to medium subangular to angular rinded flint GRAVEL. BLACK PARK GRAVEL MEMBER
							End of Pit at 3.30m

Depth Strike	Water Strikes	Remarks	Relative density assessed from DP323
		Stability	Sides stable





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Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL

Trial Pit Log

TrialPit No
TP323
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471478.11 - 176938.76
Level: 77.46

Date
19/07/2021

Location: Reading

Dimensions (m): 1.90

Depth
3.12

0.50

Scale
1:25

Logged
TM

Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40	77.06		Turf covered brown silty gravelly fine to medium SAND with frequent rootless. Gravel is fine to medium rounded to subrounded. TOPSOIL	
	1.40	PP	PP=2kg/cm2				Firm to stiff orangish brown sandy gravelly CLAY with frequent rootlets and medium cobble content. Gravel is fine to coarse angular to subangular rinded flint. Sand is fine to coarse. Cobbles are angular to subrounded rinded flints. LAMBETH GROUP	1
				2.00	75.46		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc SEAFORD CHALK FORMATION	2
	2.50	B						
				3.10	74.36		End of Pit at 3.12m	3
								4
								5

Water Strikes	
Depth Strike	Rose to (mlog)

Remarks

Stability Sides stable





Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL
www.gesl.net

Trial Pit Log

TrialPit No
TP324
Sheet 1 of 1

Project Name: Reading Golf Course

Project No.
GE20079

Co-ords: 471481.61 - 176967.80
Level: 77.10

Date
19/07/2021

Location: Reading

Dimensions (m): 2.20
Depth 3.10

Scale
1:25

Logged
TM

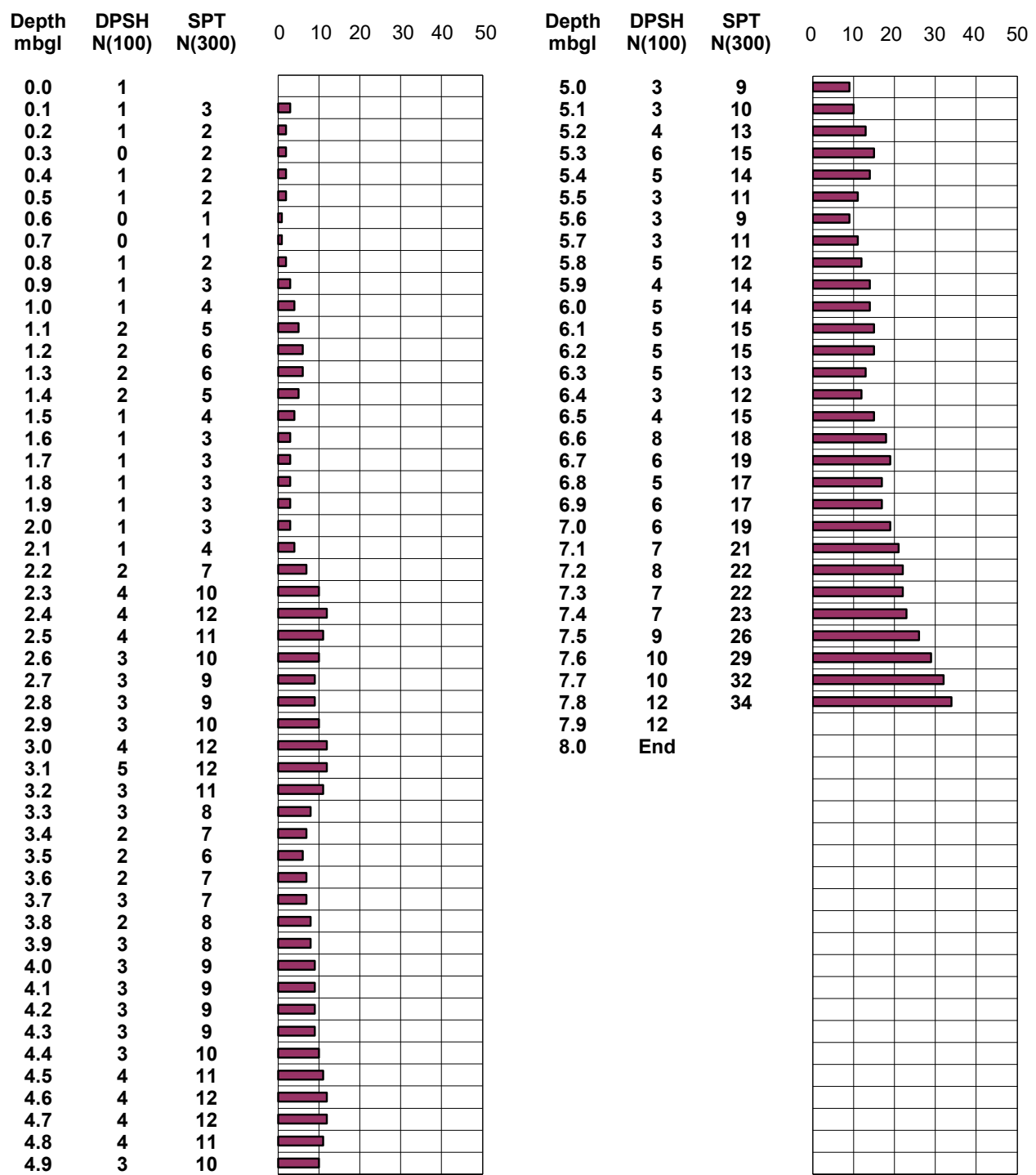
Client: Vistry Thames Valley

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	76.80		Turf covered brown sandy gravelly SILT with frequent rootlets. Sand is fine to medium. Gravel is fine to medium rounded to subrounded. TOPSOIL
				1.70	75.40		Firm brown sandy gravelly CLAY with occasional to frequent rootless. Sand is fine to coarse. Gravel is fine to coarse angular to subrounded. LAMBETH GROUP
				2.00	75.10		Firm to stiff orangish brown sandy gravelly CLAY with occasional rootlets and a low rinded flint cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular rinded flint. LAMBETH GROUP
				3.00	74.10		White to off white recovered as destructured black speckled black speckled Ciria grade Dc CHALK like coarse sand clasts. rinded flint is angular coarse gravel, cobbles and boulders. SEAFORD CHALK FORMATION
				3.10	74.00		Structureless off-white and white CHALK composed of sand and gravel sized very weak to weak clasts with some silt size matrix and localised black speckling on clast faces. Occasional cobble size chalk clasts and some cobble sized flint. CIRIA Grade Dc
							End of Pit at 3.10m

Remarks: *(Sample of chalk does not contain fist sized clumps)*

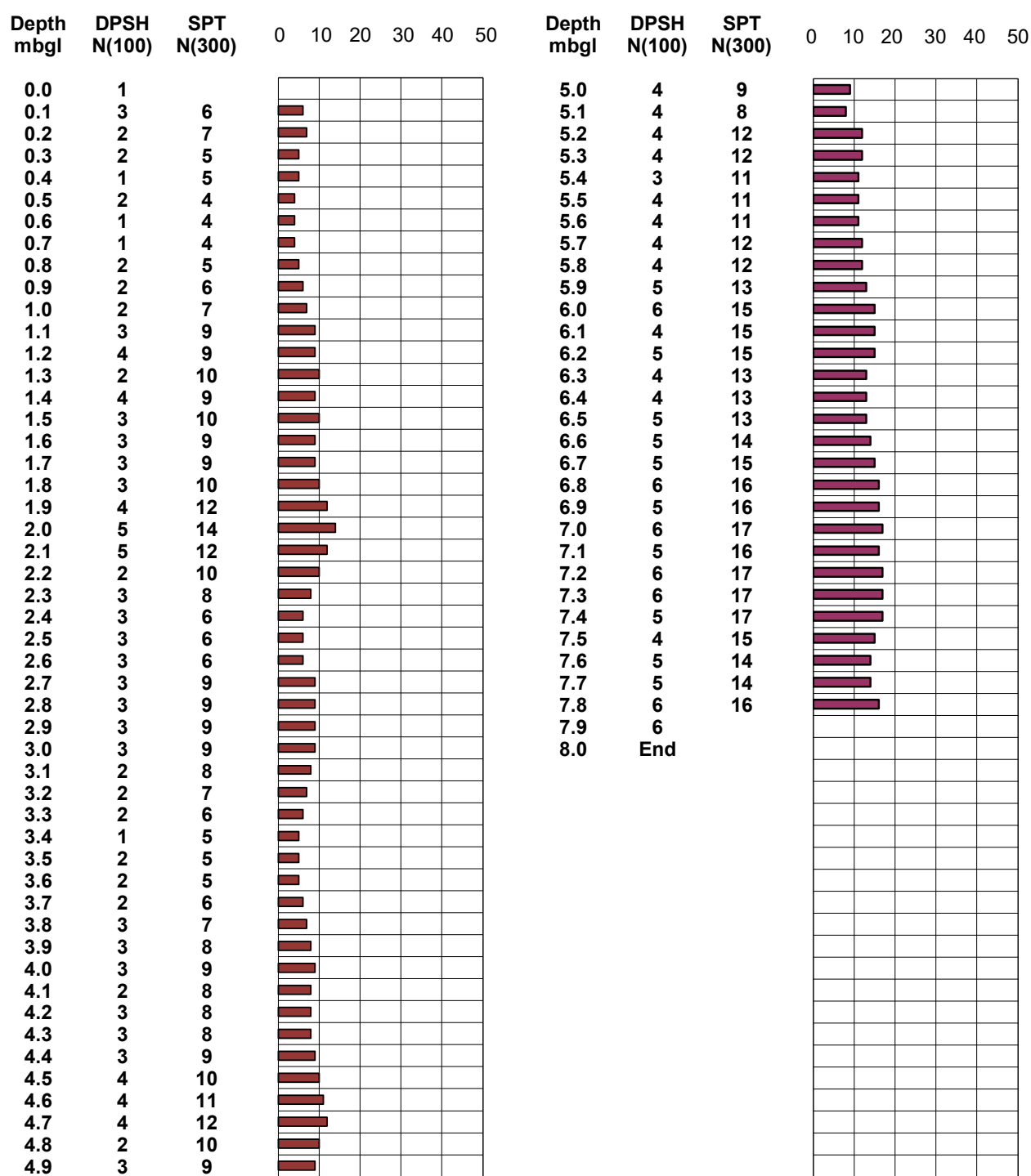
Stability: Sides stable





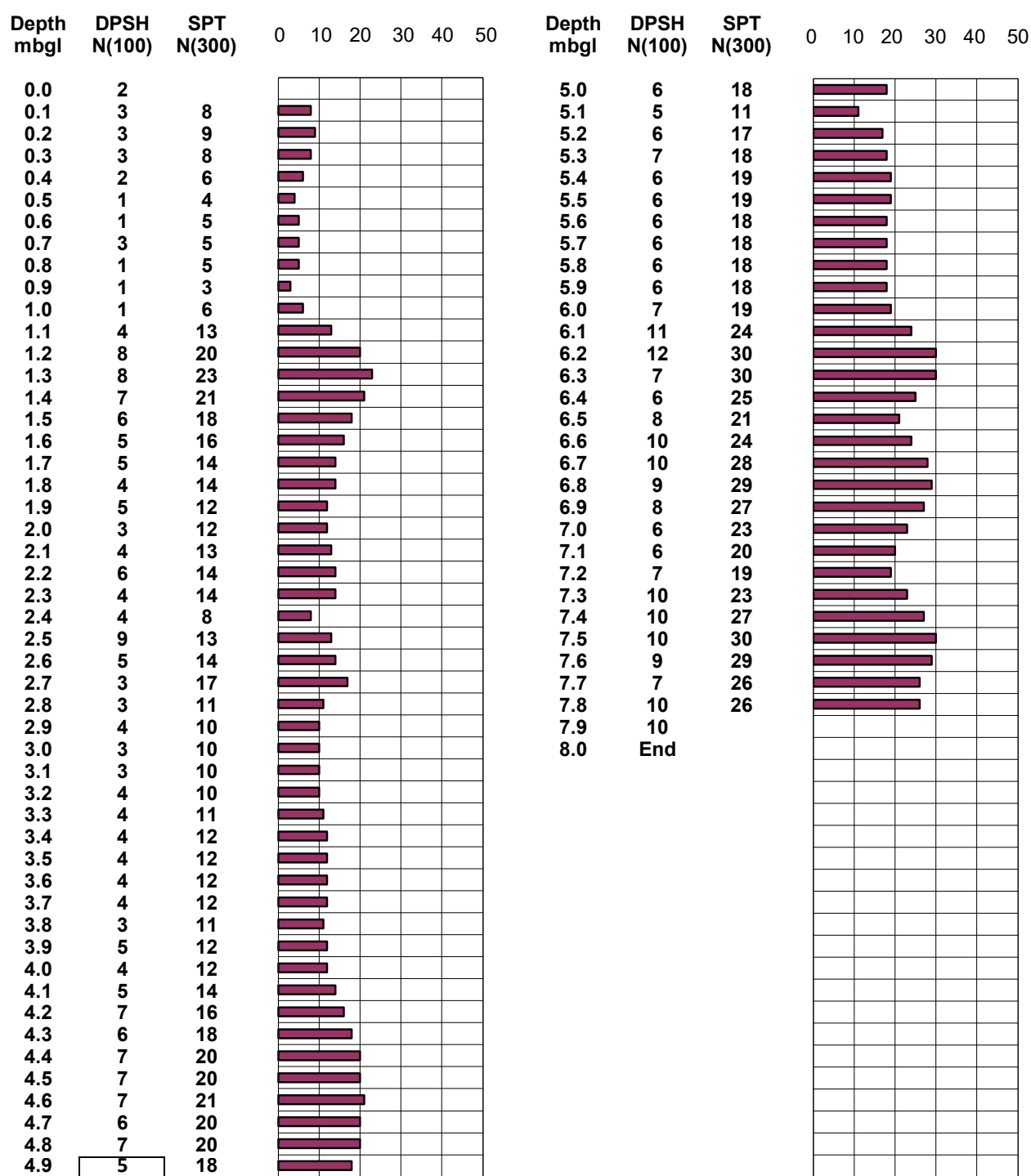
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP1
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



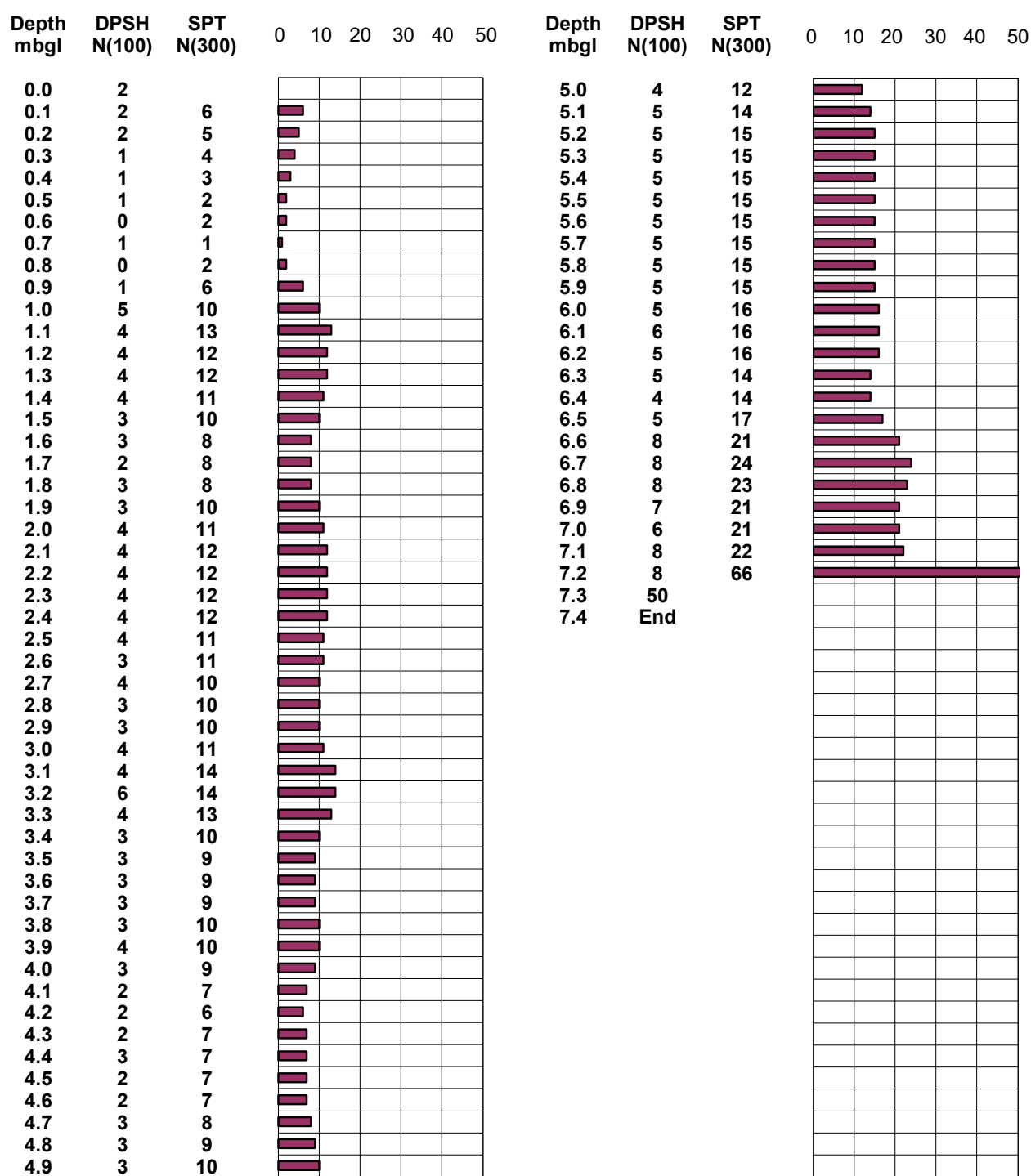
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP2
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



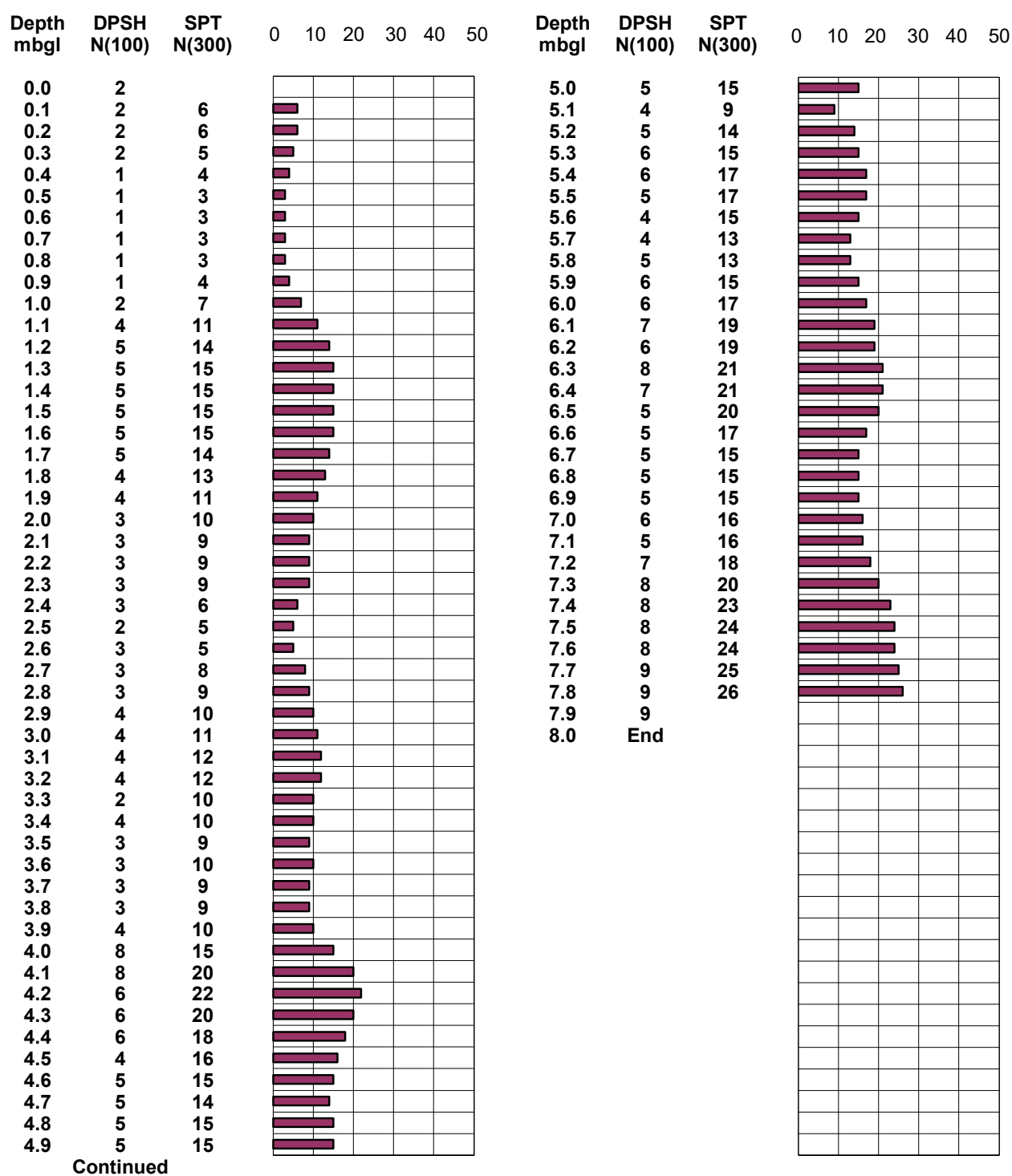
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP3
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



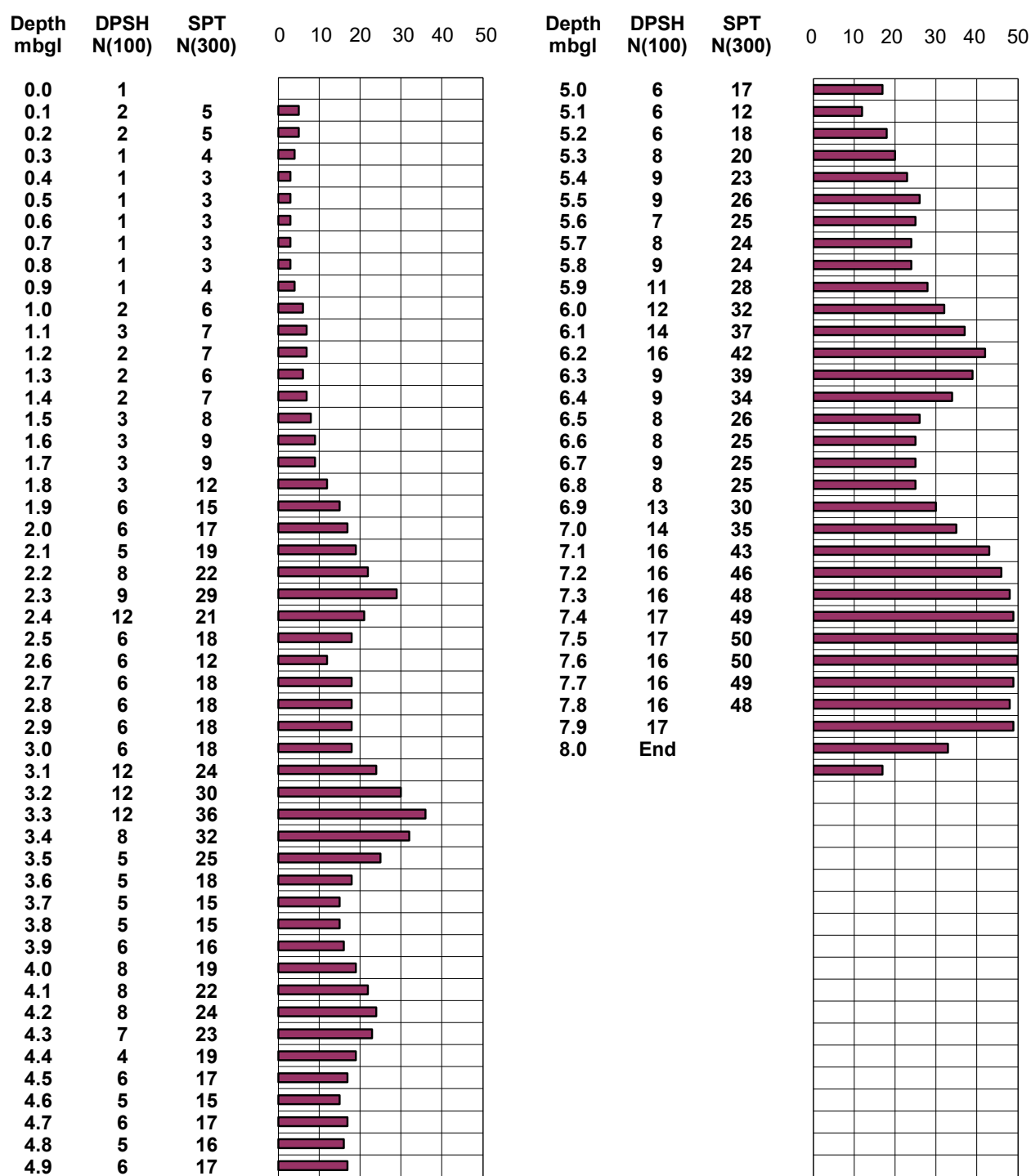
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP4
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



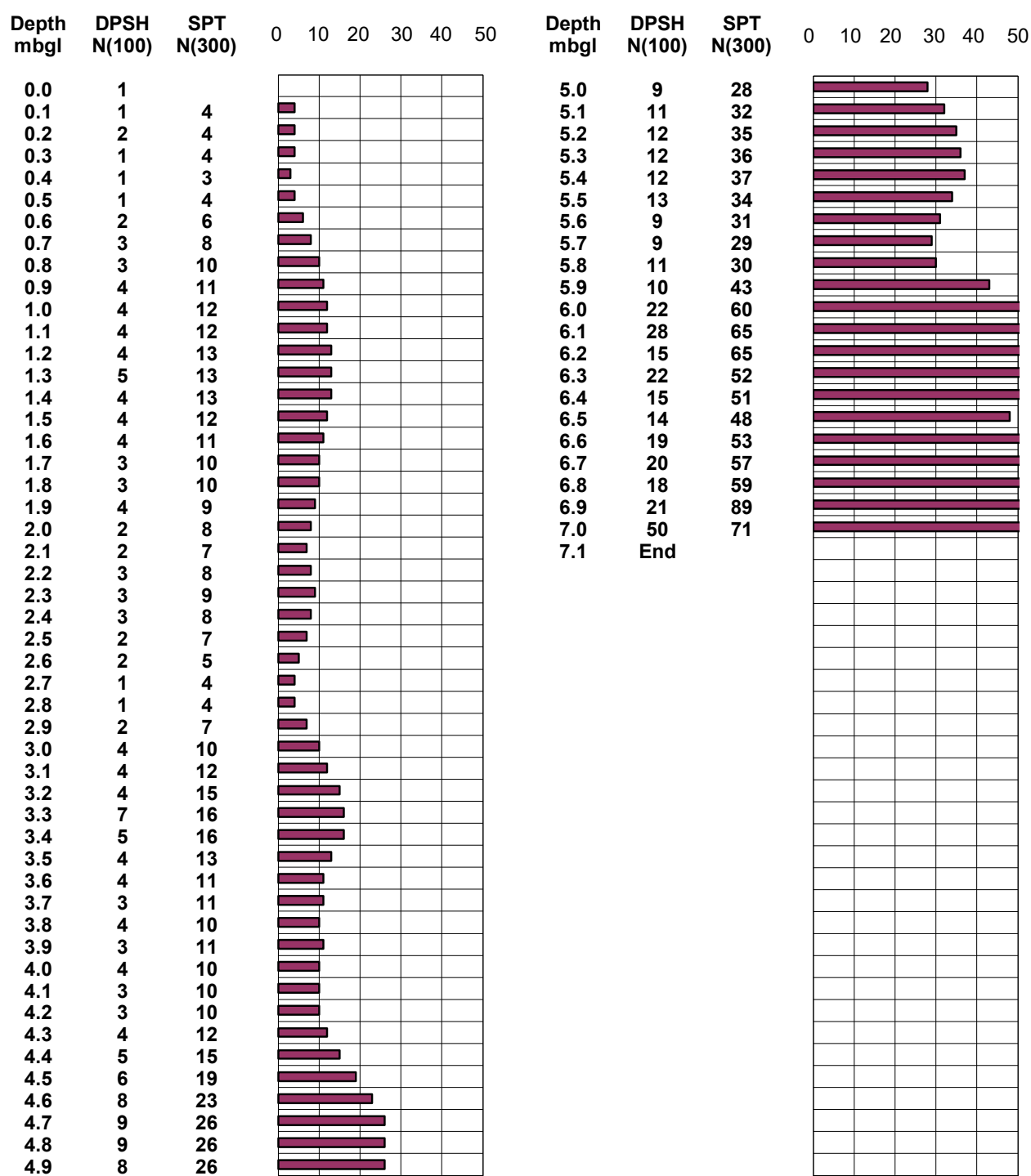
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP5
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



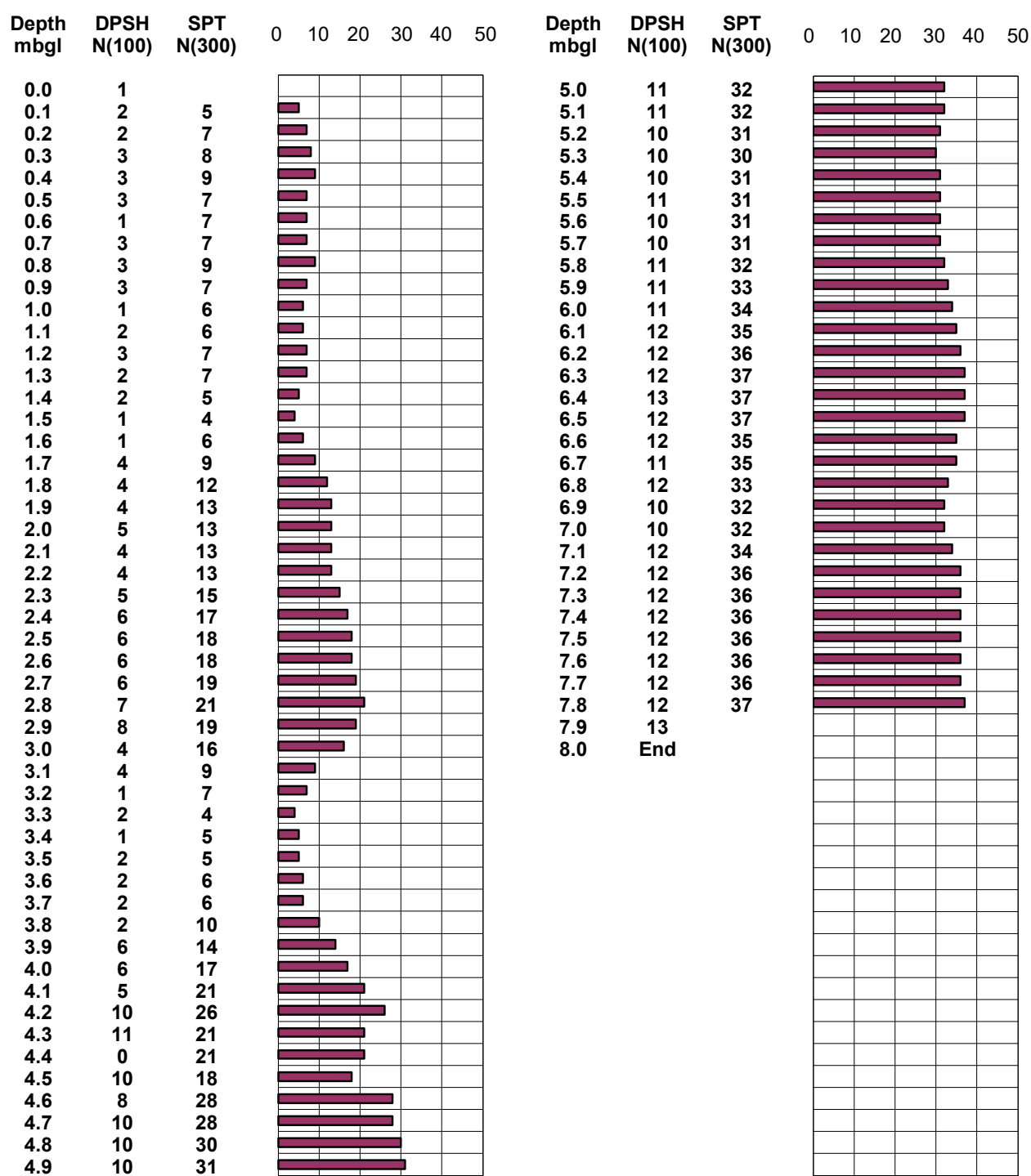
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP6
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



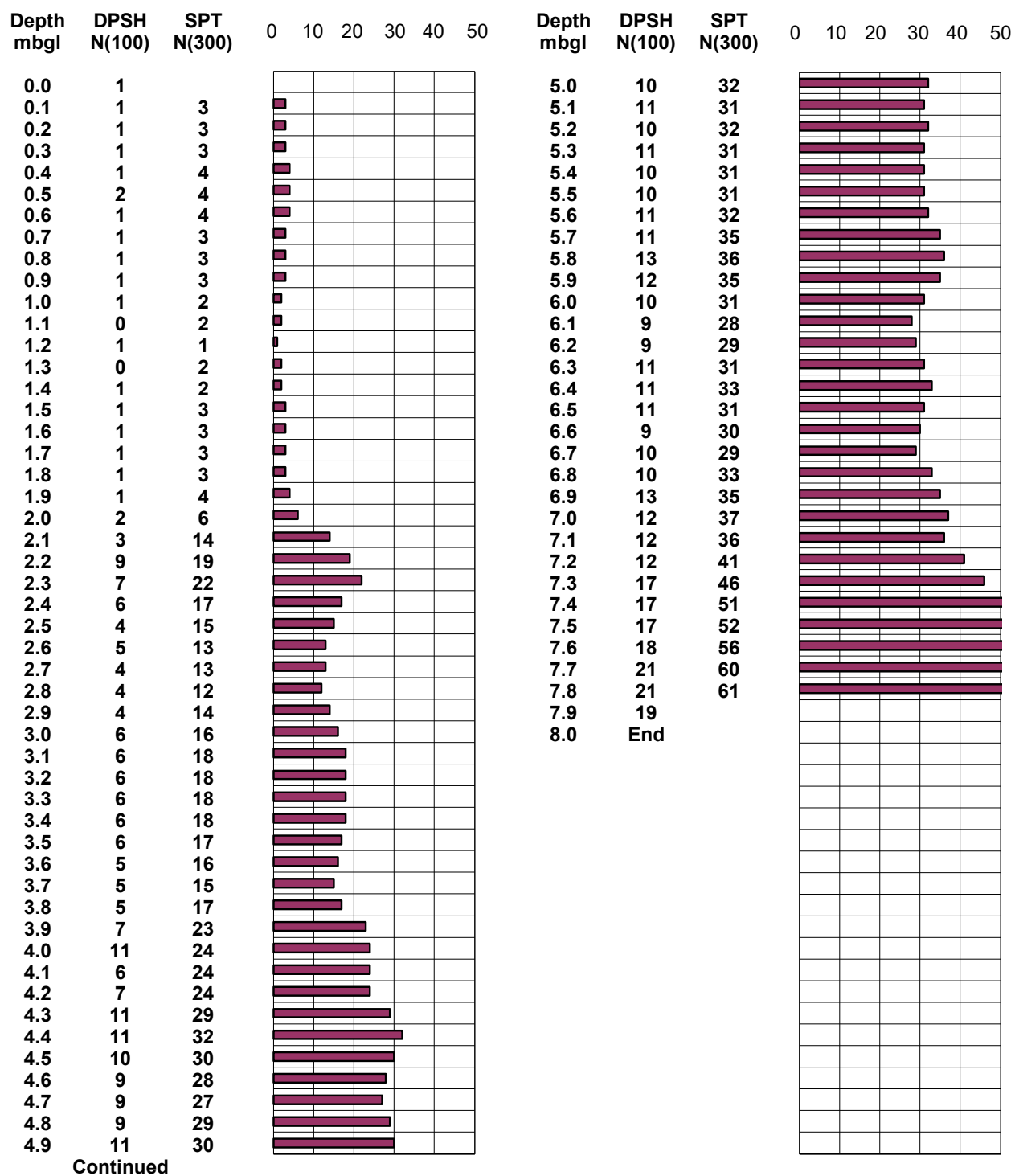
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP7
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



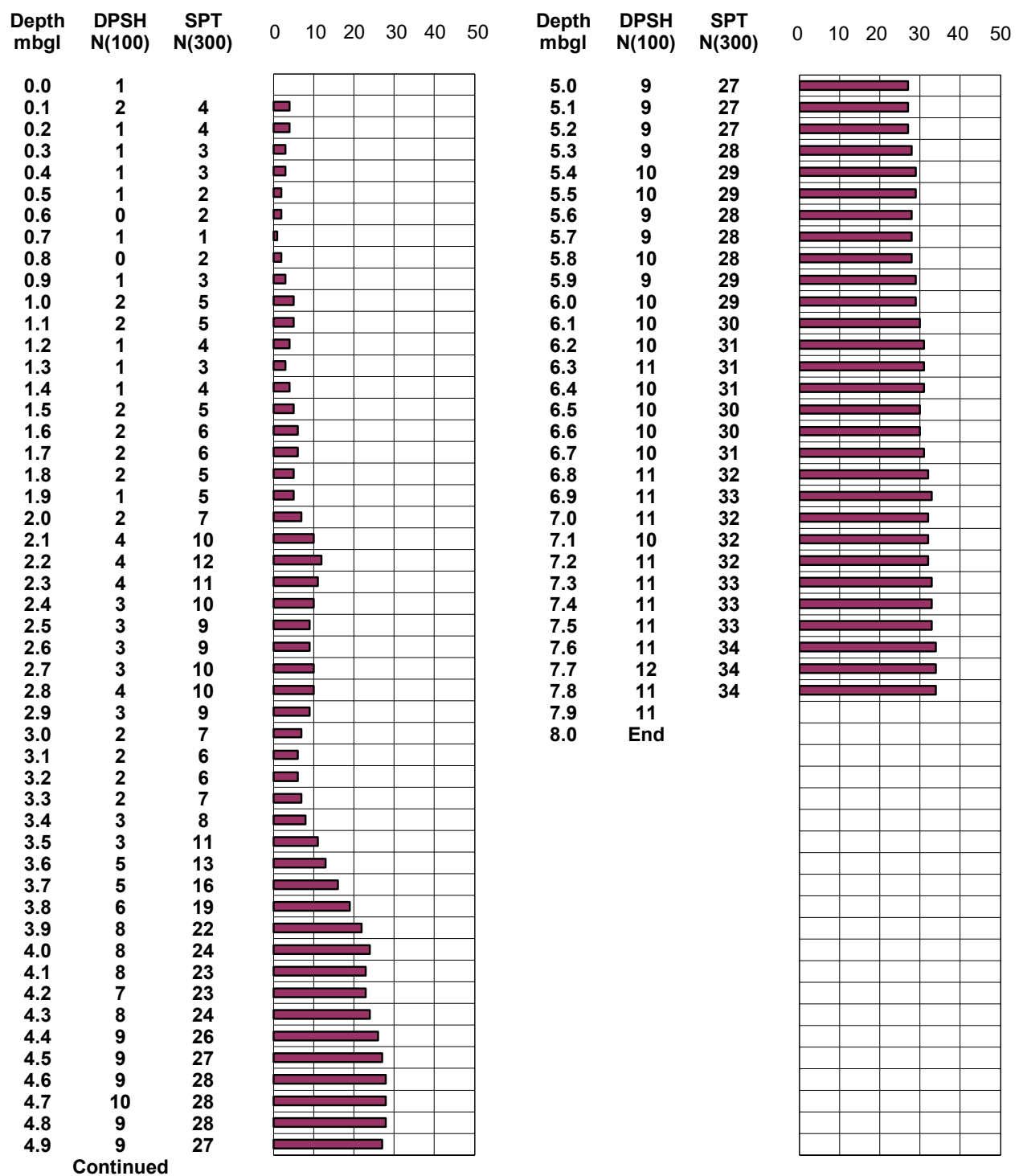
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP8
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



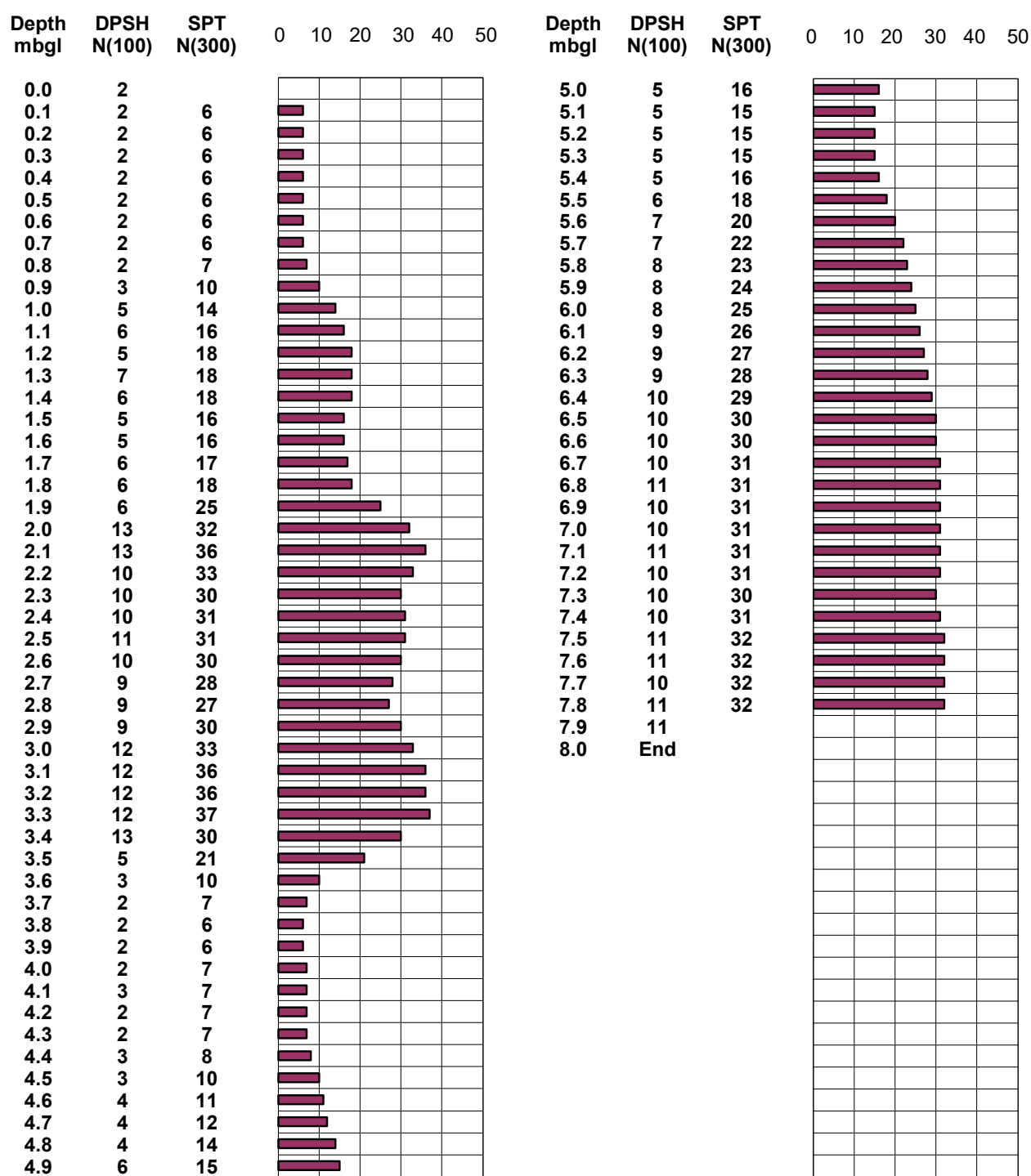
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP9
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



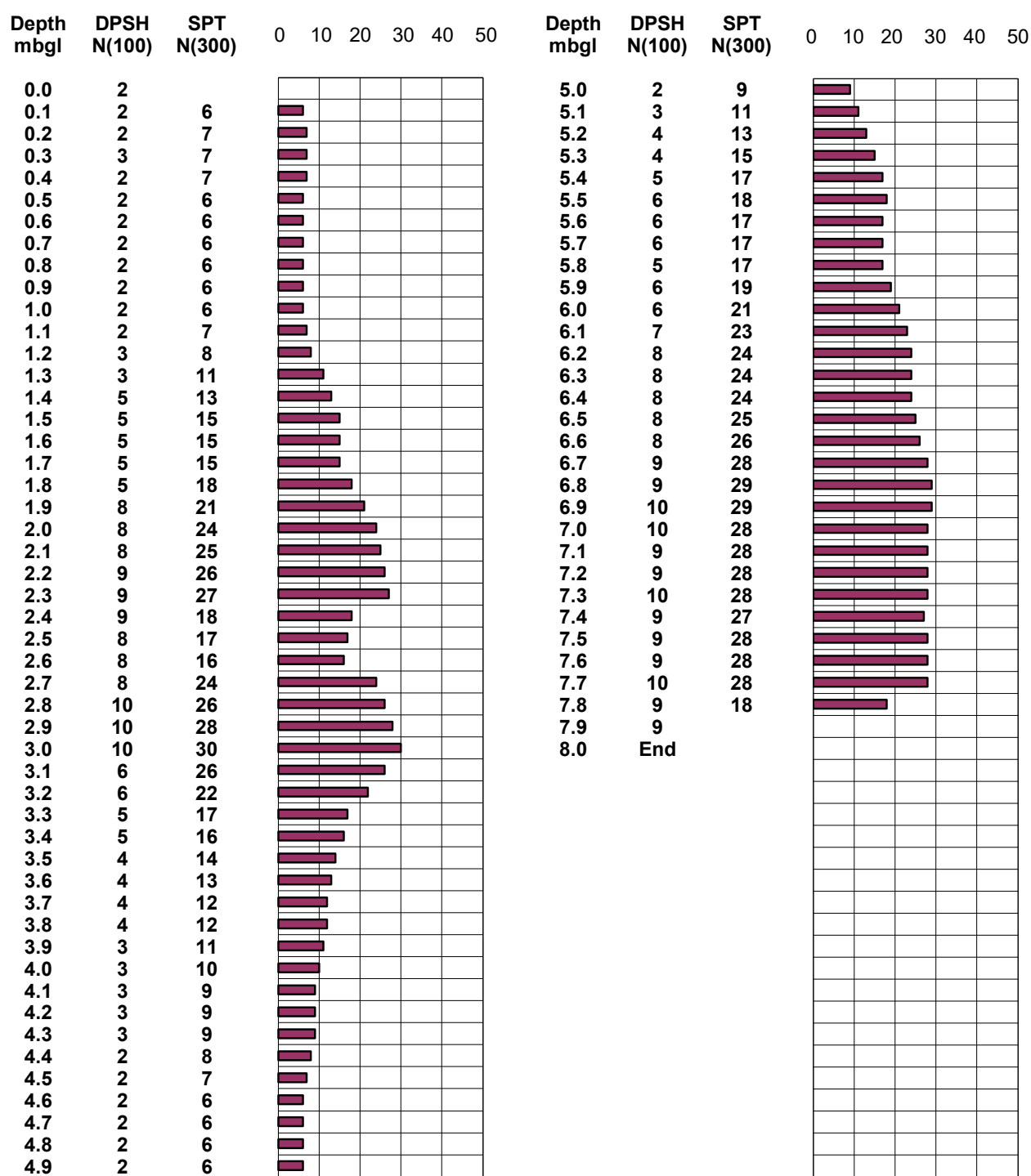
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP10
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

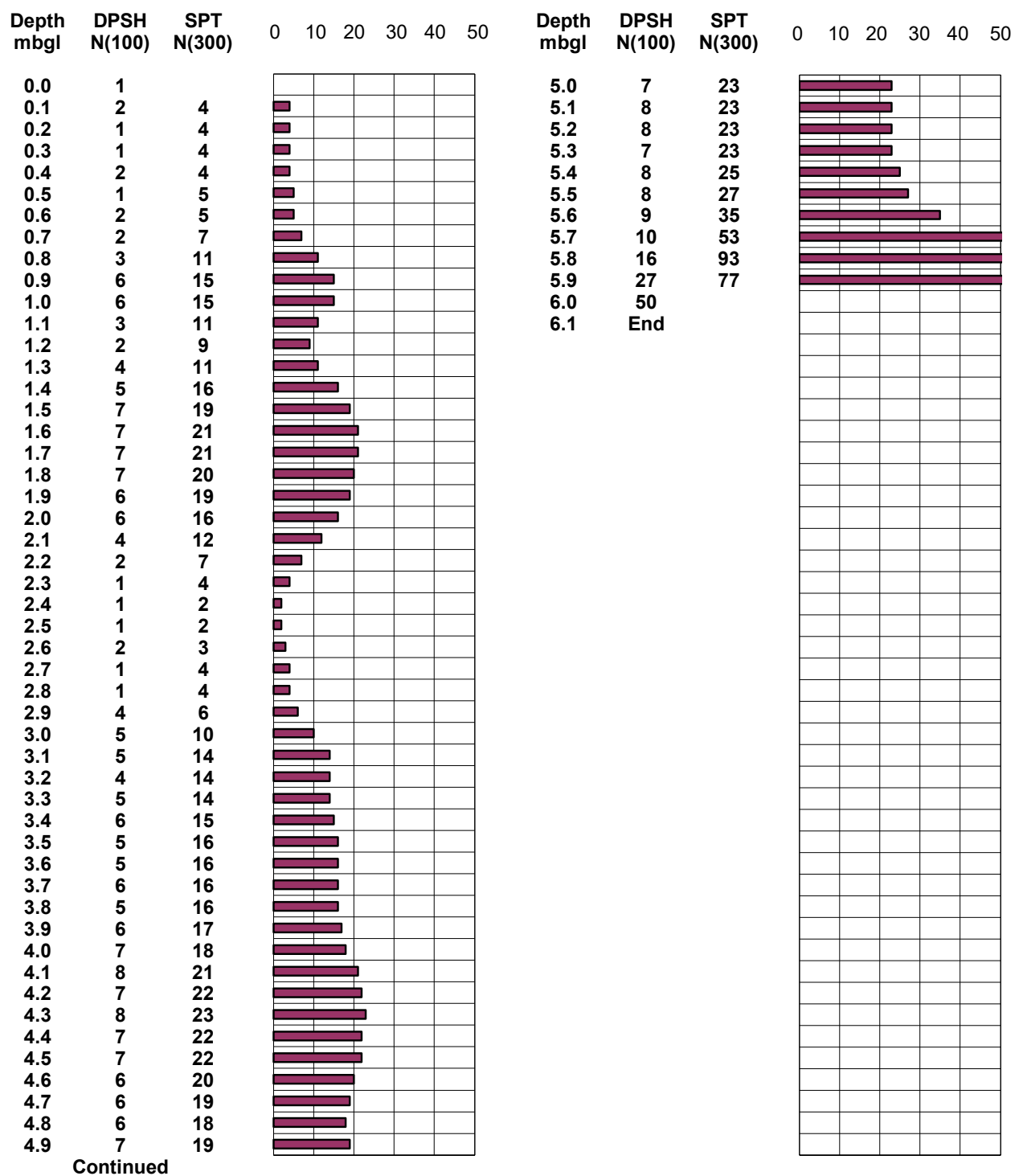
Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP11
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



Continued

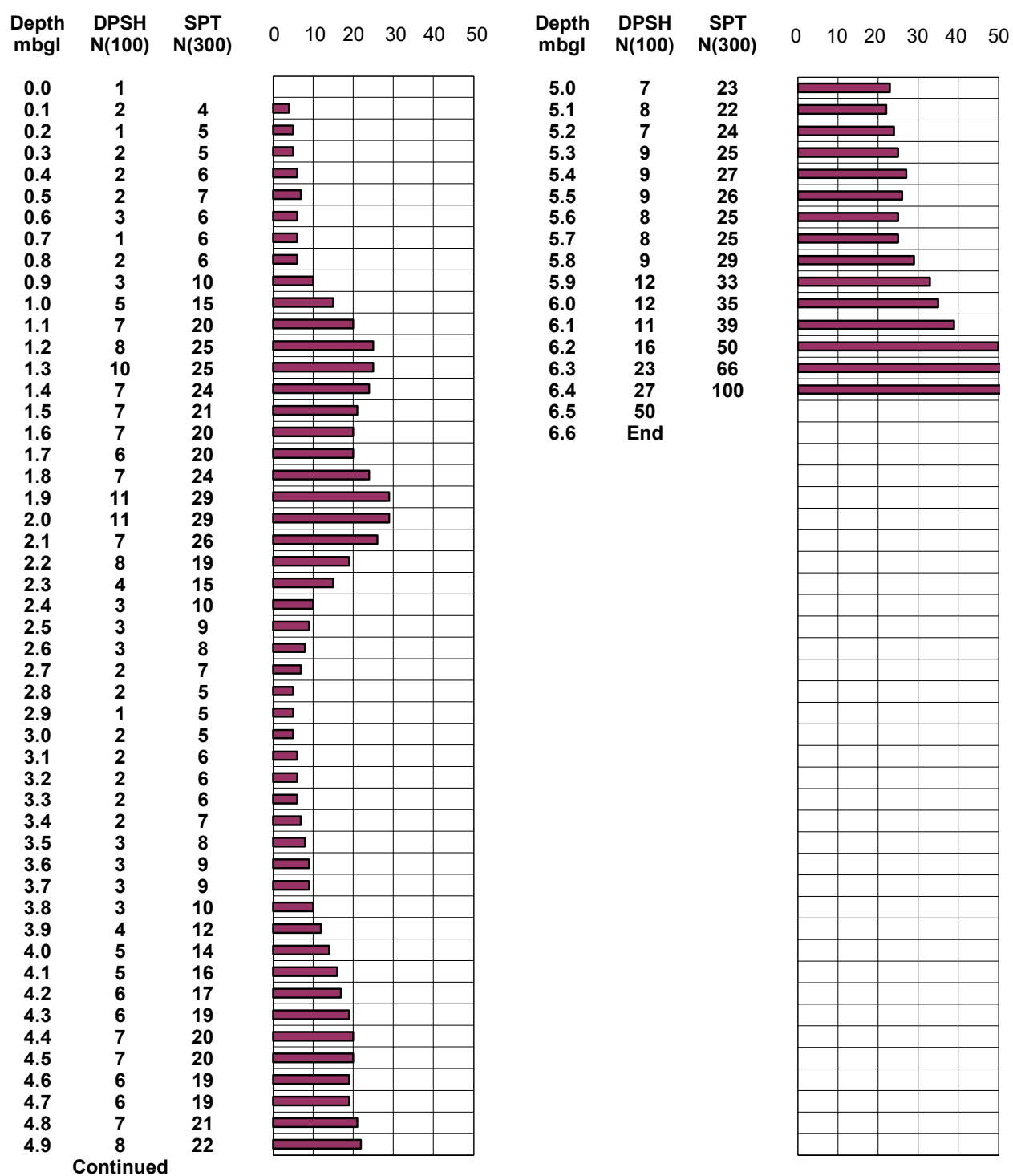
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP12		
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972			
Ref No:	GE20079	Rev:	0				
Drawn:	-	Date:					
Figure:	-	Scale:	Not To Scale				



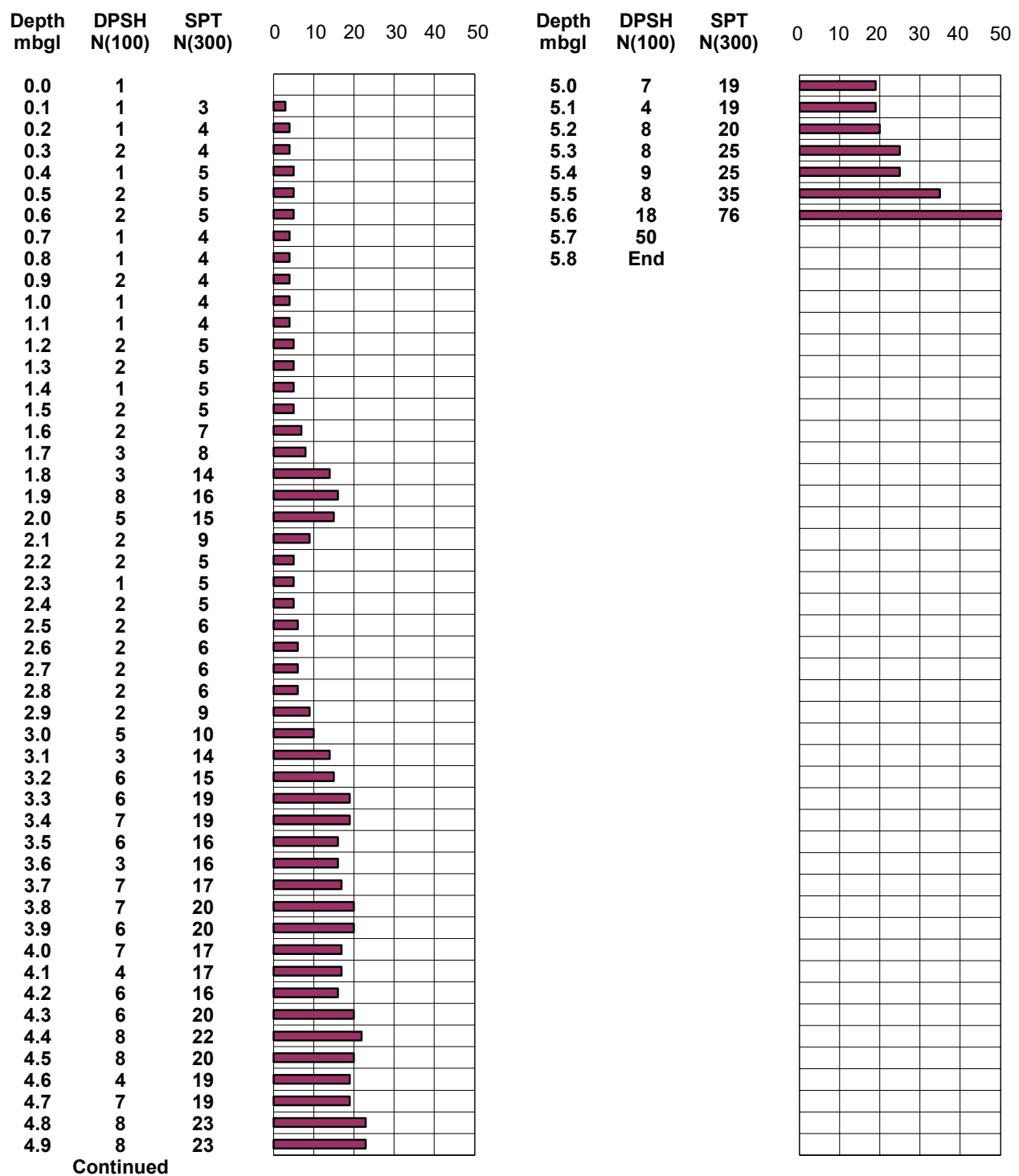
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP13
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



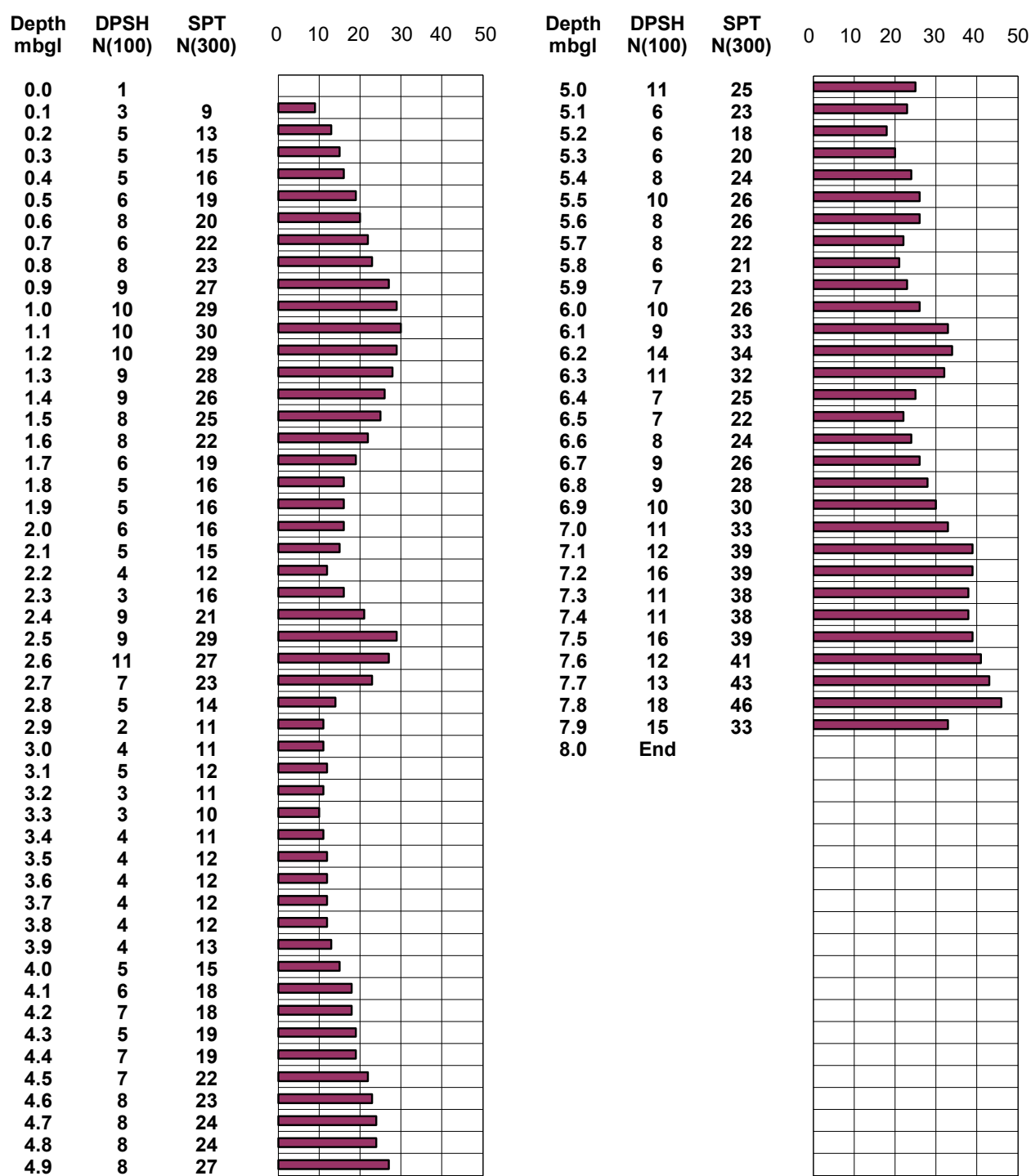
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP14		
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972			
Ref No:	GE20079	Rev:	0				
Drawn:	-	Date:					
Figure:	-	Scale:	Not To Scale				



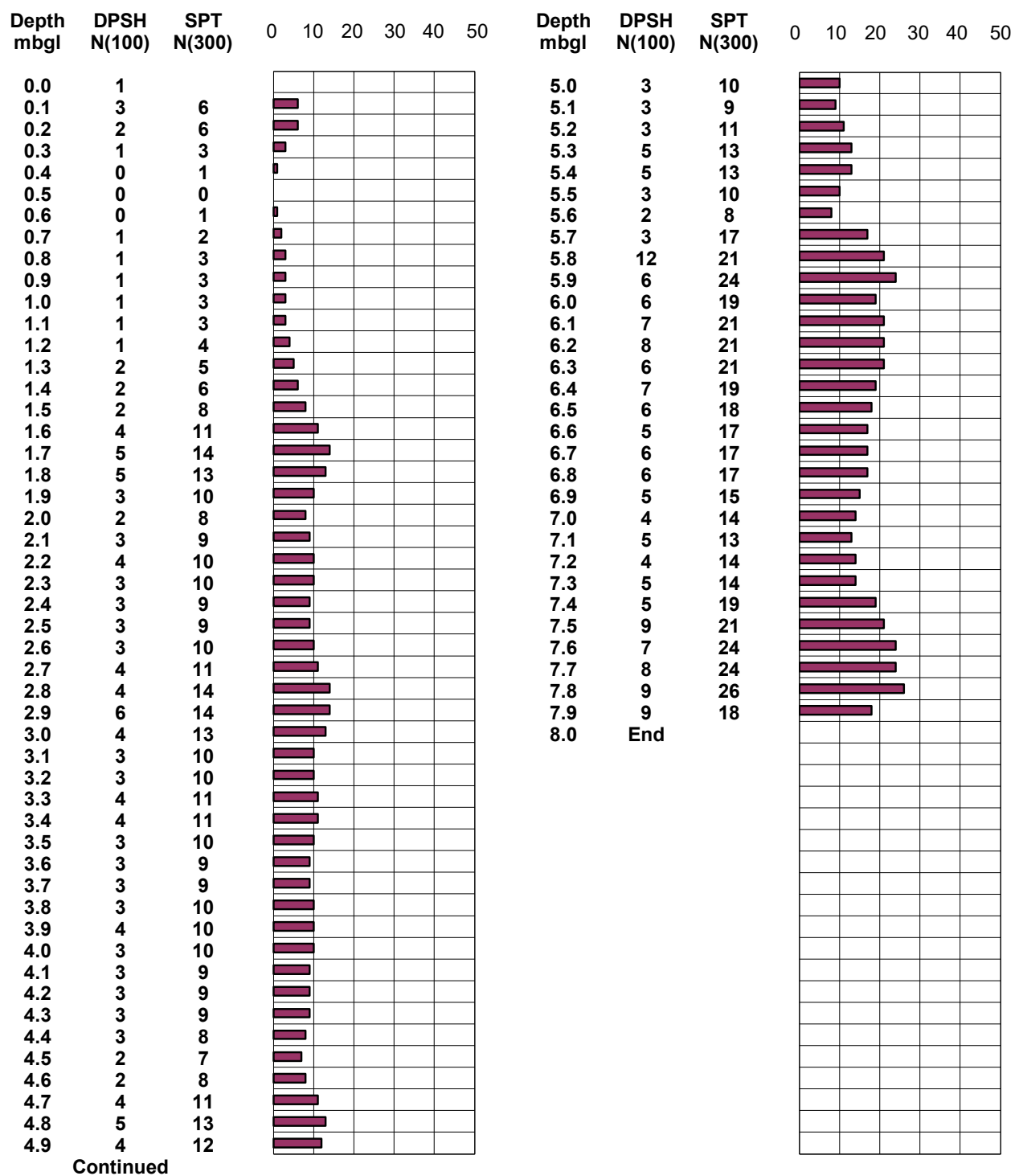
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP15
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



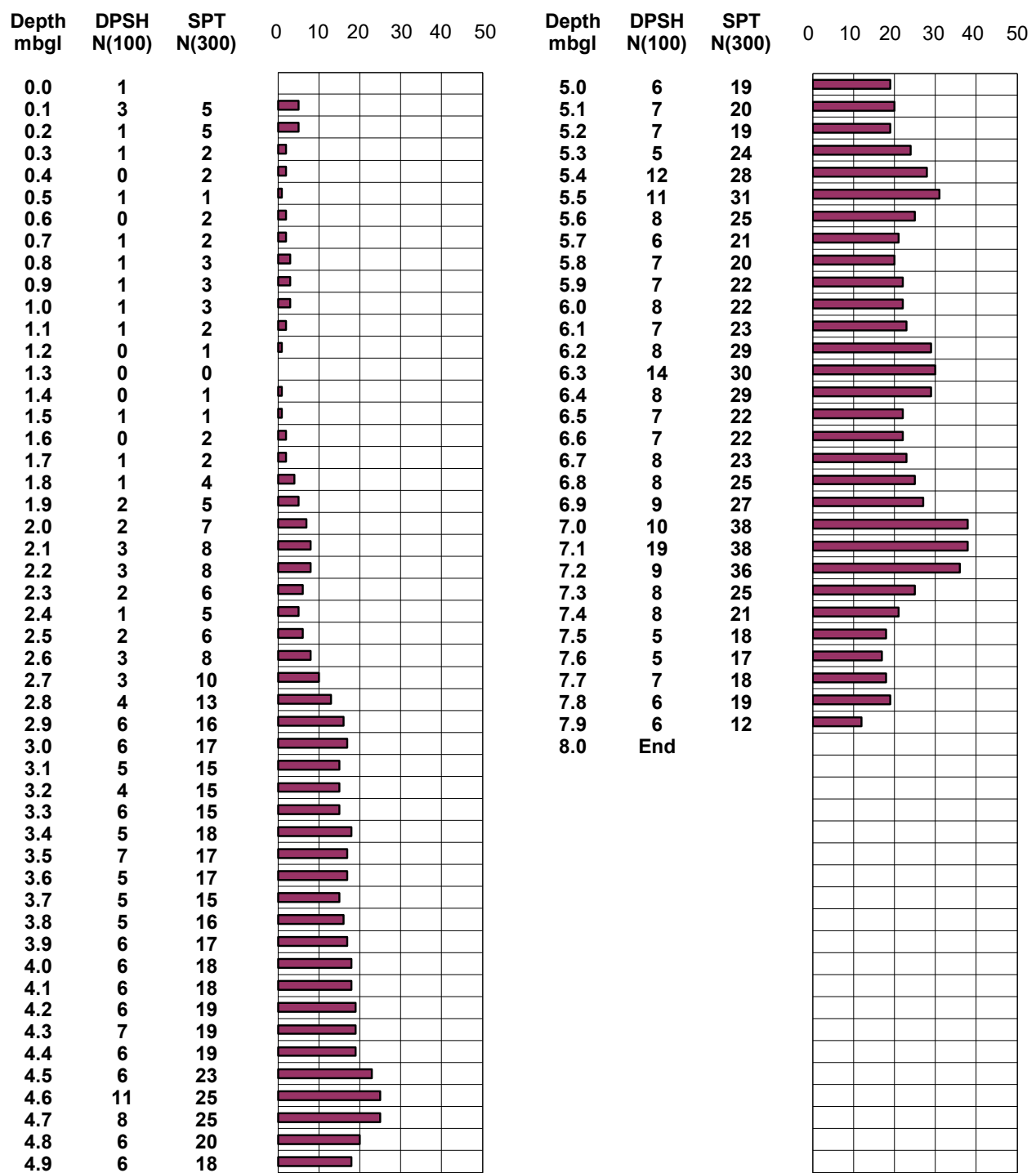
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP301
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



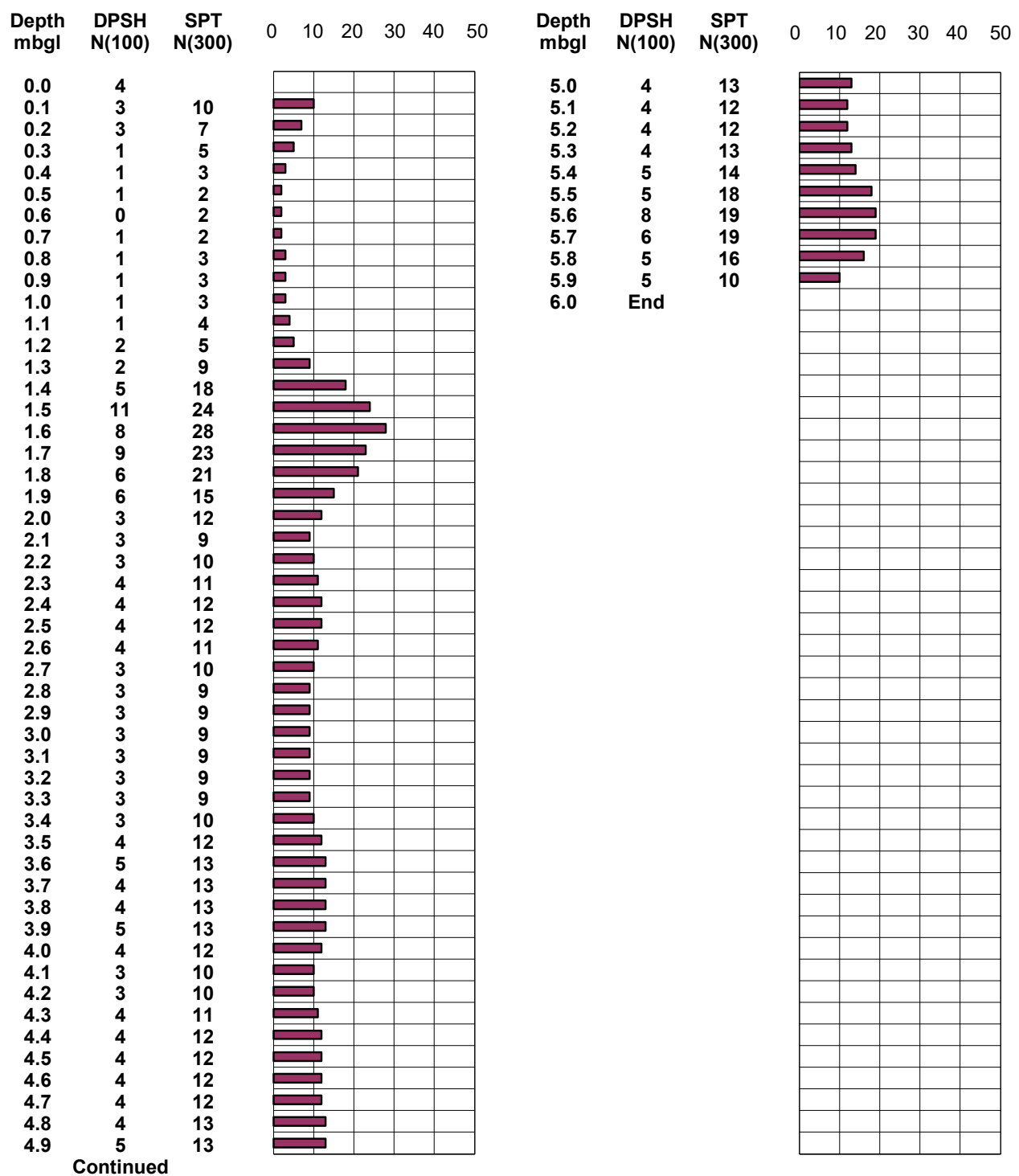
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP303
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



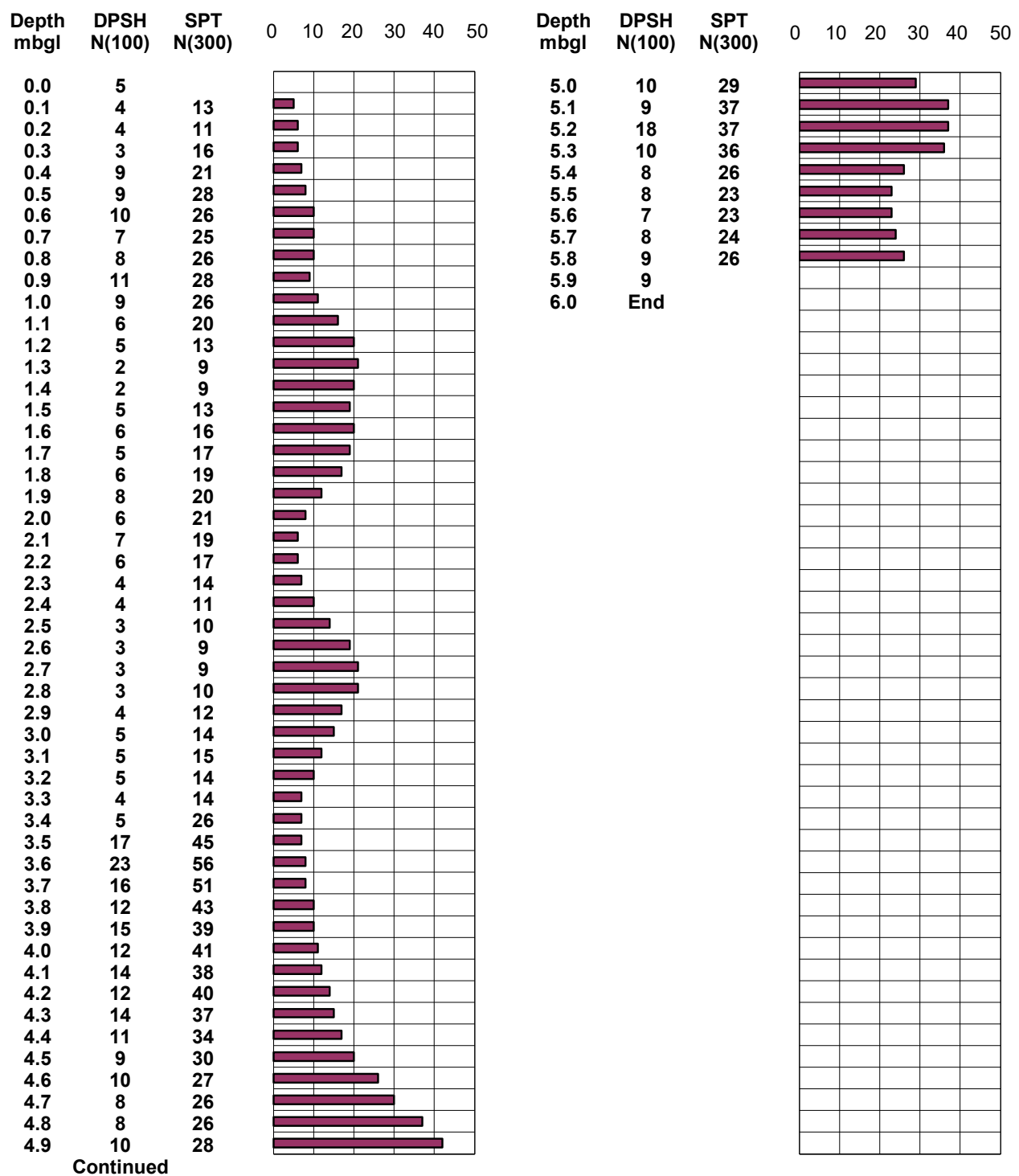
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP304
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



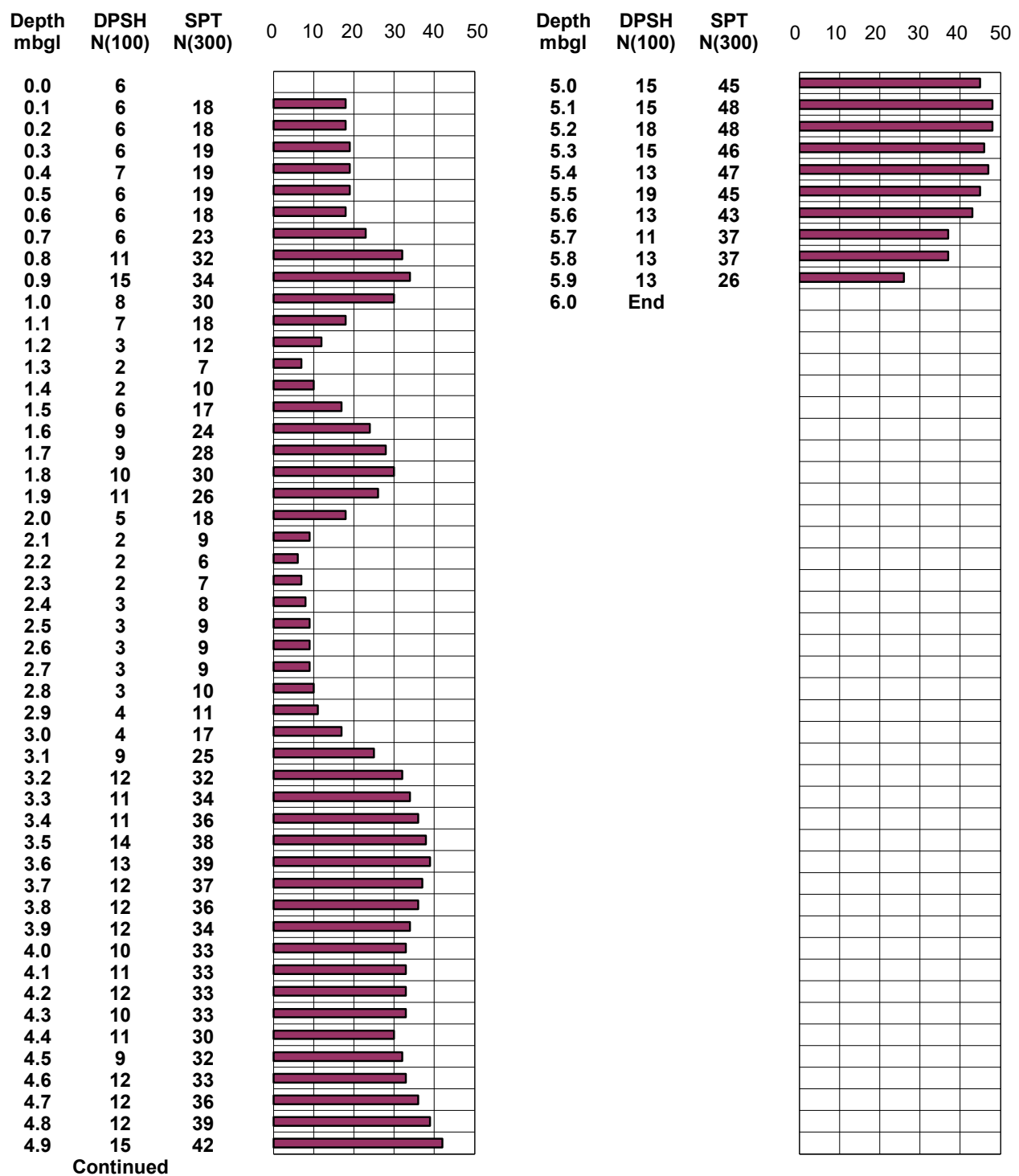
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP306
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



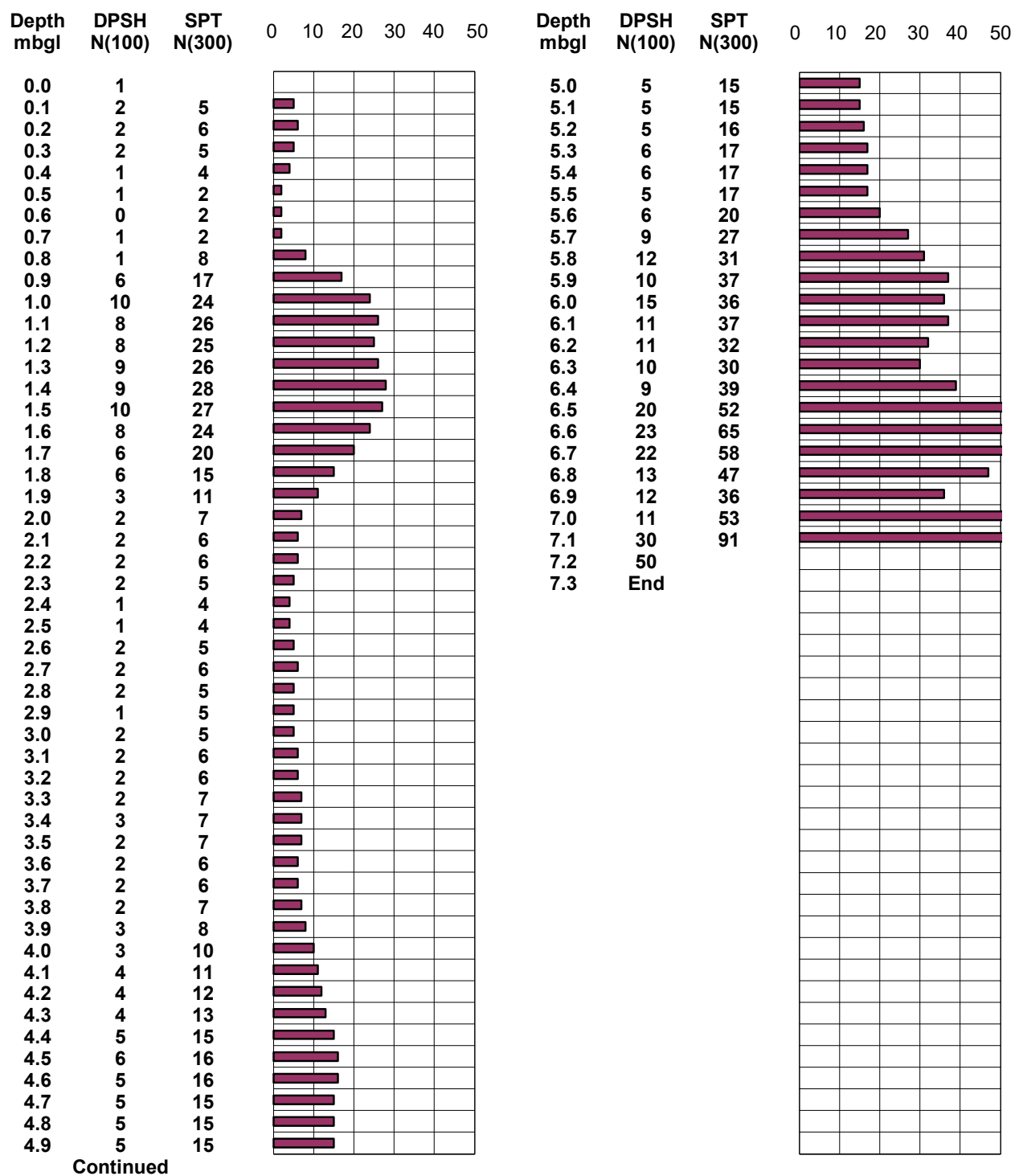
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP307
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



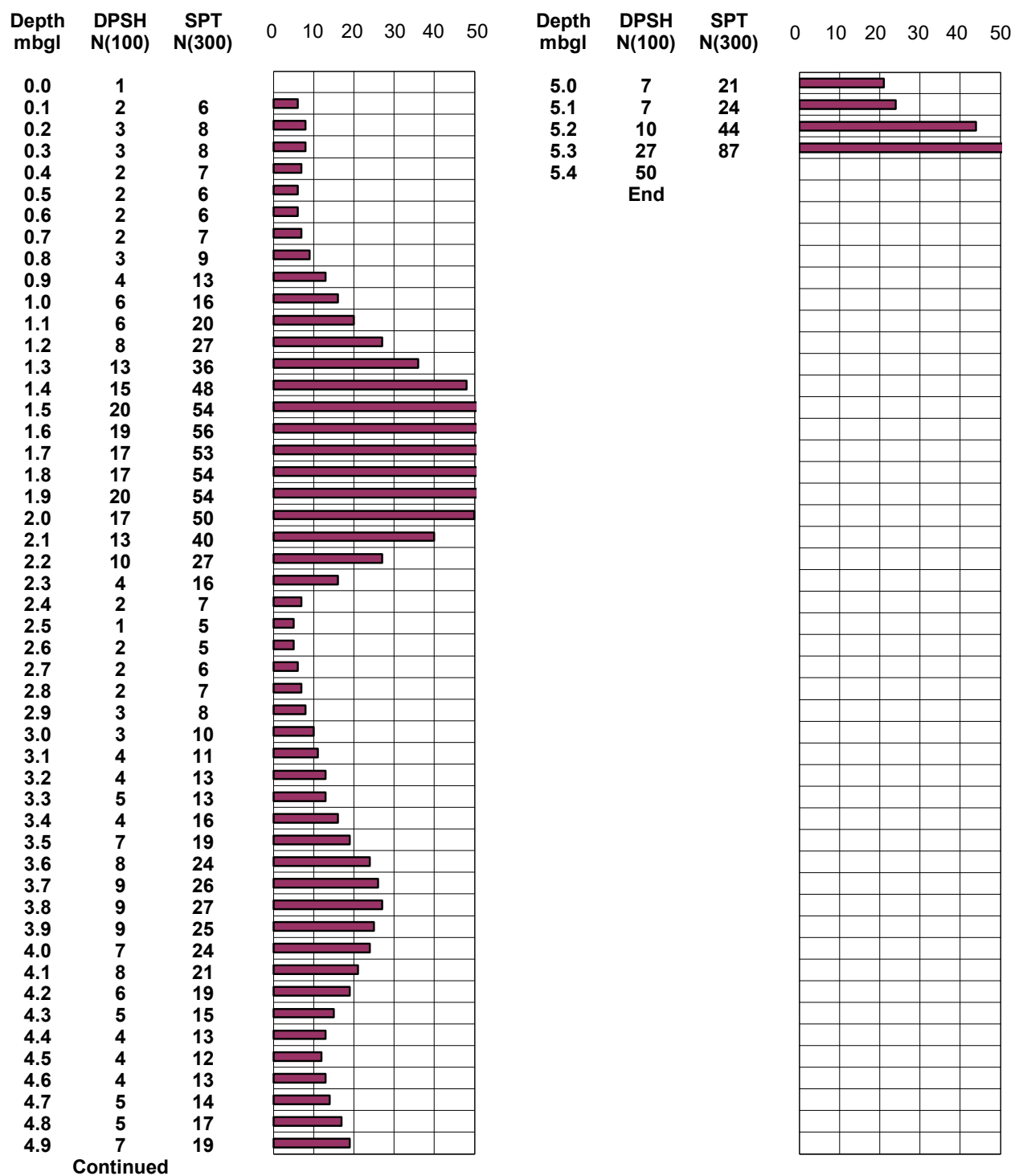
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP308
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



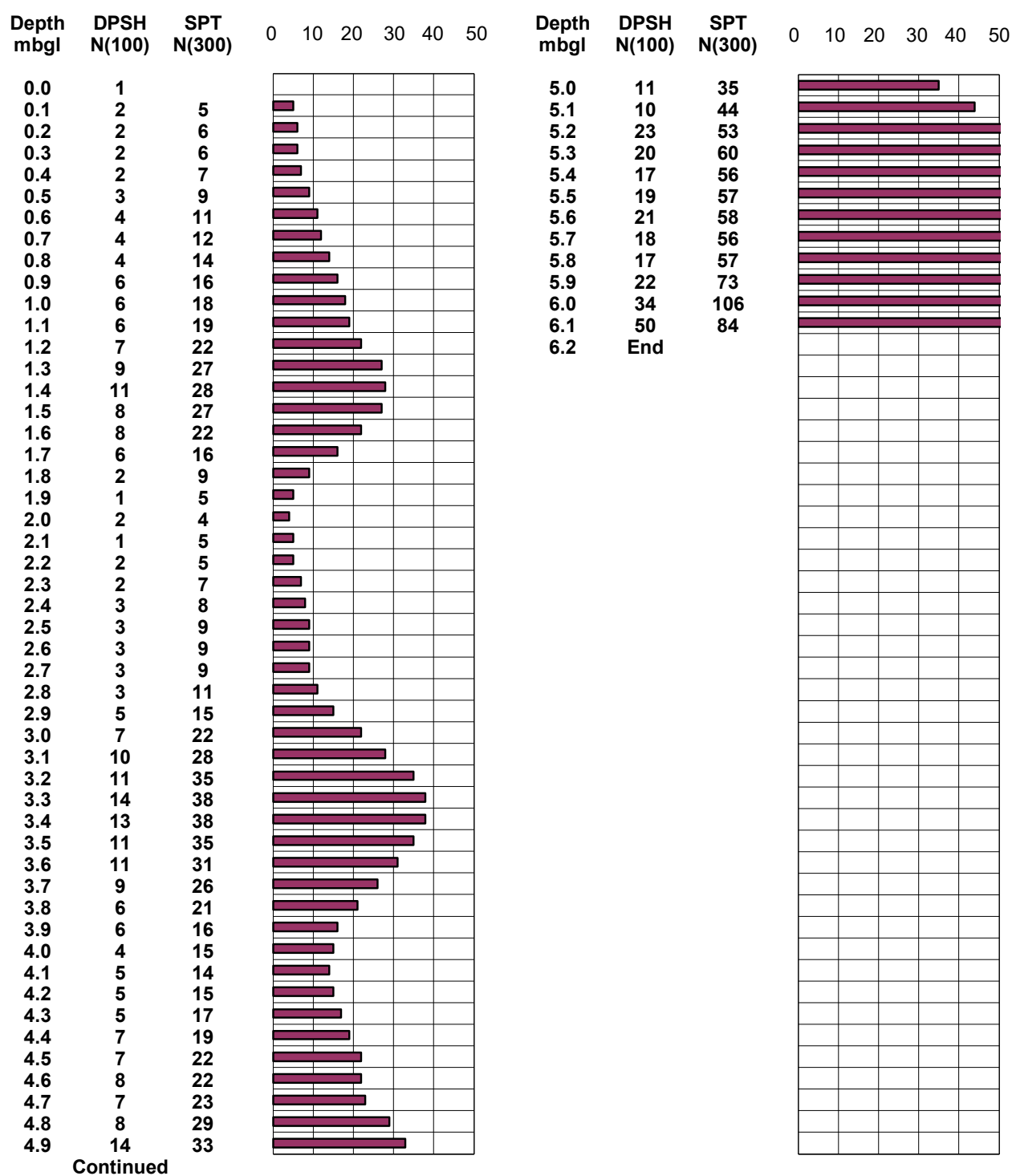
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP309
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



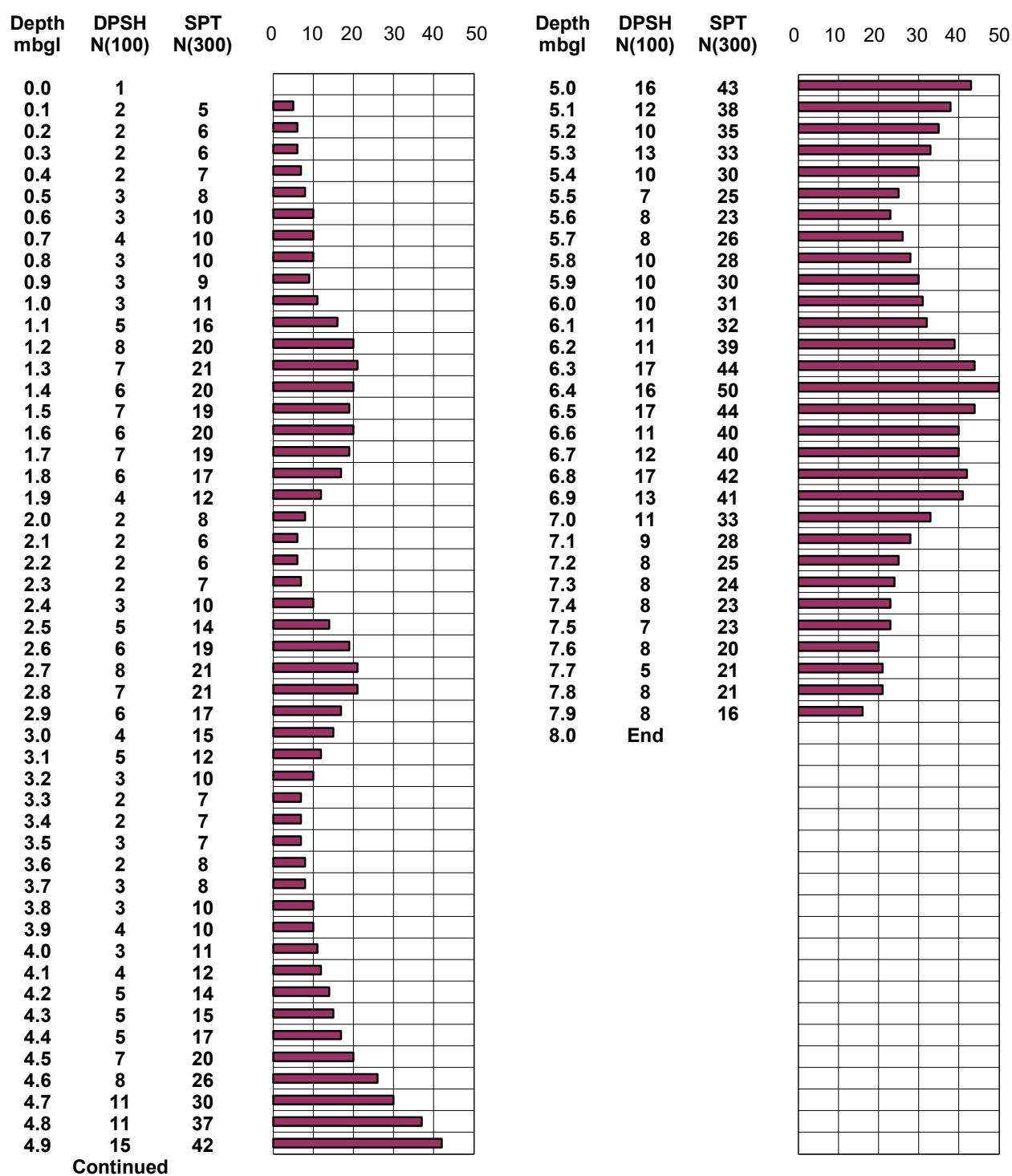
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP310
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



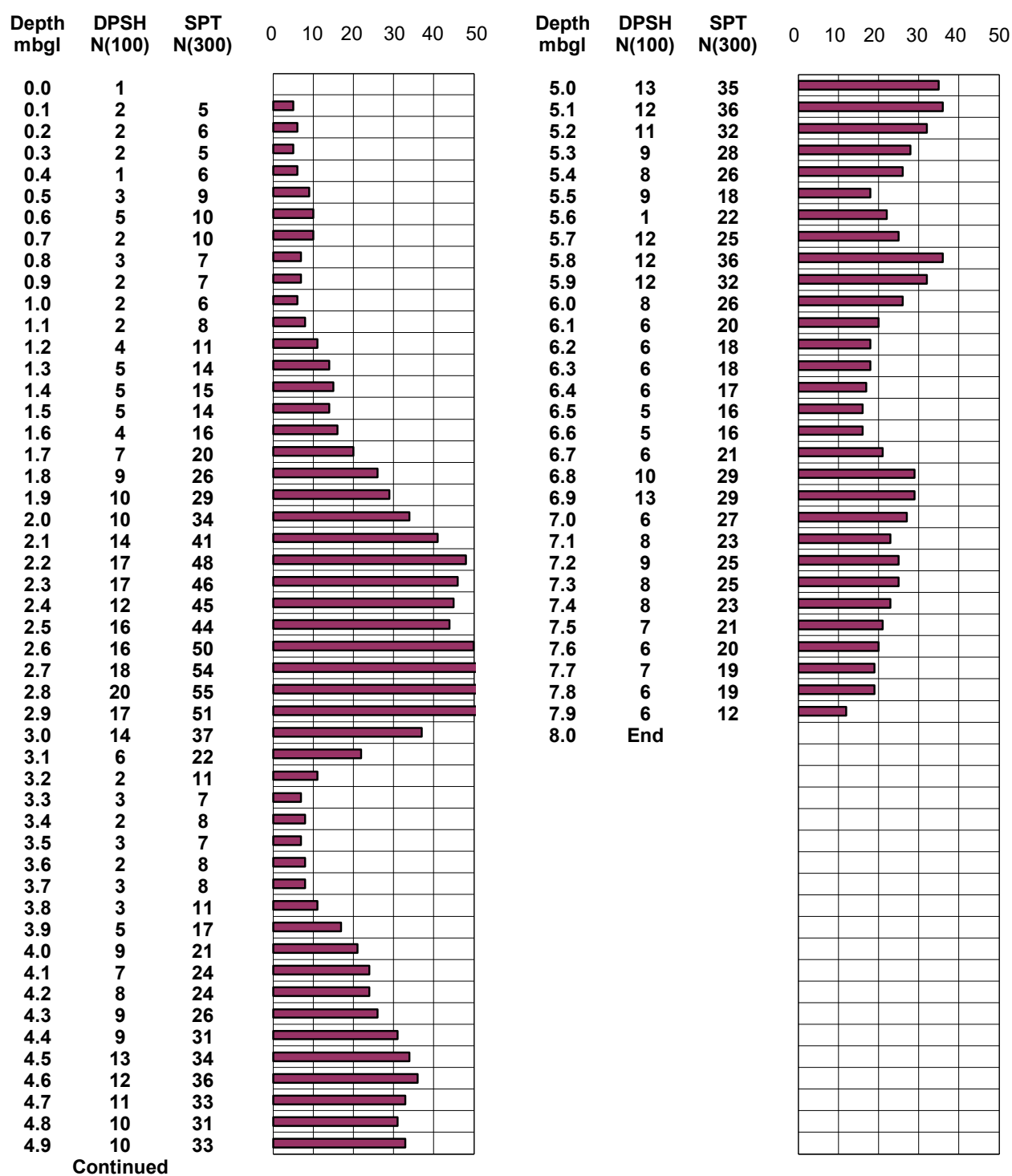
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP311
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



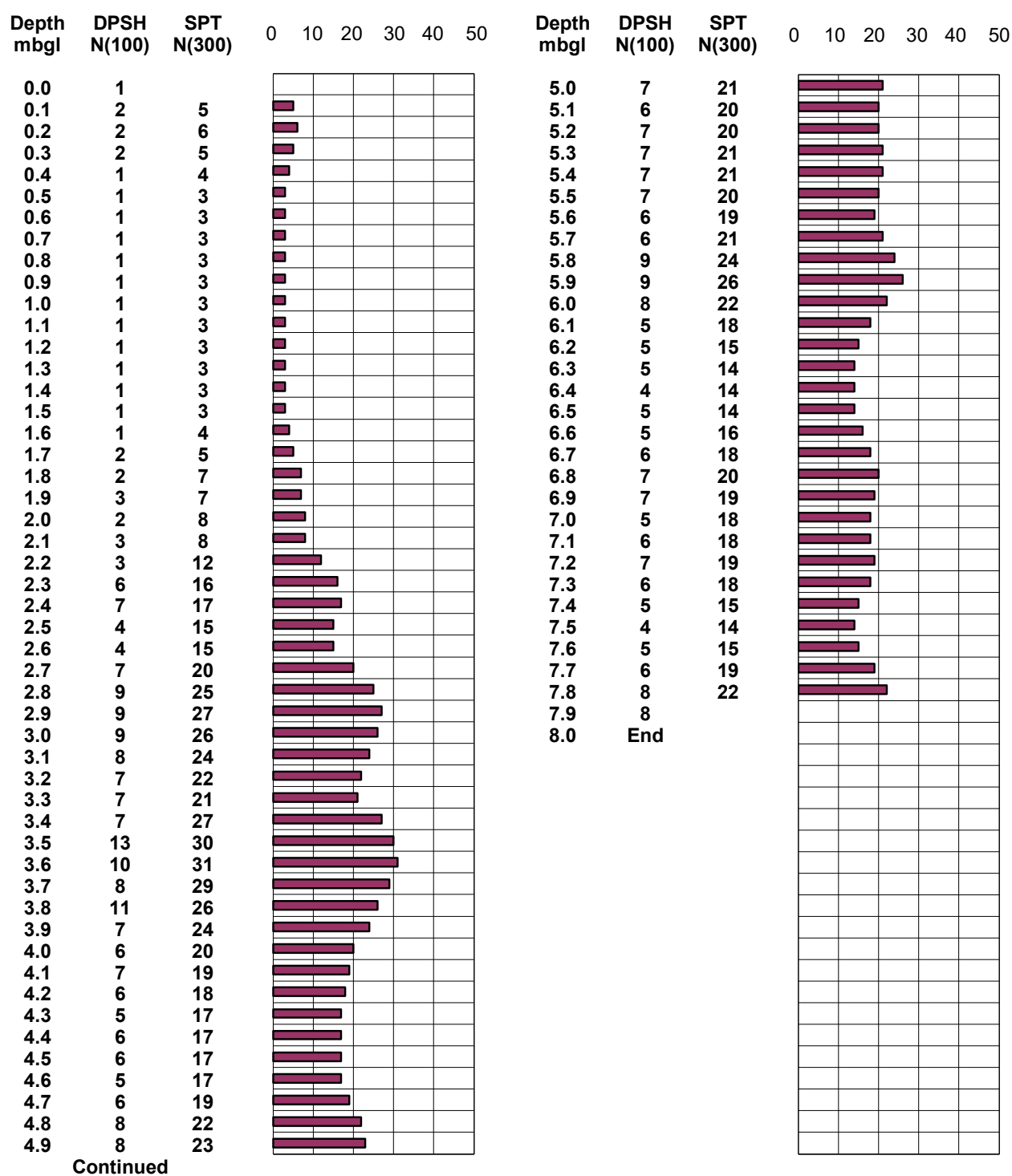
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP312		
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972			
Ref No:	GE20079	Rev:	0				
Drawn:	-	Date:					
Figure:	-	Scale:	Not To Scale				



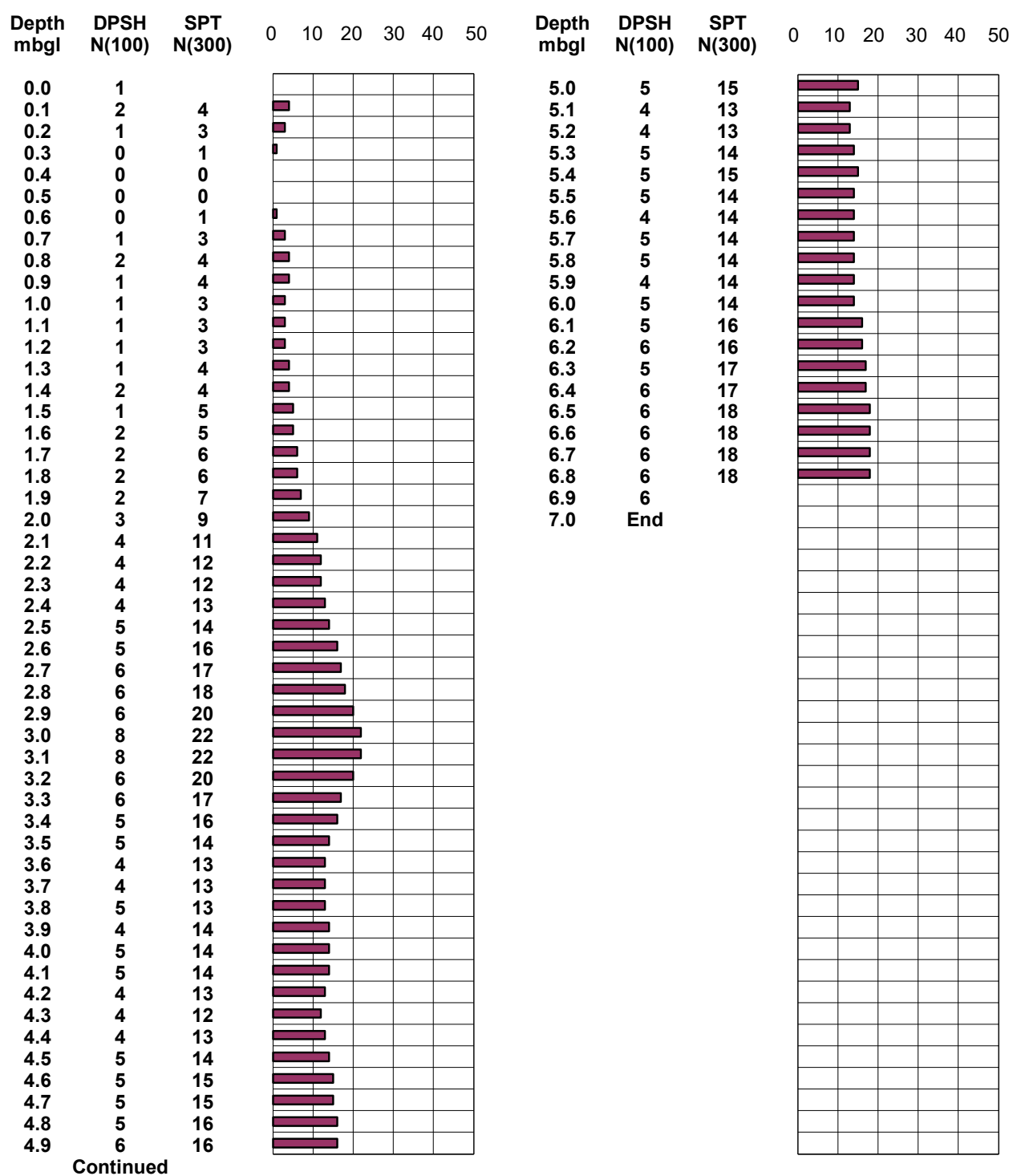
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP313
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



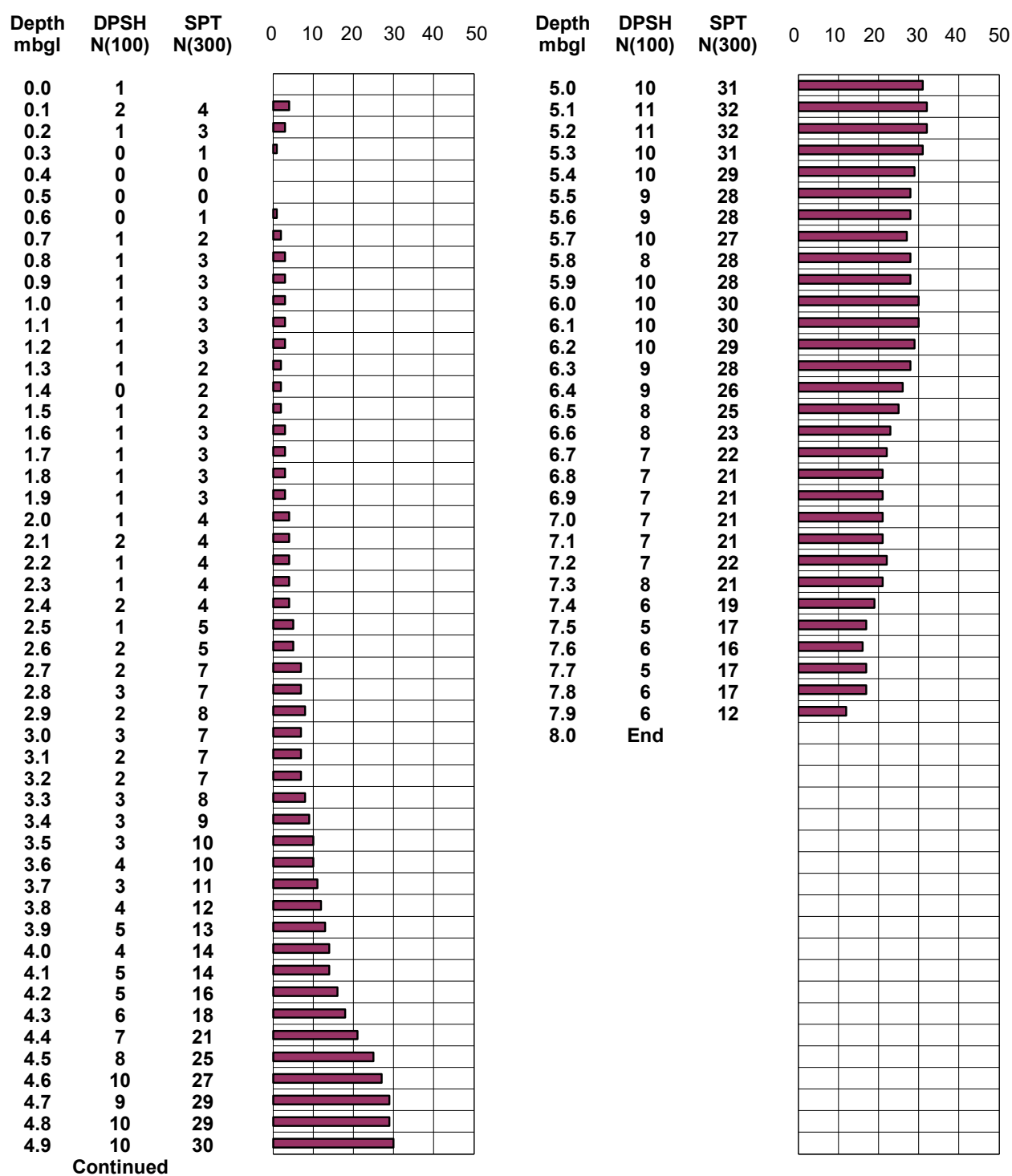
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP314
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



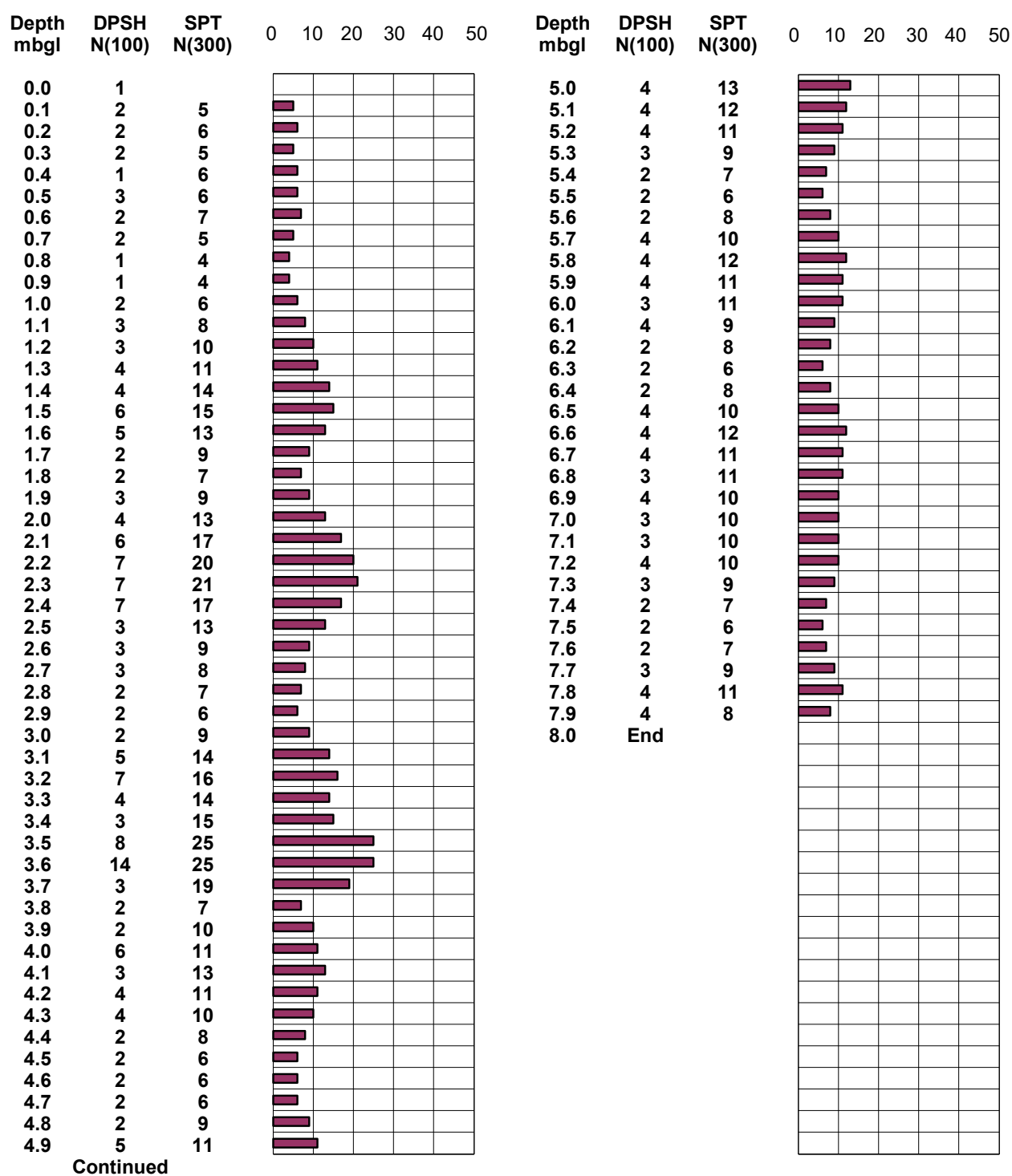
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP315
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



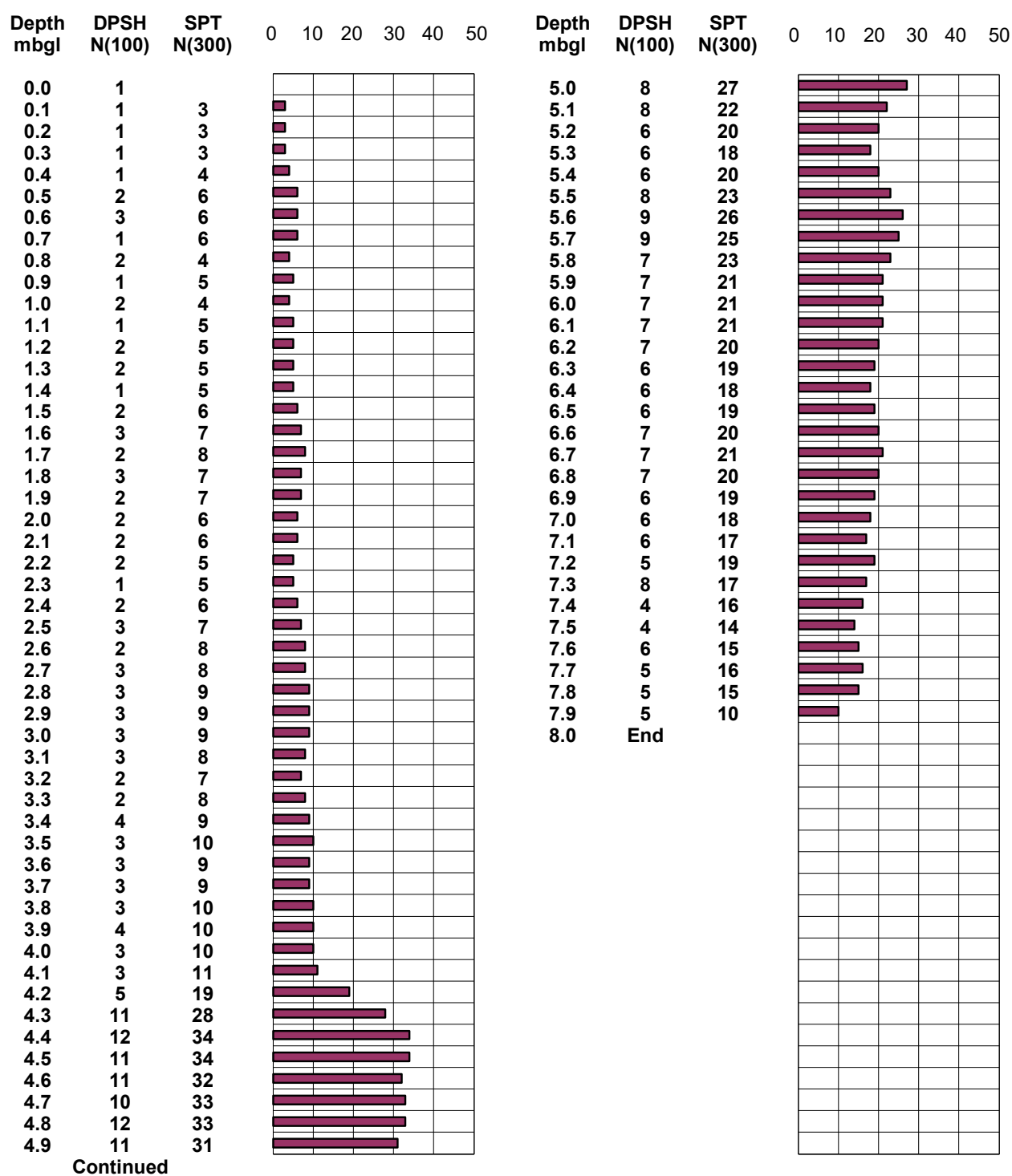
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP316
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



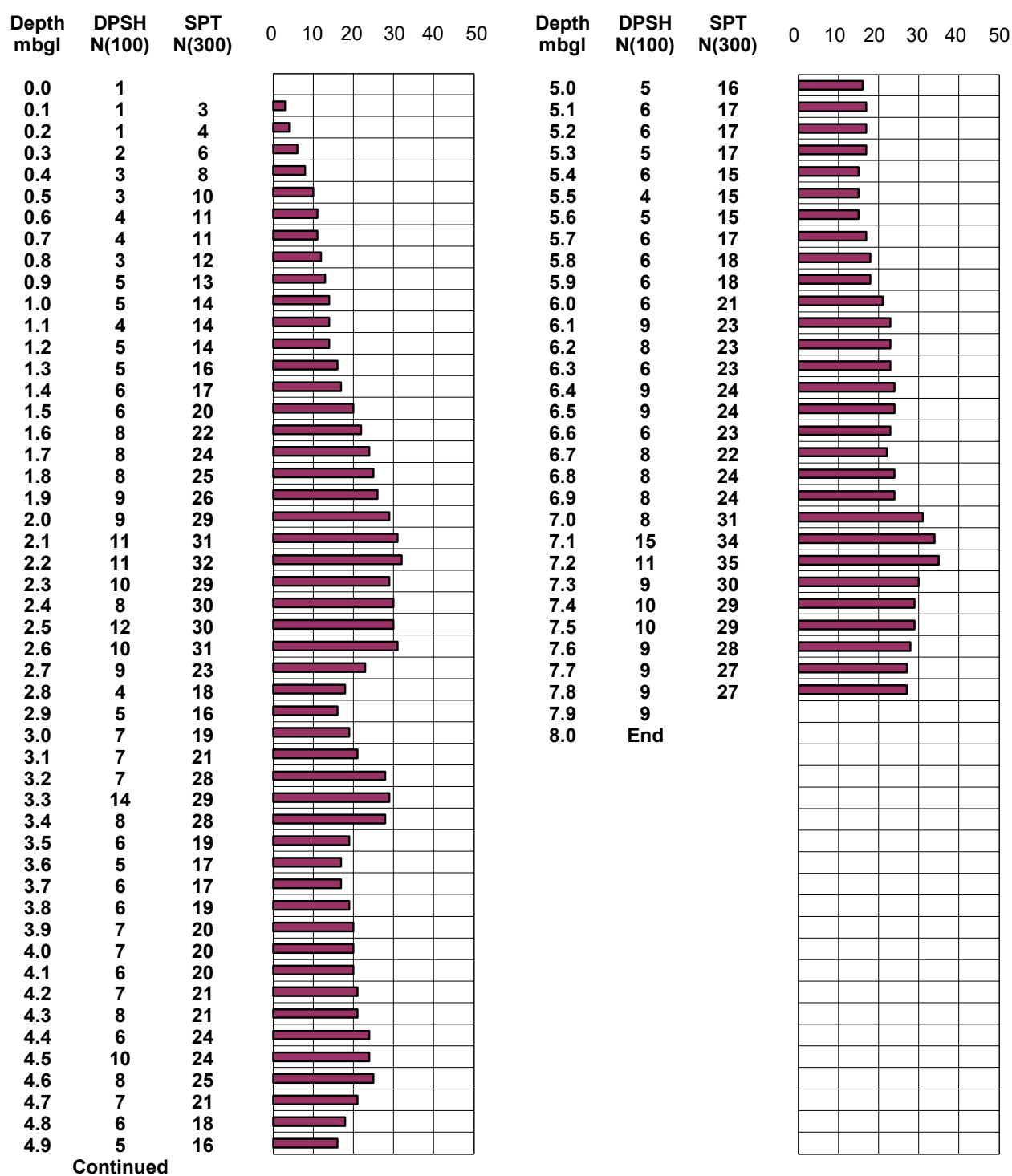
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP317
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



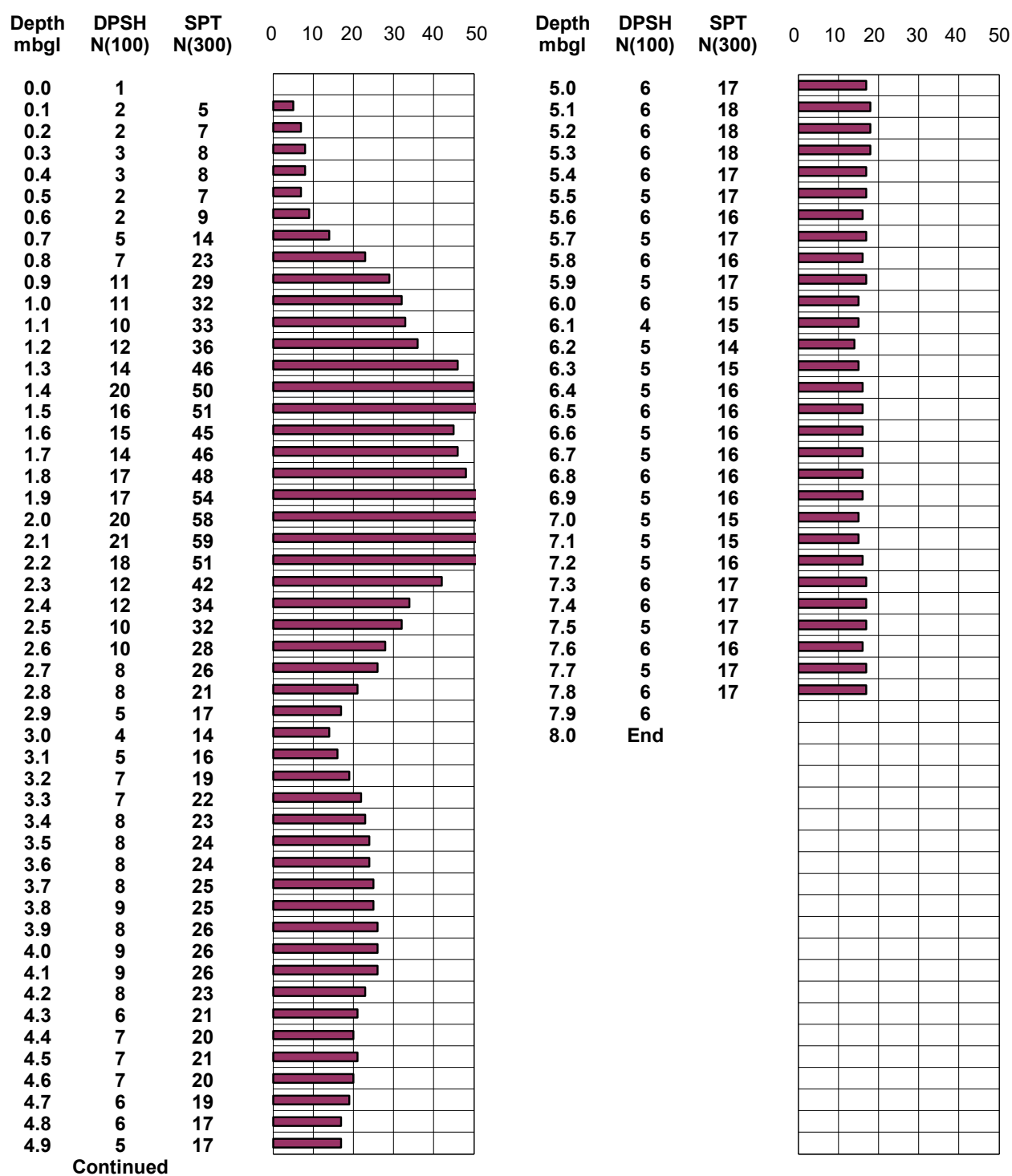
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP318
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



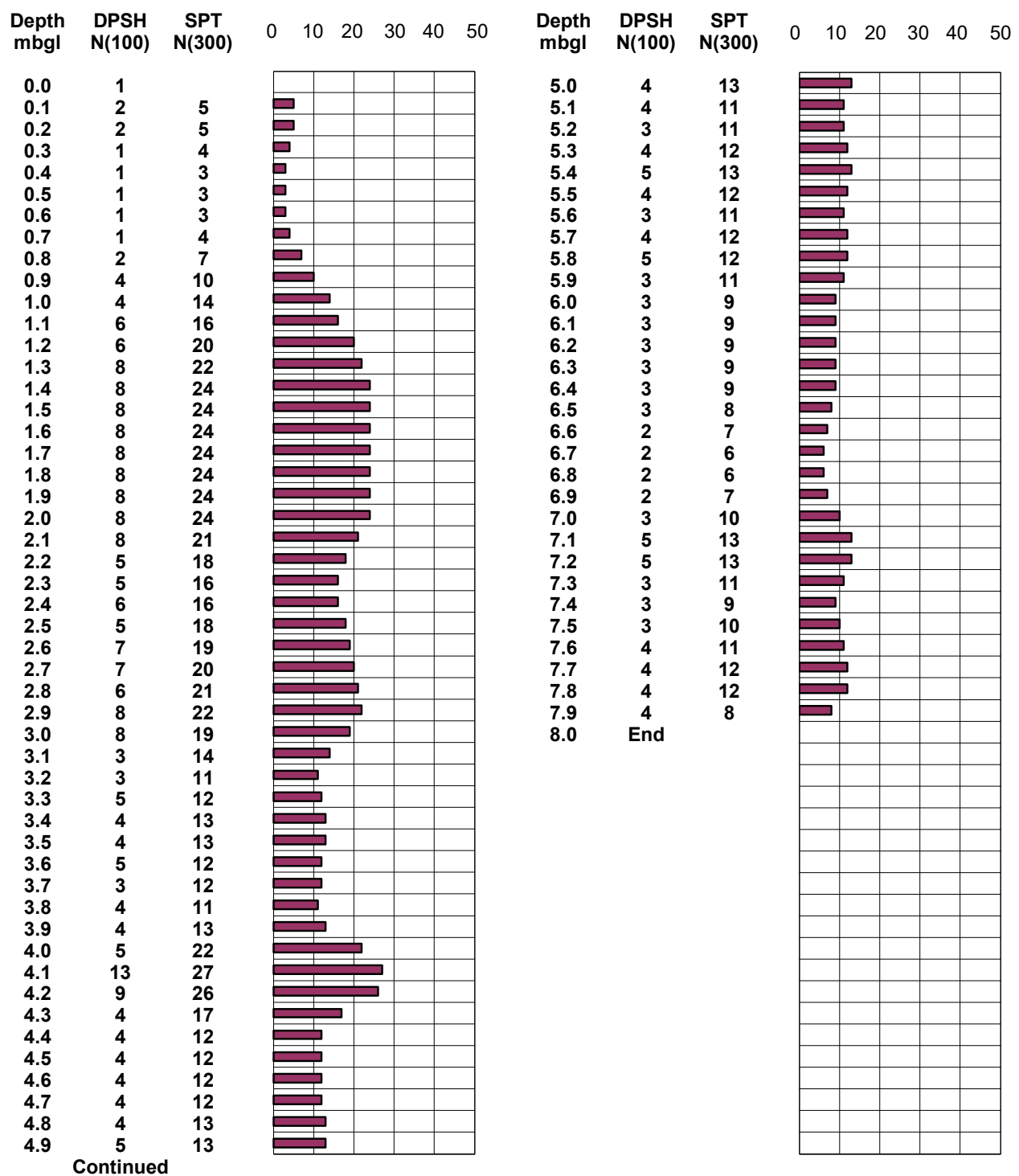
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP319
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



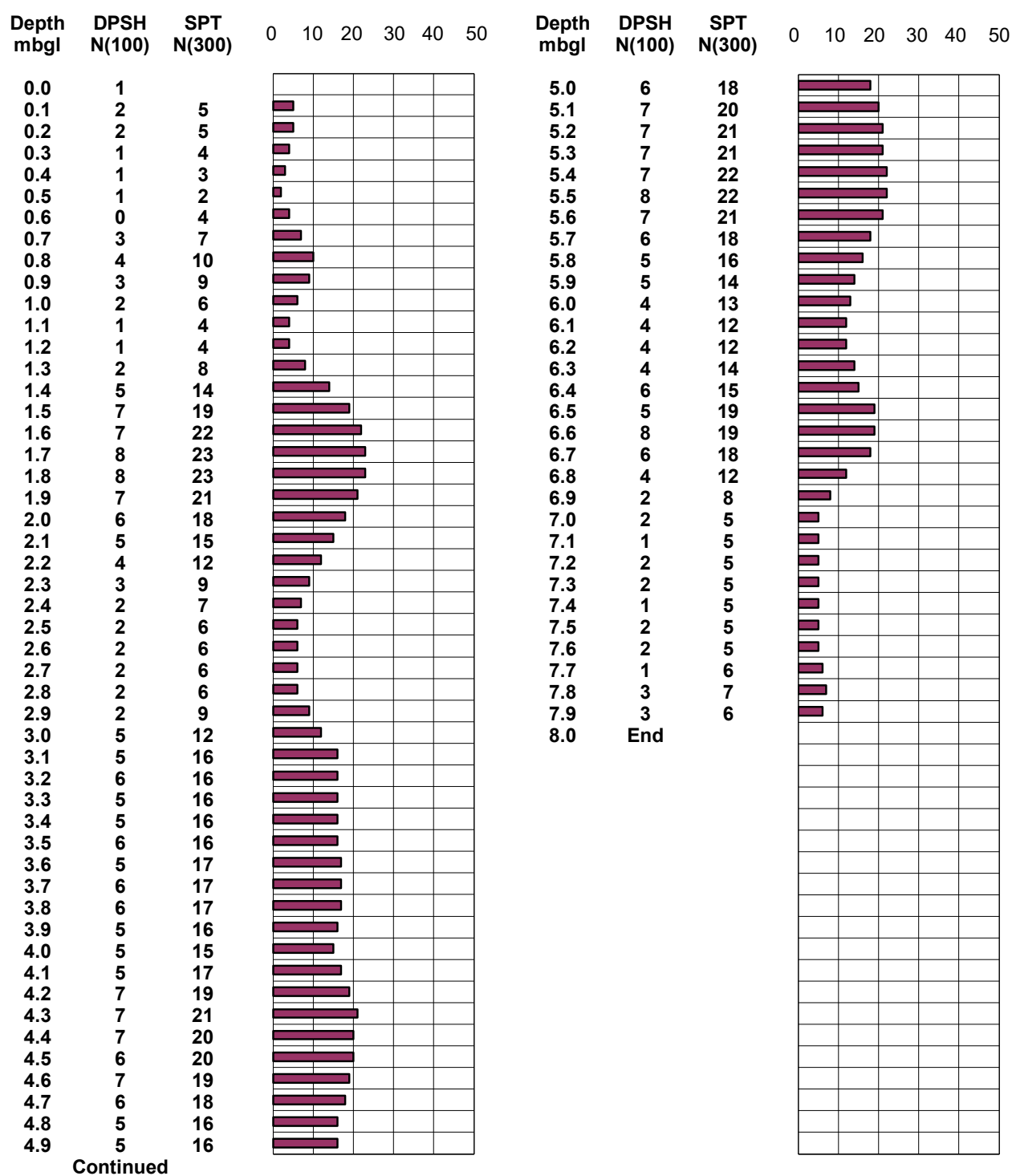
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP320		
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972			
Ref No:	GE20079	Rev:	0				
Drawn:	-	Date:					
Figure:	-	Scale:	Not To Scale				



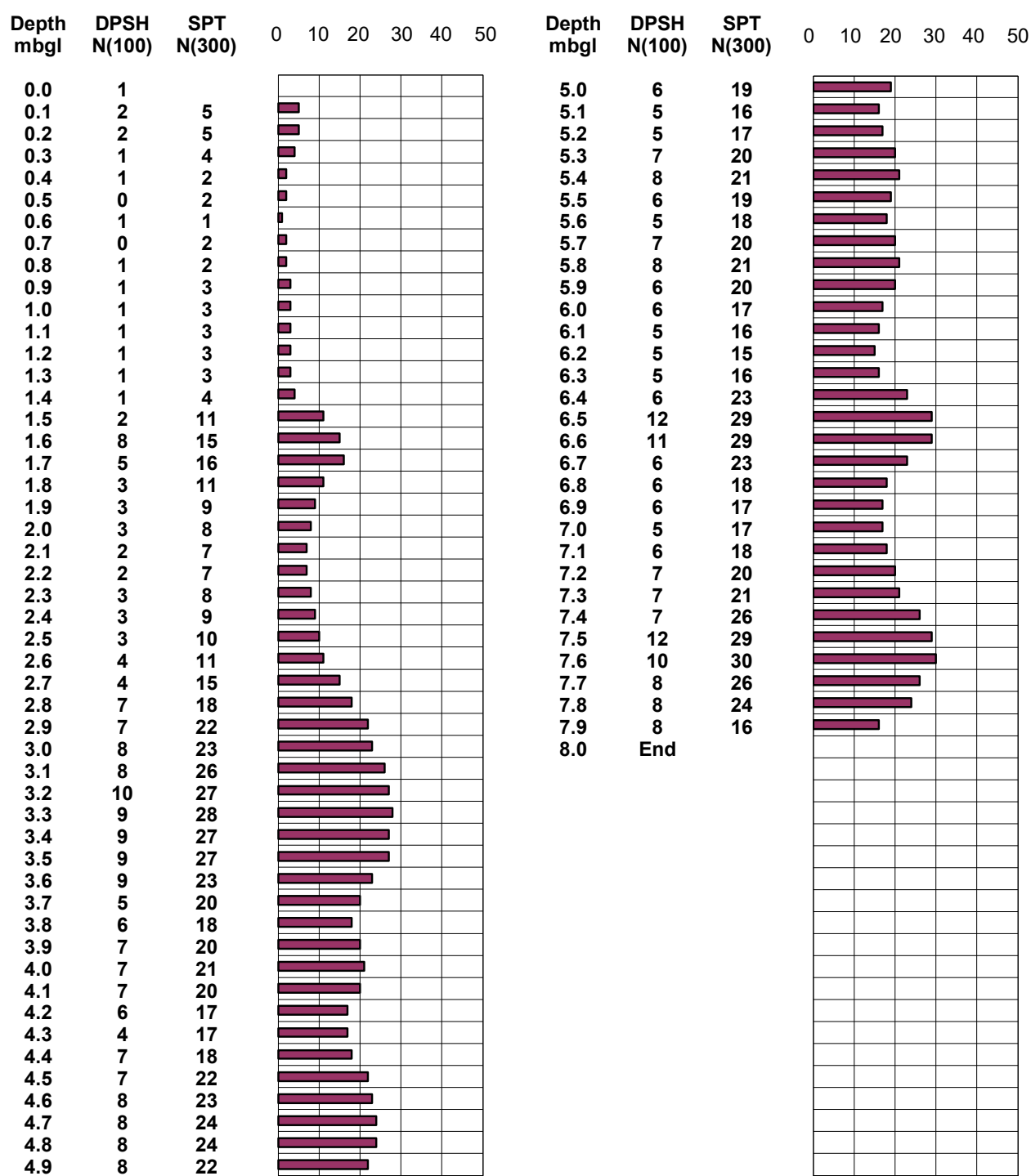
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP321
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



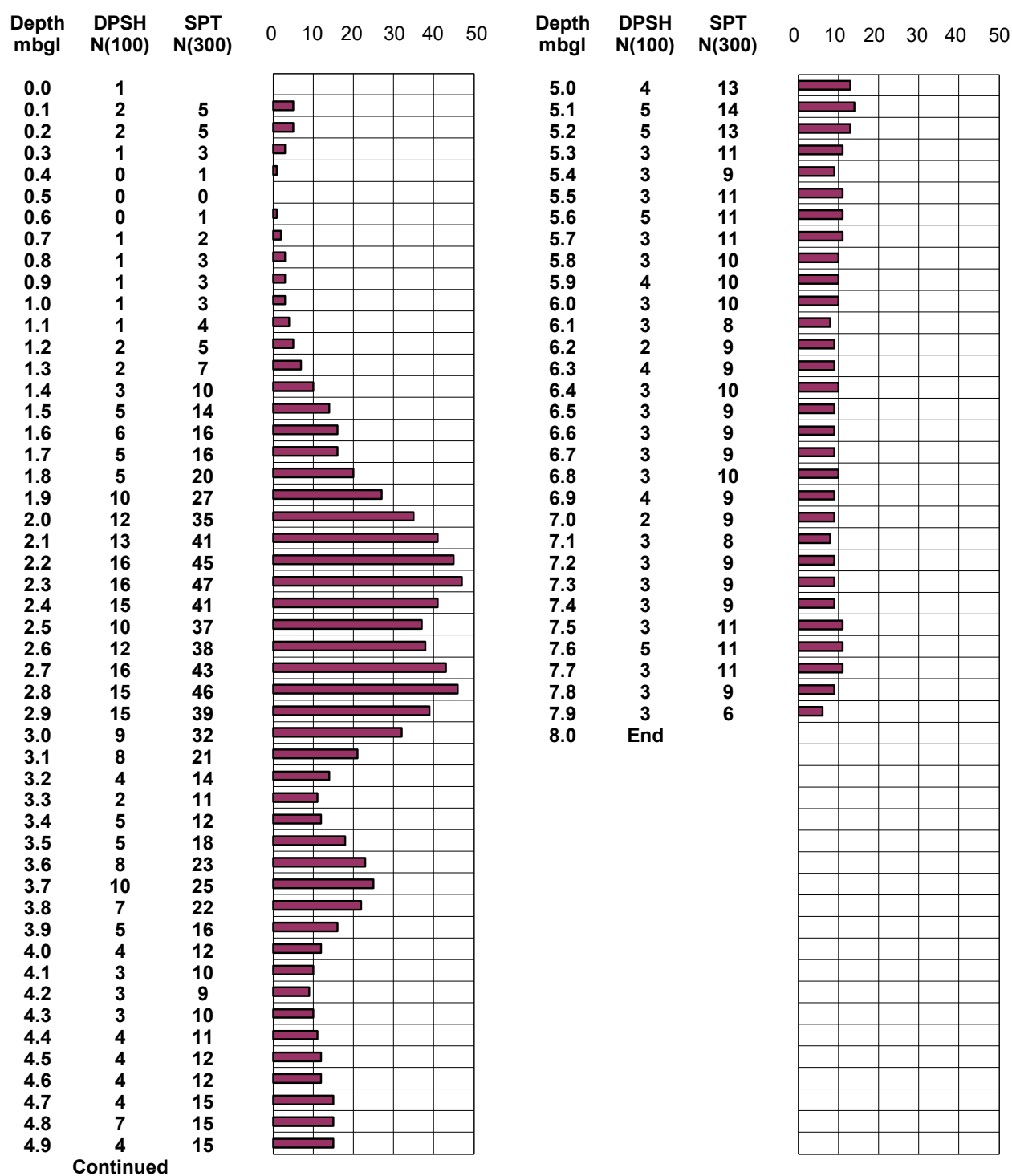
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP323
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



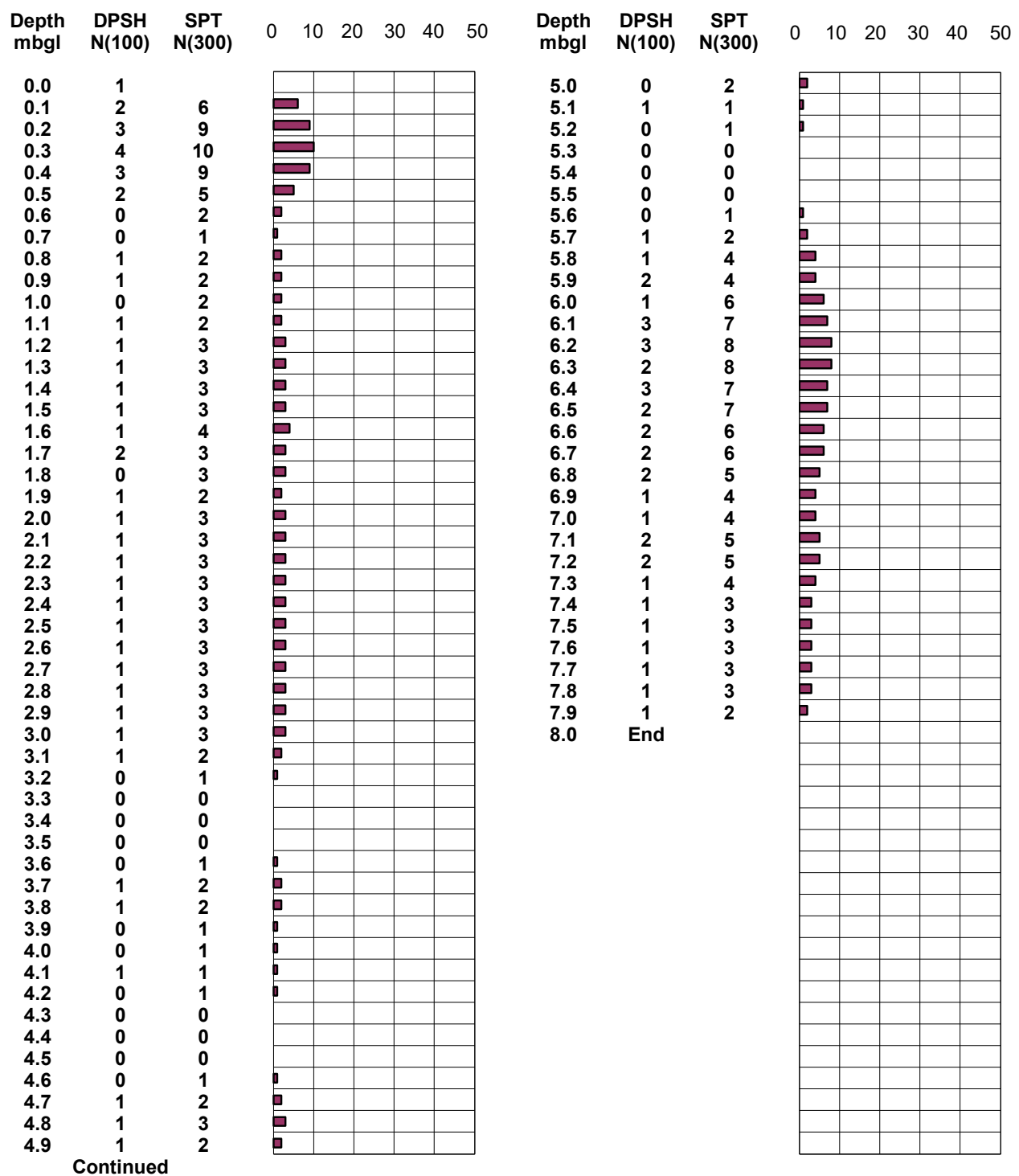
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP324
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



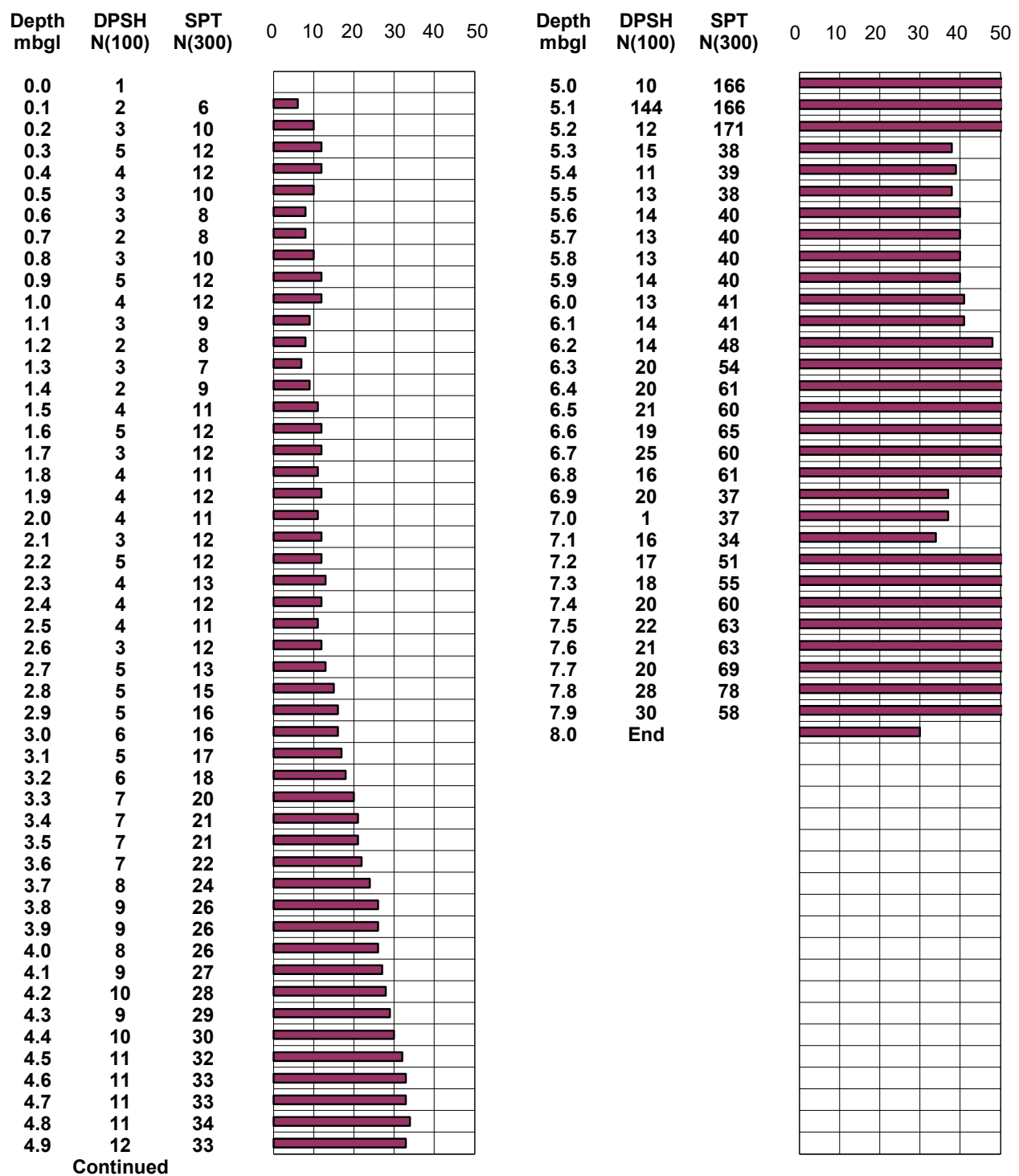
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP325		
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972			
Ref No:	GE20079	Rev:	0				
Drawn:	-	Date:					
Figure:	-	Scale:	Not To Scale				



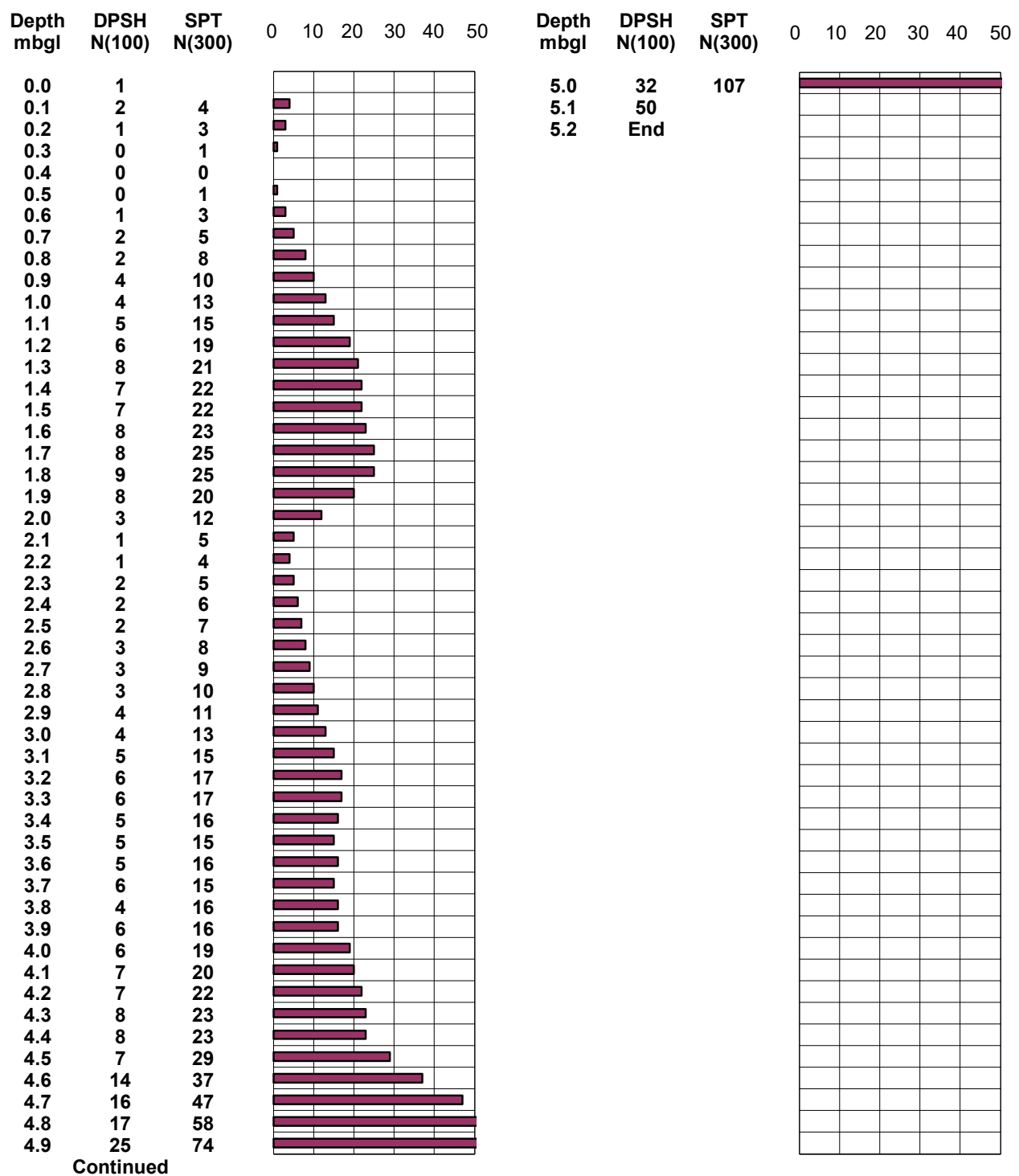
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP326		
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972			
Ref No:	GE20079	Rev:	0				
Drawn:	-	Date:					
Figure:	-	Scale:	Not To Scale				



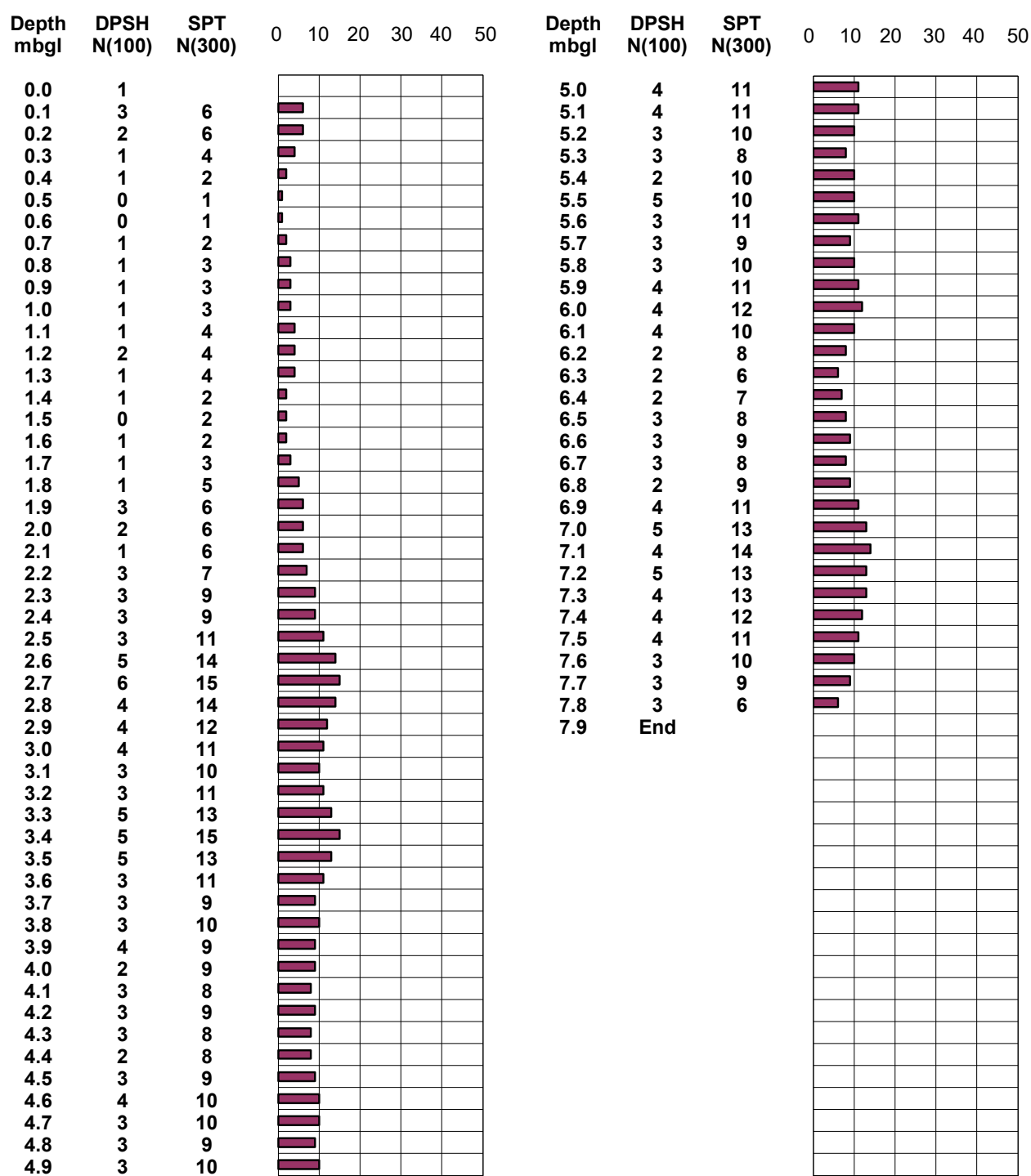
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP327
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



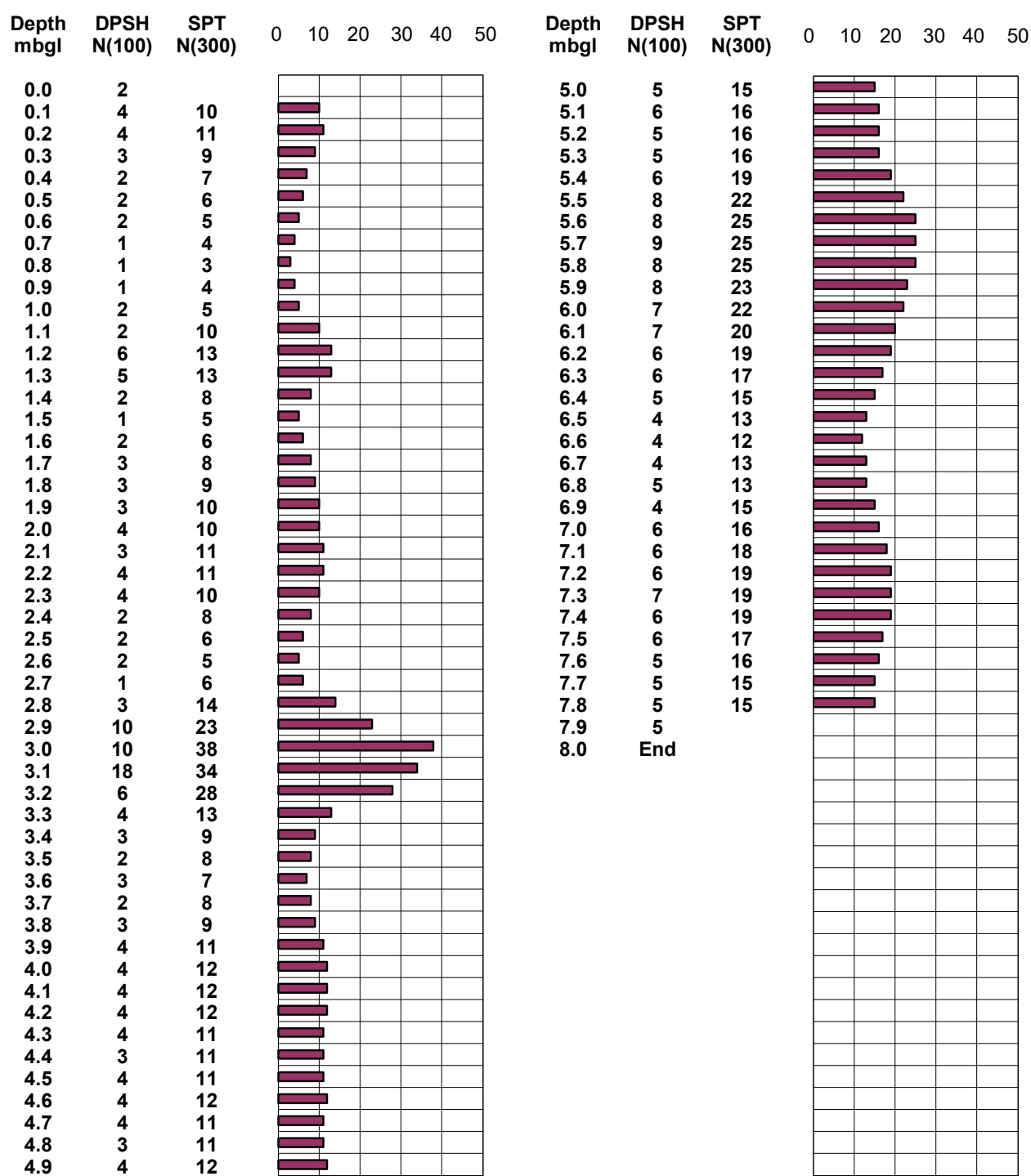
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP328
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP329
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Reading Golf Course			Title:	DYNAMIC PROBE LOG DP330
Client:	Vistry			Geo-Environmental Services Ltd Unit 7, Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex, BN6 9GL E: mail@gesl.net T: 01273 832972	
Ref No:	GE20079	Rev:	0		
Drawn:	-	Date:			
Figure:	-	Scale:	Not To Scale		



APPENDIX C

Soakage Test Results



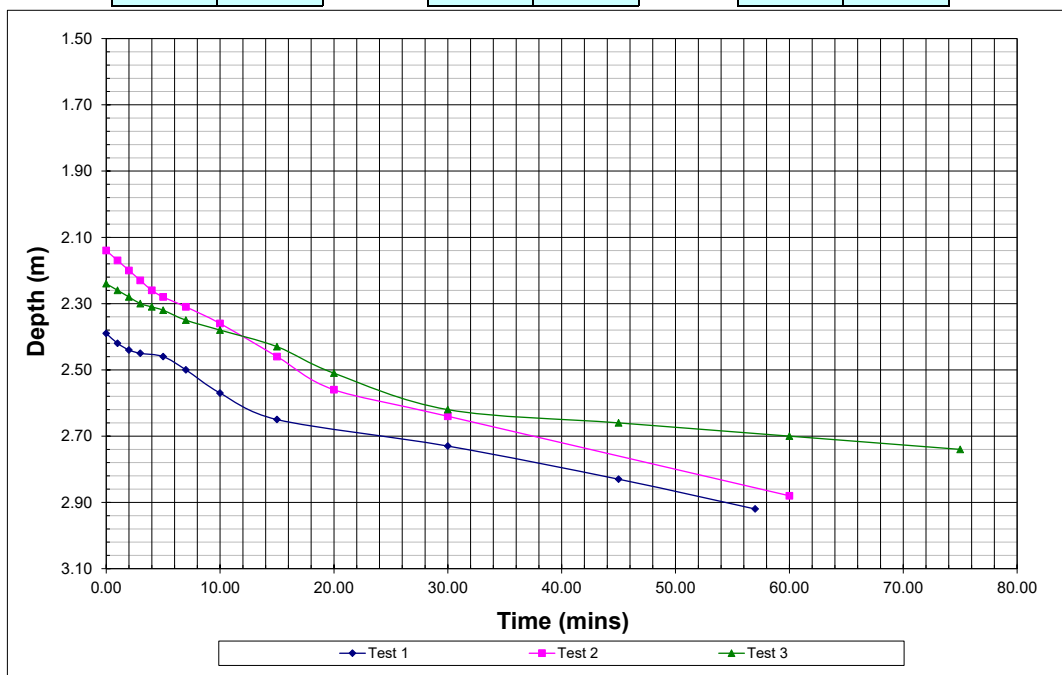
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net
Project Name : Reading Golf Course Client : Vistry		Job No. : GE20079 Date : 22/07/2021

Pit reference	TP201		
Test reference	Test1	Test2	Test3
Pit depth (m)	3.03	3.07	2.90
Pit width (m)	0.50	0.50	0.50
Pit length (m)	2.00	2.00	2.00
Depth to standing water (m)			

Test 1	
Time (min)	Depth (m)
0.0	2.39
1.0	2.42
2.0	2.44
3.0	2.45
5.0	2.46
7.0	2.50
10.0	2.57
15.0	2.65
30.0	2.73
45.0	2.83
57.0	2.92

Test 2	
Time (min)	Depth (m)
0.0	2.14
1.0	2.17
2.0	2.20
3.0	2.23
4.0	2.26
5.0	2.28
7.0	2.31
10.0	2.36
15.0	2.46
20.0	2.56
30.0	2.64
60.0	2.88

Test 3	
Time (min)	Depth (m)
0.0	2.24
1.0	2.26
2.0	2.28
3.0	2.30
4.0	2.31
5.0	2.32
7.0	2.35
10.0	2.38
15.0	2.43
20.0	2.51
30.0	2.62
45.0	2.66
60.0	2.70
75.0	2.74



Max. depth (m)	3.03	3.07	2.90
Effective depth (m)	0.64	0.93	0.66
75% effective depth (m)	2.55	2.37	2.41
50% effective depth (m)	2.71	2.61	2.57
25% effective depth (m)	2.87	2.84	2.74
t75 (min)	9.00	10.50	12.00
t50 (min)	26.00	26.00	26.00
t25 (min)	50.00	55.00	75.00
Vp 75-25	0.32	0.47	0.33
ap 50	2.6	3.325	2.65
tp 75-25	41.00	44.50	63.00

Soil infiltration rate (m/s)	5.0E-05	5.2E-05	3.3E-05
Soil infiltration rate (mm/hr)	1.80E+02	1.89E+02	1.19E+02

Notes:

- 1 Blue cells require input data
- 2 Infiltration calculated to method in 'BRE Digest 365 (1991) - Soakaway Design'
- 3 First line of table must be depth at time = 0

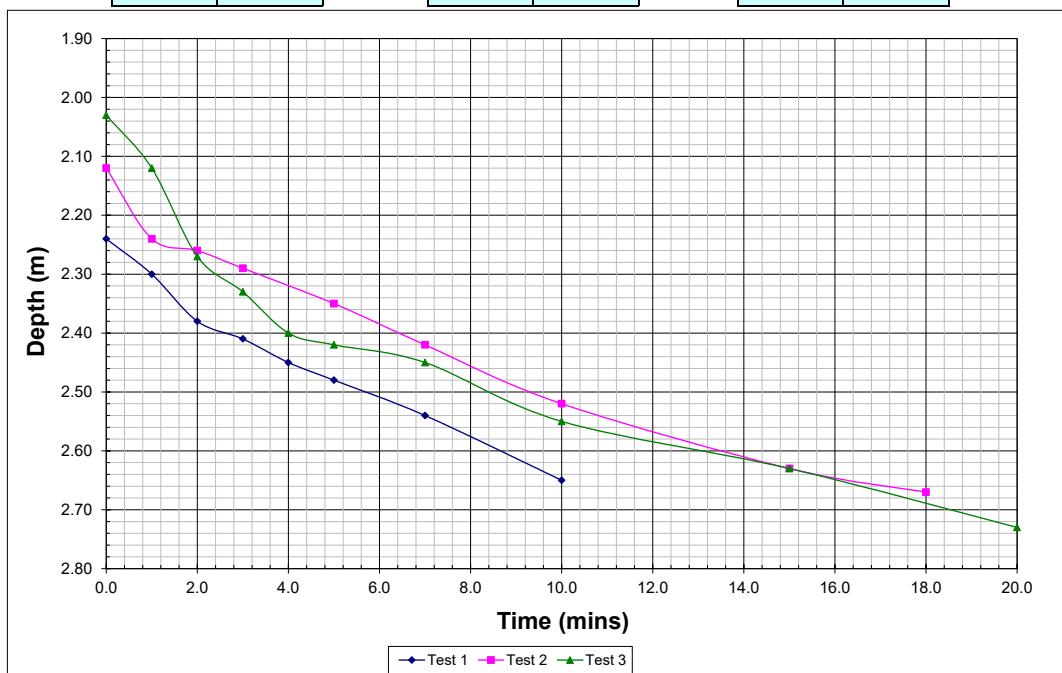
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net
Project Name : Reading Golf Course Client : Vistry		Job No. : GE20079 Date : 22/07/2021

Pit reference	TP202		
Test reference	Test1	Test2	Test3
Pit depth (m)	2.77	2.78	2.80
Pit width (m)	0.50	0.50	0.50
Pit length (m)	2.00	2.00	2.00
Depth to standing water (m)			

Test 1	
Time (min)	Depth (m)
0.0	2.24
1.0	2.30
2.0	2.38
3.0	2.41
4.0	2.45
5.0	2.48
7.0	2.54
10.0	2.65

Test 2	
1	Depth (m)
0.0	2.12
1.0	2.24
2.0	2.26
3.0	2.29
5.0	2.35
7.0	2.42
10.0	2.52
15.0	2.63
18.0	2.67

Test 3	
Time (min)	Depth (m)
0.0	2.03
1.0	2.12
2.0	2.27
3.0	2.33
4.0	2.40
5.0	2.42
7.0	2.45
10.0	2.55
15.0	2.63
20.0	2.73



Max. depth (m)	2.77	2.78	2.80
Effective depth (m)	0.53	0.66	0.77
75% effective depth (m)	2.37	2.29	2.22
50% effective depth (m)	2.51	2.45	2.42
25% effective depth (m)	2.64	2.62	2.61
t75 (min)	1.80	3.00	1.80
t50 (min)	6.00	8.00	7.00
t25 (min)	9.60	14.40	13.80
Vp 75-25	0.27	0.33	0.39
ap 50	2.325	2.65	2.925
tp 75-25	7.80	11.40	12.00

Soil infiltration rate (m/s)	2.4E-04	1.8E-04	1.8E-04
Soil infiltration rate (mm/hr)	8.77E+02	6.55E+02	6.58E+02

Notes:

- 1 Blue cells require input data
- 2 Infiltration calculated to method in 'BRE Digest 365 (1991) - Soakaway Design'
- 3 First line of table must be depth at time = 0

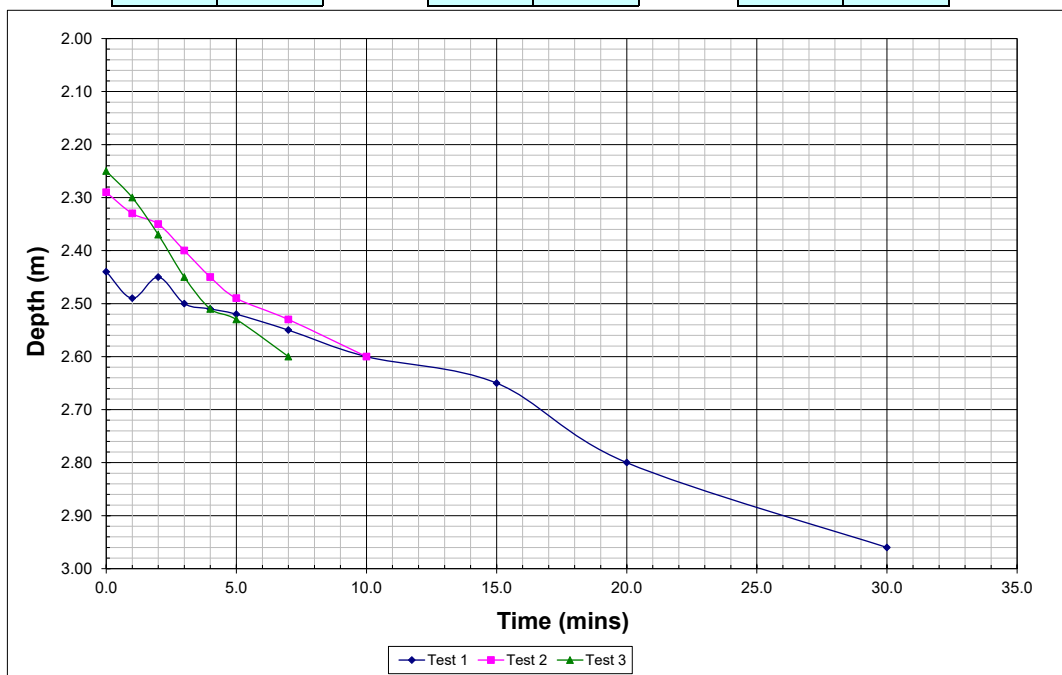
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net
Project Name : Reading Golf Course Client : Vistry		Job No. : GE20079 Date : 22/07/2021

Pit reference	TP203		
Test reference	Test1	Test2	Test3
Pit depth (m)	2.96	2.68	2.67
Pit width (m)	2.00	2.00	2.00
Pit length (m)	0.50	0.50	0.50
Depth to standing water (m)			

Test 1	
Time (min)	Depth (m)
0.0	2.44
1.0	2.49
2.0	2.45
3.0	2.50
4.0	2.51
5.0	2.52
7.0	2.55
10.0	2.60
15.0	2.65
20.0	2.80
30.0	2.96

Test 2	
Time (min)	Depth (m)
0.0	2.29
1.0	2.33
2.0	2.35
3.0	2.40
4.0	2.45
5.0	2.49
7.0	2.53
10.0	2.60

Test 3	
Time (min)	Depth (m)
0.0	2.25
1.0	2.30
2.0	2.37
3.0	2.45
4.0	2.51
5.0	2.53
7.0	2.60



Max. depth (m)	2.96	2.68	2.67
Effective depth (m)	0.52	0.39	0.42
75% effective depth (m)	2.57	2.39	2.36
50% effective depth (m)	2.70	2.49	2.46
25% effective depth (m)	2.83	2.58	2.57
t75 (min)	8.00	2.80	1.90
t50 (min)	16.60	5.00	3.20
t25 (min)	21.50	9.20	6.00
Vp 75-25	0.26	0.20	0.21
ap 50	2.3	1.975	2.05
tp 75-25	13.50	6.40	4.10

Soil infiltration rate (m/s)	1.4E-04	2.6E-04	4.2E-04
Soil infiltration rate (mm/hr)	5.02E+02	9.26E+02	1.50E+03

Notes:

- 1 Blue cells require input data
- 2 Infiltration calculated to method in 'BRE Digest 365 (1991) - Soakaway Design'
- 3 First line of table must be depth at time = 0

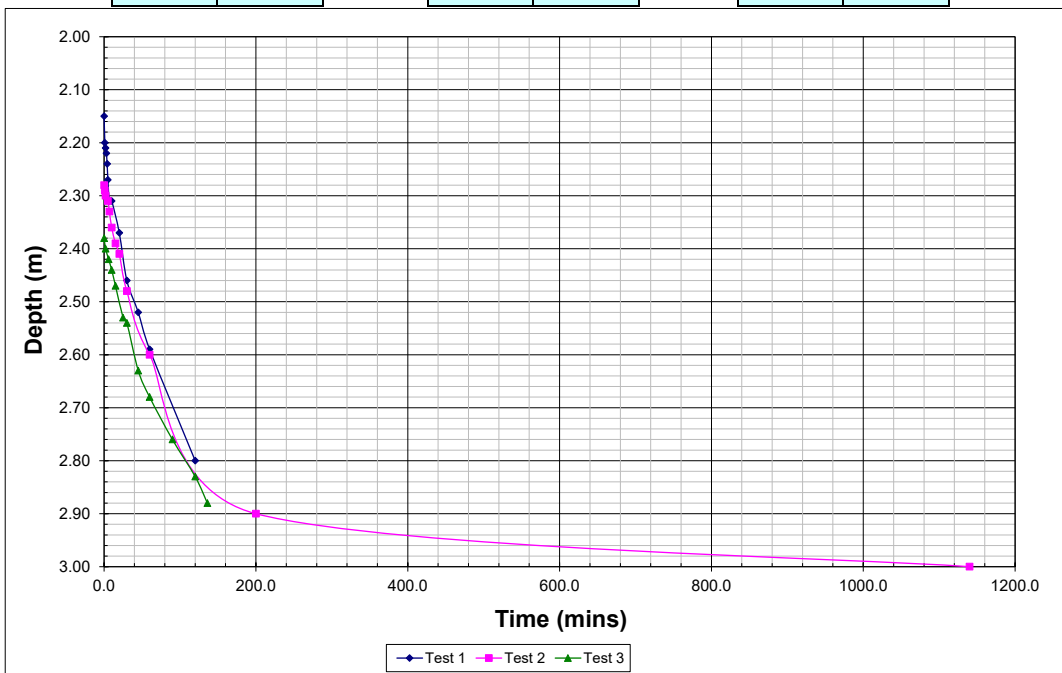
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net
Project Name : Reading Golf Course Client : Vistry		Job No. : GE20079 Date : 22/07/2021

Pit reference	TP204		
Test reference	Test1	Test2	Test3
Pit depth (m)	3.00	3.00	3.00
Pit width (m)	1.80	1.80	1.80
Pit length (m)	0.50	0.50	0.50
Depth to standing water (m)			

Test 1	
Time (min)	Depth (m)
0.0	2.15
1.0	2.20
2.0	2.21
3.0	2.22
4.0	2.24
5.0	2.27
7.0	2.31
10.0	2.31
20.0	2.37
30.0	2.46
45.0	2.52
60.0	2.59
120.0	2.80

Test 2	
Time (min)	Depth (m)
0.0	2.28
1.0	2.29
2.0	2.30
5.0	2.31
7.0	2.33
10.0	2.36
15.0	2.39
20.0	2.41
30.0	2.48
60.0	2.60
200.0	2.90
1140.0	3.00

Test 3	
Time (min)	Depth (m)
0.0	2.38
2.0	2.40
6.0	2.42
10.0	2.44
15.0	2.47
25.0	2.53
30.0	2.54
45.0	2.63
60.0	2.68
90.0	2.76
120.0	2.83
136.0	2.88



Max. depth (m)	3.00	3.00	3.00
Effective depth (m)	0.85	0.72	0.62
75% effective depth (m)	2.36	2.46	2.54
50% effective depth (m)	2.58	2.64	2.69
25% effective depth (m)	2.79	2.82	2.85
t75 (min)	16.00	27.00	30.00
t50 (min)	55.00	70.00	65.00
t25 (min)	115.00	115.00	125.00
Vp 75-25	0.38	0.32	0.28
ap 50	2.855	2.556	2.326
tp 75-25	99.00	88.00	95.00

Soil infiltration rate (m/s)	2.3E-05	2.4E-05	2.1E-05
Soil infiltration rate (mm/hr)	8.12E+01	8.64E+01	7.58E+01

Notes:

- 1 Blue cells require input data
- 2 Infiltration calculated to method in 'BRE Digest 365 (1991) - Soakaway Design'
- 3 First line of table must be depth at time = 0

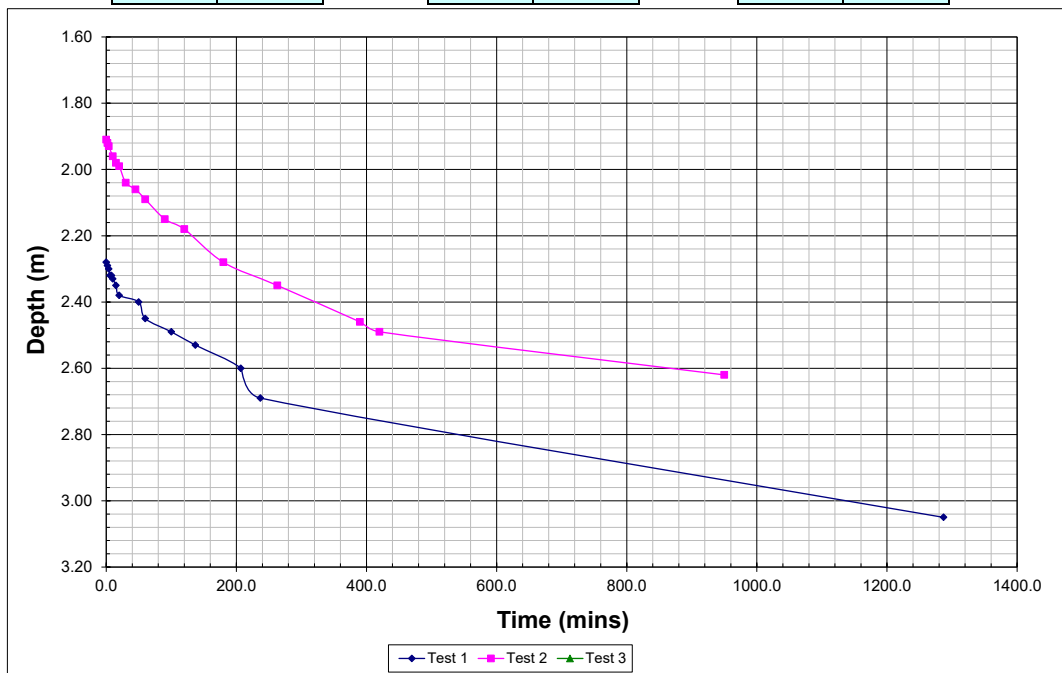
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net
Project Name : Reading Golf Course		Job No. : GE20079
Client : Vistry		Date : 22/07/2021

Pit reference	TP206		
Test reference	Test1	Test2	Test3
Pit depth (m)	3.05	2.85	
Pit width (m)	0.55	0.55	
Pit length (m)	1.80	1.80	
Depth to standing water (m)			

Test 1	
Time (min)	Depth (m)
0.0	2.28
2.0	2.29
4.0	2.30
6.0	2.32
8.0	2.32
10.0	2.33
15.0	2.35
20.0	2.38
50.0	2.40
60.0	2.45
100.0	2.49
137.0	2.53
207.0	2.60
237.0	2.69
1287.0	3.05

Test 2	
Time (min)	Depth (m)
0.0	1.91
2.0	1.92
4.0	1.93
10.0	1.96
15.0	1.98
20.0	1.99
30.0	2.04
45.0	2.06
60.0	2.09
90.0	2.15
120.0	2.18
180.0	2.28
263.0	2.35
390.0	2.46
420.0	2.49
950.0	2.62

Test 3	
Time (min)	Depth (m)



Max. depth (m)	3.05	2.85	0.00
Effective depth (m)	0.77	0.94	0.00
75% effective depth (m)	2.47	2.15	0.00
50% effective depth (m)	2.67	2.38	0.00
25% effective depth (m)	2.86	2.62	0.00
t75 (min)	75.00	90.00	
t50 (min)	210.00	300.00	
t25 (min)	900.00	950.00	
Vp 75-25	0.38	0.47	0.00
ap 50	2.7995	3.199	0
tp 75-25	825.00	860.00	0.00

Soil infiltration rate (m/s)	2.8E-06	2.8E-06	
Soil infiltration rate (mm/hr)	9.90E+00	1.01E+01	

Notes:

- Blue cells require input data
- Infiltration calculated to method in 'BRE Digest 365 (1991) - Soakaway Design'
- First line of table must be depth at time = 0

- 1 Blue cells require input data
2 Infiltration calculated to method in 'BRE Digest 365 (1991) - Soakaway Design'
3 First line of table must be depth at time = 0

The graph displays the relationship between Depth (m) and Time (mins) for three different tests. The Y-axis represents Depth (m) and ranges from 0.60 to 0.95, with values increasing downwards. The X-axis represents Time (mins) and ranges from 0.0 to 1800.0. Test 1 is represented by a blue line with diamond markers, showing a decreasing trend. Test 2 (magenta squares) and Test 3 (green triangles) are not visible, likely overlapping with Test 1.

Time (mins)	Test 1 Depth (m)	Test 2 Depth (m)	Test 3 Depth (m)
0.0	0.67	0.67	0.67
50.0	0.69	0.69	0.69
100.0	0.73	0.73	0.73
200.0	0.74	0.74	0.74
1250.0	0.89	0.89	0.89
1600.0	0.92	0.92	0.92

- 1 Blue cells require input data
2 Infiltration calculated to method in 'BRE Digest 365 (1991) - Soakaway Design'
3 First line of table must be depth at time = 0

- 1 Blue cells require input data
2 Infiltration calculated to method in 'BRE Digest 365 (1991) - Soakaway Design'
3 First line of table must be depth at time = 0