



e3p

Phase II Geoenvironmental Site Assessment
Land South of Lickers Lane, Whiston

Reference: 15-065-R2-1
Date: November 2021



PHASE II GEOENVIRONMENTAL SITE ASSESSMENT

**Land south of Lickers Lane
Whiston
Prescot
L35 3JE**

Prepared for:



**Report Ref: 15-065-R2-1
Date Issued: November 2021**

Land South of Lickers Lane

Phase II Geoenvironmental Site Assessment

November 2021

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EXECUTIVE SUMMARY

Site Address	Land south of Lickers Lane, Whiston, Prescott, L35 3JE	
Grid Reference	E 347490, N 390400.	
Site Area	2.55 Ha.	
Proposed Development	At the time of this letter being prepared E3P understands that Vistry Partnerships considering the proposed acquisition and future redevelopment of a parcel of land to the south of Lickers Lane, Whiston for low rise residential housing with associated adopted estate roads and utility infrastructure.	
Current Site Use	The site is roughly rectangular in shape and is located to the south of Lickers Lane, Prescott. Two connected bodies of water border the site on the northern boundary. The general topography of the site is uniform with a gradual slope to the south of the site. There are frequent ruts and ditches caused by off-road vehicles across the site. Access is most effectively gained from the northern entrance of the site off Lickers Lane. Upton entering site, the northern third of the site is overgrown with a mix of mature and semi mature trees and shrubbery. The areas south of the mature and semi-mature trees consist of waist-high vegetation. Historical mapping does not indicate the presence of any building or structures having been erected on the site. The site is currently open to the public, during the site walkover people were seen using the site for dog walking and other recreational activities.	
Site History	A review of the pertinent Ordnance Survey mapping dating from circa 1850 to the present day confirmed the site has remained undeveloped agricultural land. Mapping indicates that Pre 1937 the site has several of trees with a field boundary traversing from north-west to southeast. 1975 mapping illustrates the field boundary has been removed and replaced with another boundary running from east to west within the northern central sector of the site. The site also forms part of the Halsnead Park.	
Environmental Setting	Drift Geology	Glacial Till – SAND, CLAY, GRAVEL
	Bedrock Geology	Kinnerton Sandstone Formation – SANDSTONE Pennine Middle Coal Measures Formation – MUDSTONE, SILTSTONE, SANDSTONE
	Faults	The Ecclestone fault runs through the west of the site trending N-S.
	Hydrogeology	Secondary Undifferentiated aquifer (drift) overlying a Principle and secondary A aquifer (solid). Two groundwater abstractions have been identified within a 1 km radius.
	Hydrology	Unnamed water features 7 m to the North East of the site.
	Flood Risk	The site is primarily located in an area that has limited potential for groundwater flooding to occur. The South West corner of the site is regarded as having potential for groundwater flooding of properties located below ground level.



Natural Landform and Geomorphology	The site is located within an area in which glacial till overlies Pennine Coal Measures Bedrock and Kinnerton Sandstone Formation - Sandstone. The subject site appears to have been predominantly undeveloped since historic mapping began, suggesting that the current landform is natural.
Previous Reports	Coal Mining Risk Assessment prepared by Wardell Armstrong ✿ The coal mining risk assessment has not identified any mine entries on-site or within influencing distance to the site. ✿ The coal mining risk assessment has indicated the site is located within the zone of influence of past coal mining from seams of coal from 146 m and 427 m in depth. ✿ There is no recorded mine gas within the site boundary. ✿ Geological mapping indicates that the site is underlain by glacial till.
Utility Locations	A full ground penetrating radar (GPR) survey has not been undertaken for the site. However, service plans have been obtained showing a, 11Kv overhead electric cable travelling along the Western Boundary of the site.
Landfill Sites and Ground Gases	The Enviro Check report has not identified any landfills, historic or present within 250 m of the site. The closest recorded Landfill is located 794 m to the North West of the site.
Radon	Unaffected – no special precautions required.
Coal Mining/Land Stability	The site is located in a coal mining reporting, with the western sector of the site falling into the development high-risk area. The 1:10,000 geological mapping for the area indicated that the Eccleston Fault (trending N/S) bisects the western sector of the site, with the Higher and Lower Bug Coal Seams (now known as Higher and Lower Florida) outcropping on site. The Cheshire Mine Coal is present roughly 50 m to the north of the site and the Coal With Cannel is present roughly 200 m to the south. All four coal seams shown outcropping on or close to the site are shown to be dipping in a south-westerly direction. The direction of dip indicated that the Higher and Lower Bug Coal may be present beneath the south-western tip of the site. Wardell Armstrong have completed a Coal Mining Risk Assessment (ref: GM11893-001/FINAL – dated July 2021).
Brine Workings	This site is not located in an area that is associated with brine workings, due to this, there is little risk of instability due to brine dissolution.
Hazardous Installations	No hazardous installations that could potentially prejudice the proposed construction of highly sensitive residential dwellings have been identified within influencing distance of the subject site.
Initial Conceptual Site Model	Contaminant Sources: ✿ Made Ground (infilled field boundaries) – Polycyclic Aromatic Hydrocarbons (PAHs), heavy metals, Asbestos Containing Material (ACM) and ground gases Pathways:



	☼ Direct contact and ingestion ☼ Volatilisation/indoor explosion ☼ Vapour inhalation ☼ Dust inhalation Receptors ☼ Future site users (proposed residential end-users and construction workers) ☼ Buildings (proposed residential units) ☼ Unnamed watercourse (pond) and Underlying aquifer (Principle bedrock aquifer)
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GROUND INVESTIGATION

Ground Investigation Works	E3P has completed an intrusive ground investigation comprising: ☼ 15 x mechanically excavated trial pits, ☼ 6 x window sample boreholes, ☼ 4 x Rotary open holes and ☼ Construction of environmental monitoring installations.
Ground Conditions	MADE GROUND – 0.00 m bgl to 0.40 m bgl Made Ground has been identified within one location (TP115). Made Ground consisted of Black sandy gravelly clay, gravels included angular to subrounded fragments of brick, mudstone, sandstone and ceramics. TOPSOIL – 0.00 m bgl to 0.60 m bgl Topsoil deposits were formed from dark grey to black slightly clayey, gravelly SAND with frequent rootlets. Gravels were made up of fine to medium subrounded to rounded of mudstone and sandstone. DRIFT – 0.20 m bgl to 2.60 m bgl Superficial geology was identified within all boreholes to a maximum depth of 2.60m bgl. Ground conditions consisted of granular medium dense gravelly SAND becoming dense at depth within weathered sandstone. Clay deposits were identified within the central northern sector of the site which comprised of firm to stiff medium to high strength gravelly clays. SOLID – 1.00 m bgl to 40.00 m bgl Solid geology was noted within all exploratory boreholes which consisted of Sandstone bedrock. GROUNDWATER – Groundwater was not encountered.



CONTAMINATED LAND ASSESSMENT

Human Health	A Tier I human health risk assessment has been undertaken using the chemical analysis results of the soils and comparing them to the relevant Tier I criteria. This assessment has identified the presence of elevated Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenzo(a,h)anthracene. All of the exceedances have been identified within TP115. All the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion, soil ingestion and consumption of homegrown produce. As all of the exceedance has been identified within one exploratory location they are considered to be an isolated hotspot, therefore during the enabling works, it is recommended the impacted Made Ground is excavated and placed within an area of low sensitivity. The Made Ground identified within TP115 is not considered suitable for use within the upper 300mm of a residential garden given the presence of deleterious elements. It will therefore be necessary to place a minimum of 150mm of sub-soil and 150mm topsoil to constitute a 300mm clean soil matrix within all areas of private gardens where Made Ground remains. Chemical analysis of topsoil and subsoil confirms the material is suitable for re-use within proposed gardens and public open spaces areas. It should be noted that further chemical analysis will be required to confirm soils are chemically suitable in line with intended re-use volumes.
Controlled Waters	It should be noted that groundwater monitoring installations were noted as dry during monitoring events and therefore, leachate samples have been utilised to inform the controlled waters assessment. This comparison indicates that there were no exceedances of the DWS values identified on the site however, several exceedances in heavy metals were noted for EQS values. In respect to the exceedances identified, leachate testing often overstates the risk, no solid exceedances were noted for heavy metals within soil samples that were analysed. As there is no pathway to the slight exceedances noted, these exceedances are not seen to pose a risk to the unknown water body 7 m to the northeast of the site. The PAHs identified in soils in Table 4.3 are of low mobility and leachate testing has not recorded a leachable potential of such. The assessment has identified that there is considered to be no unacceptable risk to the underlying principle aquifer across this sector of the site.
Ground Gas	At the time of this report being prepared the ground gas analysis is ongoing. Initial gas monitoring suggests CS1 however, allowance should be made for CS2 protection measures.
Potable Water Infrastructure	This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.



COAL MINING ASSESSMENT

Coal Mining	In accordance with industry best practice as detailed within CIRIA 32, E3P has concluded that shallow mine workings are not present in the southwestern sector of the site. No evidence of workings or broken ground was identified as part of the intrusive investigation. Thus, the assessment has concluded that there is sufficient rock cover to provide the required degree of stability in the event of successive collapses (cavitation's) within potential workings beneath the site.
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GEOTECHNICAL ASSESSMENT

Underground Obstructions	The site investigation uncovered limited amounts of MADE GROUND on site, consisting of brick and ceramic material. The mechanically excavated trial pits did not uncover any obstructions or foundations within the natural or MADE GROUND. Due to the undeveloped nature of the site, there is not expected to be substantial underground obstructions present across the site.
Allowable Bearing Pressure	The underlying natural granular drift deposits have been assessed as being medium dense to very dense very with a net allowable bearing pressure (ABP) in the order of 100 to 240 kN/m² at circa 1 m bgl increasing to 456 kN/m² at circa 2 m bgl The underlying natural clay drift deposits identified with WS105 and WS106 have been assessed as being very stiff, high strength with a net allowable bearing pressure (ABP) in the order of 150 to 240 kN/m² at circa 1 m bgl.
Foundation Options	At the time of writing, development levels are unknown, It is considered likely that the proposed structures will be founded on a combination of strip / trench fill type foundations where medium dense of firm clays are present at 1.00m bgl or found upon the sandstone bedrock present at the near-surface (<1.5 to 2.0m). Foundation depths within the conjectured influence of former, existing or proposed trees will need to be deepened to ensure that structural loading bears within the underlying target founding stratum, which cannot be subject to volumetric instability associated with fluctuation in moisture content within areas where clay deposits have been identified. Consideration must be given to the varying soil matrices and differing settlement characteristics and where a foundation spans two varying matrices the sub-structure should be designed accordingly.
Building Floor Slabs	Ground-bearing floor slabs are unlikely to be viable.
Heave Precautions	Given that the underlying clay in the north of the site has been assessed as being of low volume change potential, heave precautions will not be required to the internal face of a foundation less than 1.5 m in depth.
Soakaway Drainage	Soil infiltration was taken over the wetted area from between 75% and 25% of the effective depth. All tests showed granular drift deposits to have good soakage potential, however, in locations where clay drift deposits were present, soakage potential was significantly reduced. Within SA102 and SA103 infiltration testing identified that in these locations the tests soaked away within 24 hours, however, to be compliant with BRE 365 it is recommended that further testing is completed in these areas to allow 3 No tests to be completed over an allotted number of days in order to inform infiltration design.



Sulphate Assessment	Concrete classification will be DS1 AC1s.
CBR Design %	Granular soils can be re-engineered to ensure 5% within the subgrade during favourable climatic conditions. Natural clay soils will provide a CBR in the order of 3–5% during drier climatic periods. However, if water is allowed to shed onto the formation, the CBR will reduce to < 2%, which will require specialist engineering of the subgrade.
Cut/Fill	Development levels are unknown at this time.
Civil Engineering Excavations	The E3P Intrusive Ground Investigation has identified the presence of weathered/competent bedrock at a shallow depth, the presence of which will impede the excavation materials to form sewerage and drainage infrastructure and foundations.
Waste Characterisation	Any material that is to be disposed off-site should undergo assessment using Technical Guidance WM3: Waste Classification – <i>Guidance on the classification and assessment of waste</i> .

RECOMMENDATIONS

Based on the findings of the geoenvironmental site assessment, the following additional works are recommended to be completed in due course:

- ✳ Plot-specific foundation schedule (upon receipt of the final development levels).
- ✳ Arboricultural survey.
- ✳ Geotechnical earthworks strategy (infrastructure).
- ✳ Remediation and enabling works strategy.
- ✳ Construction phase Surface Water Management Plan.



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DRAWING LIST

15-065-001 - Site Location Plan
15-065-003 - Historical Features Plan
15-065-004 - Site Features Plan
15-065-005 - Exploratory Hole Location Plan
15-065-006 - Depth of Made Ground Plan
15-065-007 - Depth to Topsoil Plan
15-065-008 - Depth to Founding Strata Plan
15-065-010 - Conceptual Site Model
15-065-012 - Depth to Bedrock Plan
15-065-018 - Contamination Issue Plan



1. INTRODUCTION

1.1. BACKGROUND

E3P has been commissioned by Vistry Partnerships to undertake a detailed Phase II Geoenvironmental Site Assessment for a parcel of scrub land south of Lickers Lane, Prescott.

This report is required to determine potential contaminated land liabilities, remediation requirements and geotechnical engineering works that will be required as part of the proposed development for a proposed low-rise residential development.

1.2. PROPOSED DEVELOPMENT

At the time of this report being prepared E3P understands that Vistry Partnerships considering the proposed acquisition and future redevelopment of a parcel of land to the south of Lickers Lane, Whiston for low rise residential housing with associated adopted estate roads and utility infrastructure.

1.3. OBJECTIVES

The objectives of the geoenvironmental assessment are as follows:

-  Review historical plans, geology, hydrogeology, site sensitivity, floodplain issues, mining records and any local authority information available in order to complete a desk study in line with Environment Agency (EA) document *Land Contamination: Risk Management (LCRM) (2019)*.
-  Undertake a preliminary stage of sampling and analysis to provide an overview of environmental issues identified.
-  Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors.
-  Assess the geotechnical information and provide preliminary recommendations in relation to foundations, pavement construction and floor slabs.
-  Provide recommendations regarding future works required.

1.4. SCOPE OF WORKS

The scope of work includes the following elements:



- ✧ A detailed review of historic information;
- ✧ Design of suitable intrusive ground investigation;
- ✧ Window sample probeholes with, and construction of, environmental monitoring installations;
- ✧ Rotary boreholes;
- ✧ Mechanically excavated trial pits;
- ✧ In-situ geotechnical testing;
- ✧ Chemical and geotechnical laboratory analysis;
- ✧ Groundwater monitoring and sampling;
- ✧ Ground gas monitoring;
- ✧ Contamination risk assessment and conceptual site model;
- ✧ Geotechnical assessment and interpretation; and
- ✧ Factual and interpretive reporting.

1.5. CONFIDENTIALITY

E3P has prepared this report solely for the use of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from E3P; a charge may be levied against such approval.



2. GROUND INVESTIGATION

2.1. PREVIOUS SITE INVESTIGATIONS

There has been no previous intrusive site investigation on the site however, Wardell Armstrong have previously completed a Coal Mining Risk Assessment (ref: GM11893-001/FINAL – dated July 2021) commissioned by Vistry Partnerships North West. The report has been reviewed by E3P and a summary is provided below:

- ✿ The coal mining risk assessment has not identified any mine entries on-site or within influencing distance to the site.
- ✿ Lower Florida and Higher Florida Coal seams sub-crop across the site and are potentially at a shallower depth in the western sector of the site.
- ✿ The coal mining risk assessment has indicated the site is located within the zone of influence of past coal mining from seams of coal from 146 m and 427 m in depth.
- ✿ There is no recorded mine gas within the site boundary.
- ✿ Geological mapping indicates that the site is underlain by glacial till.

Additionally, E3P have completed a phase I desk study for the site ref; 15-065 dated November 2021.

2.2. GENERAL OVERVIEW

A ground investigation has been designed based on the findings of the desk study, with exploratory holes advanced to target specific potential contaminant sources identified within the previous site investigations. The investigation has also been used to collect geotechnical information to assist in the design and construction of the proposed development.

Exploratory fieldwork was completed between 23rd September 2021 and 24th September 2021. The works are summarised in Table 2.1.

2.3. SCOPE OF INVESTIGATION

TABLE 2.1 SUMMARY OF FIELDWORK

POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
General Ground Conditions Including the Presence/Nature of Obstructions – Northern Sector of Site (Historic Field Boundary Pre 1937-Pre 1959)	TP101	Mechanically Excavated Trial Pits	1.80	N/A
General Ground Conditions Including the Presence/Nature of Obstructions – Northern Sector of Site (Historic Field Boundary Pre 1959-Pre 1999)	WS105	Window Sample Probehole	2.29	0.70-1.70



POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
General Ground Conditions Including the Presence/Nature of Obstructions – Central Sector of Site (Historic Field Boundary Pre 1937-Pre 1959)	WS103		1.70	0.70-1.70
General Ground Conditions Including the Presence/Nature of Obstructions – Northern Sector of Site	TP111-115	Mechanically Excavated Trial Pits	2.50	N/A
	WS106	Window Sample Probehole	2.60	0.50-2.50
General Ground Conditions Including the Presence/Nature of Obstructions – Southern Sector of Site	TP102-TP110	Mechanically Excavated Trial Pits	2.60	N/A
	WS101	Window Sample Probehole	1.50	0.50-1.50
	WS102		1.45	0.40-1.40
	WS102A		1.45	N/A
	WS104		2.45	0.45-2.45
Potential Presence of Shallow Historic Workings within Coal Crop – South West Sector of Site	RB101-RB104	Rotary Borehole	40.00	N/A

Mechanically excavated trial pits were advanced to investigate ground conditions and to retrieve environmental samples, spatially distributed to offer the maximum site coverage whilst also being advanced to target specific contaminant sources.

Window sample probeholes were advanced to undertake in-situ detailed geotechnical testing, obtain environmental samples and install groundwater and ground gas monitoring wells.

The series of rotary boreholes were advanced to investigate the potential presence of shallow mine workings. These boreholes were drilled in accordance with the CA permissions process and industry best practices.

The sampling locations are illustrated in Drawing 15-065-005 (Appendix III). The ground conditions encountered are indicated on the logs, which are provided in Appendix IV.

Return visits were made to monitor installations for groundwater level and gas concentrations. In addition, selected wells were purged, however, there was not a sufficient level of groundwater, within the wells to allow chemical samples to be sent for analysis.

2.4. IN-SITU STANDARD PENETRATION TESTING (SPT)

In-situ geotechnical testing was conducted using the standard penetration test (SPT) and, where the ground is granular, a 60° cone (SPT(C)) was used instead of the sampling tube. The results are shown in the probehole logs in Appendix IV and presented in Table 3.5 and discussed in Section 3.



2.5. LABORATORY ANALYSIS

Selected soil samples were submitted for a range of chemical analysis comprising:

-  Metals.
-  pH, total sulphate, water-soluble sulphate (2:1 extract).
-  Sulphide.
-  Cyanide.
-  Phenols.
-  Total and speciated polycyclic aromatic hydrocarbons (PAHs).
-  Asbestos identification and quantification.
-  Speciated and banded total petroleum hydrocarbon (TPH).

I2 Analytical undertook the analytical work and the testing results are included in Appendix V and discussed in Section 4.

Selected samples were submitted to PSL Laboratory where the following geotechnical tests were undertaken:

-  Atterberg limits determinations; and
-  Single-stage triaxial tests.

Laboratory analysis sheets are included in Appendix IX and are summarised in Section 3.



3. GROUND AND GROUNDWATER CONDITIONS

3.1. SUMMARY OF GROUND CONDITIONS

The ground investigation generally confirms the published geology and identifies the strata set out in Table 3.1.

TABLE 3.1 SUMMARY OF STRATA

HOLE	DEPTH TO STRATUM (m bgl)						
	TOPSOIL	MADE GROUND	SAND	MEDIUM DENSE / DENSE SAND	GRAVELLY SAND	GRAVELLY CLAY	SANDSTONE (BEDROCK)
TP101	0.00-0.40	–	0.40-1.50	–	1.50-1.80	–	–
TP102	0.00-0.40	–	0.40-1.20	–	1.20-1.80	–	–
TP103	0.00-0.50	–	0.50-1.20	–	1.20-1.40	–	1.40-1.70
TP104	0.00-0.50	–	0.50-1.60	–	1.60-2.40	–	2.40-2.60
TP105	0.00-0.60	–	0.60-1.50	–	1.50-2.00	–	2.00-2.30
TP106	0.00-0.50	–	0.50-1.10	–	1.10-2.30	–	–
TP107	0.00-0.40	–	0.40-1.80	–	–	–	–
TP108	0.00-0.60	–	–	–	0.60-2.00	–	–
TP109	0.00-0.40	–	0.40-0.90	–	0.90-1.90	–	–
TP110	0.00-0.40	–	0.40-1.10	–	1.10-1.80	–	–
TP111	0.00-0.60	–	–	–	1.60-2.50	0.60-1.60*	–
TP112	0.00-0.60	–	–	–	1.90-2.40	0.60-1.90*	–
TP113	0.00-0.60	–	–	–	0.90-2.40	0.60-0.90*	–
TP114	0.00-0.60	–	–	–	0.70-2.20	0.60-0.70	–
TP115	–	0.00-0.40	–	–	2.00-2.40	0.40-2.00*	–
WS101	0.00-0.50	–	–	0.50-1.50	–	–	1.50-1.69
WS102	0.00-0.40	–	–	0.40-1.00	–	–	1.00-1.39
WS102A	0.00-0.30	–	0.30-1.45	–	–	–	–
WS103	0.00-0.60	–	–	0.60-1.70	–	–	–
WS104	0.00-0.60	–	–	0.60-2.00	–	–	2.00-2.16
WS105	0.00-0.30	–	–	1.50-2.00	0.30-1.00	1.00-1.50*	2.00-2.29
WS106	0.00-0.30	–	–	1.30-2.60	–	0.30-1.30**	–
RB101	0.00-0.20	–	0.20-1.60	–	–	–	1.60-40.00
RB102	0.00-0.20	–	0.20-1.60	–	–	–	1.60-40.00
RB103	0.00-0.30	–	0.30-1.90	–	–	–	1.90-40.00
RB104	0.00-0.30	–	0.30-1.80	–	–	–	1.80-40.00

Notes

*Firm, medium strength CLAY

** Stiff, high strength CLAY



3.2. MADE GROUND

Made Ground deposits were encountered in one location (TP115) between 0.00 m and 0.40 m bgl.

Made Ground consisted of Black sandy gravelly clay, gravels included angular to subrounded fragments of brick, mudstone, sandstone and ceramics.

A Depth of Made Ground Plan is presented as Drawing 15-065-006 in Appendix III.

3.3. TOPSOIL

Topsoil deposits were encountered within all exploratory hole locations apart from TP115 in which reworked Made Ground was identified. Topsoil deposits were encountered between 0.00 m and 0.60 m bgl.

Topsoil deposits were formed from dark grey to black slightly clayey, gravelly SAND with frequent rootlets. Gravels were made up of fine to medium subrounded to rounded of mudstone and sandstone.

3.4. DRIFT DEPOSITS

Drift deposits were encountered within all of the exploratory locations to a maximum depth of 2.60 m bgl.

Ground conditions consisted of granular medium dense gravelly SAND becoming dense at depth within weathered sandstone. Clay deposits were identified within the central northern sector of the site which comprised of firm to very stiff medium to very high strength gravelly clays.

3.5. SOLID GEOLOGY

The solid bedrock geology was encountered between 1.00 m and 40.00 m bgl.

The bedrock was consistent across the site being formed of yellow brown SANDSTONE.

3.6. GROUNDWATER

No groundwater strikes were encountered during the intrusive site investigation.

3.7. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

Visual and olfactory evidence of potential contamination has not been identified during the site investigation.

3.8. SOIL CONSISTENCY

Undrained shear strength values were measured using field hand shear vane tests. Results of the tests are presented in Table 3.2, which indicate the clay soils vary between stiff and very stiff. Strength test data is generally consistent with the field descriptions of the aforementioned soils.



TABLE 3.2 SUMMARY OF HAND SHEAR VANE TESTS

LOCATION	DEPTH	SHEAR STRENGTH (kPA)	CALCULATED ALLOWABLE BEARING PRESSURE (kN/m ²)
TP111	0.80	75	176.3
TP111	1.20	92	216.2
TP112	1.20	133	312.6
TP112	1.60	95	223.3
TP112	1.90	89	209.2
TP113	0.70	140	329
TP113	0.90	135	317.3
TP115	0.50	71	166.9
TP115	1.10	54	126.9
TP115	1.60	106	249.1
TP115	1.90	124	291.4

Notes

ABP Calculated using Stroud and Butler et al 1974.

Results of the standard penetration tests, including undrained shear strengths derived from SPTs are included in Table 3.3.

3.9. SIDE STABILITY AND EASE OF EXCAVATION

The sides of the exploratory trial pit excavations appeared to be stable during excavation. During the site instigation, the 15 trial pit excavations were noted to be stable, with no collapses being noted.



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TABLE 3.3 STANDARD/CONE PENETRATION TEST RESULTS

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS101	1	Yellow brown fine to medium grained SAND.	35	35.29	Dense	N/A	N/A	N/A	352.85
WS101	1.5	Yellow brown fine to medium grained SAND.	50	47.51	Dense	N/A	N/A	N/A	475.08
WS102	1	Orange brown fine to medium grained SAND.	50	50.41	Very Dense	N/A	N/A	N/A	504.07
WS103	1	Yellow brown fine to medium grained SAND.	50	50.41	Very Dense	N/A	N/A	N/A	504.07
WS104	1	Yellow brown fine to medium grained SAND.	11	11.09	Medium Dense	N/A	N/A	N/A	110.90
WS105	2	Yellow brown fine to medium grained SAND.	50	45.68	Dense	N/A	N/A	N/A	456.77
WS105	1	Brown sandy gravelly CLAY.	24	24.20	N/A	High strength	Very Stiff	120.98	248.73
WS105	2	Orange brown fine to medium grained SAND.	50	45.68	Dense	N/A	N/A	N/A	456.77



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BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS106	1	Yellow gravelly brown fine to medium grained SAND.	18	18.15	Medium Dense	N/A	N/A	N/A	186.47
WS106	2	Yellow gravelly brown fine to medium grained SAND.	50	45.68	Dense	N/A	N/A	N/A	456.77

NOTES

* The Allowable Bearing Pressure (ABP) should be considered indicative.

The interpretation of in situ mass undrained shear strength (cu) data from SPT Blow Count (N) results and the influence of the Plasticity Index (PI) was reported in Standard Penetration Test in Insensitive Clays and Soft Rocks. Stroud (1974). The standard penetration test and the engineering properties of glacial materials subsequently. Stroud and Butler (1975) and (1989).

Allowable bearing pressure on sands. Soil Mechanics in Engineering Practice Terzaghi, K. & Peck, R.B. 1996.



3.10. PARTICLE SIZE DISTRIBUTION

Particle Size Distribution Tests have been undertaken on selected samples of granular material via wet sieve to obtain information on the soil fractions. The results are included in Table 3.4. The full results can be found in Appendix VIII.

TABLE 3.4 SUMMARY OF PARTICLE SIZE DISTRIBUTION TEST RESULTS

LOCATION	DEPTH (m)	SOIL FRACTION (%)			
		COBBLES	GRAVEL	SAND	SILT/CLAY
TP105	2.00 (Natural)	0	10	88	2
TP111	2.00 (Natural)	0	1	89	10

3.11. SOIL INFILTRATION

In-situ BRE 365 Soakaway tests were undertaken over a 48 hour period within trial pits completed as SA101-SA104.

The results are presented in Table 3.5 below and the test certificates are included within Appendix IX.

TABLE 3.5 BRE365 SOAKAWAY TESTING RESULTS

LOCATION	DEPTH (m)	MATERIAL	TEST NO.	SOIL INFILTRATION RATE (m/s)
SA101	2.01	Brown sandy gravelly CLAY.	Test No.1	FAIL
SA102	1.89	Yellow gravelly brown fine to medium grained SAND.	Test No.1	3.475E-06
SA103	2.23	Yellow gravelly brown fine to medium grained SAND.	Test No.1	4.67E-06
SA104	2.10	Brown sandy gravelly CLAY.	Test No.1	FAIL

Soil infiltration was taken over the wetted area from between 75% and 25% of the effective depth. All tests showed granular drift deposits to have good soakage potential, however, in locations where clay drift deposits were present, soakage potential was significantly reduced. Within SA102 and SA103 infiltration testing identified that in these locations the tests soaked away within 24 hours, however, to be compliant with BRE 365 it is recommended that further testing is completed in these areas to allow 3 No tests to be completed over an allotted number of days in order to inform infiltration design.

Therefore, considering the significant volumes of permeable Sand and Gravel on the site, it is considered that soakaway drainage may be suitable for the proposed development. However, the application of soakaway drainage will ultimately be dependent on the specific requirements of the development. All soakaways should be designed in accordance with BRE Special Digest 365 – *Soakaway Design*.

3.12. SOIL PLASTICITY

The Atterberg limits determinations, summarised in Table 3.6, show the clay to be of low plasticity across the site. It should be noted that cohesive soils were only noted in the northern sector of the site within TP111-115 and WS105-106.



TABLE 3.6 SUMMARY OF PLASTICITY INDEX TEST RESULTS

LOCATION	DEPTH (m)	NATURAL MOISTURE CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING 425 μ m SIEVE (%)	MODIFIED PLASTICITY INDEX	NHBC VOLUME CHANGE POTENTIAL
TP111	1.00	18	15	34	19	92	17.48	Low
TP111	1.50	18	16	36	20	95	19	Low
TP112	1.20	32	15	32	17	95	16.15	Low
TP112	1.80	16	15	31	16	92	14.72	Low
TP115	1.50	15	14	28	14	99	13.86	Low

The results of the Atterberg limits testing confirmed that the soils would be deemed to be "Low Volume Change Potential" in accordance with the classification system utilised by the LABC/NHBC industry guidance.

3.13. pH AND SULPHATE

Chemical analyses for pH and soluble sulphate content contained in Appendix V (summarised in Table 3.8), shows that the soils across the site meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE *Special Digest 1* (2005).

TABLE 3.7 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
WS101	0.20	0.0027	6.0	DS-1, AC-1s
WS102	0.90	0.0015	5.3	DS-1, AC-1s
WS102A	0.20	0.0013	4.9	DS-1, AC-1s
WS103	1.50	<0.0013	6.8	DS-1, AC-1s
WS104	0.20	0.0047	6.0	DS-1, AC-1s
WS105	0.90	0.0044	6.1	DS-1, AC-1s
WS106	0.20	0.0047	5.4	DS-1, AC-1s
TP101	1.60	0.0016	6.4	DS-1, AC-1s
TP102	0.30	0.0033	5.5	DS-1, AC-1s
TP103	0.90	0.0015	6.0	DS-1, AC-1s
TP104	0.20	0.0025	5.1	DS-1, AC-1s
TP105	1.90	<0.0013	7.2	DS-1, AC-1s
TP106	0.30	0.0028	4.9	DS-1, AC-1s
TP107	1.50	<0.0013	7.9	DS-1, AC-1s
TP108	0.30	0.0062	5.5	DS-1, AC-1s
TP109	1.80	0.0029	6.1	DS-1, AC-1s



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LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
TP110	0.30	0.0074	5.4	DS-1, AC-1s
TP111	1.80	0.0051	7.8	DS-1, AC-1s
TP112	0.30	0.0033	5.8	DS-1, AC-1s
TP113	1.90	0.010	8.4	DS-1, AC-1s
TP114	0.40	0.0044	6.0	DS-1, AC-1s
TP115	0.30	0.015	7.1	DS-1, AC-1s



4. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

E3P has undertaken a Tier 1 qualitative risk assessment to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable level of risk to the identified receptors.

4.1. DEVIATING SAMPLES

Deviating samples were to be avoided during the ground investigation by using best practice sampling procedures including the use of appropriate sampling containers and adhering to the laboratory holding times for each contaminant analysis undertaken. As these practices were followed, no samples were noted to have deviated.

4.2. HUMAN HEALTH RISK ASSESSMENT

At Tier 1 stage, the long term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with reference values published in LQM/CIEH S4UL (S4UL3267).

The results of this comparison have been summarised within Table 4.1.



TABLE 4.1 SUMMARY OF INORGANIC AND HYDROCARBON TOXICITY ASSESSMENT FOR A RESIDENTIAL END USE

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Arsenic	mg/kg	37	22	14	N/A	1	No Further Action
Cadmium	mg/kg	11	22	1.5	N/A	1	No Further Action
Chromium (VI)	mg/kg	6.0	22	< 4.0	N/A	1	No Further Action
Lead	mg/kg	200	22	86	N/A	1	No Further Action
Mercury	mg/kg	1.2	22	< 0.30	N/A	4	No Further Action
Nickel	mg/kg	130	22	19	N/A	1	No Further Action
Selenium	mg/kg	250	22	< 1.0	N/A	1	No Further Action
Copper	mg/kg	2400	22	51	N/A	1	No Further Action
Zinc	mg/kg	3700	22	120	N/A	1	No Further Action
Cyanide – Total	mg/kg	791	22	< 1.0	N/A	1	No Further Action
Phenols – Total	mg/kg	120	22	< 1.0	N/A	1	No Further Action
Asbestos	Fibres	NFD	12	N/A	N/A	3	No Further Action
Naphthalene	mg/kg	2.3	22	3.2	N/A	4	No Further Action
Acenaphthylene	mg/kg	170	22	0.69	N/A	2	No Further Action
Acenaphthene	mg/kg	210	22	0.77	N/A	1	No Further Action
Fluorene	mg/kg	170	22	0.67	N/A	1	No Further Action
Phenanthrene	mg/kg	95	22	6.1	N/A	2	No Further Action
Anthracene	mg/kg	2400	22	2.6	N/A	2	No Further Action
Fluoranthene	mg/kg	280	22	21	N/A	2	No Further Action
Pyrene	mg/kg	620	23	19	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	23	13	TP115 – 0.30m	2	Further Action
Chrysene	mg/kg	15	23	11	N/A	2	No Further Action
Benzo(b)Fluoranthene	mg/kg	2.6	23	14	TP115 – 0.30m	2	Further Action
Benzo(k)Fluoranthene	mg/kg	77	23	5.7	N/A	2	No Further Action
Benzo(a)Pyrene	mg/kg	2.2	23	11	TP115 – 0.30m	2	Further Action
Indeno(123-cd)Pyrene	mg/kg	27	22	7.2	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.24	22	2.1	TP115 – 0.30m	2	Further Action
Benzo(ghi)Perylene	mg/kg	320	22	8.1	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	22	1	N/A	3	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	22	0.1	N/A	3	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	22	0.1	N/A	3	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	74	22	2	N/A	3	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	140	22	8.3	N/A	3	No Further Action
TPH C16-C21 (aromatic)*	mg/kg	260	22	62	N/A	1	No Further Action
TPH C21-C35 (aromatic)*	mg/kg	1100	22	430	N/A	1	No Further Action



Notes

PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation; PL4 = Vapour/Gas Inhalation; PL5 = Vertical / Lateral Migration; PL6 = Corrosion of concrete; PL7=Tainting of water supply; PL8 = Uptake by plants

Abbreviations: GAC = general assessment criteria, n = number of samples, MC = maximum concentration; Loc of Ex = location of exceedance; NFD = no fibres detected.

* The Tier 1 GAC for the hydrocarbon fraction is derived from the CIEH assessment for petroleum hydrocarbons Criteria Working Group (CWG) for both aliphatic and aromatic compounds. E3P has utilised the Tier 1 values for aliphatic compounds for the volatile and semi volatile fractions (C5-C12) and the Tier 1 values for aromatic compound for the non-volatile fractions (C12-C35). The comparison of a total (aliphatic/aromatic) compounds to an individual fraction is considered to be a conservative approach and satisfactory for the protection of human health.

Referring to Table 4.1, the results of this direct comparison indicates that the data exceeds the screening criteria for a residential end use for the following contaminants:

- ✳ Benzo(a)Anthracene;
- ✳ Benzo(b)Fluoranthene;
- ✳ Benzo(a)Pyrene; and
- ✳ Dibenzo(a,h)Anthracene.

No asbestos was identified within any of the soils submitted for analysis and there were no visual signs of ACM within the soils during the site investigation.

No significant concentrations of hydrocarbon compounds or heavy metals were identified in the soils submitted for chemical analysis.

The laboratory analysis confirms the constituents of concern are non-volatile PAHs.

In relation to these exceedances, the following can be determined:

- ✳ The main exposure pathways based on the Tier I exceedances are:
 - Soil ingestion;
 - Vapour inhalation (indoor);
 - Dermal contact and ingestion; and
 - Consumption of homegrown vegetables.
- ✳ The exceedances for all determinants are associated with shallow Made Ground deposits with TP115 at 0.30 m bgl.



HUMAN HEALTH RISK ASSESSMENT AND MITIGATION

All of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils and consumption of homegrown vegetables.

The risk to chronic human health associated with the elevated concentration of the non-volatile PAH compound can be mitigated through a shallow surface scrape of the impacted material, so it may be segregated. Soils may be placed in an area of low sensitivity, such as Public Open Space (POS) with a suitable clean cover system that will remove any potential for direct exposure of the receptors to the impacted soils.

At the time of enabling works, the near surface soils should be stripped and if proposed for re-use, should undergo further validation testing to confirm suitability. Anthropogenic or deleterious inclusions of brick and pottery debris should be screened from the soils.

If any soils are identified to contain asbestos fibres, they should be managed according to the asbestos risk mitigation conceptual site model shown in Figure 4.1.

FIGURE 4.1 ASBESTOS RISK MITIGATION CONCEPTUAL SITE MODEL



Notes

ND None Detect

0.001% Soils may contain $\leq 0.001\%$ asbestos using composite testing to ensure there is no potential risk to human health. This value is present within areas where there may be a short term low level exposure of soils containing trace asbestos fibres by construction workers where an appropriate level of asbestos management is employed (dust suppression)

0.1% Soils at a depth of $>1.00\text{m}$ bgl may contain $<0.1\%$ asbestos using composite testing where they will not be likely to be disturbed in the future and will therefore be in an area of low sensitivity. Risk assessment completed in accordance with Asbestos JIWG risk assessment tools.

Undefined- this will be dependent upon soils encountered during earthworks, which may be placed at these depths to ensure no potential risk to human health.



Chemical analysis of the natural SAND and CLAY drift deposits has identified these soils to be acceptable for use as subsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this. The topsoil deposits onsite have initially been deemed to be acceptable, however further chemical validation will confirm this.

4.3. CONTROLLED WATERS RISK ASSESSMENT

E3P has undertaken a controlled waters risk assessment for the site based on the consideration of the conceptual site model and the sensitive receptors which are summarised in Table 4.2.

TABLE 4.2 CONTROLLED WATERS CONCEPTUAL MODEL AND SENSITIVITY PROFILE

DISCUSSION		SENSITIVITY RATING
Contaminant Source		
Made Ground Heavy metal and PAH contamination may be present as a result of the potential Made Ground infill material from historical infilled field boundaries across the site. Made Ground was identified within TP115 with exceedances of non-volatile PAHs being identified circa 0.40 m bgl.		Moderate
Pathway		
Vertical Migration Due to the site being underlain by granular (SAND) with rare interbedded cohesive (CLAY) deposits in the centre of the site, contamination has the potential to migrate vertically. There is limited drift cover across the site with bedrock being encountered between 1.40 and 1.80 m bgl.		High
Lateral migration Lateral migration of contaminants is considered possible due to the presence of granular alluvium deposits across the site.		High
Receptor		
Aquifer Classification in Superficial Drift Deposits	Secondary Undifferentiated aquifer	Medium
Aquifer Classification in Bedrock	Principle aquifer (Kinnerton Sandstone Formation)	High
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The majority of the site is situated within Zone 3 (Total catchment).	Medium
Distance to the Closest Groundwater Abstraction Point	Two identified within 1km of the site. The closest abstraction point is situated 963m to the east.	Low
Is the Site Located Within 50 m of a Surface Watercourse?	Unnamed water features (ponds) 7 m to the North East of the site.	High
The ICSM developed within the context of the site setting has a viable pollutant pathway, which would be the downward migration of potentially mobile phase-soluble contaminants towards the underlying Principle aquifer and the lateral migration towards the unnamed water feature circa 7 m to the northeast.		



To ensure a robust appraisal of the identified risk to controlled waters, E3P has identified the sources of potential contamination that represent a risk to controlled waters from the initial CSM, we have then assessed the availability of ground investigation data in the form of analysis of the solid phase (soil) and dissolved phase within the perched groundwater or aquifer. The results of this assessment are presented in Table 4.3.

TABLE 4.3 QUALITATIVE RISK TO CONTROLLED WATERS FROM SOIL ANALYTICAL RESULTS

CONTAMINANT	ASSESSMENT RATING	DISCUSSION
BTEX > 1 mg/kg	No potential sources of BTEX or VOC have been identified	None
Total VOC > 1 mg/kg		
Total SVOC > 1 mg/kg	No potential sources of SVOC have been identified	None
C5-C10 > 5 mg/kg	All concentrations are below the laboratory LOD.	None
C10-C12 > 10 mg/kg	All concentrations are below the laboratory LOD.	None
C12-C16 > 50 mg/kg	All concentrations are below the laboratory LOD.	None
Phenols > 2 mg/kg	All concentrations are below the laboratory LOD.	None
Naphthalene > 2 mg/kg	All concentrations are below the laboratory LOD.	None
Total PAH > 10 mg/kg	Total concentrations of low-solubility PAH compounds greater than 10 mg/kg have been detected within one exploratory hole location onsite, with a maximum concentration recorded in TP115 (0.30 m bgl) at 124 mg/kg.	Further Action
PCB > 1 mg/kg	No potential sources of PCB have been identified	None
Heavy metals > 500 mg/kg	No heavy metals concentrations above 500 mg/kg have been identified on-site.	None

The Tier I assessment has included a comparison of leachate analysis from samples taken across the site to drinking water standards and environmental quality standards (EQS). During return visits to the site groundwater monitoring at the site, boreholes were noted to be dry. Further leachate samples have been collected from the site to establish a robust controlled waters assessment for the site. The table below includes site investigation data from E3P from October 2021.

These are presented in Table 4.4.



TABLE 4.4 COMPARISON OF GROUNDWATER AND LEACHATE ANALYSIS WITH TIER 1 SCREENING LEVELS

DETERMINANT	UNIT	EQS 1, 2, 3	DWS 3,4,5	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA					
Arsenic	µg/l	50	10	4	<1.0	N/A	No Further Action
Cadmium	µg/l	0.08-0.25	5	4	<0.08	N/A	No Further Action
Chromium (VI)	µg/l	3.4	–	4	<5.0	N/A	No Further Action
Chromium (III)	µg/l	4.7	50	4	5.4	TP115 – 0.30 m bgl	Further Action
Copper	µg/l	1	2000	4	42 16 9.7 1.7	TP115 – 0.30 m bgl TP102 TP103 TP111	Further Action
Total Cyanide	µg/l	1	50	4	<1.0	N/A	No Further Action
Lead	µg/l	1.2	10	4	8.5 2.4 1.2	TP103 TP115 – 0.30 m bgl TP102	Further Action
Mercury	µg/l	–	1.0	4	<0.5	N/A	No Further Action
Nickel	µg/l	4	20	4	11 9.2 5.9	TP102 TP103 TP111	Further Action
Selenium	µg/l	–	10	4	<4.0	N/A	No Further Action
Zinc	µg/l	10.9	–	4	19 18 15 6.6	TP115 – 0.3 m bgl TP103 TP102 TP111	Further Action
pH	6–9			4	8.5	N/A	No Further Action
Polycyclic Aromatic Hydrocarbons							
Naphthalene	µg/l	2	10*	4	<0.01	N/A	No Further Action
Anthracene	µg/l	0.1	10*	4	<0.01	N/A	No Further Action



DETERMINANT	UNIT	EQS 1, 2, 3	DWS 3,4,5	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA					
Benzo[b]fluoranthene	µg/l	0.00017*	10*	4	<0.01	N/A	No Further Action
Benzo[k]fluoranthene	µg/l	0.00017*	10*	4	<0.01	N/A	No Further Action
Benzo(a)pyrene	µg/l	0.00017*	10*	4	<0.01	N/A	No Further Action
Indeno(123-cd)pyrene	µg/l	0.00017*	10*	4	<0.01	N/A	No Further Action
Fluoranthene	µg/l	0.0063	10*	4	<0.01	N/A	No Further Action
Benzo(ghi)perylene	µg/l	1.7–4	10*	4	<0.01	N/A	No Further Action
Aromatic Hydrocarbon ⁵							
TPH C5-C6 (benzene)	µg/l	10	1	4	<1.0	N/A	No Further Action
TPH C6-C8 (toluene)	µg/l	74	700	4	<1.0	N/A	No Further Action
TPH C8-C10 (ethyl benzene)	µg/l	20	300	4	<1.0	N/A	No Further Action
TPH C10-C12 (xylene)	µg/l	30	500	4	<10	N/A	No Further Action
TPH C12-C16	µg/l	2	90 ⁵	4	<10	N/A	No Further Action
TPH C16-C35	µg/l	50#	90 ⁵	4	<10	N/A	No Further Action
Aliphatic Hydrocarbon ⁵							
TPH C5-C6	µg/l	–	15000	4	<1.0	N/A	No Further Action
TPH C6-C8	µg/l	–	15000	4	<1.0	N/A	No Further Action
TPH C8-C10	µg/l	–	300	4	<1.0	N/A	No Further Action
TPH C10-C12	µg/l	–	300	4	<10	N/A	No Further Action
TPH C12-C16	µg/l	–	300	4	<10	N/A	No Further Action
TPH C16-C21	µg/l	–	300**	4	<10	N/A	No Further Action
TPH C21-C35	µg/l	–	300**	4	<1.0	N/A	No Further Action



DETERMINANT	UNIT	EQS 1, 2, 3	DWS 3,4,5	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA					
Volatile Organic Compounds							
Tetrachloroethylene	µg/l	0.4	10	N/A	N/A	N/A	No Further Action
Trichloroethylene	µg/l	10	10	N/A	N/A	N/A	No Further Action
Trichlorobenzene	µg/l	0.4	–	N/A	N/A	N/A	No Further Action
Trichloromethane	µg/l	2.5	–	N/A	N/A	N/A	No Further Action
Dichloromethane	µg/l	20	200	N/A	N/A	N/A	No Further Action
Carbon Tetrachloride	µg/l	12	3	N/A	N/A	N/A	No Further Action
Vinyl Chloride	µg/l	–	0.3	N/A	N/A	N/A	No Further Action

Notes

Solubility <0.01µg/l

AA – Annual Average

MAC- Maximum Admissible Concentration

* Polyaromatic hydrocarbons (PAH) - Benzo(a)pyrene (BaP), Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)-perylene and Indeno(1,2,3-cd)-pyrene. Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene needs to be monitored for comparison with the biota EQS or the corresponding AA-EQS in water

** There are no WHO Guideline Values for aliphatic fractions C16-C21 and C21-C35, therefore the guideline value for aliphatic fractions inclusive of C8-C16 (300µg/l) has been applied.

1. The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations (2015)
2. Directive establishing a framework for Community action in the field of water policy (Water Framework Directive)
3. Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (Dangerous Substances Directive) - List II substances
4. Council Directive on the quality of water intended for human consumption (Drinking Water Directive)
5. WHO Guidelines for Drinking Water Quality. Third edition (2004)



4.3.1. CONTROLLED WATER RISK ASSESSMENT AND MITIGATION

This comparison indicates that the data exceeds the EQS values for the following inorganic compounds:

- ✳ Chromium (VI)
- ✳ Chromium (III)
- ✳ Lead
- ✳ Nickel
- ✳ Zinc

There are no data exceedances when comparing the results to DWS values.

Where leachate analysis has been undertaken, this can overstate the risk and is not wholly representative of the site characterisation, however, no groundwater has been encountered onsite.

4.3.2. DISCUSSION OF CONTROLLED WATERS RISK ASSESSMENT

During return visits to the site, all six of the monitoring well positions have not recorded sufficient volumes of groundwater to warrant a sample. As a result, groundwater analysis has not been carried out. Further leachate sampling was taken across the site to form this assessment. In the absence of historical development and the greenfield nature of the site, it was not seen as prudent to install deep monitoring wells into the bedrock rock aquifer to gain groundwater samples.

This comparison indicates that there were no exceedances of the DWS values identified on the site however, several exceedances in heavy metals were noted for EQS values. In respect to the exceedances identified, leachate testing often overstates the risk, no solid exceedances were noted for heavy metals within soil samples that were analysed. As there is no pathway to the slight exceedances noted, these exceedances are not seen to pose a risk to the unknown water body 7 m to the northeast of the site. The PAHs identified in soils in Table 4.3 are of low mobility and leachate testing has not recorded a leachable potential of such.

The assessment has identified that there is considered to be no unacceptable risk to the underlying principle aquifer across this sector of the site.

The results of the data review and Tier 1 qualitative risk assessment has allowed E3P to draw the following conclusions in respect to the risk to controlled waters:

- ✳ The primary receptor has been identified as the underlying Principle bedrock aquifer and the unnamed watercourse (pond);
- ✳ It is unlikely that significant contaminant impact to the aquifer or the watercourse will occur due to there being no identified soil sources of contamination and a lack of groundwater to mobilise any such contaminants;
- ✳ The Tier 1 assessment has identified that there is considered to be no unacceptable risk to the underlying principle aquifer across this sector of the site investigated. Further investigation of the farmyard is required to confirm this conclusion.



4.4. GROUND GAS

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in CIRIA Report 665 – *Assessing risks posed by hazardous ground gases to buildings* (2007). However, it is recommended that the full ground gas assessment and recommended protection measures are agreed with the local authority prior to their adoption on site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.

4.1. INVESTIGATION RATIONALE

The ICSM has identified that the underlying Made Ground, backfilled field boundaries and underlying coal measures on site may represent a potential source of ground gas generation. Based on the identification of these sources, E3P has determined that the site represents a low ground gas source generation potential.

Within the context of the proposed residential end-use and ground gas generation potential, the gas assessment requires that six visits are required over three months, with at least two sets of readings at low or falling atmospheric pressure as set out within CIRIA 665 Tables 5.5a and 5.5b.

The spacing requirements for monitoring wells are detailed within CIRIA 665 Table 4.2, which indicates that for low gas hazard sites (Made Ground with limited degradable material, organic clay of limited thickness) and a high sensitivity development, nominal well spacing should be between 25 m and 50 m.

TABLE 4.5 GROUND GAS MONITORING LOCATION RATIONALE

LOCATION	GROUND GAS SOURCE	DEPTH OF MONITORING WELL (m)
WS101	Granular drift deposits	0.50-1.50
WS102	Granular drift deposits	0.50-1.00
WS103	Granular drift deposits	0.50-1.50
WS104	Granular drift deposits	0.50-2.00
WS105	Drift deposits	0.70-1.70
WS106	Drift deposits	0.50-2.50

4.2. MONITORING METHODOLOGY

Concentrations of methane (CH₄), carbon dioxide (CO₂) and oxygen (O₂) were measured using a calibrated infra-red gas analyser (GFM435) with gas flow rates were measured using an integrated flow meter.

Gas measurements were recorded for a minimum of 300 seconds at each location, at which point the maximum concentration of CH₄ and CO₂, together with the lowest concentration of O₂ were recorded. The results of the ground gas monitoring are presented in Table 8.9.

CIRIA C665 and NHBC Report No 10627-R01 provide assessments for carbon dioxide and methane based upon gas screening values (GSVs) utilising flow rates and concentrations. The site based GSVs for steady state methane and carbon dioxide are based upon the following equation:

$$GSV = \frac{\text{concentration (by vol)}}{100} \times \text{flowrate (l / hr)}$$



The GSVs within CIRIA C665 are based upon all buildings other than standard residential houses. The NHBC GSVs are based upon standard residential houses with precast concrete floors (block and beam). The CIRIA 665 report author (Steve Wilson) since provided further clarification regarding which guidance should be adopted for residential houses that have suspended cast in-situ concrete floor slab: for the avoidance of doubt, it was confirmed that the GSVs within the CIRIA 665 guidance should be adopted. The thresholds for GSVs based upon NHBC and CIRIA guidance are provided within Table 4.6.

TABLE 4.6 RESIDENTIAL THRESHOLDS FOR GAS SCREENING VALUES (GSV) IN ACCORDANCE WITH CIRIA C665 AND NHBS REPORT NO 10627-R01 – RESIDENTIAL END USE

CIRIA – NO SUBFLOOR VOID		NHBC – SUBFLOOR VOID		
CLASSIFICATION	GSV (METHANE AND CARBON DIOXIDE)	CLASSIFICATION	GSV (METHANE)	GSV (CARBON DIOXIDE)
CS1	< 0.07	Green	< 0.13	< 0.76
CS2	< 0.70	Amber 1	< 0.63	< 1.60
CS3	< 3.5	Amber 2	< 1.60	< 3.10
CS4	< 15	Red	> 1.60	> 3.10
CS5	< 70	N/A	N/A	N/A
CS6	> 70	N/A	N/A	N/A

4.2.1. SUMMARY OF MONITORING RESULTS

Table 4.7 presents of the ground gas and groundwater monitoring results to date.



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TABLE 4.7 SUMMARY OF GROUND GAS MONITORING RESULTS

WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS101	04/11/21	0.1	0.1	0.0001	1.3	1.4	0.0014	19.1	1009	Rising	0.1	0.50-1.50	1.39	Dry
WS102	04/11/21	0.1	0.1	0.0001	4.1	4.1	0.0041	15.2	1008	Rising	0.1	0.50-1.00	0.86	Dry
WS103	04/11/21	0.1	0.1	0.0001	1.6	0.8	0.0008	19	1009	Rising	0.1	0.50-1.50	1.10	Dry
WS104	04/11/21	0.1	0.1	0.0001	1.2	1.4	0.0014	18.7	1009	Rising	0.1	0.50-2.00	1.65	Dry
WS105	04/11/21	Well Destroyed										0.70-1.70	N/A	
WS106	04/11/21	0.1	0.1	0.0001	3.3	3.3	0.0033	17.1	1009	Rising	0.1	0.50-2.50	2.50	2.20

NOTES

NHBC Traffic Light System		Typical Max CH ₄ Concentration	GSV CH ₄	Typical Max CO ₂ Concentration	GSV CO ₂
	Amber 1	1	0.16-0.63	5	0.78-1.56
	Amber 2	5	0.63-1.56	10	1.56-3.13
	Red	20	1.56+	30	3.13+

Values in **BOLD** exceed Amber 1 Thresholds

Values in **BLUE** denote water above monitoring well



4.2.2. SOURCES OF GROUND GAS

The Phase I report and subsequent ground investigation has identified the following potential sources of ground gas:

- ✳ Localised pockets of Made Ground;
- ✳ Infilled features (field boundaries);
- ✳ Extensive topsoil deposits;
- ✳ Granular drift deposits; and
- ✳ Coal workings.

4.2.3. GROUNDWATER

Groundwater has only been identified within WS106 in the northern sector of the site, at a depth of 2.20m bgl.

The remaining wells were noted as dry during the initial round of gas monitoring carried out onsite.

4.2.4. GAS FLOW

During the monitoring, a positive flow was noted in all wells. The measure of positive flow is considered to be the result of groundwater fluctuations and flooding of the well causing compression – as opposed to gas generation – as the highest flows are recorded during periods of high groundwater levels.

If negative flows are recorded these are indicative of back pressure from wind being greater than the active flow from the wells.

4.2.5. GAS CONCENTRATIONS

No elevated levels of methane have been recorded across the site with all monitoring locations having a maximum concentration of 0.1% v/v during the initial round of gas monitoring.

Carbon dioxide concentrations were recorded within all the monitoring wells at concentrations ranging from 0.8% v/v (WS103) to 4.1% v/v (WS102). The maximum carbon dioxide levels were also associated with low oxygen concentrations.



4.2.6. GAS ASSESSMENT

In accordance with the methodology outlined with the CIRIA publication C665, E3P have utilised the results of the ground gas monitoring surveys to calculate a tentative gas screening value (GSV). The GSVs for the monitoring positions are summarised in Table 4.8.

TABLE 4.8 GAS RISK PROFILE AND LOCATION

LOCATION	MAX CH ₄ (% v/v)	GSV (l/hr)	MAX CO ₂ (% v/v)	GSV (l/hr)	CLASSIFICATION
WS101	0.1	0.0001	1.4	0.0014	CS1/Green
WS102	0.1	0.0001	4.1	0.0041	CS1/Green
WS103	0.1	0.0001	1.6	0.0008	CS1/Green
WS104	0.1	0.0001	1.4	0.0014	CS1/Green
WS105	Well Destroyed				
WS106	0.1	0.0001	3.3	0.0033	CS1/Green

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area.

Preliminary ground gas monitoring suggests that the site can be predominantly classified as CS1, and in these areas, it is considered that gas protection measures will not be required. However, localised areas of the site have been assessed as being CS2 and properties within this area will likely require specialist protection measures as detailed below.

4.3. RESIDENTIAL BUILDING GAS RISK MITIGATION

British Standard BS8485 (2015)+A1(2019) provides two types of residential property that require assessment. These building types are:

- 
Type A Building – Private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Some small rooms are present. Probably conventional building construction (rather than civil engineering). Examples include private housing and some retail premises.
- 
Type B Building – Private or commercial property with central building management control of any alterations to the building or its uses but limited or no central building management control of the maintenance of the building, including the gas protection measures. Multiple occupancies. Small- to medium-sized rooms with passive ventilation of rooms and other internal spaces throughout ground floor and basement areas. May be conventional building or civil engineering construction. Examples include managed apartments, multiple occupancy offices, some retail premises and parts of some public buildings (such as schools, hospitals, leisure centres) and parts of hotels.

Based on the ground gas risk assessment and the proposed Type A Building, it is envisaged that a point score of 0 will be required for affected properties, as summarised in Table 4.9.



TABLE 4.9 BS 8485 (2015) POINTS REQUIRED FOR TYPE A AND TYPE B BUILDINGS

CHARACTERISTIC SITUATION	NHBC TRAFFIC LIGHT SYSTEM	MINIMUM GAS PROTECTION SCORE (POINTS)	
		HIGH SENSITIVITY	
		TYPE A BUILDING	TYPE B BUILDING
1	Green	0	0
2	Amber 1	3.5	3.5
3	Amber 2	4.5	4
4	Red	6.5	5.5
5	N/A	N/A	6.5
6	N/A	N/A	N/A

Residential buildings should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, for example, high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system such as in institutional and/or fully serviced contractual situations.

The requisite 0 points must be achieved by installation of a suitable combination of measures detailed in Table 4.10.

TABLE 4.10 SUMMARY OF GROUND GAS MITIGATION MEASURES – BS8485 (2015)+A1(2019)

GAS PROTECTION SCORES FOR THE STRUCTURAL BARRIER	SCORE ^A
Floor and Substructure Design	
Precast Suspended Segmental Subfloor (Beam and Block)	0
Cast In-Situ Ground-Bearing Floor Slab (With Only Nominal Mesh Reinforcement)	0.5
Cast In-Situ Monolithic Reinforced Ground-Bearing Raft or Reinforced Cast In-Situ Suspended Floor Slab With Minimal Penetrations	1 or 1.5 ^B
Basement Floor and Walls Conforming to BS 8102:2009, Grade 2 Waterproofing ^C	2
Basement Floor and Walls Conforming to BS 8102:2009, Grade 3 Waterproofing ^C	2.5

^{A)} The scores are conditional on breaches of floor slabs, etc. being effectively sealed.
^{B)} To achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast in (see **A.2.2.2**).
^{C)} The score is conditional on the waterproofing not being based on the use of a geosynthetic clay liner waterproofing product (see **C.3**, Note 4).



PROTECTION ELEMENT SYSTEM		SCORE	COMMENTS
Gas protection scores for ventilation protection measures			
(a) Pressure Relief Pathway – Usually formed of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building.		0.5	Whenever possible a pressure relief pathway (as a minimum) should be installed in all gas protection measures systems. If the layer has a low permeability and/or is not terminated in a venting trench (or similar), then the score is 0.
(b) Passive Subfloor Dispersal Layer – Media used to provide the dispersal layer are: ☒ Clear void; ☒ Polystyrene void former blanket; ☒ Geocomposite void former blanket; ☒ No-fines gravel layer with gas drains; and ☒ No-fines gravel layer.	Very good performance	2.5	The ventilation effectiveness of different media depends on a number of different factors including the transmissivity of the medium, the width of the building, the side ventilation spacing and type and the thickness of the layer. The selected score should be assigned taking into account the recommendations in Annex B of BS 8485 (2015). Passive ventilation should be designed to meet at least “good performance”.
	Good performance	1.5	
(c) Active Dispersal Layer – Usually comprising fans with active abstraction (suction) from a subfloor dilution layer with roof-level vents. The dilution layer may comprise a clear void or be formed of geocomposite or polystyrene void formers.		1.5 to 2.5	This system relies on continued serviceability of the pumps, therefore alarm and response systems should be in place. There should be robust management systems in place to ensure the continued maintenance of the system, including pumps and vents. Active ventilation should always be designed to meet at least “good performance”.
(d) Active Positive Pressurisation – Provided by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket.		1.5 to 2.5	This system relies on continued operation of the pumps, therefore alarm and response systems should be in place. The score assigned should be based on the efficient “coverage” of the building footprint and the redundancy of the system. Active ventilation should always be designed to meet at least “good performance”.



(e) Ventilated Car Park – Floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park.	4	Assumes that the car park is vented to deal with car exhaust fumes, designed to Buildings Regulations 2000, Approved Document F [9].
PROTECTION ELEMENT SYSTEM	SCORE	COMMENTS
Gas Protection Score for the Gas-Resistant Membrane		
Gas-resistant membrane meeting all of the following criteria: ☑ Sufficiently impervious to the gases with a methane gas transmission rate < 40.0 ml/day/m²/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method); ☑ Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; ☑ Sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab); ☑ Sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre-reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools); ☑ Capable, after installation, of providing a complete barrier to the entry of the relevant gas; and ☑ Verified in accordance with CIRIA C735.	2	The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and integrity of joints. For example, a minimum 0.4 mm thickness (equivalent to 370 g/m² for polyethylene) reinforced membrane (virgin polymer) meets the performance criteria opposite. If a membrane is installed that does not meet all the criteria opposite, then the score is 0.
This table should be read in conjunction with the notes presented in BS 8485 (2015)+A1 (2019)		



4.3.1. NHBC

The NHBC Traffic Light guidance can still be used where the development proposals are based on the 'typical house' used in the modelling for the traffic light classification system.

A typical house is defined as a house (up to three storeys) with <100 m² footprint and minimum 150 mm depth clear ventilated void achieving sub-slab ventilation of one complete air exchange per day.

NHBC expectations for verification to satisfy the Traffic Light gas regime classifications are as detailed in Table 4.11.

TABLE 4.11 TYPICAL NHBC EXPECTATION AND VERIFICATION REQUIREMENTS

GAS REGIME	MINIMUM GAS PROTECTION EXPECTATIONS	VERIFICATION OR INFORMATION REQUIREMENTS
Green	N/A – but need to comply with BR211 radon requirements, where applicable	
Amber 1	Ventilation – subfloor venting to achieve at least one air exchange per day (minimum 150 mm void height; 1500 mm² /m air vent opening or 500 mm² /m² floor area spaced at not more than 2 m centres on at least two opposing sides). Membrane – must be suitable for purpose. Membrane installation/design - to achieve complete integrity across entire building footprint. Penetrations and joints sealed.	Construction drawings – showing position of membrane; sealing details and ventilation points to be provided. Membrane specification – technical data sheet(s) for gas membrane (including gas permeability data) to be provided. Installation – photographic evidence of installed membrane may be requested.
Amber 2	Ventilation – subfloor venting to achieve at least one air exchange per day. Membrane – must be suitable for purpose (criterion detailed in BS8485 clause 7.2.4). Membrane installation and design to achieve complete integrity across entire building footprint. Penetrations and joints sealed. Installer – installers must be experienced and appropriately trained and/or qualified.	Construction drawings showing position of membrane, sealing details and ventilation points to be provided. Membrane specification – technical data sheet(s) for gas membrane (including gas permeability data) to be provided. Installation – third-party verification report with supporting evidence to be included (i.e. photographic evidence and certificates of conformity, observations relating to sealing, location of ventilators and standards of installation). Integrity testing – may be requested; testing plan to be agreed in advance.
Red	Standard residential housing is not generally acceptable without further ground gas risk assessment and/or possible remedial mitigation measures to reduce or remove the source of the ground gases.	



4.4. POTABLE WATER SUPPLY

This section provides a summary of the site investigation data with reference to the selection of potable water supply pipework. The assessment is made with reference to the UK Water Industry Research (UKWIR) publication "Guidance on the selection of Water Supply Pipes to be used in Brownfield Sites"

TABLE 4.12 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

Contaminant Group	PE-threshold (mg/kg)	Concentrations at <u>Current</u> pipeline depth (mg/kg)
Total VOC	0.5	N/A
Total BTEX And MTBE	0.1	N/A
Total SVOCs (Excluding PAH and those substances marked with an *)	2	N/A
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2	<1.0
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	<4.0
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	<10
Phenols (From SVOC Analysis)*	2	N/A
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	NA
Ethers*	0.5	NA
Nitrobenzene*	0.5	NA
Ketones*	0.5	NA
Aldehydes*	0.5	NA
Amines	Fail	NA
Other Consideration		
Are there any exceedances of the PE threshold outside of the pipeline depth?	None present onsite.	
Is free product present in soil and groundwater?	None present onsite.	
Could hydrocarbon impact at greater depth than current pipeline depth be mobilised by rising groundwater levels?	No – Hydrocarbon impact has not been identified onsite and limited low solubility PAH impacted has been identified within shallow soils with TP115. Groundwater levels are anticipated to be significantly deeper than the pipeline depth, furthermore shallow groundwater has not been identified onsite.	
Will soils impacted with above determinants likely be utilised elsewhere on-site?	No	
Will soils be imported to site as part of any future earthworks	Currently unknown, however, it is unlikely soils will be required to be imported to site.	

Notes - Pipe line depth normally between 0.75m–1.35m



Based on the assessment of current site conditions it is likely that polyethylene pipe will be required at the proposed development.



4.5. CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 4.13 has been prepared for the site.

TABLE 4.13 CONCEPTUAL MODEL

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL1 PL2	Heavy Metals, non-volatile PAH (Made Ground)	Dermal contact. Dermal contact and ingestion.	Future site users. Off-site receptors.	Low likelihood	Very Low	LOW
There is a low likelihood probability due to elevated PAH identified within an isolated location at TP115 circa 0.30 m bgl. Samples obtained from the wider site did not identify any elevated heavy metals or non-volatile contaminants. The risk to chronic human health associated with the elevated concentration of the non-volatile PAH compound can be mitigated through a shallow surface scrape of the impacted material, so it may be segregated. Soils may be placed in an area of low sensitivity, such as Public Open Space or the installation of a clean cover system which will remove any potential for direct exposure of the receptors to the impacted soils. No further contamination has been identified onsite. Recommendation: Removal of soils impacted at TP115 and placement within an area of POS or the installation of a clean cover system depending on the final proposed development layout. Construction works should be completed with PPE and provision of welfare to ensure exposure and direct contact with impacted materials is at a minimum.						
PL3	ACM in Made Ground	Inhalation of dust.	Future site users. Buildings. Off-site land users.	Unlikely	Low	LOW
Assessment: No ACM has been identified, as such there is considered to be an overall low risk to human health.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL4	Volatile Contaminants such as hydrocarbons	Inhalation of vapours.	Future site users. Off-site receptors.	Unlikely	Low	LOW
Assessment: No volatile compounds have been identified, as such there is considered to be an overall low risk to human health.						
Recommendation: Construction works completed with appropriate PPE and provision of welfare.						
PL4	Methane, carbon dioxide (Coal measures and potentially infilled features on and within 250 m of the site)	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Low likelihood	Low	LOW
Assessment: Preliminary ground gas monitoring carried out onsite has not identified any elevated concentrations of methane or carbon dioxide.						
Recommendation: Initial monitoring suggests that the site can be classified as CS1/Green, however, this will be confirmed on completion of the monitoring. Precautionary CS2/Amber 1 measures required.						



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PL5	Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds	Surface runoff. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (Principle aquifer). Surface water (Unnamed Watercourse (pond)).	Low likelihood	Low	LOW
Assessment: There is an unlikely probability of the presence of mobile contaminants onsite as no significant sources of mobile contamination have been identified.						
Recommendation: Construction works completed with PPE and provision of welfare Sampling of groundwater required if possible.						
PL6	Sulphate (potential ash within Made Ground)	Sulphate attack on concrete.	Building structure.	Low likelihood	Low	LOW
Assessment: Chemical analysis suggests that the soils meet DS-1, AC-1S.						
Recommendation: Specialist concrete is unlikely to be required. Additional sulphate analysis in the farmyard area is recommended to confirm this on a site-wide basis.						
PL7	Organic contaminants such as hydrocarbons, solvents (Made Ground)	Ingestion of tainted water supply.	Future site users. Water pipes.	Unlikely	Low	LOW
Assessment: No significant sources have been identified on the site and no elevated concentrations have been detected in the chemical analysis of soils that might present a risk to water pipelines to date.						
Recommendation: PE barrier pipe is likely to be suitable onsite of site. This will need to be confirmed with a UKWIR risk assessment post-demolition/remediation.						

Main exposure pathways:



PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation; PL4 = Vapour/Gas Inhalation; PL5 = Vertical / Lateral Migration; PL6 = Corrosion of concrete; PL7=Tainting of water supply; PL8 = Uptake by plants;



5. COAL MINING

5.1. SCOPE OF INTRUSIVE GROUND INVESTIGATION

The potential presence of a sub-crop within the Higher and Lower Florida Coal Seam in the south-western sector of the site, with the seam being mapped on site and dipping to the southwest, the Wardell Armstrong report also indicates that there is a possibility of shallow coal workings beneath this area of the site. A series of rotary boreholes have been advanced in accordance with Coal Authority Permission to assess the potential presence of workings within this seam and the potential for ground instability to induce a future subsidence event within the proposed development.

5.2. SUMMARY OF GROUND INVESTIGATION WORKS

5.2.1. ROTARY BOREHOLES TO INVESTIGATE WORKINGS IN COAL

Four rotary boreholes have been advanced at the locations detailed within the E3P exploratory borehole location plan at positions to intersect the potential coal seams and assess the potential for any workings.

TABLE 5.1 ROTARY BOREHOLES

ROTARY BOREHOLE	DEPTH TO ROCKHEAD (m bgl)	DEPTH TO COAL (m bgl)	EVIDENCE OF MINING ACTIVITY/SEAM	REMARKS
RB101	1.60	N/A	N/A	Sandstone bedrock recorded 1.60-40.00 m with no evidence of coal workings.
RB102	1.60	N/A	N/A	Sandstone bedrock recorded 1.60-40.00 m with no evidence of coal workings.
RB103	1.90	N/A	N/A	Sandstone bedrock recorded 1.90-40.00 m with no evidence of coal workings.
RB104	1.80	N/A	N/A	Sandstone bedrock recorded 1.80-40.00 m with no evidence of coal workings.

There was evidence of broken ground or coal workings identified as part of the intrusive investigation.



5.3. SUMMARY OF COAL MINING ISSUES

The Wardell Armstrong Coal Mining risk assessment indicates that the western sector of the site may be affected by shallow coal workings with the Higher and Lower Florida Coal Seam potentially outcropping in this sector. A summary of the E3P coal mining intrusive ground investigation is given below.

- ✿ The intrusive ground investigations comprising four, deep, rotary boreholes did not identify any shallow coal seams or evidence of historic mine workings to the base of the boreholes.
- ✿ No evidence of coal workings have been identified onsite, with SANDSTONE being encountered to 40.00 m bgl in all locations, with no evidence of broken ground.
- ✿ The assessment has concluded that there is sufficient rock cover to provide the required degree of stability in the event of successive collapses (cavitation's) within potential workings beneath the site.



6. GEOTECHNICAL ASSESSMENT

6.1. PROPOSED DEVELOPMENT

At the time of this report being prepared E3P understands that Vistry Partnerships considering the proposed acquisition and future redevelopment of a parcel of land to the south of Lickers Lane, Whiston for low rise residential housing with associated adopted estate roads and utility infrastructure.

6.2. SUMMARY OF GROUND CONDITIONS

MADE GROUND

Made Ground deposits were encountered in one location (TP115) between 0.00 m and 0.40 m bgl.

Made Ground consisted of Black sandy gravelly clay, gravels included angular to subrounded fragments of brick, mudstone, sandstone, and ceramics.

TOPSOIL

Topsoil deposits were encountered within all exploratory hole locations apart from TP115 in which reworked Made Ground was identified. Topsoil deposits were encountered between 0.00 m and 0.60 m bgl.

Topsoil deposits were formed from dark grey to black slightly clayey, gravelly SAND with frequent rootlets. Gravels were made up of fine to medium subrounded to rounded of mudstone and sandstone.

DRIFT

Drift deposits were encountered within all of the exploratory locations to a maximum depth of 2.60 m bgl.

Ground conditions consisted of granular medium dense gravelly SAND becoming dense at depth within weathered sandstone. Clay deposits were identified within the central northern sector of the site which comprised of firm to very stiff medium to very high strength gravelly clays.

SOLID

The solid bedrock geology was encountered between 1.00 m and 40.00 m bgl.

The bedrock was consistent across the site being formed of yellow brown SANDSTONE.

GROUNDWATER

No groundwater strikes were encountered during the intrusive site investigation.



6.3. SITE PREPARATION

The site should be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the *Manual of Contract Documents for Highway Works (MCHW)*. This should include the following:

- ✿ Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void infilled with suitable compacted engineered fill.
- ✿ Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill.
- ✿ Buried structures if encountered on site should be excavated from below the proposed development footprint with the resulting void backfilled.

6.4. FOUNDATION CONDITIONS AND ASSESSMENT OF POTENTIAL BEARING CAPACITIES

In due consideration of the identified ground conditions, in-situ and laboratory geotechnical testing, E3P has undertaken an assessment of the net safe allowable bearing pressure (ABP) within the underlying natural stratum to assist in the detailed design of foundations and infrastructure and determine the target founding stratum. The results of this assessment are summarised in Table 6.1.

TABLE 6.1 SUMMARY OF ABP

GRANULAR SOILS			
Description	Depth (Range m bgl)	Relative Density	Allowable Bearing Pressure (kN/m ²)
Medium Dense to Dense SAND	1.00-2.00	Medium Dense – Dense	110.9–504.07
COHESIVE SOILS			
Description	Depth (range m bgl)	Undrained Shear Strength (Cu) (kN/m ²)	Allowable Bearing Pressure (kN/m ²)
Firm to Very Stiff, Gravelly CLAY	0.40-1.90	54-140	126.9–329

Based on the assessment of the relative in-situ densities and corresponding safe net allowable bearing pressure, the suitable target founding stratum has been identified as the underlying medium dense to dense granular soils and firm to stiff clays.

Therefore, upon completion of these enabling works, it is likely that proposed structures will be founded on a combination of strip / trench fill type foundations where medium dense or firm clays are present at 1.00m bgl or found upon the sandstone bedrock present at the near surface (<1.5 to 2.0m).



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Foundation depths within the conjectured influence of former, existing or proposed trees will need to be deepened to ensure that structural loading bears within the underlying target founding stratum, which cannot be subject to volumetric instability associated with fluctuation in moisture content within areas where clay deposits have been identified.

Consideration must be given to the varying soil matrices and differing settlement characteristics and where a foundation spans two varying matrices the sub-structure should be designed accordingly.

Foundation depths should take account of the presence of existing and proposed trees, with foundations deepened locally to mitigate the potential for volumetric instability attributed to fluctuations in moisture content, in accordance with the requirements of NHBC standards.

It is recommended that at working drawing stage a foundation schedule is prepared for the development, taking into account of the physical change of natural clay soils and the current/proposed locations of trees.

At this time it is not possible to accurately define the foundation types due to the absence of a detailed tree survey and final development levels; however, based on our extensive experience of similar sites, we would anticipate that the final foundation solution would be a combination of the following:

- ✳ Shallow Strip foundations at circa;
- ✳ Mass Trench foundations at circa;

A summary of anticipated foundations is presented in Table 6.2 and A detailed foundation zoning plan is included as Drawing 15-065-009 in Appendix XI.

TABLE 6.2 ANTICIPATED FOUNDATIONS

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	TARGET STRATUM	TREES	COAL	FOUNDATION TYPE	TYPE OF CONCRETE
WS101	1.45	N/A	Medium Dense SAND	N	N	Mass Trench	DS-1 AC-1s
WS102	1.00	N/A	Bedrock	N	N	Mass Trench	DS-1 AC-1s
WS102a	1.05	N/A	SAND	N	N	Shallow Strip	DS-1 AC-1s
WS103	1.55	N/A	Dense SAND	N	N	Mass Trench	DS-1 AC-1s
WS104	1.55	N/A	Medium Dense SAND	N	N	Mass Trench	DS-1 AC-1s
WS105	2.00	N/A	Bedrock	N	N	Mass Trench	DS-1 AC-1s
WS106	1.20	N/A	Stiff CLAY	N	N	Shallow Strip	DS-1 AC-1s
TP101				N	N		
TP102				N	N		
TP103	1.40	N/A	Bedrock	N	N	Mass Trench	DS-1 AC-1s
TP104				N	N		



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TP105				N	N		
TP106	1.45	N/A	SAND	N	N	Mass Trench	DS-1 AC-1s
TP107	0.80	N/A	SAND	N	N	Shallow Strip	DS-1 AC-1s
TP108	0.95	N/A	SAND	N	N	Shallow Strip	DS-1 AC-1s
TP109	1.25	N/A	SAND	N	N	Shallow Strip	DS-1 AC-1s
TP110	1.35	N/A	SAND	N	N	Shallow Strip	DS-1 AC-1s
TP111	1.20	N/A	Firm CLAY	N	N	Shallow Strip	DS-1 AC-1s
TP112	1.20	N/A	Firm CLAY	N	N	Shallow Strip	DS-1 AC-1s
TP113	1.25	N/A	SAND	N	N	Shallow Strip	DS-1 AC-1s
TP114	1.05	N/A	SAND	N	N	Shallow Strip	DS-1 AC-1s
TP115	1.20	N/A	Firm CLAY	N	N	Shallow Strip	DS-1 AC-1s

E3P has prepared a ground improvement design risk matrix, which is summarised in Table 6.3, to assess the suitability of ground improvement techniques. This is applicable to plots where levels are to be raised or where natural conditions require improvement.

TABLE 6.3 GROUND IMPROVEMENT DESIGN RISK MATRIX

RISK ITEM	COMMENT	PASS/FAIL
Soft clays with an undrained shear strength less than 30 kN/m ²	No soft clays have been identified onsite.	PASS
Ground with peat layers close to foundation level or the base of the stone column, or where intermediate layers of peat are thicker than 200 mm, either as a single layer or the sum of the thicknesses of individual layers throughout the length of the stone column	No Peat or organic silts have been identified within the site	PASS
Voided filled ground, e.g. old water tanks, pottery, glass bottles, concrete rubble or brick fill of unsuitable grading	Very limited Made Ground encountered (TP115 – 0.40 m)	PASS – on completion of enabling works
Loose or non-engineered fill not previously subject to rising or fluctuating water levels saturation	None identified.	PASS
Filled ground still settling or expected to settle under its own weight or due to the effects of surcharging/upfilling where there is a high organic content or where decay is continuing	None identified.	PASS
Fill, containing degradable material where organic material forms more than 15% of fill by volume	None identified.	PASS



RISK ITEM	COMMENT	PASS/FAIL
Clays with a plasticity index greater than 40%	None identified.	PASS
Highly sensitive soils liable to collapse or remoulding	None identified.	PASS
Cohesive soils with trees in influencing distance	Plots where tree influence has been modelled and will either be subject to a piled or mass trench-fill solution	PASS
Sensitive utility infrastructure	No Peat or organic silts have been identified within the site	Pass
Overall Risk Rating and Suitability for Vibratory Ground Improvement		PASS

6.5. GROUND FLOOR SLABS

Current building control regulations require that where infilled ground is present to depths in excess of 600 mm, or where the substratum is variable in terms of the structure and settlement potential, or where clay soils are present within the influence of existing or proposed trees, a suspended floor slab is required.

In this instance, it is considered that the majority of substructures in the area of site investigated would not have variable structure or in excess of 600 mm of fill and therefore a ground floor slab may be viable.

Where a cast in-situ suspended slab is utilised with no subfloor void, appropriate compressible material (heave precautions) will be required in the construction of the substructure.

6.6. HEAVE PRECAUTIONS

The site has been proven to be underlain by clay soils, which are susceptible to volumetric instability due to fluctuations in moisture content, particularly within influencing distance of trees as per the NHBC/LABC conjectured zones of influence.

As the clay is deemed to be low plasticity, heave precautions are not required to the internal face of the external load-bearing walls (outside or within tree influence).

If a ground beam is to be constructed within the zone of tree influence, heave precautions are required to the underside of this and edge beams.

If the ground floor slab is to be constructed with a beam and block floor, a minimum subfloor void of 200 mm is required within any structures located in the zone of conjectured tree influence.

If the ground floor slab is constructed with a cast in-situ suspended floor slab, then heave precautions that can tolerate 50 mm of clay swelling are required within any part of the floor slab to be located within the zone of influence of a tree.

A summary of heave precautions is presented in Table 6.4.



TABLE 6.4 SUMMARY OF HEAVE PRECAUTIONS

		MINIMUM VOID DIMENSION FOR FOUNDATIONS, GROUND BEAMS AND SUSPENDED IN-SITU CONCRETE GROUND FLOORS		MINIMUM VOID DIMENSIONS UNDER PRECAST CONCRETE AND SUSPENDED TIMBER FLOORS
Plasticity Index of Soil	Required Foundation Depth (m)	Thickness of Void Former Against Side of Foundation or Ground Beam (mm)	Thickness of Void Former on Underside of Edge Beam and Floor Slab (mm)	Void Dimension (mm)
High Plasticity (> 40)	> 2.5	Engineer Design		Engineer Design
	2.0–2.5	35	150	300
	1.5–2.0	25	75	
Moderate Plasticity (20–40)	> 2.5	Engineer Design		Engineer Design
	2.0–2.5	25	100	250
	1.5–2.0	25	50	
Low Plasticity (< 20)	2.0–2.5	N/A	50	200
	> 2.0	No Special Precautions		

6.7. HIGHWAYS CONSTRUCTION

A programme of remediation and enabling works will be required to remediate the proposed road subgrade in accordance with the requirements of the Manual of Contract Documents for Highway Works Volume 1 Specification For Highway Works (Series 600-Earthworks) for a method compaction.

It is considered that the material can be re-engineered using method compaction to achieve a CBR in excess of 5% if works are completed in favourable climatic conditions.

6.8. DRAINAGE

Soil infiltration was taken over the wetted area from between 75% and 25% of the effective depth. All tests showed granular drift deposits to have good soakage potential, however, in locations where clay drift deposits were present, soakage potential was significantly reduced. Within SA102 and SA103 infiltration testing identified that in these locations the tests soaked away within 24 hours, however, to be compliant with BRE 365 it is recommended that further testing is completed in these areas to allow 3 No tests to be completed over an allotted number of days in order to inform infiltration design.

6.9. CONCRETE DURABILITY

Based upon the results of the chemical analyses it is considered that subsurface concrete can be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with the recommendations provided in BRE Special Digest 1 (2005).



6.10. EXCAVATIONS

Trial pits were stable in both the limited Made Ground (TP115) and natural strata; as such, it is considered that near-surface excavations will be feasible.

During obstructions such as historic building slabs were encountered during site investigations and significant below ground obstructions are not anticipated given the undeveloped nature of the site.

If deep excavations are being advanced into the granular deposits, it is considered that all excavations are supported or battered back in accordance with guidance contained in CIRIA R97.

If local pumping of groundwater is required during the advancement of excavations for the proposed foundations then consideration should be given to the potential for dewatering gravels in the surrounding areas that may cause structural damage to building substructures in close proximity to the site.

TABLE 6.5 CIVIL ENGINEERING EXCAVATION RISK MATRIX

RISK ITEM	PRESENT	COMMENT
Running Sands	No	No running sand has been identified.
Minor Water Ingress	No	Minor water ingress will require localised dewatering/sump pumping during the construction of site drainage infrastructure. Ingress of water into foundation excavation will potentially flood foundation excavations, limiting the viability of spread foundations to be constructed.
Shallow Bedrock	Yes	Shallow heavily weathered bedrock has been identified across the site. The presence of bedrock will impede excavation for drainage infrastructure using traditional excavation plant and equipment.



6.11. CONSTRUCTION ACTIVITY AND INSPECTION

The following activities and inspections should be incorporated into the site works:

- ✿ Due to the variability of the soils at the site, it is recommended that sufficient allowance is made for the inspection of formations and sub-formations to foundations and pavement construction.
- ✿ Excavations where access is required should be subject to a risk assessment from a competent person and, where appropriate, mitigation measures such as benching back the sides or use of support systems in accordance with CIRIA R97 should be utilised.
- ✿ It is considered that dewatering may be required, especially following periods of heavy rainfall. Removal of surface water and water within trenches should be possible with conventional sump pumping. Discharge of any water should be agreed with the relevant regulatory body and be undertaken under a trade effluent discharge, where required. Measures to remove silt and suspended solids may be required and consideration should be given to provision of space for settling tanks or an attenuation pond.
- ✿ Where access to confined spaces is required, appropriate mitigation measures should be addressed within the construction stage health and safety plan. Particular account should be taken of the gas results.
- ✿ The presence of potential contamination and mitigation measures should be addressed as part of the construction stage health and safety plan and should include measures to design out the risks, reduce their impact and, finally, to include the use of personnel protective equipment (PPE).



6.12. GEOTECHNICAL RISK REGISTER

POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Remediation of contaminated soils		Onsite	5%	A single exceedance of non-volatile PAH contamination has been identified within TP115 circa 0.30 m bgl. The presence of non-volatile PAHs within this isolated area requires a shallow surface scrape of the impacted material so it may be segregated. No further contamination has been identified across the site.
Bedrock		Onsite	100%	Shallow bedrock is identified beneath the site. The presence of shallow bedrock represents a risk in terms of the viability of excavations to install infrastructure using standard construction equipment.
Cohesive Stratum overlying shallow Bedrock (<3.00m)		Onsite	40%	The northern sector of the site has interbedded cohesive and granular strata above shallow SANDSTONE bedrock.
Obstructions		N/A	N/A	No obstructions were encountered as part of the site investigation.
Artificially levelled and filled platforms		N/A	N/A	The site topography appears representative of the natural landform.
Retaining walls		N/A	N/A	There are no retaining structures present on the site.
Trench collapse		Onsite	100%	No instabilities were noted during the site investigation however granular deposits have been identified across the site and if large excavations are being advanced these have the potential to collapse. It is considered that all excavations are supported or battered back in accordance with guidance contained in CIRIA R97.
Mature trees		Northern boundary	15%	Arboriculture survey required to determine areas of potential tree influence of the sporadic mature trees that can be found on the northern boundary of the site. The site is predominantly surfaced by soft-standing with wind-blown vegetation and semi-mature shrubs and bushes.



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POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Volume change potential clay		Onsite	40%	The site is generally underlain by granular soils; however, pockets of cohesive clays being identified within TP111-115 and WS105-106. Geotechnical testing confirms soils to be of low volume change potential and heave precautions will not be required at the site.
Peat		N/A	N/A	Not encountered as part of the ground investigation.
Running sands		N/A	N/A	Not encountered. Data searches indicate very low risk.
Ground dissolution		N/A	N/A	Not encountered. Data searches indicate no hazard.
Concrete design		On-site	100%	The site meets Class DS-1, AC-1s characteristics.
Low-permeability ground		Onsite	40%	The northern sector of the site is underlain by low permeability cohesive deposits.
Services/sensitive structures		Onsite – western boundary	5%	Service plans indicate that there is an 11Kv overhead electric cable travelling along the Western Boundary of the site.
Abnormal foundation solutions		Onsite	TBC	At the time of writing, development levels are unknown, It is considered likely that the proposed structures will be founded on a combination of strip / trench fill type foundations where medium dense of firm clays are present at 1.00m bgl or found upon the sandstone bedrock present at the near surface (<1.5 to 2.0m).
Areas not investigated		N/A	N/A	The site investigation encompassed the whole site.
Surface water features		7 m to the north of site	N/A	There are no surface water features onsite however there is an unnamed watercourse (pond) roughly 7 m to the north of site.
Mining		N/A	N/A	The rotary boreholes in the southwestern sector of the site have not identified any evidence of coal workings or broken ground.
Slope		Onsite	10%	The site has a gentle slope to the south.



6.13. FURTHER WORKS

Based on the findings of the intrusive site investigation, the following additional works are recommended to be completed in due course:

-  Plot-specific foundation schedule (upon receipt of the final development levels).
-  Arboricultural survey.
-  Geotechnical earthworks strategy (infrastructure).
-  Remediation and enabling works strategy.
-  Construction phase Surface Water Management Plan.



7. CONCLUSIONS AND RECOMMENDATIONS

7.1. CONTAMINATED LAND ASSESSMENT

Human Health	A Tier I human health risk assessment has been undertaken using the chemical analysis results of the soils and comparing them to the relevant Tier I criteria. This assessment has identified the presence of elevated Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenzo(a,h)anthracene. All of the exceedances have been identified within TP115. All the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion, soil ingestion and consumption of homegrown produce. As all of the exceedance has been identified within one exploratory location they are considered to be an isolated hotspot, therefore during the enabling works, it is recommended the impacted Made Ground is excavated and placed within an area of low sensitivity. A growing The Made Ground identified within TP115 is not considered suitable for use within the upper 300mm of a residential garden given the presence of deleterious elements. It will therefore be necessary to place a minimum of 150mm of sub-soil and 150mm topsoil to constitute a 300mm clean soil matrix within all areas of private gardens where Made Ground remains. Chemical analysis of topsoil and subsoil confirms the material is suitable for re-use within proposed gardens and public open spaces areas. It should be noted that further chemical analysis will be required to confirm soils are chemically suitable in line with intended re-use volumes.
Controlled Waters	It should be noted that groundwater monitoring installations were noted as dry during monitoring events and therefore, leachate samples have been utilised to inform the controlled waters assessment. This comparison indicates that there were no exceedances of the DWS values identified on the site however, several exceedances in heavy metals were noted for EQS values. In respect to the exceedances identified, leachate testing often overstates the risk, no solid exceedances were noted for heavy metals within soil samples that were analysed. As there is no pathway to the slight exceedances noted, these exceedances are not seen to pose a risk to the unknown water body 7 m to the northeast of the site. The PAHs identified in soils in Table 4.3 are of low mobility and leachate testing has not recorded a leachable potential of such. The assessment has identified that there is considered to be no unacceptable risk to the underlying principle aquifer across this sector of the site.
Ground Gas	At the time of this report being prepared the ground gas analysis is ongoing, a full analysis will be presented in the full phase two report. Initial gas monitoring suggests CS1 however, allowance should be made for CS2 protection measures.



Potable Water	This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.
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7.2. COAL MINING

Coal Mining	In accordance with industry best practice as detailed within CIRIA 32, E3P has concluded that shallow mine workings are not present in the south-western sector of the site. No evidence of workings or broken ground was identified as part of the intrusive investigation. Thus, the assessment has concluded that there is sufficient rock cover to provide the required degree of stability in the event of successive collapses (cavitation's) within potential workings beneath the site.
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7.3. GEOTECHNICAL ASSESSMENT

Ground conditions predominantly comprise topsoil with limited thicknesses of Made Ground (TP115) overlying generally granular sand deposits. Cohesive deposits clay deposits have been identified within TP111-115 and WS105-106. Sandstone was encountered across the site at depths of between 1.00 and 2.00 m bgl.

The underlying granular drift deposits have been assessed as being medium dense to dense with a net ABP in the order of 100 to 240 kN/m² at circa 1 m bgl increasing to 456 kN/m² at circa 2 m bgl.

The underlying natural clay drift deposits identified with WS105 and WS106 have been assessed as being very stiff, high strength with a net allowable bearing pressure (ABP) in the order of 150 to 240 kN/m² at circa 1 m bgl.

A phase of cut-and-fill enabling works may be required in order to create a proposed development platform suitable for a residential development. Proposed levels are currently unknown but are expected to remain similar to current.

Concrete foundations will require concrete classification DS-1, AC-1s.

END OF REPORT



APPENDIX I LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.3.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.
8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
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10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.



APPENDIX II

GLOSSARY

TERMS

ACM	Asbestos-containing material	MMP	Materials management plan
ADS	Acoustic design statement	ND	Not detected
AST	Above-ground storage tank	NDP	Nuclear density probe
BGS	British Geological Survey	NMP	Noise management plan
BSI	British Standards Institute	NPSE	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	NR	Not recorded
CA	Coal Authority	PAH	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	PCB	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	PI	Plasticity index
CIRIA	Construction Industry Research Association	PID	Photo ionisation detector
CLEA	Contaminated land exposure assessment	POS	Public open space
CML	Council of Mortgage Lenders	PPE	Personnel protective equipment
CoC	Contaminants of concern	ProPG	Professional practice guidance
CSM	Conceptual site model	QA	Quality assurance
DNAPL	Dense non-aqueous phase liquid (chlorinated solvents, PCB)	SGV	Soil guideline value
DWS	Drinking water standard	SPH	Separate-phase hydrocarbon
EA	Environment Agency	SPT	Standard penetration test
EQS	Environmental quality standard	SVOC	Semi-volatile organic compound
FFL	Finished floor level	TPH	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	UKWIR	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	UST	Underground storage tank
HCV	Health criteria value	VCC	Vibro-concrete column
ICSM	Initial conceptual site model	VOC	Volatile organic compound
LEL	Lower explosive limit	VRSC	Vibro-replacement stone columns
LMRL	Lower method reporting limit	VSC	Vibro-stone columns
LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	WHO	World Health Organisation
MCV	Moisture condition value	WRAP	Waste and Resources Action Programme



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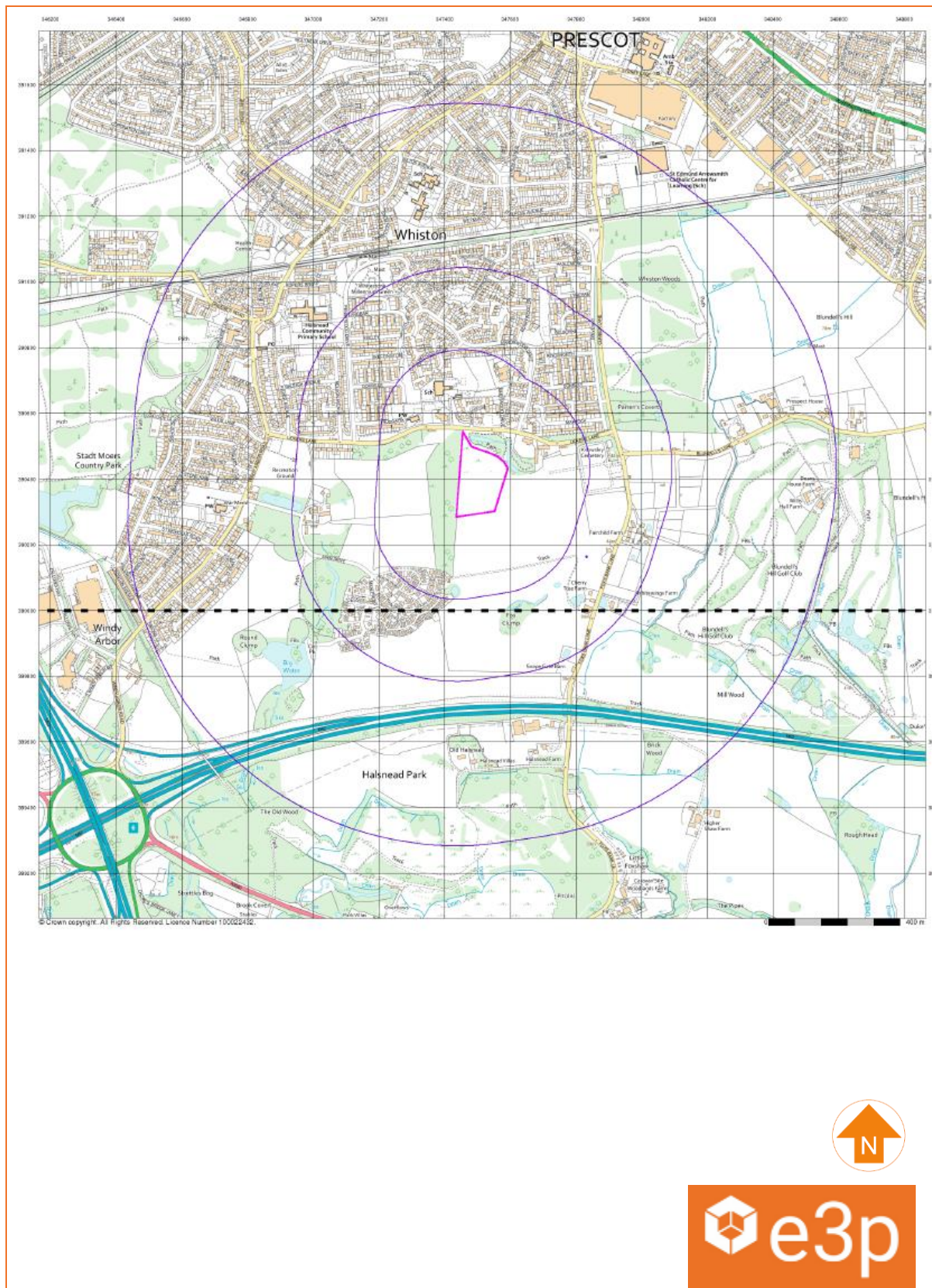
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m²	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	SSRT	Site Specific Remediation Target
PSD	Particle Size Distribution	DD	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	Mc	Moisture Content
ρ	Bulk Density	GPR	Ground Penetrating Radar
NDP	Nuclear Density Probe	FFL	Finished Floor Level
LEL	Lower Explosive Limit	UKWIR	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	LOD	Limit of Detection

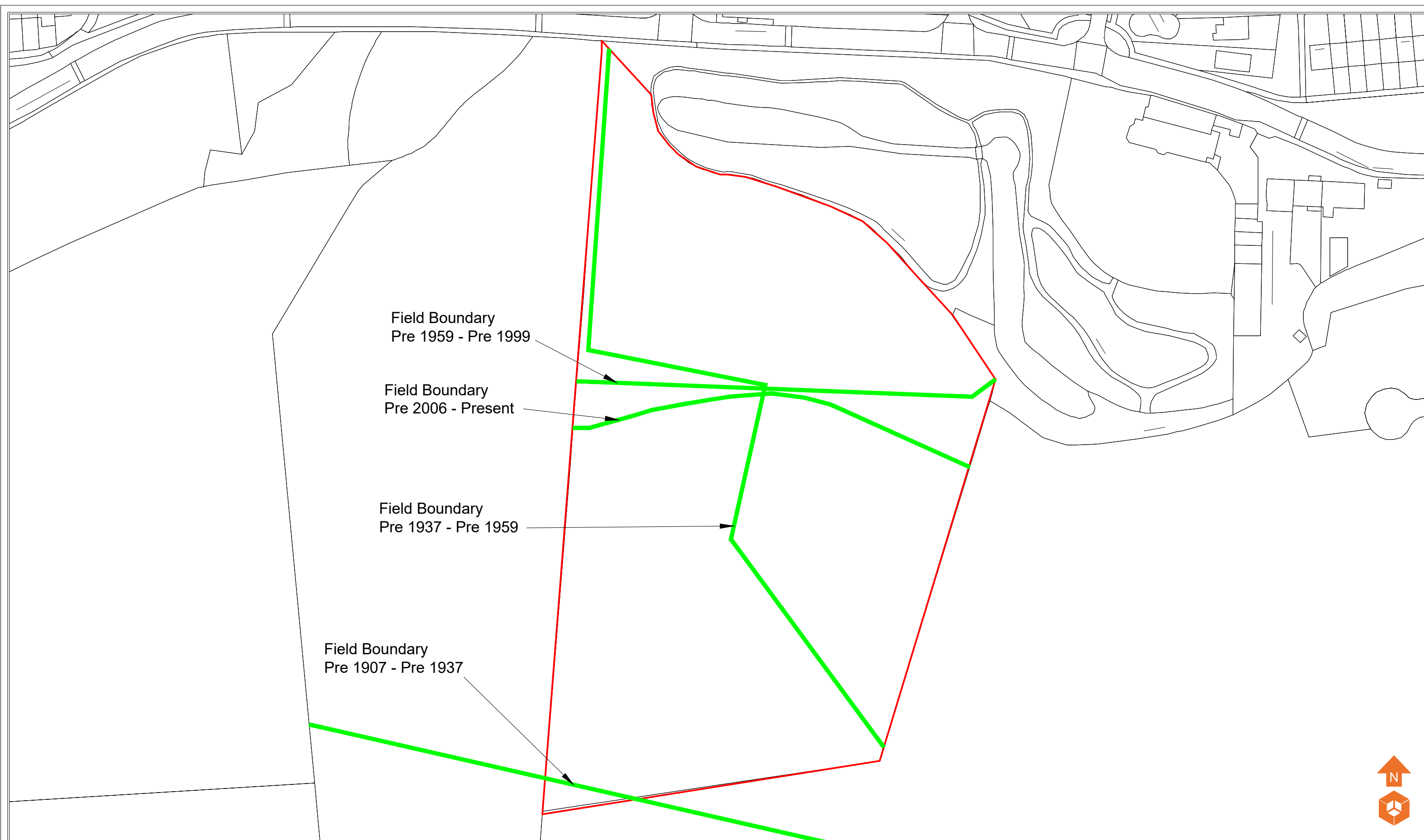


APPENDIX III

DRAWINGS

DRAWING 15-065-001 – SITE LOCATION PLAN





Historical Features

Field Boundary

Notes:

P1	REVA	20.10.2021	CB	RH
Phase	Issue	Date	Drawn	Checked

Client:

Vistry

Job Title:

Halnsead,
Lickers Lane

Job No:

15-065

Drawing No:

003

Date:

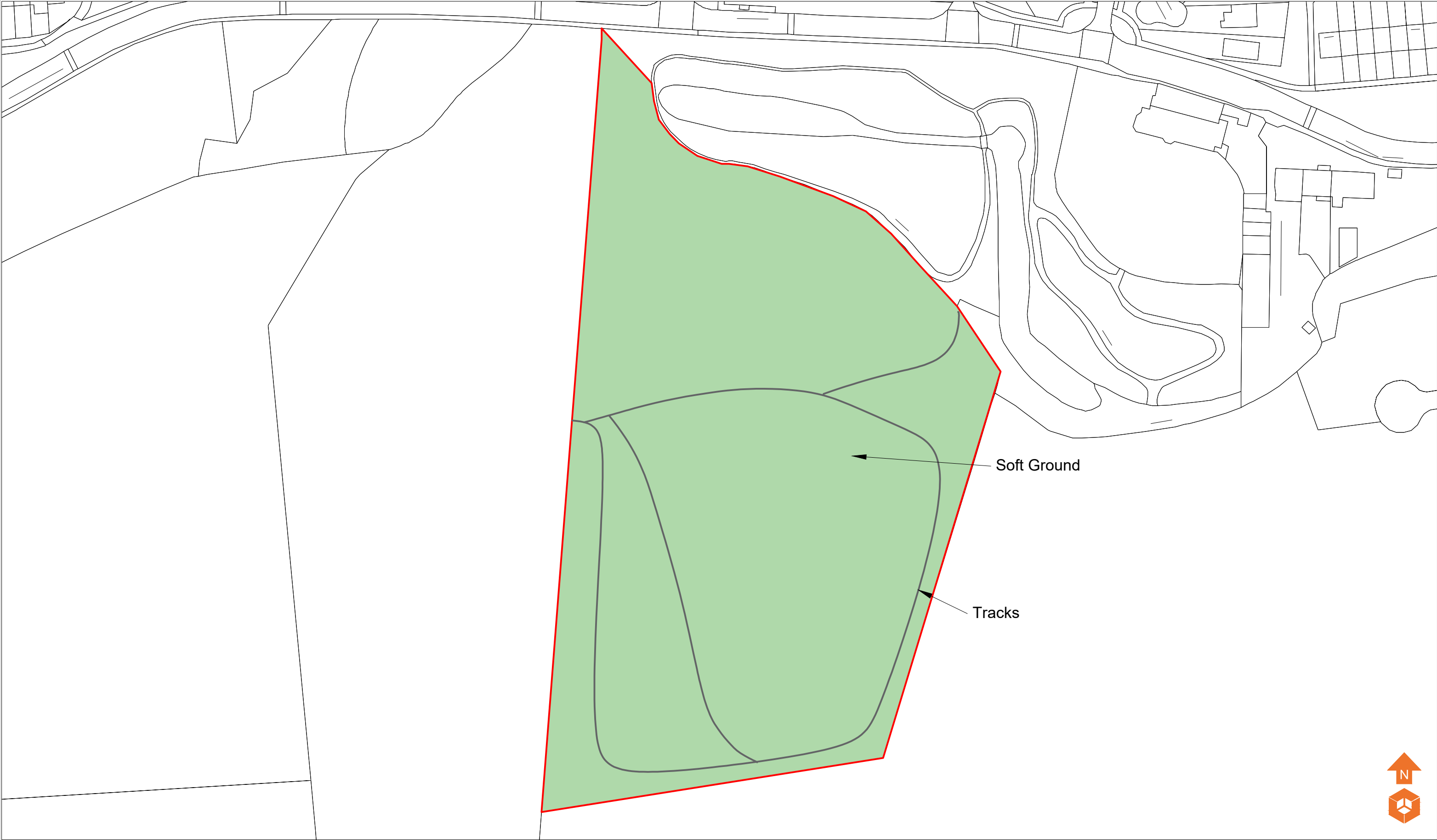
20.10.2021

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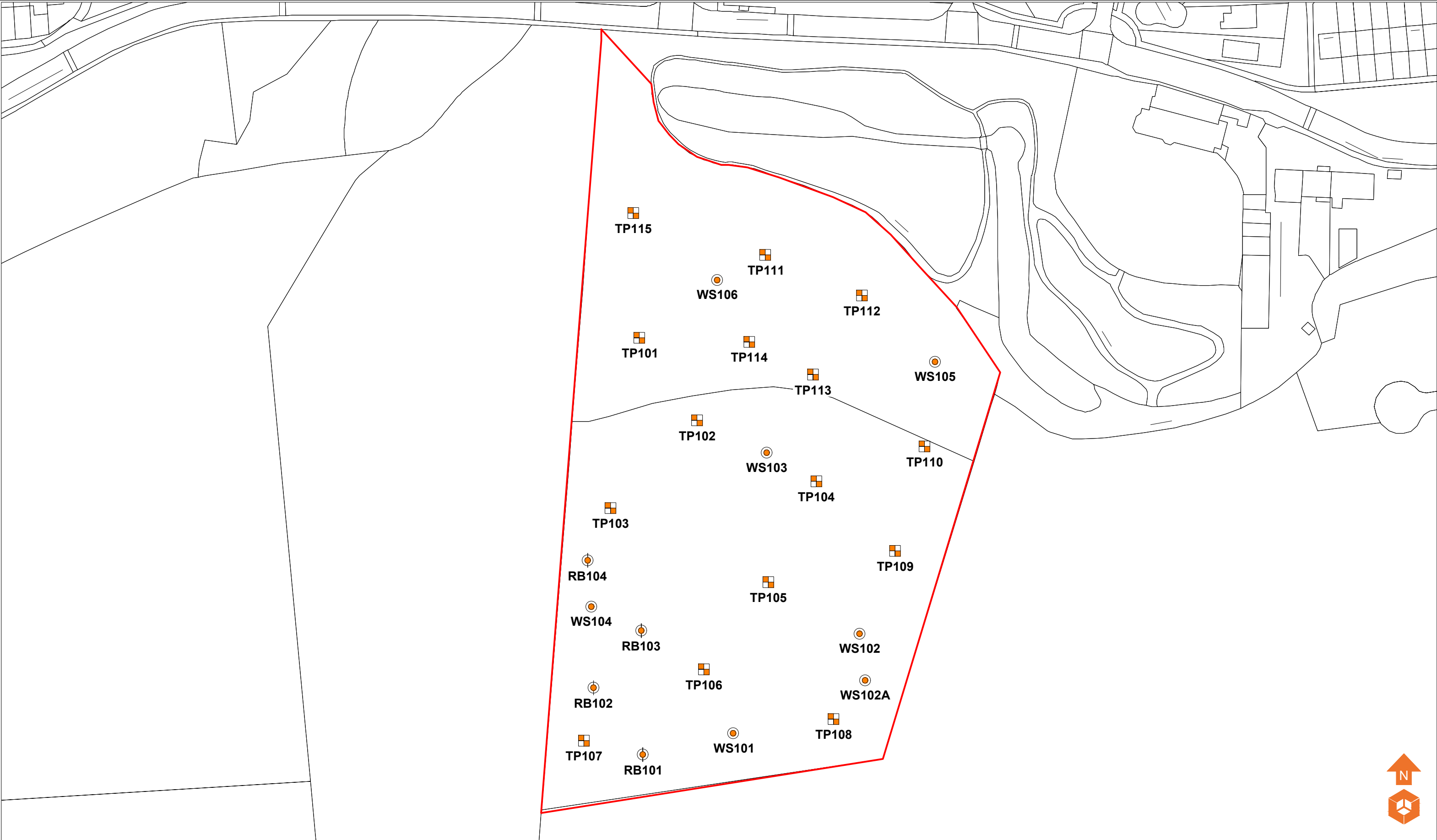
NTS@ A3

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Website: www.e3p.co.uk

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Site Features Soft Ground Tracks	Notes:					Client:	Vistry	Job No:	15-065	Date:	27.10.2021	e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk	
								Drawing No:	004	Scale:	NTS@ A3		
	P1 REVA 27.10.2021 EB RH Phase Issue Date Drawn Checked					Job Title:	Hainsead, Lickers Lane	Drawing Title:	Site Features Plan	The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.			



Location Symbols

-  Approximate Window Sample Probehole Location
-  Approximate Trial Pit Location
-  Approximate Rotary Borehole Location

Notes:

--	--	--	--	--

P1	REVA	18.10.2021	EB	RH
Phase	Issue	Date	Drawn	Checked

Client:

Vistry

Hainsead, Lickers Lane

Job No:

15-065
Drawing No:
005

Date:

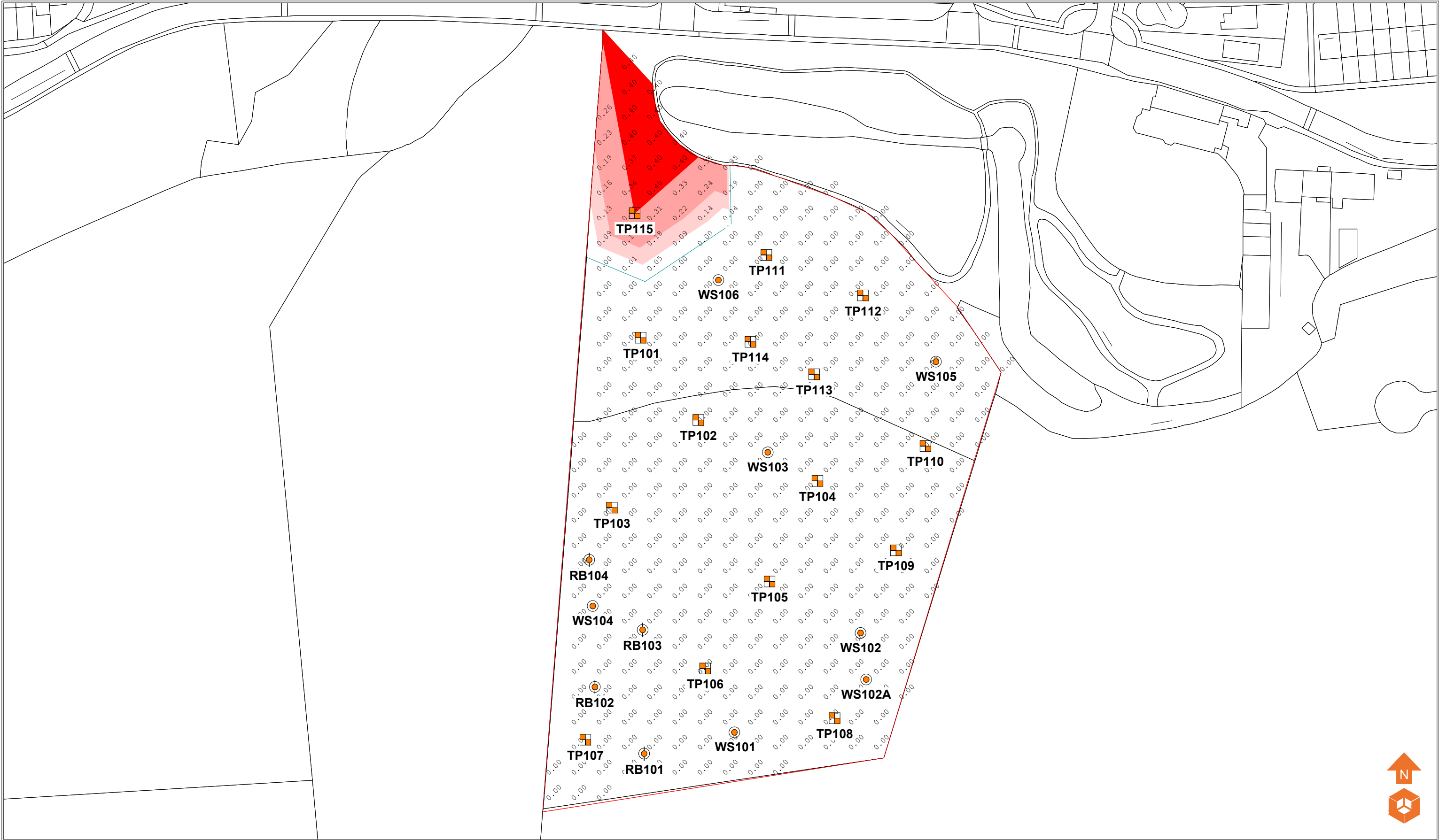
18.10.2021
Scale:
NTS@ A3



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E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

Exploratory Hole Location Plan

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- Location Symbols**
- Approximate Window Sample Probehole Location
 - Approximate Trial Pit Location
 - Approximate Rotary Borehole Location

- Made Ground Depth (m)**
- Made Ground not Identified
 - Depth of Made Ground 0.00 - 0.19m
 - Depth of Made Ground 0.20 - 0.39m
 - Depth of Made Ground >0.40m

Notes:

Client:

Vistry

Job No:
15-065

Drawing No:
006

Date:
03.11.2021

Scale:
NTS@ A3



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Website: www.e3p.co.uk

P1	REVB	03.11.2021	LM	MJ
P1	REVA	20.10.2021	CB	RH
Phase	Issue	Date	Drawn	Checked

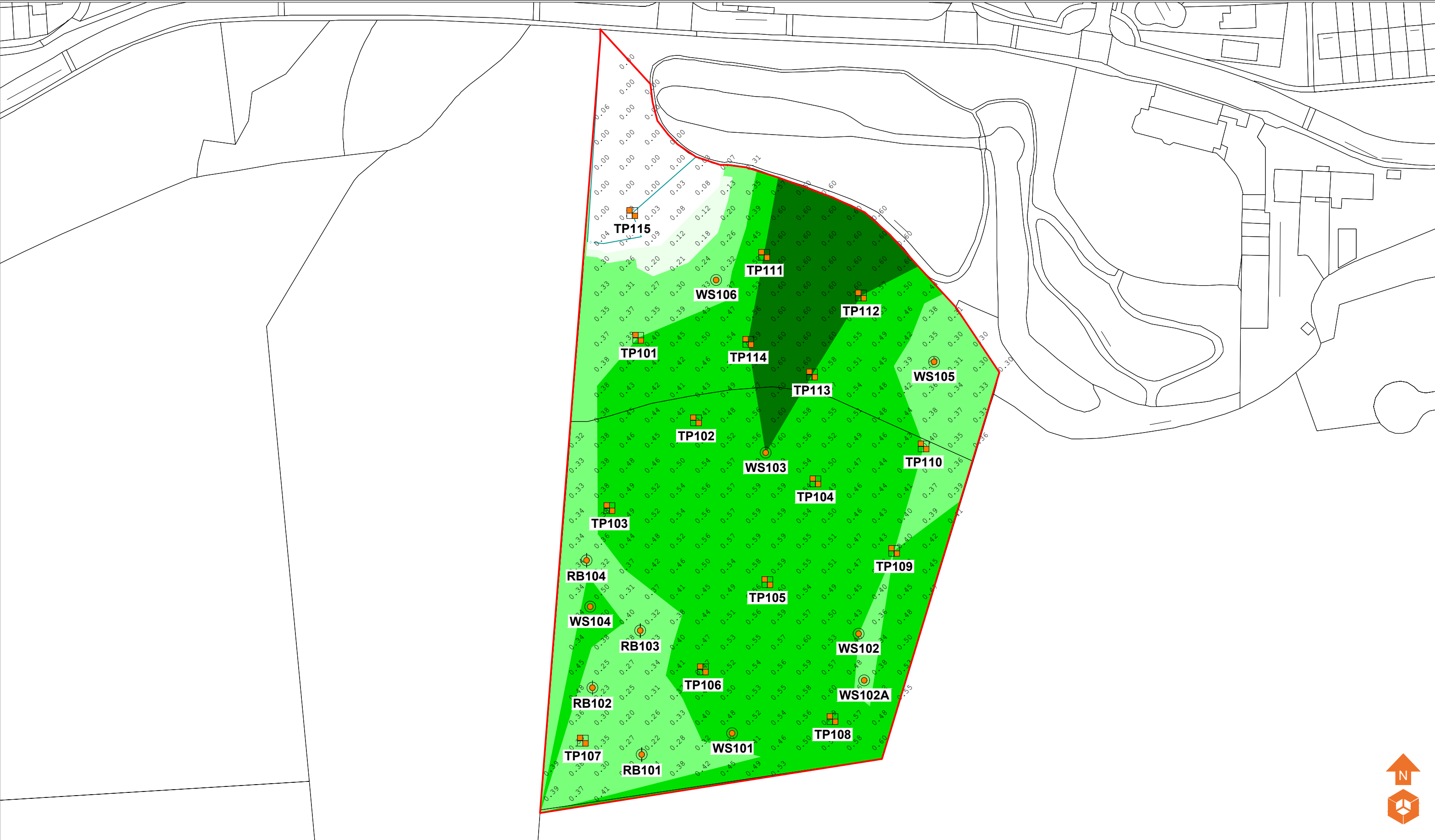
Job Title:

Hainsead,
Lickers Lane

Drawing Title:

Depth of Made Ground Plan

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Location Symbols

- Approximate Window Sample Probehole Location
- Approximate Trial Pit Location
- Approximate Rotary Borehole Location

Topsoil Depth (m)

- Topsoil not Identified
- Depth of Topsoil 0.00 - 0.19m
- Depth of Topsoil 0.20 - 0.39m
- Depth of Topsoil 0.40 - 0.59m
- Depth of Topsoil >0.60m

Notes:

P1	REVA	20.10.2021	CB	RH
Phase	Issue	Date	Drawn	Checked

Client:

Vistry

Job Title:

Hainsead,
Lickers Lane

Job No:

15-065

Drawing No:

007

Date:

20.10.2021

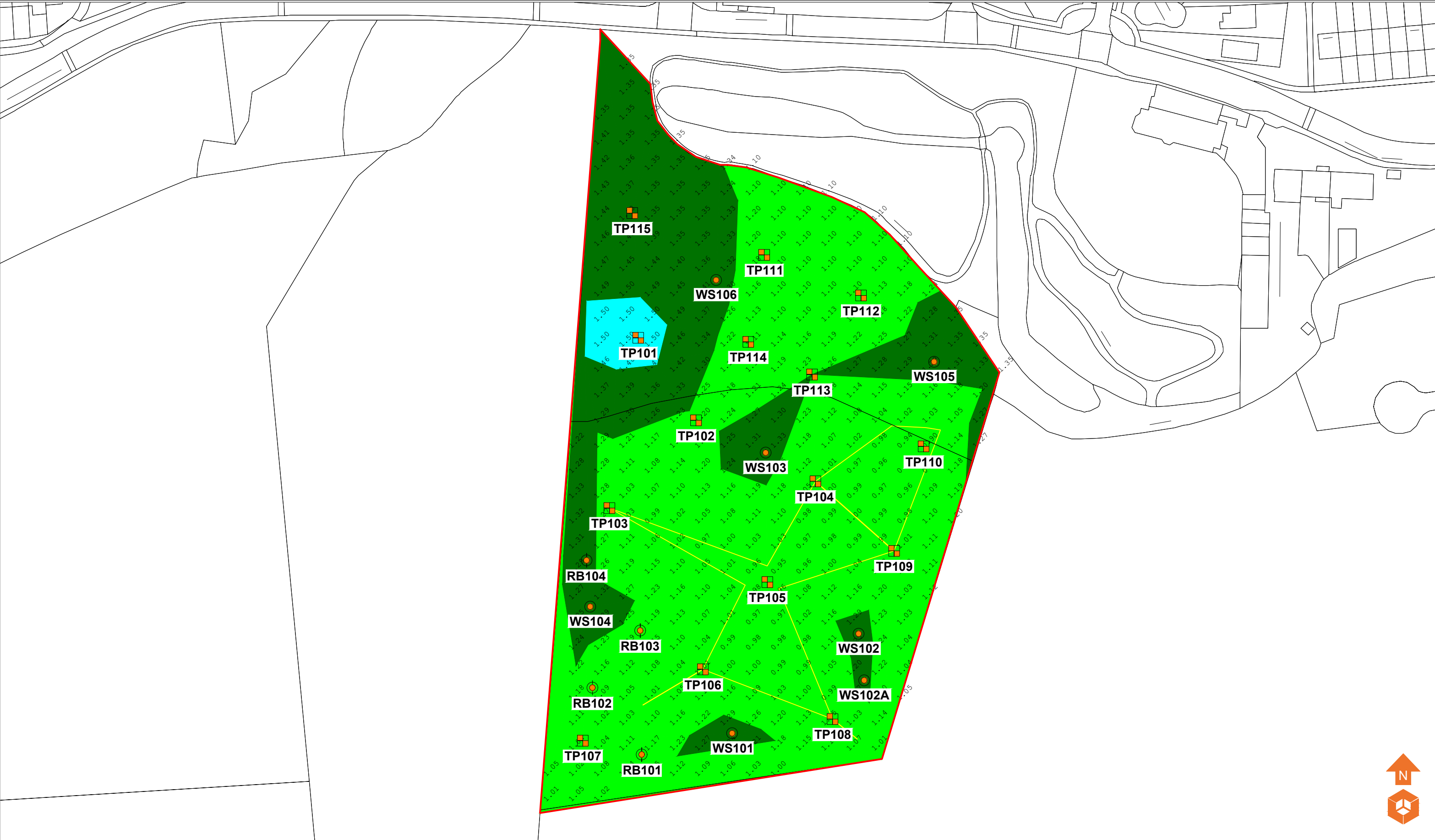
Scale:

NTS@ A3



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Location Symbols

- Approximate Window Sample Probehole Location
- Approximate Trial Pit Location
- Approximate Rotary Borehole Location

Shallow Spread Footings

- Depth to Founding Strata 0.00 - 1.24m
- Depth to Founding Strata 1.25 - 1.49m

Mass Trench Fill Footings

- Depth to Founding Strata 1.50 - 1.74m
- Depth to Founding Strata 1.75 - 1.99m
- Depth to Founding Strata 2.00 - 2.24m

Engineered Footings

- Depth to Founding Strata 2.25 - 2.49m
- Depth to Founding Strata >2.50m

Notes:

P1	REVA	20.10.2021	CB	RH
Phase	Issue	Date	Drawn	Checked

Client:

Vistry

Job Title:

Hainsead,
Lickers Lane

Job No:

15-065

Drawing No:

008

Date:

20.10.2021

Scale:

NTS@ A3

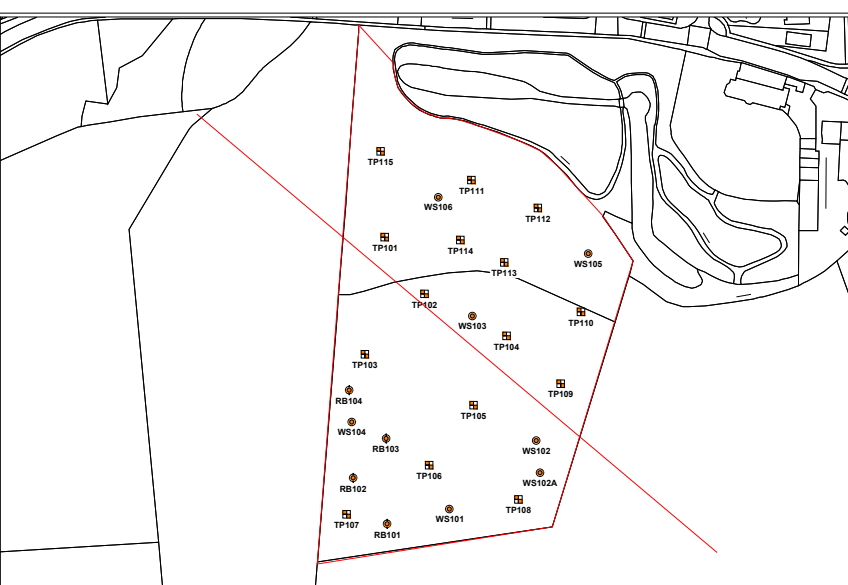
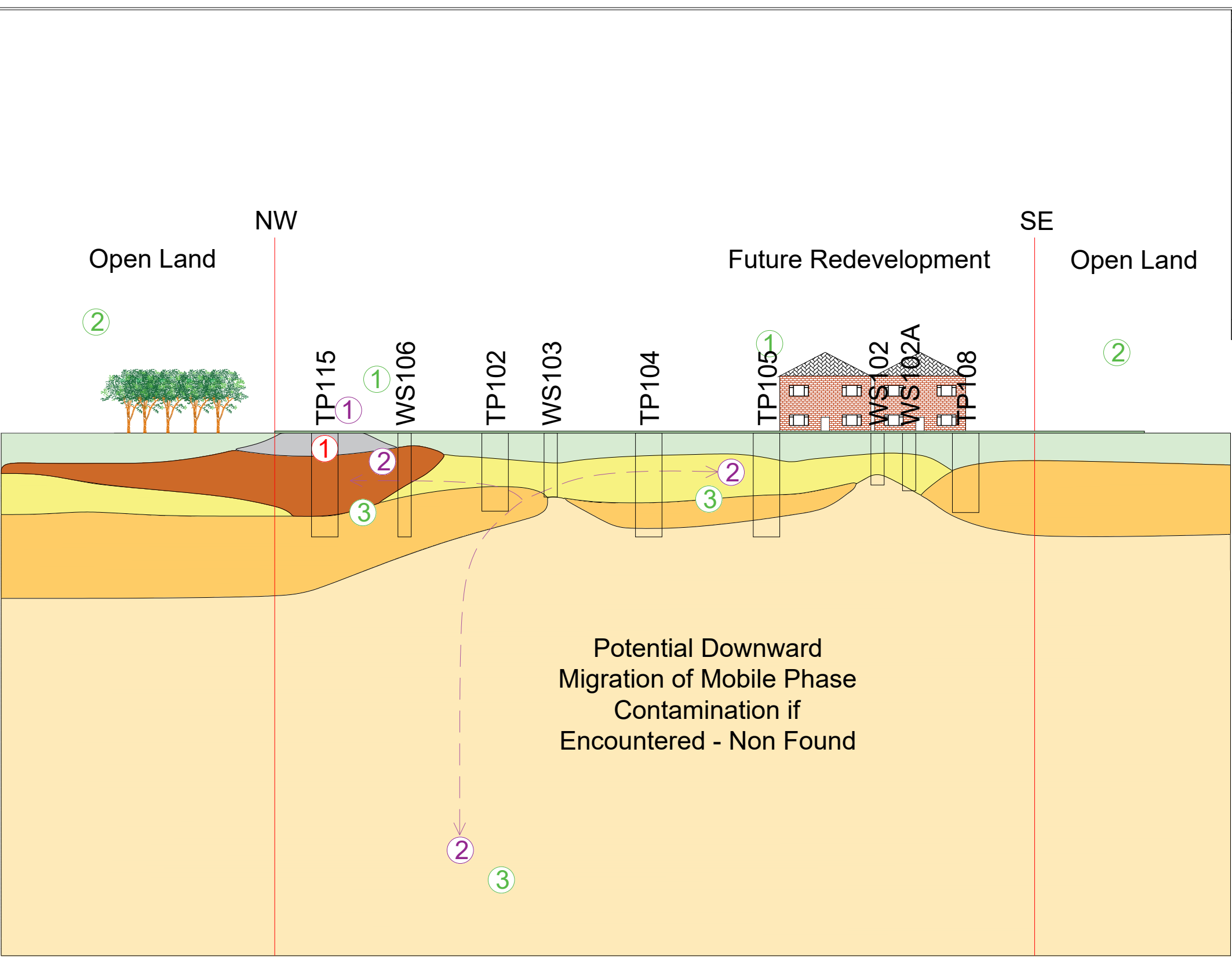
Drawing Title:

Depth to Founding Strata Plan

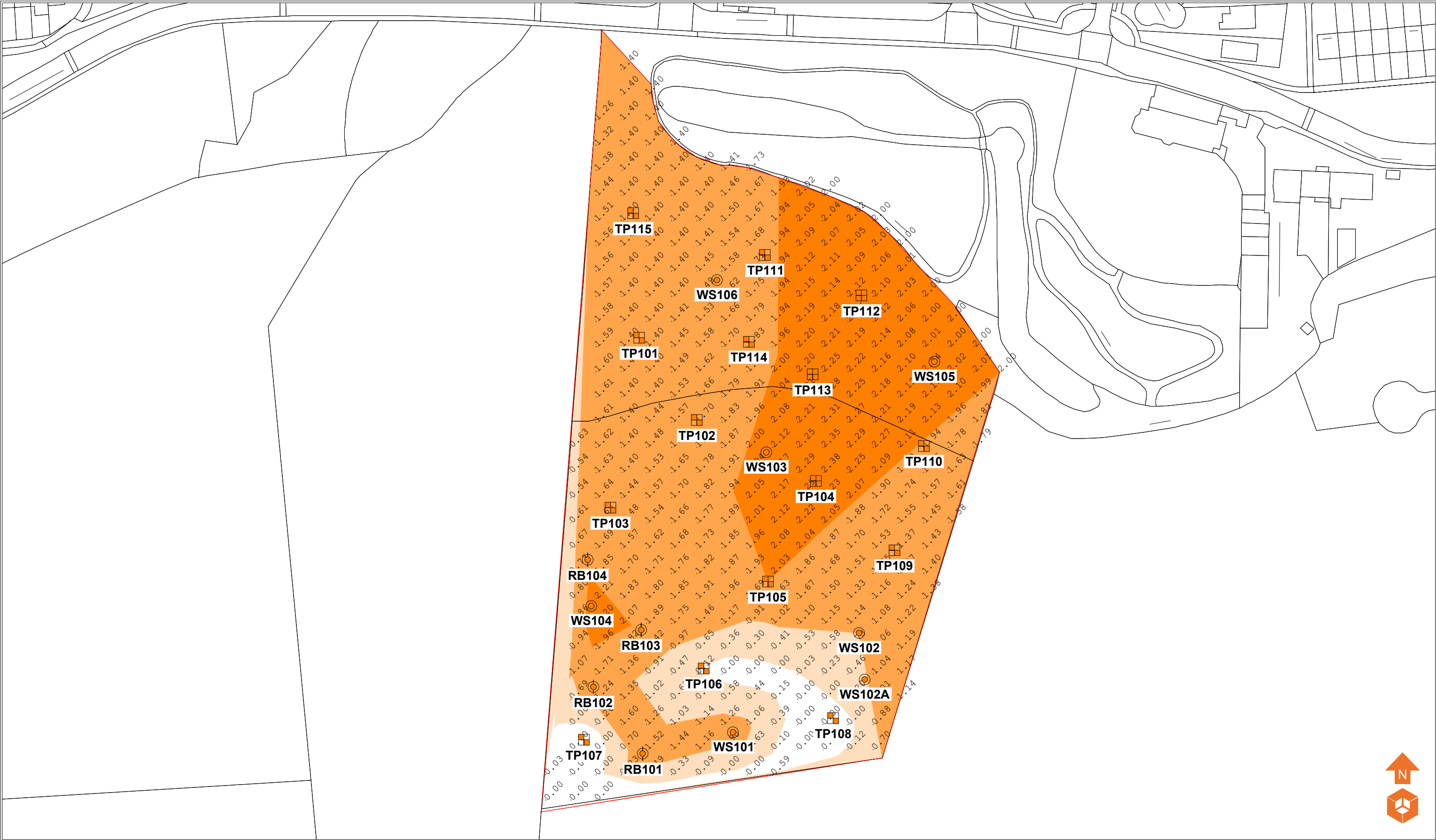


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Geology Key Made Ground Topsoil Clay Sand Gravelly Sand Sandstone Bedrock	Contam Issues 1 PAH	Pathways 1 Soil Ingestion 2 Migration / Vertical / Lateral
---	--	--



- Location Symbols**
- Approximate Window Sample Probehole Location
 - Approximate Trial Pit Location
 - Approximate Rotary Borehole Location

- Depth to Bedrock (m)**
- Bedrock not Identified
 - Depth to Bedrock 0.00 - 0.99m
 - Depth to Bedrock 1.00 - 1.99m
 - Depth to Bedrock >2.00m

Notes:

Client:

Vistry

Job No:

15-065

Date:

03.11.2021

Drawing No:

012

Scale:

NTS@ A3



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Website: www.e3p.co.uk

P1	REVC	03.10.2021	LM	MJ
P1	REVA	20.10.2021	CB	RH
Phase	Issue	Date	Drawn	Checked

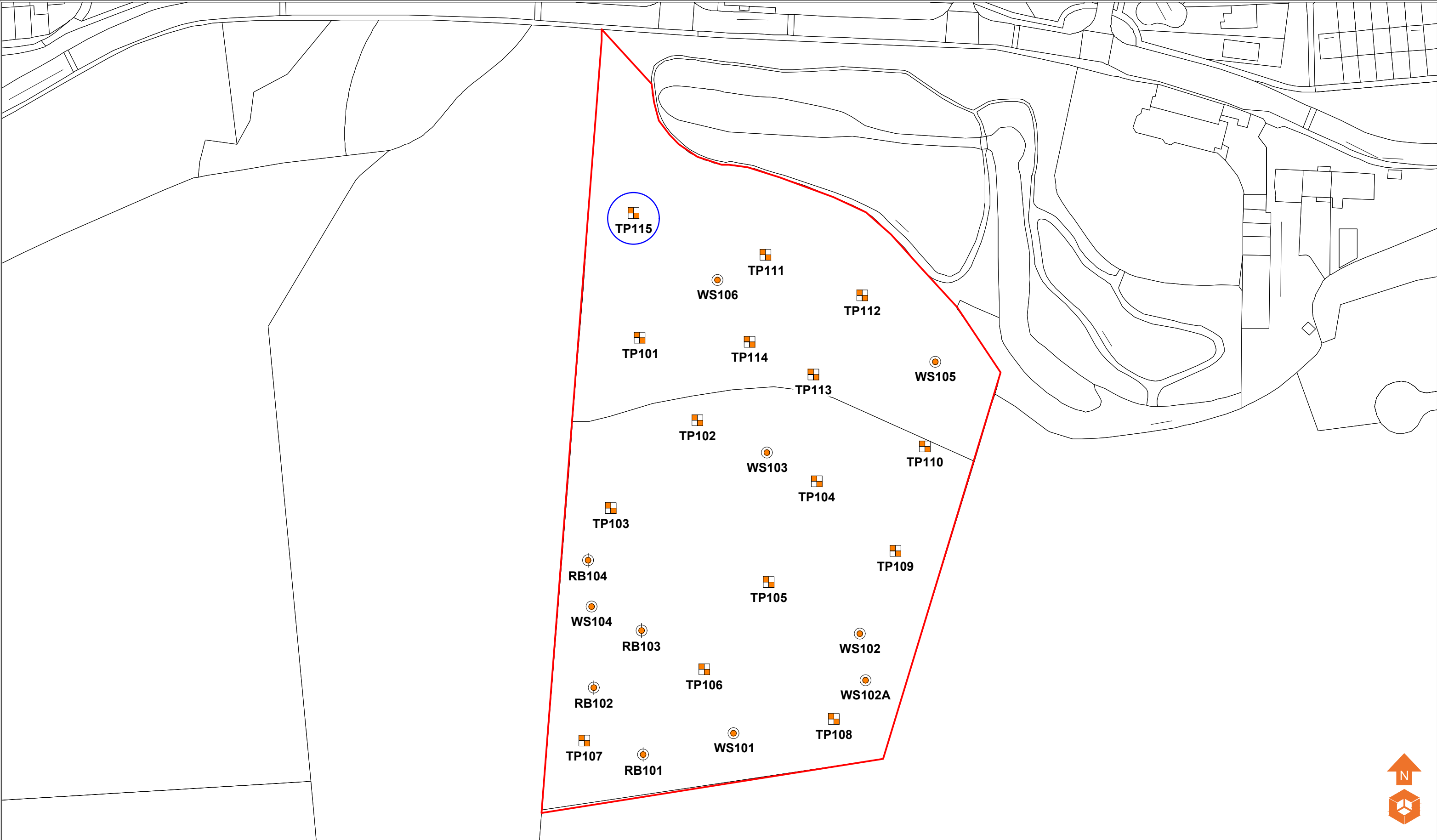
Job Title:

Hainsead,
Lickers Lane

Drawing Title:

Depth to Bedrock Plan

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Location Symbols WS101 Approximate Window Sample Probehole Location TP101 Approximate Trial Pit Location RB101 Approximate Rotary Borehole Location Contamination Issues PAH		Notes:					Client: Vistry		Job No: 15-065		Date: 02.11.2021		e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk														
							Job Title: Hainsead, Lickers Lane		Drawing No: 018		Scale: NTS@ A3																
		<table><tr><td></td><td></td><td></td><td></td><td></td></tr><tr><td>P1</td><td>REVA</td><td>02.11.2021</td><td>EB</td><td>MJ</td></tr><tr><td>Phase</td><td>Issue</td><td>Date</td><td>Drawn</td><td>Checked</td></tr></table>										P1	REVA	02.11.2021	EB	MJ	Phase	Issue	Date	Drawn	Checked			Drawing Title: Contamination Issues Plan		The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.	
P1	REVA	02.11.2021	EB	MJ																							
Phase	Issue	Date	Drawn	Checked																							

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APPENDIX IV

PHOTOGRAPHS

PLATE 1 WESTERN BOUNDARY FACING SOUTH



PLATE 2 CENTRAL SECTOR OF SITE



PLATE 3 NORTHERN SECTOR – ACCESS VIA LICKERS LANE



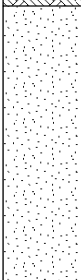
PLATE 4 OVERGROWN NORTHERN SECTOR OF SITE



APPENDIX V

E3P EXPLORATORY HOLE LOGS

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347463.00 - 390416.00 Level:	Date 23/09/2021
Location: Whiston		Dimensions (m): 1.80 Depth 1.80	Scale 1:30
Client: Vistry Partnerships North West			Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
							Orange brown fine to coarse SAND.	1
	1.60	ES		1.50			Orange brown gravelly fine to medium SAND. Gravel is fine to coarse angular to sub-round sandstone.	
				1.80			End of Pit at 1.80m	2
								3
								4

Trial Pit Photographs



Trial Pit 101

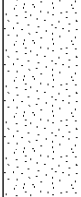


Trial Pit 101 Spoil

Remarks: 1. Trial pit completed at 1.80 m bgl.

Stability: Stable.

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347470.00 - 390393.00 Level:	Date 23/09/2021
Location: Whiston	Dimensions (m): Depth 1.80		Scale 1:30
Client: Vistry Partnerships North West			Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES		0.40			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
				1.20			Orange brown fine to coarse SAND.	1
				1.40			Yellow brown gravelly SAND. Gravel is fine to coarse angular to sub-round sandstone.	
				1.80			Orange brown gravelly SAND. Gravel is fine to coarse angular to sub-round sandstone.	
							End of Pit at 1.80m	2
								3
								4

Trial Pit Photographs



Trial Pit 102

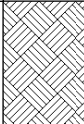


Trial Pit 102 Spoil

Remarks: 1. Trial pit completed at 1.80 m bgl.

Stability: Stable.

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347457.00 - 390355.00 Level:	Date 23/09/2021
Location: Whiston	Dimensions (m): Depth 1.70		Scale 1:30
Client: Vistry Partnerships North West	0.70 1.80		Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.90	ES		0.50			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
				1.20			Orange brown fine to coarse SAND.	1
				1.40			Orange brown gravelly SAND. Gravel is fine to coarse angular to sub-angular sandstone.	
				1.70			Orange brown SANDSTONE.	
							End of Pit at 1.70m	2
								3
								4

Trial Pit Photographs



Trial Pit 103

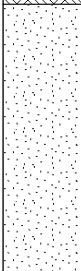
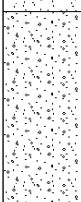


Trial Pit 103 Spoil

Remarks: 1. Trial pit completed at 1.70 m bgl. 2. Weathered SANDSTONE bedrock circa 1.40 m bgl.

Stability: Stable.

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347511.00 - 390378.00 Level:	Date 23/09/2021
Location: Whiston		Dimensions (m): 0.70 x 1.80	Scale 1:30
Client: Vistry Partnerships North West		Depth 2.60	Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES					Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
				0.50			Yellow brown fine to coarse SAND.	1
				1.60			Orange brown gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-round sandstone.	2
				2.40			Yellow brown SANDSTONE.	
				2.60			End of Pit at 2.60m	3
								4

Trial Pit Photographs



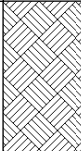
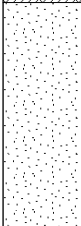
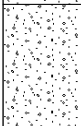
Trial Pit 104

Trial Pit 104 Spoil

Remarks: 1. Trial pit completed at 2.60 m bgl. 2. 2. Weathered SANDSTONE bedrock circa 2.40 m bgl.

Stability: Stable.

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347506.00 - 390349.00 Level:	Date 23/09/2021
Location: Whiston	Dimensions (m): 1.80 0.70		Scale 1:30
Client: Vistry Partnerships North West	Depth 2.30		Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.60			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
				1.50			Orange brown fine to coarse SAND.	1
	1.90 2.00	ES Bulk		2.00			Orange brown gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-round sandstone.	2
				2.30			Yellow SANDSTONE.	
							End of Pit at 2.30m	
								3
								4

Trial Pit Photographs



Trial Pit 105

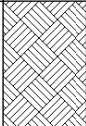
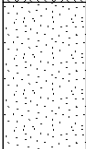
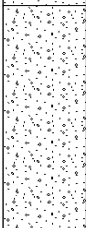


Trial Pit 105 Spoil

Remarks: 1. Trial pit completed at 2.30 m bgl. 2. Weathered SANDSTONE bedrock circa 2.00 m bgl.

Stability: Stable.

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347474.00 - 390336.00 Level:	Date 23/09/2021
Location: Whiston		Dimensions (m): 1.80 Depth 2.30	Scale 1:30 Logged H.Morgan
Client: Vistry Partnerships North West			

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES		0.50			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
				1.10			Orange brown fine to coarse SAND.	1
				2.00			Light brown slightly gravelly SAND. Gravel is fine to coarse angular to sub-round sandstone.	2
				2.30			Light brown gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-round sandstone.	3
							End of Pit at 2.30m	4

Trial Pit Photographs



Trial Pit 106

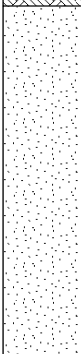


Trial Pit 106 Spoil

Remarks: 1. Trial pit completed at 2.30 m bgl.

Stability: Stable.

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347448.00 - 390301.00 Level:	Date 23/09/2021
Location: Whiston		Dimensions (m): 1.80 0.70	Scale 1:30
Client: Vistry Partnerships North West		Depth 1.80	Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
	1.50	ES		1.80			Orange brown fine to coarse SAND.	1
							End of Pit at 1.80m	2
								3
								4

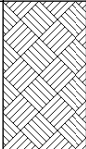
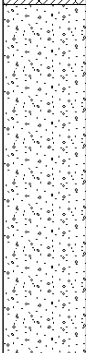
Trial Pit Photographs



Remarks: 1. Trial pit completed at 1.80 m bgl.

Stability: Stable.

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347539.00 - 390316.00 Level:	Date 23/09/2021
Location: Whiston		Dimensions (m): 1.80 Depth 2.00	Scale 1:30
Client: Vistry Partnerships North West			Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES		0.60			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
				2.00			Orange brown slightly gravelly fine to coarse SAND. Gravel is fine to medium angular to sub-round sandstone.	1
							End of Pit at 2.00m	2
								3
								4

Trial Pit Photographs



Trial Pit 108

Trial Pit 108 Spoil

Remarks: 1. Trial pit completed at 2.00 m bgl.

Stability: Stable.



Trial Pit Log

TrialPit No
TP109
Sheet 1 of 1

Project Name: Lickers Lane

Project No.
15065

Co-ords: 347560.00 - 390365.00
Level:

Date
23/09/2021

Location: Whiston

Dimensions (m): 1.80

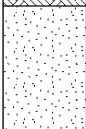
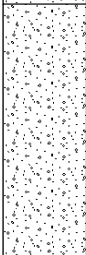
Depth
1.90

0.70

Scale
1:30

Logged
H.Morgan

Client: Vistry Partnerships North West

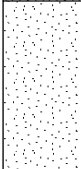
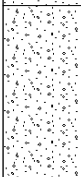
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
				0.90			Orange brown fine to coarse SAND.	
	1.80	ES		1.90			Light brown slightly gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-round sandstone.	1
							End of Pit at 1.90m	2
								3
								4

Remarks: 1. Trial pit completed at 1.90 m bgl.

Stability: Stable.



Project Name: Lickers Lane	Project No. 15065	Co-ords: 347573.00 - 390412.00 Level:	Date 23/09/2021
Location: Whiston		Dimensions (m): 0.70 1.80	Scale 1:30
Client: Vistry Partnerships North West		Depth 1.80	Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES		0.40			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
				1.10			Light brown fine to medium SAND.	1
				1.80			Orange brown gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-round sandstone.	
							End of Pit at 1.80m	2
								3
								4

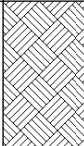
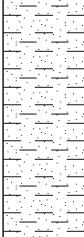
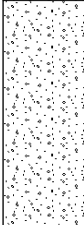
Trial Pit Photographs



Remarks: 1. Trial pit completed at 1.80 m bgl.

Stability: Stable.

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347498.00 - 390478.00 Level:	Date 24/09/2021
Location: Whiston	Dimensions (m): 1.80 0.70		Scale 1:30
Client: Vistry Partnerships North West	Depth 2.50		Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.60			Black slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
	0.80	HVP	75				Firm medium strength brown slightly gravelly sandy CLAY. Gravel is fine to medium sub-angular to round sandstone and mudstone. (Becoming stiff high strength at 1.20m bgl).	1
	1.00	Tub						
	1.20	HVP	92					
	1.50	Tub						
	1.80	ES		1.60			Orange brown gravelly fine to medium SAND. Gravel is fine to coarse angular to sub-round sandstone.	2
	2.00	Bulk						
				2.50			End of Pit at 2.50m	3
								4

Trial Pit Photographs



Trial Pit 111

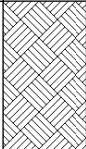
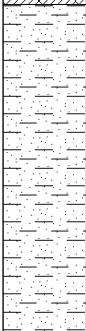
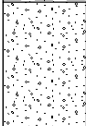


Trial Pit 111 Spoil

Remarks: 1. Trial pit completed at 2.50 m bgl.

Stability: Stable.

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347532.00 - 390471.00 Level:	Date 24/09/2021
Location: Whiston		Dimensions (m): 1.80 Depth 2.40	Scale 1:30
Client: Vistry Partnerships North West			Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES		0.60			Black slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
	1.20 1.20	Tub HVP	133				Firm medium strength brown slightly gravelly sandy CLAY. Gravel is fine to medium sub-angular to round sandstone and mudstone. (Becoming stiff high strength at 1.20m bgl).	1
	1.60	HVP	95					
	1.80 1.90	Tub HVP	89	1.90			Orange brown gravelly fine to medium SAND. Gravel is fine to coarse angular to sub round sandstone.	2
				2.40			End of Pit at 2.40m	3
								4

Trial Pit Photographs



Trial Pit 112

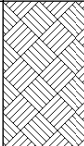
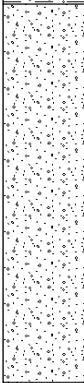


Trial Pit 112 Spoil

Remarks: 1. Trial pit completed at 2.40 m bgl.

Stability: Stable.

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347521.00 - 390436.00 Level:	Date 24/09/2021
Location: Whiston	Dimensions (m): 1.80 0.70		Scale 1:30
Client: Vistry Partnerships North West	Depth 2.40		Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.60			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
	0.70	HVP	140				Stiff high strength brown sandy gravelly CLAY. Gravel is fine to medium angular to sub-round mudstone and sandstone.	
	0.90	HVP	135	0.90			Orange brown gravelly SAND. Gravel is fine to coarse angular to sub-rounded of sandstone.	1
	1.90	ES						2
				2.40			End of Pit at 2.40m	3
								4

Trial Pit Photographs



Trial Pit 113

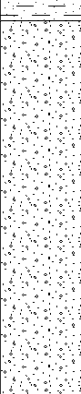


Trial Pit 113 Spoil

Remarks: 1. Trial pit completed at 2.40 m bgl.

Stability: Stable.

Project Name: Lickers Lane	Project No. 15065	Co-ords: 347486.00 - 390437.00 Level:	Date 24/09/2021
Location: Whiston	Dimensions (m): 1.80 0.70		Scale 1:30
Client: Vistry Partnerships North West	Depth 2.20		Logged H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.40	ES		0.60 0.70			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
							Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse angular to round sandstone and mudstone. Orange brown slightly gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-round sandstone.	1 2 3 4
				2.20			End of Pit at 2.20m	

Trial Pit Photographs



Trial Pit 114

Trial Pit 114 Spoil

Remarks: 1. Trial pit completed at 2.20 m bgl.

Stability: Stable.

Project Name: Lickers Lane

Project No.
15065

Co-ords: 347467.00 - 390498.00
Level:

Date
25/09/2021

Location: Whiston

Dimensions (m): 1.80

Scale
1:30

Client: Vistry Partnerships North West

Depth
2.40

0.70

Logged
H.Morgan

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES		0.40			MADE GROUND: Black sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded of brick mudstone sandstone and ceramics.	
	0.50	HVP	71				Firm medium strength brown sandy gravelly CLAY. Gravel is fine to medium subangular to rounded of sandstone.	
	1.10	HVP	54					1
	1.50	Tub HVP	106					
	1.60	HVP	124					
	1.90	HVP		2.00			Orange brown gravelly SAND. Gravel is fine to medium angular to subrounded of sandstone.	2
				2.40			End of Pit at 2.40m	
								3
								4

Trial Pit Photographs



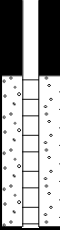
Trial Pit 115

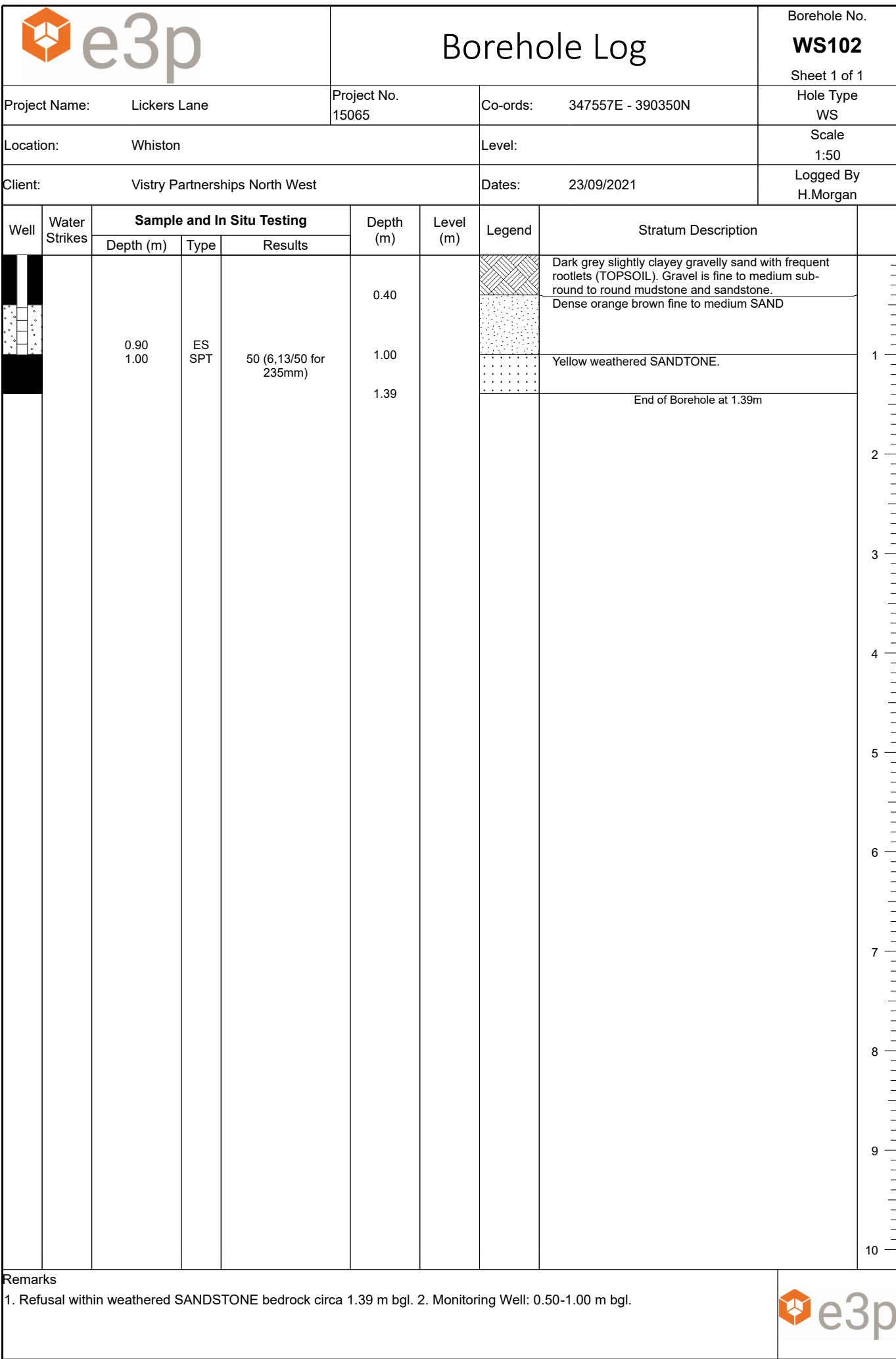


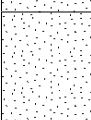
Trial Pit 115 Spoil

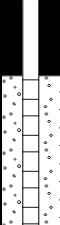
Remarks: 1. Trial pit completed at 2.40 m bgl.

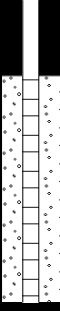
Stability: Stable.

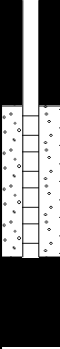
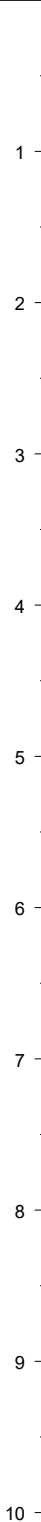
				Borehole Log				Borehole No. WS101 Sheet 1 of 1	
Project Name: Lickers Lane				Project No. 15065		Co-ords: 347487E - 390311N		Hole Type WS	
Location: Whiston				Level:		Scale 1:50			
Client: Vistry Partnerships North West				Dates: 23/09/2021		Logged By H.Morgan			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.50		 Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	1	
		1.00	SPT	N=35 (3,4/5,7,8,15)	1.10		 Orange brown fine to medium SAND.		
		1.50	SPT	50 (25 for 105mm/50 for 85mm)	1.50		 Medium dense yellow brown fine to medium SAND.		
					1.69		 Yellow weathered SANDSTONE.		
								End of Borehole at 1.69m	2
								3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	
Remarks 1. Refusal within weathered SANDSTONE bedrock circa 1.69 m bgl. 2. Monitoring Well: 0.50-1.50 m bgl.									

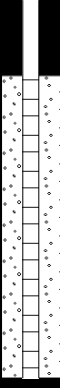
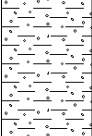
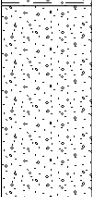


					Borehole Log			Borehole No. WS102a Sheet 1 of 1	
Project Name: Lickers Lane					Project No. 15065		Co-ords: 347557E - 390350N		Hole Type WS
Location: Whiston					Level:		Scale 1:50		
Client: Vistry Partnerships North West					Dates: 23/09/2021		Logged By H.Morgan		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.30			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	1
					0.70			Orange brown fine to medium SAND	
					1.45			Yellow brown fine to medium SAND	
								End of Borehole at 1.45m	3
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Terminated at 1.45 m bgl within weathered SANDSTONE bedrock.									

				Borehole Log				Borehole No. WS103 Sheet 1 of 1	
Project Name: Lickers Lane				Project No. 15065		Co-ords: 347488E - 390395N		Hole Type WS	
Location: Whiston				Level:		Scale 1:50			
Client: Vistry Partnerships North West				Dates: 23/09/2021		Logged By H.Morgan			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.90 1.00	ES SPT	28 (25 for 105mm/28 for 160mm)	0.60 1.20 1.70			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	1
								Orange brown fine to medium SAND	
								Dense yellow brown fine to medium SAND	
								End of Borehole at 1.70m	
Remarks 1. Terminated at 1.70 m bgl within weathered SANDSTONE bedrock. 2. Monitoring Well: 0.50-1.5 m bgl.									
									

				Borehole Log				Borehole No. WS104 Sheet 1 of 1	
Project Name: Lickers Lane				Project No. 15065		Co-ords: 347448E - 390352N		Hole Type WS	
Location: Whiston						Level:		Scale 1:50	
Client: Vistry Partnerships North West						Dates: 23/09/2021		Logged By H.Morgan	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES					Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	1
					0.60			Brown slightly clayey fine to medium SAND	
	1.00	SPT	N=11 (2,2/2,2,3,4)	1.20			Medium dense yellow brown fine to coarse SAND		
	2.00	SPT	50 (25 for 115mm/50 for 49mm)	2.00 2.16			Yellow weathered SANDSTONE.	2	
								End of Borehole at 2.16m	3
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Refusal within weathered SANDSTONE bedrock circa 2.16 m bgl. 2. Monitoring Well: 0.50-2.00 m bgl.									

				Borehole Log				Borehole No. WS105 Sheet 1 of 1	
Project Name: Lickers Lane				Project No. 15065		Co-ords: 347569E - 390462N		Hole Type WS	
Location: Whiston				Level:		Scale 1:50			
Client: Vistry Partnerships North West				Dates: 23/09/2021		Logged By H.Morgan			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	
					1.00			Brown gravelly fine to coarse SAND. Gravel is fine to medium angular to sub-round sandstone.	
	0.90	ES SPT	N=24 (4,6/7,6,5,6)					Very stiff, high strength brown sandy gravelly CLAY. Gravel is fine to medium sub-angular to round mudstone and sandstone.	
	1.00								
					1.50				
					2.00			Yellow weathered SANDSTONE.	2
		2.00	SPT	50 (25 for 115mm/50 for 180mm)	2.29			End of Borehole at 2.29m	
Remarks 1. Refusal within weathered SANDSTONE bedrock circa 2.29 m bgl. 2. Monitoring Well: 0.70-1.70 m bgl.									

				Borehole Log				Borehole No. WS106 Sheet 1 of 1	
Project Name: Lickers Lane				Project No. 15065		Co-ords: 347489E - 390480N		Hole Type WS	
Location: Whiston						Level:		Scale 1:50	
Client: Vistry Partnerships North West						Dates: 23/09/2021		Logged By H.Morgan	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.30		 Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.	1	
		1.00	SPT	N=18 (2,3/4,5,4,5)	1.30		 Stiff high strength brown sandy gravelly CLAY. Gravel is fine to medium angular to sub-round mudstone, coal and sandstone		
		2.00	SPT	50 (7,10/50 for 255mm)	2.60		 Medium dense yellow brown gravelly fine to medium SAND. Gravel is fine to medium angular to sub-round sandstone. (Becoming Dense circa 2.00 m bgl)	2	
							End of Borehole at 2.60m	3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	
Remarks 1. Terminated at 2.60 m bgl within weathered SANDSTONE bedrock. 2. Monitoring Well: 0.50-2.50 m bgl.									

					Borehole Log			Borehole No. RB101	
Project Name: Lickers Lane					Project No. 15065		Co-ords: 347453E - 390300N		Sheet 1 of 4
Location: Whiston					Level:			Hole Type BH	
Client: Vistry Partnerships North West					Dates: 26/09/2021			Scale 1:50	
Logged By H.Morgan									

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone. Orange brown fine to coarse SAND.	1
					1.60			Yellow brown SANDSTONE.	2
					3.50			Yellow SANDSTONE with infrequent grey and red bands.	3
									4
									5
									6
									7
									8
									9
									10

Remarks 1. Complete 40.00 m bgl.								
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Borehole Log

Borehole No.

RB101

Sheet 2 of 4

Project Name: Lickers Lane

Project No.
15065

Co-ords: 347453E - 390300N

Hole Type
BH

Location: Whiston

Level:

Scale
1:50

Client: Vistry Partnerships North West

Dates: 26/09/2021

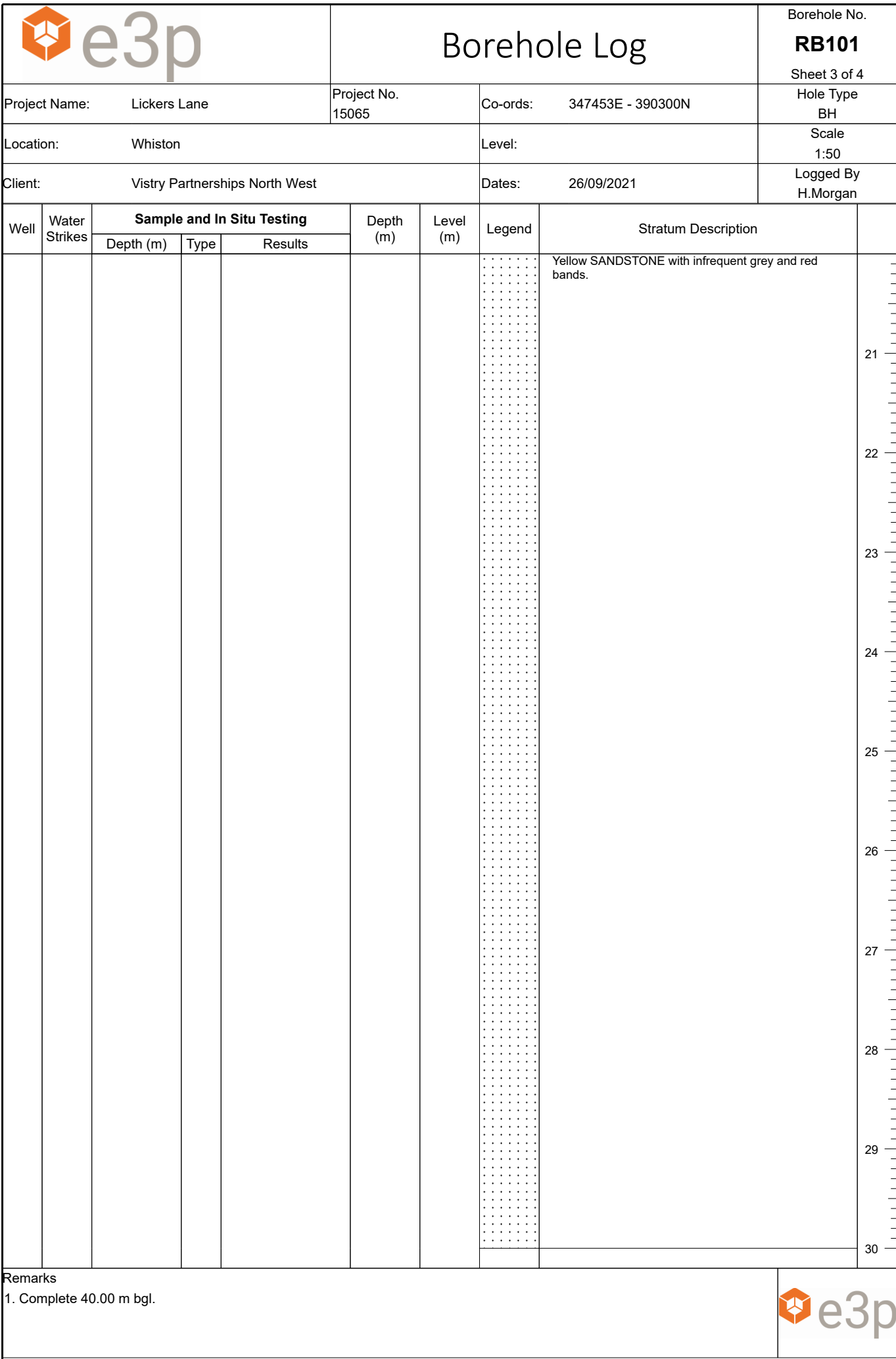
Logged By
H.Morgan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Yellow SANDSTONE with infrequent grey and red bands.	11
									12
									13
									14
									15
									16
									17
									18
									19
									20

Remarks

1. Complete 40.00 m bgl.







Sheet 4 of 4

Hole Type
BH

Scale
1:50

Logged By
H.Morgan

Remarks	
1. Complete 40.00 m bgl.	



Borehole Log

Borehole No.

RB102

Sheet 1 of 4

Project Name: Lickers Lane

Project No.
15065

Co-ords: 347448E - 390321N

Hole Type
BH

Location: Whiston

Level:

Scale
1:50

Client: Vistry Partnerships North West

Dates: 27/09/2021

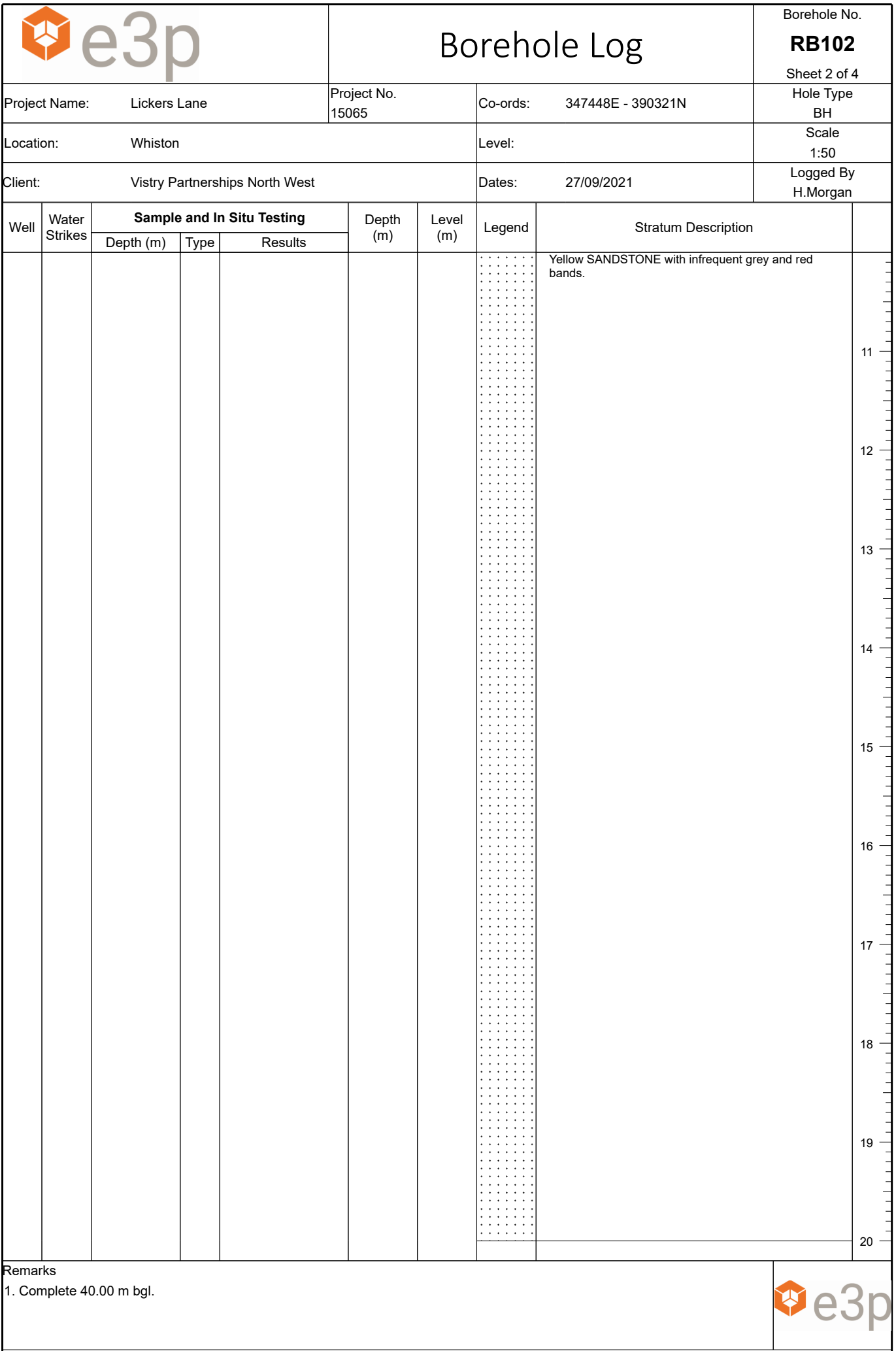
Logged By
H.Morgan

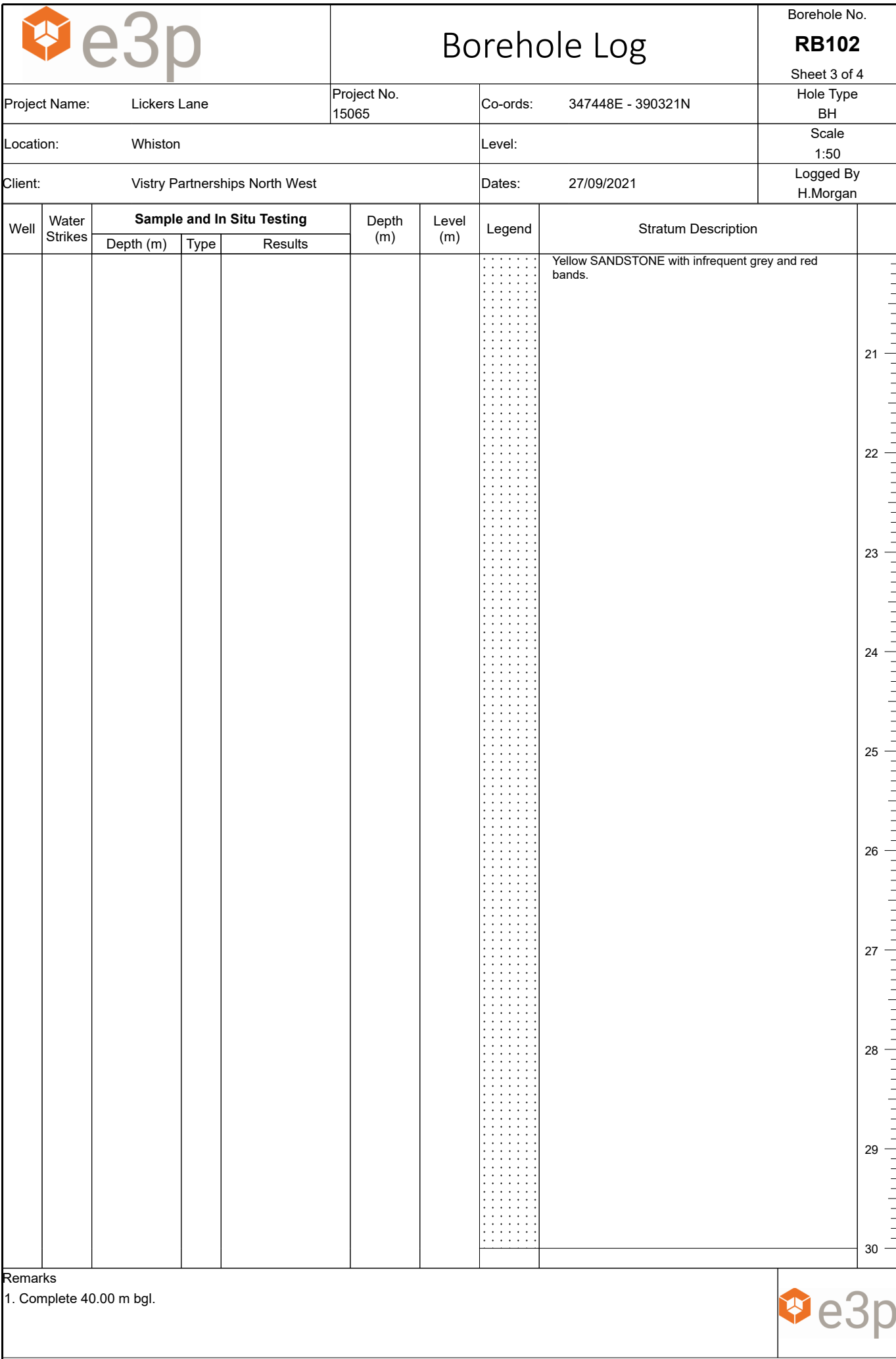
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone. Compact orange brown fine to coarse SAND.	1
					1.60			Yellow SANDSTONE.	2
					3.10			Yellow SANDSTONE with infrequent grey and red bands.	3
									4
									5
									6
									7
									8
									9
									10

Remarks

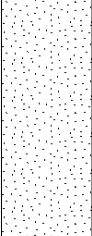
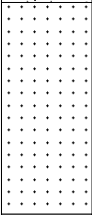
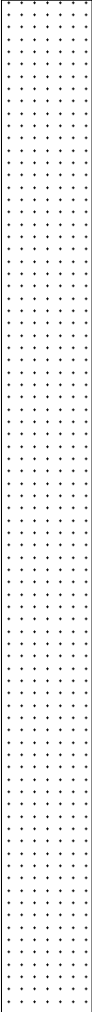
1. Complete 40.00 m bgl.

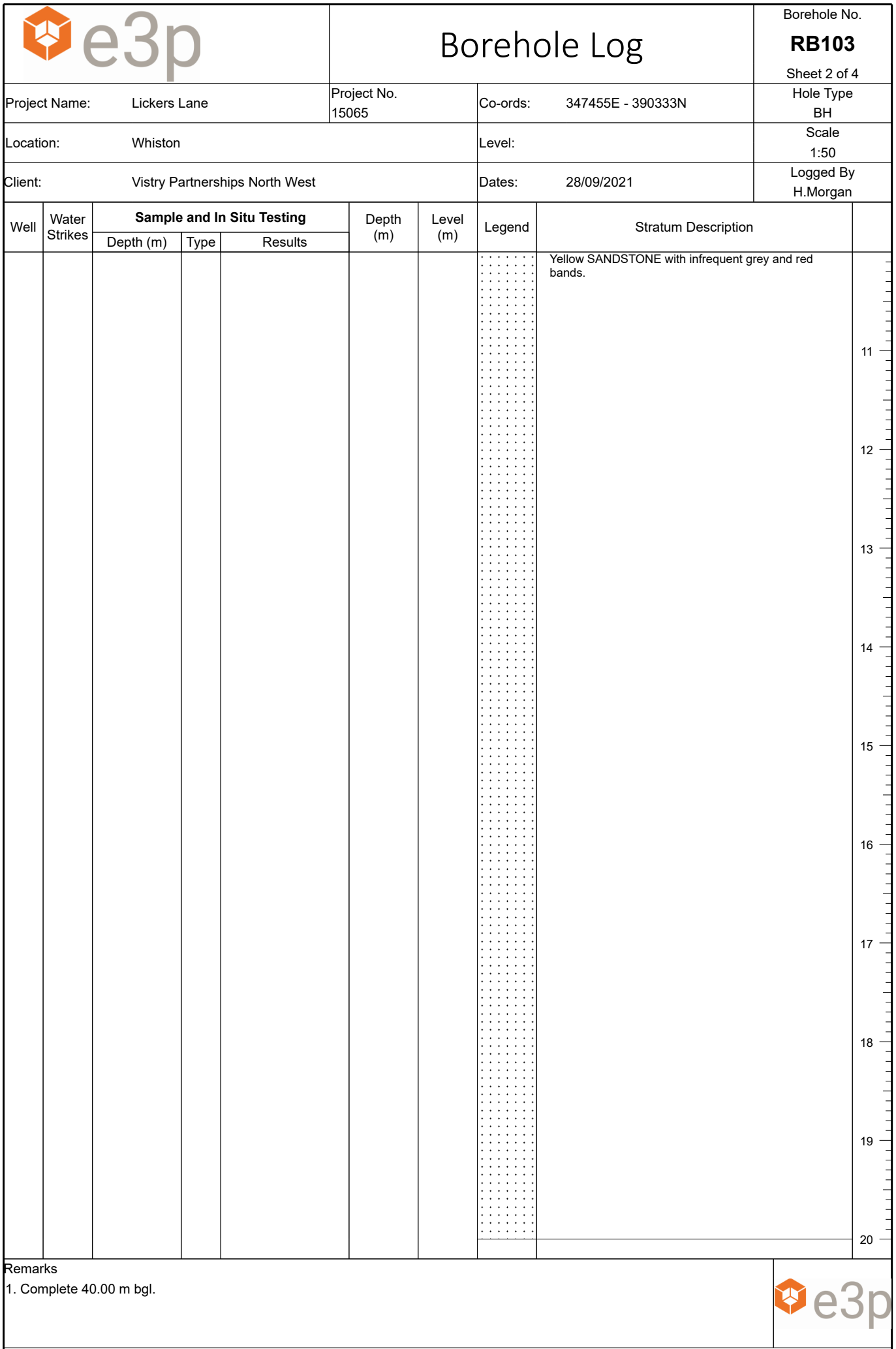


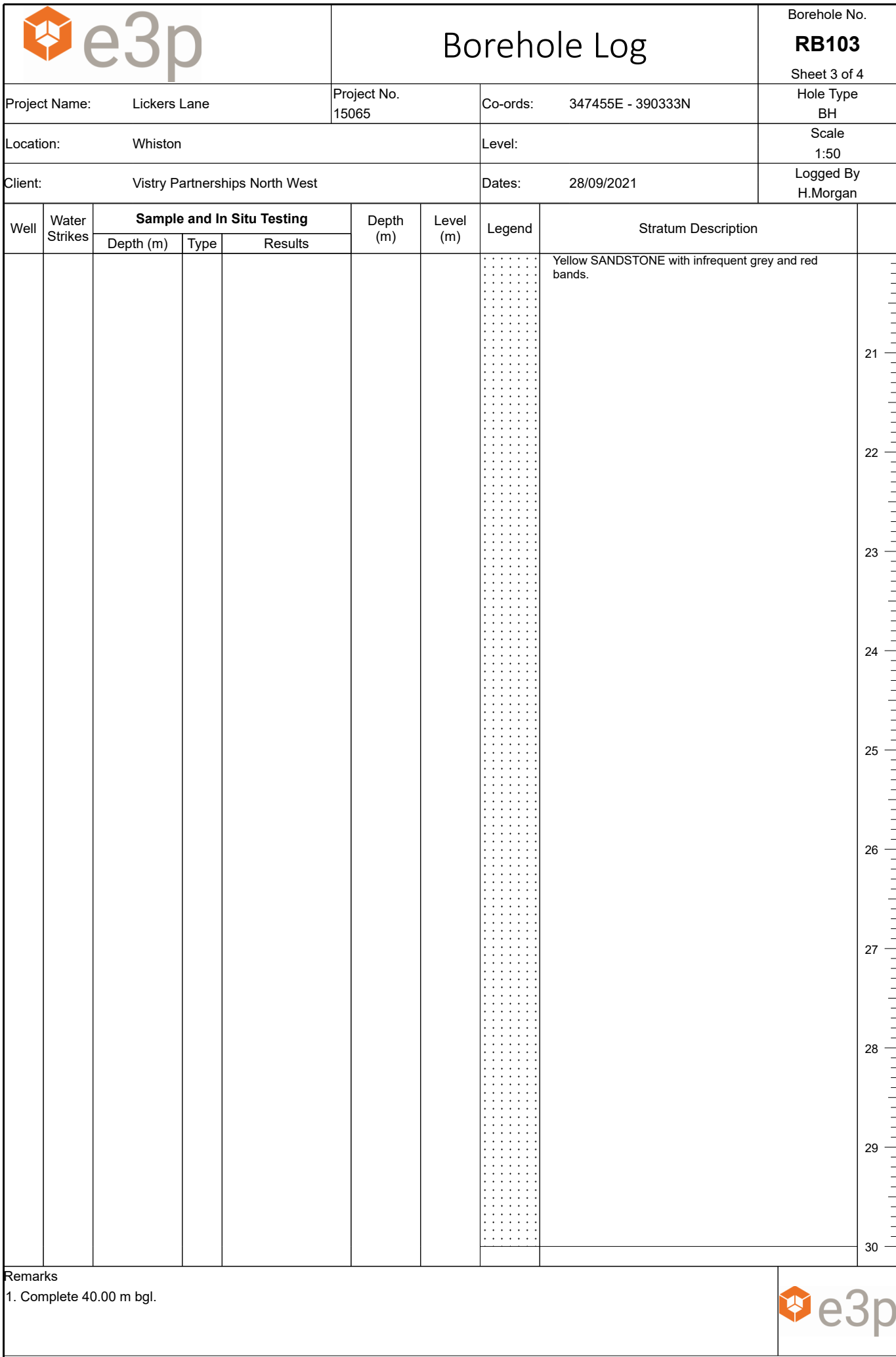




					Borehole Log			Borehole No. RB102 Sheet 4 of 4	
Project Name: Lickers Lane					Project No. 15065		Co-ords: 347448E - 390321N		Hole Type BH
Location: Whiston					Level:		Scale 1:50		Logged By H.Morgan
Client: Vistry Partnerships North West					Dates: 27/09/2021				
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Yellow SANDSTONE with infrequent grey and red bands.	
									31
									32
									33
									34
									35
									36
									37
									38
									39
					40.00			End of Borehole at 40.00m	40
Remarks 1. Complete 40.00 m bgl.									

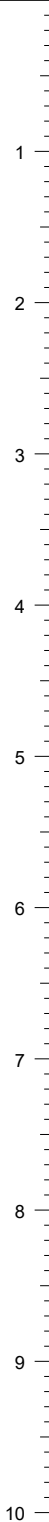
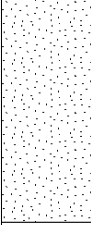
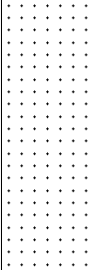
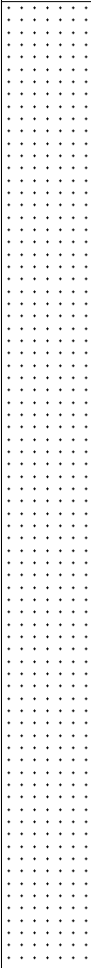
					Borehole Log			Borehole No. RB103 Sheet 1 of 4	
Project Name: Lickers Lane					Project No. 15065		Co-ords: 347455E - 390333N		Hole Type BH
Location: Whiston					Level:		Scale 1:50		
Client: Vistry Partnerships North West					Dates: 28/09/2021		Logged By H.Morgan		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		 	Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone. Yellow fine to coarse SAND.	1
					1.90			Yellow brown SANDSTONE.	2
					3.30			Yellow SANDSTONE with infrequent grey and red bands.	3
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Complete 40.00 m bgl.									

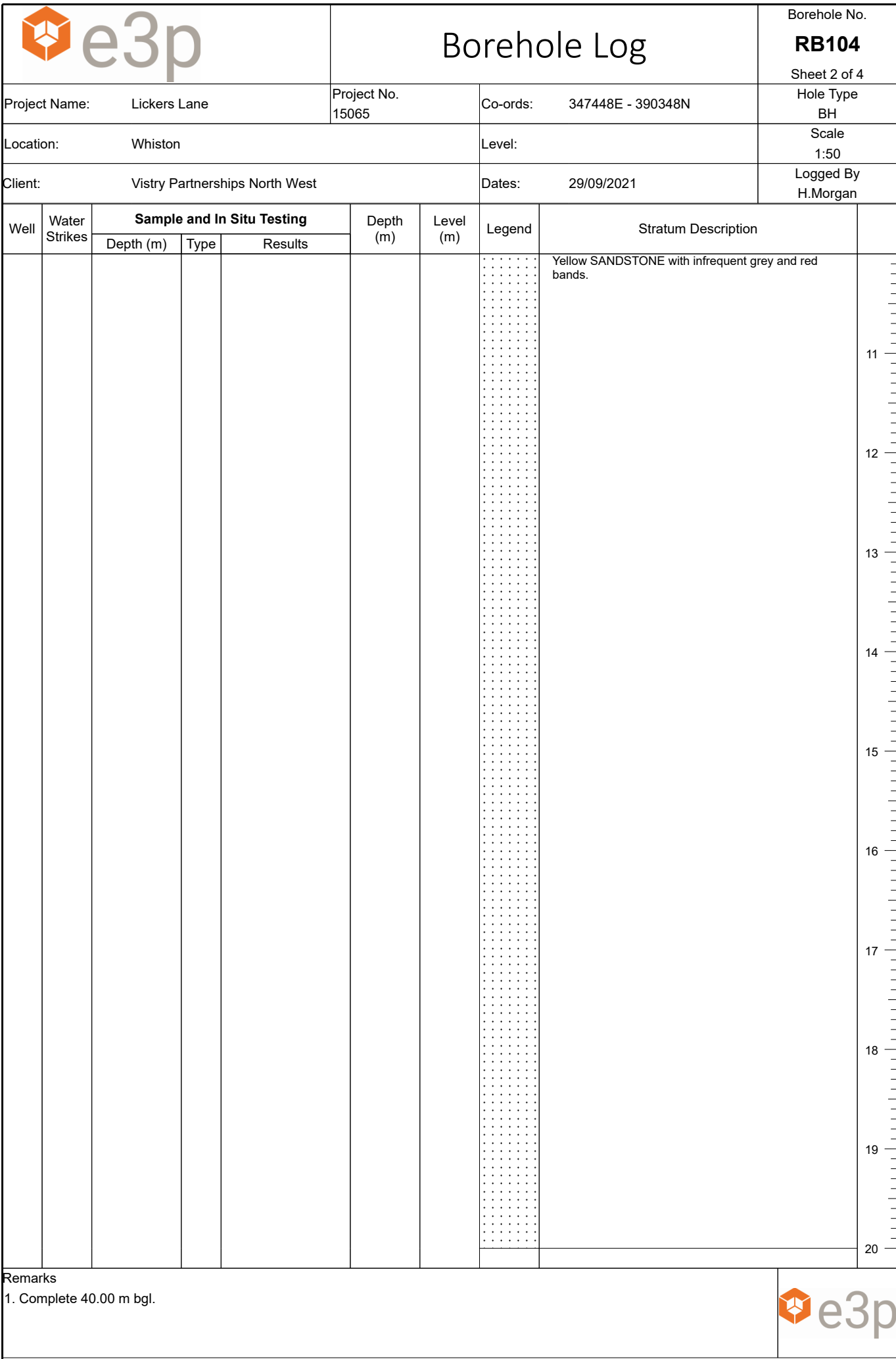


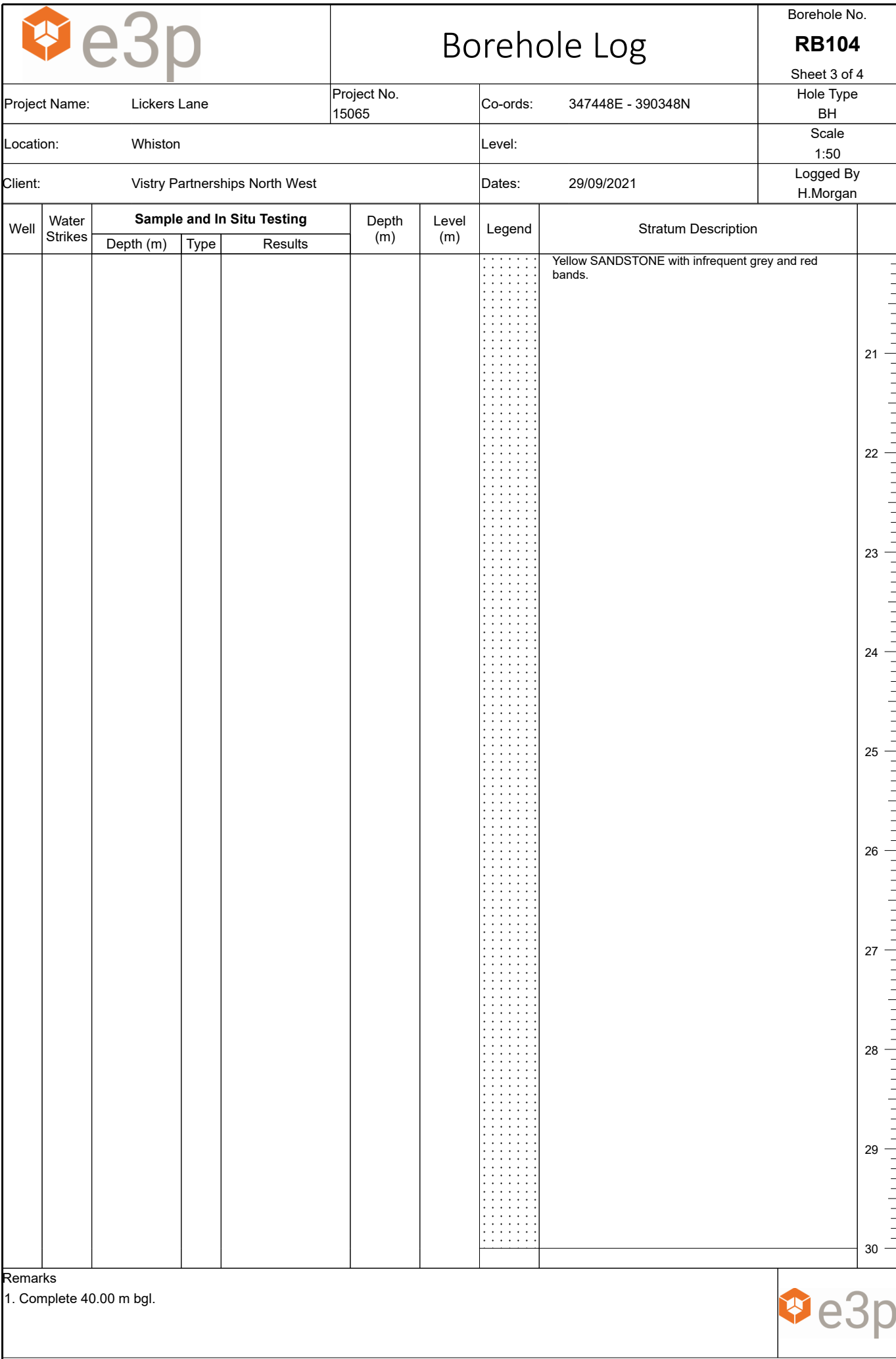


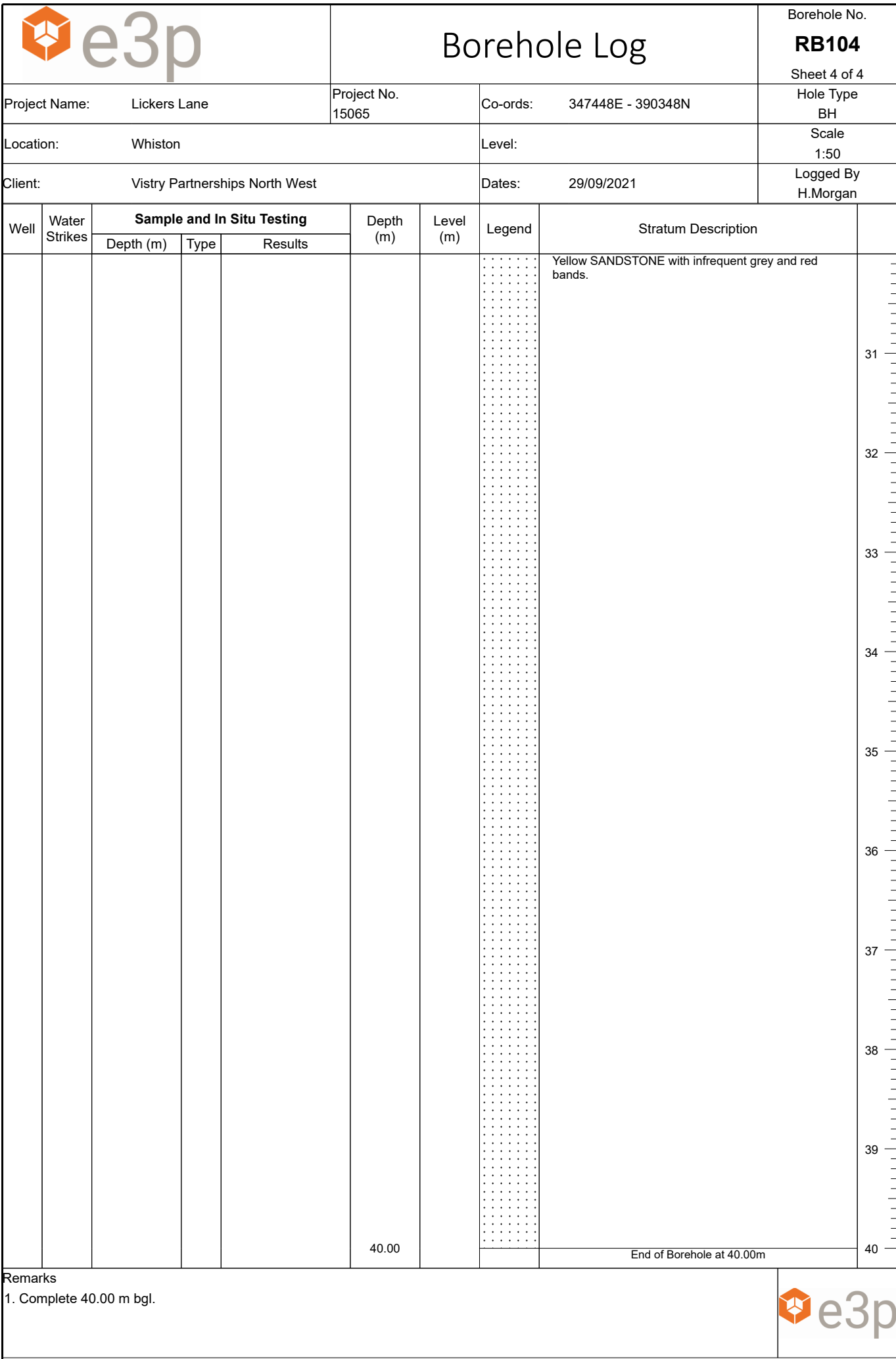
				Borehole Log				Borehole No. RB103 Sheet 4 of 4	
Project Name: Lickers Lane				Project No. 15065		Co-ords: 347455E - 390333N		Hole Type BH	
Location: Whiston						Level:		Scale 1:50	
Client: Vistry Partnerships North West						Dates: 28/09/2021		Logged By H.Morgan	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Yellow SANDSTONE with infrequent grey and red bands. 31 32 33 34 35 36 37 38 39 40	
					40.00			End of Borehole at 40.00m	
Remarks 1. Complete 40.00 m bgl.									



				Borehole Log				Borehole No. RB104	
Project Name: Lickers Lane				Project No. 15065		Co-ords: 347448E - 390348N		Sheet 1 of 4	
Location: Whiston				Level:		Hole Type BH			
Client: Vistry Partnerships North West				Dates: 29/09/2021		Scale 1:50			
		Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
Well	Water Strikes	Depth (m)	Type	Results					
					0.30		 Dark grey slightly clayey gravelly sand with frequent rootlets (TOPSOIL). Gravel is fine to medium sub-round to round mudstone and sandstone.		
					1.80		 Yellow fine to coarse SAND.		
							 Yellow brown SANDSTONE.		
					3.60		 Yellow SANDSTONE with infrequent grey and red bands.		
Remarks 1. Complete 40.00 m bgl.									







APPENDIX VI

CHEMICAL TESTING

RESULTS



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e:

Analytical Report Number : 21-16876

Project / Site name:	Lickers Lane	Samples received on:	15/10/2021
Your job number:	15065	Samples instructed on/ Analysis started on:	15/10/2021
Your order number:	15065-RH-I	Analysis completed by:	22/10/2021
Report Issue Number:	1	Report issued on:	22/10/2021
Samples Analysed:	3 leachate samples		

Signed: *A. Czerwińska*

Agnieszka Czerwińska
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 21-16876
Project / Site name: Lickers Lane

Your Order No: 15065-RH-I

Lab Sample Number				2050028	2050029	2050030
Sample Reference				TP103	TP102	TP111
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied
Date Sampled				14/10/2021	14/10/2021	14/10/2021
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)				Units	Limit of detection	Accreditation Status

General Inorganics

pH	pH Units	N/A	ISO 17025	6.5	8.5	6.7
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	2.4	1.5	2.3
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2	< 0.2
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	2.4	2.5	< 0.4
Copper (dissolved)	µg/l	0.7	ISO 17025	9.7	16	1.7
Lead (dissolved)	µg/l	1	ISO 17025	8.5	1.2	< 1.0
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	9.2	11	5.9
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	18	15	6.6

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10	< 10	< 10



Analytical Report Number: 21-16876
Project / Site name: Lickers Lane

Your Order No: 15065-RH-I

Lab Sample Number				2050028	2050029	2050030
Sample Reference				TP103	TP102	TP111
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied
Date Sampled				14/10/2021	14/10/2021	14/10/2021
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status			

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10	< 10
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TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10

TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 21-16876
Project / Site name: Lickers Lane

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Monohydric phenols in leachate - LOW LEVEL 1 ug/l	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In house method.	L005-PL	W	ISO 17025
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
TPHCWG (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
BTEX and MTBE in leachates (Monoaromatics)	Determination of BTEX and MTBE in leachates by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Total cyanide in leachate - 1µg/l	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

**Henry Morgan**

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Analytical Report Number : 21-12667

Project / Site name:	Lickers Lane	Samples received on:	27/09/2021
Your job number:	15-065	Samples instructed on/ Analysis started on:	27/09/2021
Your order number:	15-065-HM-F	Analysis completed by:	04/10/2021
Report Issue Number:	1	Report issued on:	04/10/2021
Samples Analysed:	1 leachate sample - 22 soil samples		

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 21-12667
Project / Site name: Lickers Lane
Your Order No: 15-065-HM-F

Lab Sample Number				2026062	2026063	2026064	2026065	2026066
Sample Reference				WS101	WS102	WS102A	WS103	WS104
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.90	0.20	1.50	0.20
Date Sampled				23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	4.8	6.6	5.9	4.8	12
Total mass of sample received	kg	0.001	NONE	0.40	0.40	0.40	0.40	0.30

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.0	5.3	4.9	6.8	6.0
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	400	110	140	94	100
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.0027	0.0015	0.0013	< 0.0013	0.0047
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	5.4	3.0	2.5	< 2.5	9.4
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	2.7	1.5	1.3	< 1.3	4.7
Sulphide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	mg/kg	50	MCERTS	250	< 50	61	< 50	75
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.4	< 0.1	0.4	< 0.1	0.4

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80
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Analytical Report Number: 21-12667

Project / Site name: Lickers Lane

Your Order No: 15-065-HM-F

Lab Sample Number				2026062	2026063	2026064	2026065	2026066
Sample Reference				WS101	WS102	WS102A	WS103	WS104
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.90	0.20	1.50	0.20
Date Sampled				23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	12	2.7	3.8	3.2	3.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.0	< 0.2	< 0.2	< 0.2	0.3
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	15	2.9	4.6	4.9	9.1
Copper (aqua regia extractable)	mg/kg	1	MCERTS	51	2.9	9.8	1.8	61
Lead (aqua regia extractable)	mg/kg	1	MCERTS	52	2.3	9.2	2.8	11
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	14	2.4	3.3	5.0	9.4
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	69	14	19	13	43

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-12667
Project / Site name: Lickers Lane
Your Order No: 15-065-HM-F

Lab Sample Number				2026067	2026068	2026069	2026070	2026071
Sample Reference				WS105	WS106	TP101	TP102	TP103
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.90	0.20	1.60	0.30	0.90
Date Sampled				23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	3.5	14	5.9	8.2	4.6
Total mass of sample received	kg	0.001	NONE	0.20	0.40	0.40	0.30	0.40

Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	-	Not-detected	-
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.1	5.4	6.4	5.5	6.0
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	180	430	65	160	68
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.0044	0.0047	0.0016	0.0033	0.0015
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	8.8	9.3	3.2	6.6	3.0
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	4.4	4.7	1.6	3.3	1.5
Sulphide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	mg/kg	50	MCERTS	60	590	< 50	110	< 50
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.3	3.1	< 0.1	0.7	0.1

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80
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Analytical Report Number: 21-12667
Project / Site name: Lickers Lane
Your Order No: 15-065-HM-F

Lab Sample Number				2026067	2026068	2026069	2026070	2026071
Sample Reference				WS105	WS106	TP101	TP102	TP103
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.90	0.20	1.60	0.30	0.90
Date Sampled				23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	3.9	14	5.4	8.1	5.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	1.5	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	12	20	4.2	11	2.9
Copper (aqua regia extractable)	mg/kg	1	MCERTS	5.0	68	2.4	11	2.7
Lead (aqua regia extractable)	mg/kg	1	MCERTS	4.0	86	2.5	9.7	2.2
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	16	15	3.9	8.8	3.9
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	40	120	22	30	14

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	12	< 1.0	< 1.0	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	12	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-12667
Project / Site name: Lickers Lane
Your Order No: 15-065-HM-F

Lab Sample Number				2026072	2026073	2026074	2026075	2026076
Sample Reference				TP104	TP105	TP106	TP107	TP108
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	1.90	0.30	1.50	0.30
Date Sampled				23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	7.4	5.2	11	6.7	9.5
Total mass of sample received	kg	0.001	NONE	0.30	0.40	0.30	0.30	0.30

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	5.1	7.2	4.9	7.9	5.5
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	240	91	390	59	360
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.0025	< 0.0013	0.0028	< 0.0013	0.0062
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	4.9	< 2.5	5.6	< 2.5	12
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	2.5	< 1.3	2.8	< 1.3	6.2
Sulphide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	mg/kg	50	MCERTS	180	< 50	310	< 50	210
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.3	< 0.1	1.8	< 0.1	1.4

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80
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Analytical Report Number: 21-12667
Project / Site name: Lickers Lane
Your Order No: 15-065-HM-F

Lab Sample Number				2026072	2026073	2026074	2026075	2026076
Sample Reference				TP104	TP105	TP106	TP107	TP108
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	1.90	0.30	1.50	0.30
Date Sampled				23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.3	3.5	13	4.6	8.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.5	< 0.2	0.7	< 0.2	0.4
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	15	4.7	14	3.9	11
Copper (aqua regia extractable)	mg/kg	1	MCERTS	33	2.4	54	3.2	36
Lead (aqua regia extractable)	mg/kg	1	MCERTS	36	3.3	75	3.5	36
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11	3.7	12	5.5	7.1
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	45	19	65	18	48

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-12667
Project / Site name: Lickers Lane
Your Order No: 15-065-HM-F

Lab Sample Number				2026077	2026078	2026079	2026080	2026081
Sample Reference				TP109	TP110	TP111	TP112	TP113
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.30	1.80	0.30	1.90
Date Sampled				23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.3	4.6	6.4	8.0	6.0
Total mass of sample received	kg	0.001	NONE	0.40	0.30	0.40	0.30	0.40

Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	-	Not-detected	-
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.1	5.4	7.8	5.8	8.4
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	110	350	71	85	99
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.0029	0.0074	0.0051	0.0033	0.010
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	5.8	15	10	6.7	21
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	2.9	7.4	5.1	3.3	10.4
Sulphide	mg/kg	1	MCERTS	1.7	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	mg/kg	50	MCERTS	< 50	210	< 50	160	110
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.1	1.3	< 0.1	1.2	0.1

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80
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Analytical Report Number: 21-12667
Project / Site name: Lickers Lane
Your Order No: 15-065-HM-F

Lab Sample Number				2026077	2026078	2026079	2026080	2026081
Sample Reference				TP109	TP110	TP111	TP112	TP113
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.30	1.80	0.30	1.90
Date Sampled				23/09/2021	23/09/2021	23/09/2021	23/09/2021	23/09/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	3.3	8.3	3.9	4.1	3.0
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	4.7	13	4.6	14	5.3
Copper (aqua regia extractable)	mg/kg	1	MCERTS	4.6	30	1.7	11	2.9
Lead (aqua regia extractable)	mg/kg	1	MCERTS	3.3	38	2.8	12	4.8
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	5.0	9.7	4.6	7.2	4.8
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	33	44	11	36	15

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-12667

Project / Site name: Lickers Lane

Your Order No: 15-065-HM-F

Lab Sample Number				2026082	2026083
Sample Reference				TP114	TP115
Sample Number				None Supplied	None Supplied
Depth (m)				0.40	0.30
Date Sampled				23/09/2021	23/09/2021
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.3	12
Total mass of sample received	kg	0.001	NONE	0.30	0.20

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.0	7.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	280	720
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.0044	0.015
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	8.7	30
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	4.4	14.9
Sulphide	mg/kg	1	MCERTS	< 1.0	81
Total Sulphur	mg/kg	50	MCERTS	280	690
Total Organic Carbon (TOC)	%	0.1	MCERTS	2.1	5.0

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.69
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.77
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.67
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	6.1
Anthracene	mg/kg	0.05	MCERTS	< 0.05	2.6
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	21
Pyrene	mg/kg	0.05	MCERTS	< 0.05	19
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	13
Chrysene	mg/kg	0.05	MCERTS	< 0.05	11
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	14
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	5.7
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	11
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	7.2
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	2.1
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	8.1

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	124
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Analytical Report Number: 21-12667

Project / Site name: Lickers Lane

Your Order No: 15-065-HM-F

Lab Sample Number				2026082	2026083
Sample Reference				TP114	TP115
Sample Number				None Supplied	None Supplied
Depth (m)				0.40	0.30
Date Sampled				23/09/2021	23/09/2021
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Heavy Metals / Metalloids					
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	13	8.1
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.8	0.8
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	20
Copper (aqua regia extractable)	mg/kg	1	MCERTS	51	45
Lead (aqua regia extractable)	mg/kg	1	MCERTS	51	47
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	19	19
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	87	93

Petroleum Hydrocarbons

TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	8.3
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	62
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	430
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	210
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	720

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number: 21-12667

Project / Site name: Lickers Lane

Your Order No: 15-065-HM-F

Lab Sample Number				2026084
Sample Reference				TP115
Sample Number				None Supplied
Depth (m)				0.30
Date Sampled				23/09/2021
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status	

General Inorganics

pH	pH Units	N/A	ISO 17025	7.7
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1.0

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	< 1.0
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	< 1.0
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	5.4
Copper (dissolved)	µg/l	0.7	ISO 17025	42
Lead (dissolved)	µg/l	1	ISO 17025	2.4
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	3.1
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	19



Analytical Report Number: 21-12667

Project / Site name: Lickers Lane

Your Order No: 15-065-HM-F

Lab Sample Number				2026084
Sample Reference				TP115
Sample Number				None Supplied
Depth (m)				0.30
Date Sampled				23/09/2021
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status	

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10
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TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10

TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 21-12667

Project / Site name: Lickers Lane

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2026062	WS101	None Supplied	0.2	Brown loam with gravel and vegetation.
2026063	WS102	None Supplied	0.9	Brown clay and sand with gravel.
2026064	WS102A	None Supplied	0.2	Brown clay and sand with gravel and vegetation.
2026065	WS103	None Supplied	1.5	Brown clay and sand with gravel.
2026066	WS104	None Supplied	0.2	Brown clay and sand with gravel and vegetation.
2026067	WS105	None Supplied	0.9	Brown loam and sand with gravel.
2026068	WS106	None Supplied	0.2	Brown loam and clay with gravel and vegetation.
2026069	TP101	None Supplied	1.6	Brown clay and sand with gravel.
2026070	TP102	None Supplied	0.3	Brown clay and sand with gravel and vegetation.
2026071	TP103	None Supplied	0.9	Brown clay and sand with gravel.
2026072	TP104	None Supplied	0.2	Brown clay and sand with gravel and vegetation.
2026073	TP105	None Supplied	1.9	Brown clay and sand with gravel.
2026074	TP106	None Supplied	0.3	Brown loam and clay with gravel and vegetation.
2026075	TP107	None Supplied	1.5	Brown clay and sand with gravel.
2026076	TP108	None Supplied	0.3	Brown clay and loam with gravel and vegetation.
2026077	TP109	None Supplied	1.8	Brown clay and sand with gravel.
2026078	TP110	None Supplied	0.3	Brown loam with gravel and vegetation.
2026079	TP111	None Supplied	1.8	Brown clay and sand with gravel.
2026080	TP112	None Supplied	0.3	Brown clay and sand with gravel.
2026081	TP113	None Supplied	1.9	Brown clay and sand with gravel.
2026082	TP114	None Supplied	0.4	Brown loam and clay with gravel and vegetation.
2026083	TP115	None Supplied	0.3	Brown clay and loam with gravel and vegetation.

Analytical Report Number : 21-12667

Project / Site name: Lickers Lane

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in leachate - LOW LEVEL 1 ug/l	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In house method.	L005-PL	W	ISO 17025
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE

Analytical Report Number : 21-12667

Project / Site name: Lickers Lane

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
TPHCWG (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX and MTBE in leachates (Monoaromatics)	Determination of BTEX and MTBE in leachates by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
Total cyanide in leachate - 1µg/l	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Sulphate, water soluble, in soil (1hr extraction)	Sulphate, water soluble, in soil (1hr extraction)	In-house method	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

APPENDIX VII

ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA

Land South of Lickers Lane

Phase II Geoenvironmental Site Assessment

November 2021

CONSTITUENT	ORIGIN OF RISK ASSESSMENT VALUE
Arsenic	2014 LQM/CIEH S4ULs
Cadmium	2014 LQM/CIEH S4ULs
Chromium	2014 LQM/CIEH S4ULs
Lead	2014 LQM/CIEH S4ULs
Mercury	2014 LQM/CIEH S4ULs – methylmercury
Nickel	2014 LQM/CIEH S4ULs
Selenium	2014 LQM/CIEH S4ULs
Copper	2014 LQM/CIEH S4ULs
Zinc	2014 LQM/CIEH S4ULs
Cyanide – Total	2014 LQM/CIEH S4ULs
Phenols – Total	2014 LQM/CIEH S4ULs
Naphthalene	General assessment criteria (GAC) developed by CIEH/LQM Suitable 4 Use Levels with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM.
Acenaphthylene	
Acenaphthene	
Fluorene	
Phenanthrene	
Anthracene	
Fluoranthene	
Pyrene	
Benzo(a)Anthracene	
Chrysene	
Benzo(b/k)Fluoranthene ⁽ⁱⁱⁱ⁾	
Benzo(a)Pyrene	
Indeno(123-cd)Pyrene	
Dibenzo(a,h)Anthracene	
Benzo(ghi)Perylene	
TPH C₅-C₆ (aliphatic)	
TPH C₆-C₈ (aliphatic)	
TPH C₈-C₁₀ (aliphatic)	
TPH C₁₀-C₁₂ (aliphatic)	
TPH C₁₂-C₁₆ (aromatic)	
TPH C₁₆-C₂₁ (aromatic)	
TPH C₂₁-C₃₅ (aromatic)	



APPENDIX VIII

GEOTECHNICAL TESTING

RESULTS



LABORATORY REPORT



4043

Contract Number: PSL21/7701

Report Date: 05 November 2021

Client's Reference: 15-065

Client Name: E3P
Taylor Road
Urmston
Manchester
M41 7JQ

For the attention of: Henry Morgan

Contract Title: Lickers Lane

Date Received: 27/9/2021

Date Commenced: 27/9/2021

Date Completed: 5/11/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
(Assistant Laboratory Manager)

S Eyre
(Senior Technician)

M Fennell
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

PSL
Professional Soils Laboratory

Lickers Lane

Contract No:**PSL21/7701****Client Ref:**

15-065

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



4043

PSL

Professional Soils Laboratory

Lickers Lane

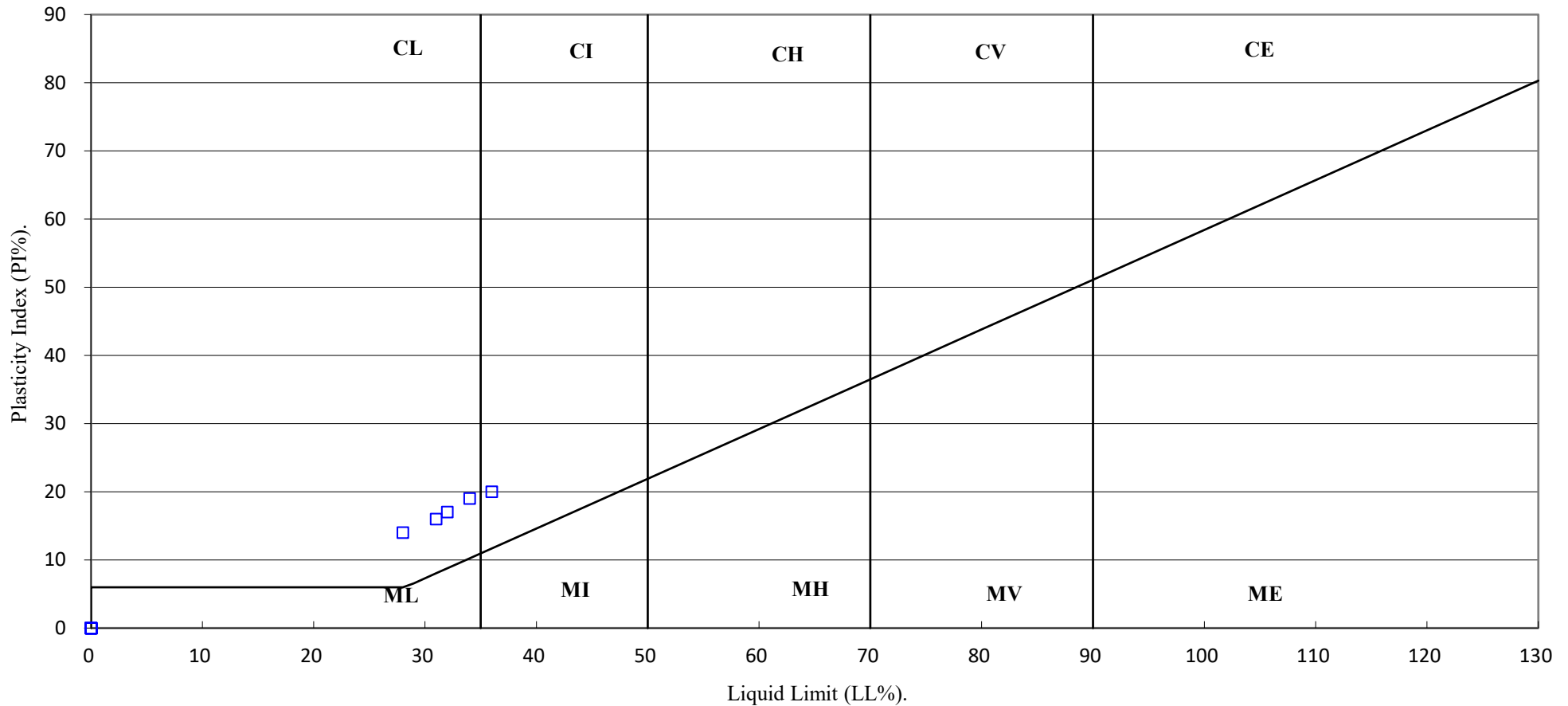
Contract No:

PSL21/7701

Client Ref:

15-065

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL

Professional Soils Laboratory

Lickers Lane

Contract No:

PSL21/7701

Client Ref:

15-065

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

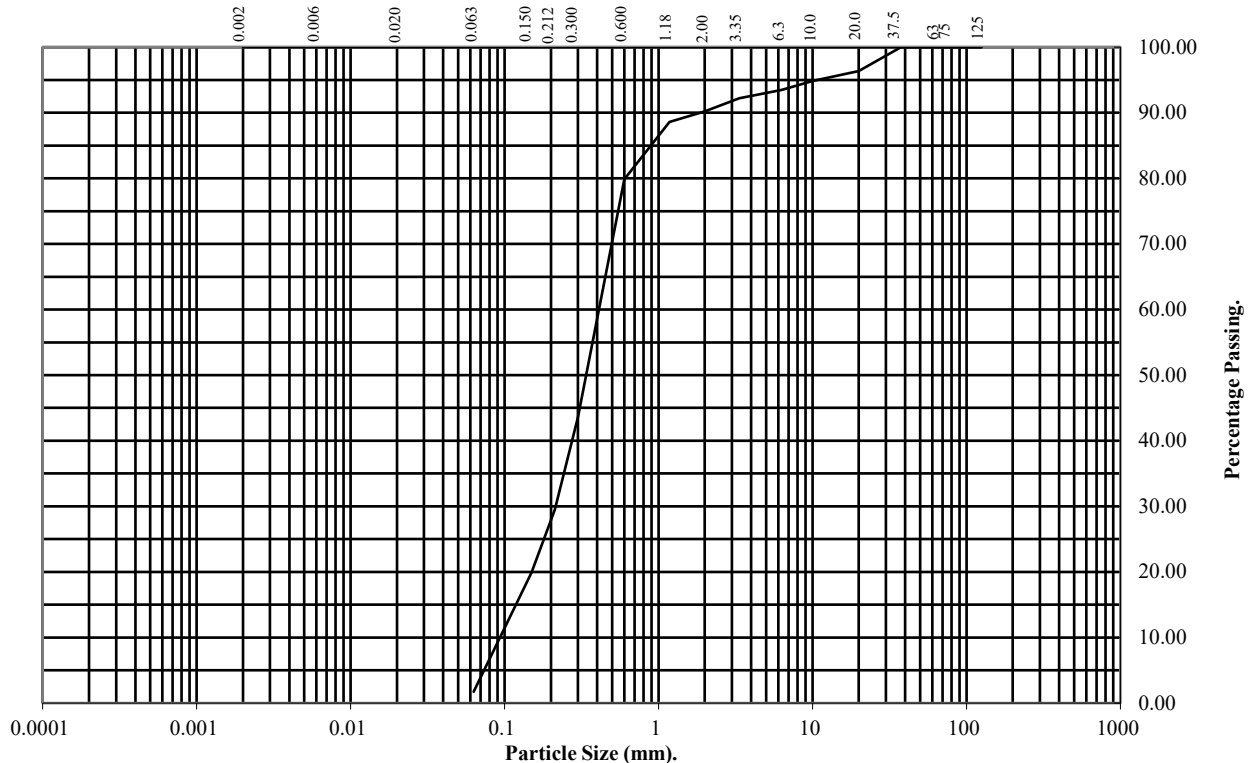
Hole Number: TP105

Top Depth (m): 2.00

Sample Number:

Base Depth(m):

Sample Type: BULK



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	95
6.3	93
3.35	92
2	90
1.18	89
0.6	80
0.3	44
0.212	29
0.15	20
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	10
Sand	88
Silt/Clay	2

Remarks:

See Summary of Soil Descriptions



PSL
Professional Soils Laboratory

Lickers Lane

Contract No:
PSL21/7701
Client Ref:
15-065

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

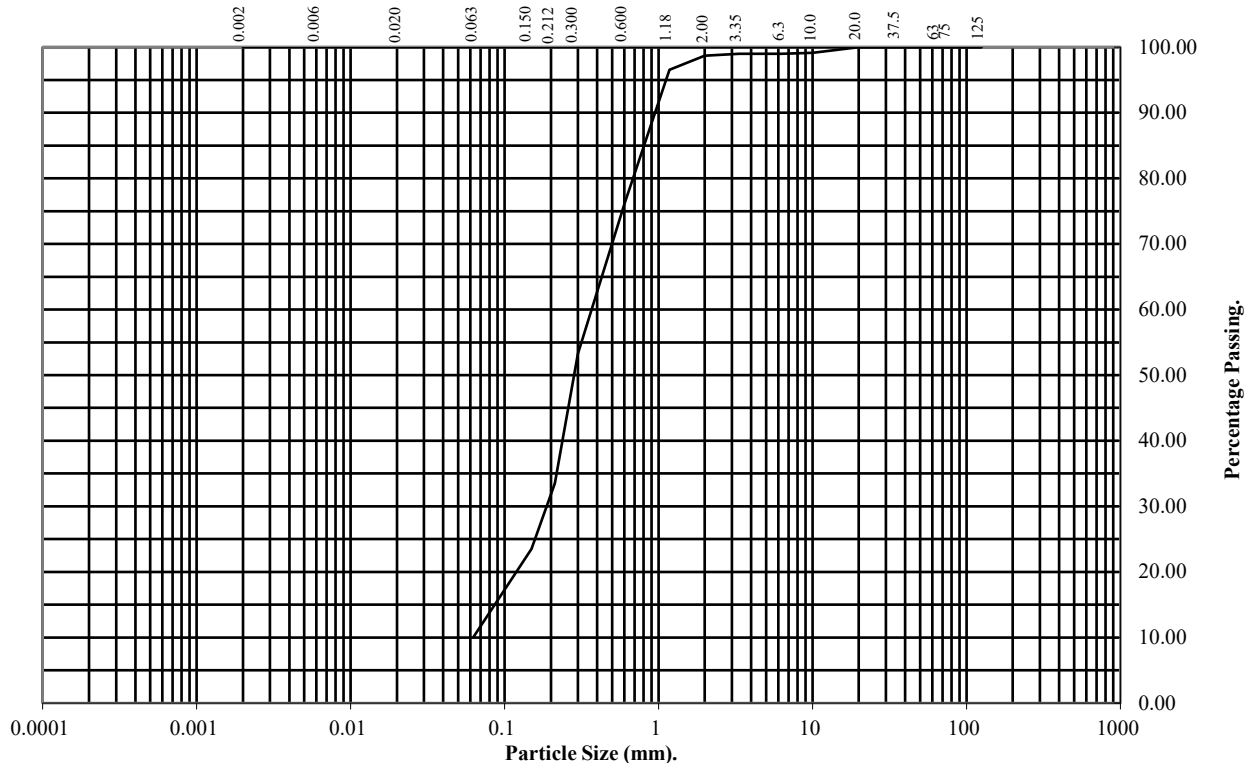
Hole Number: TP111

Top Depth (m): 2.00

Sample Number:

Base Depth(m):

Sample Type: BULK



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	99
3.35	99
2	99
1.18	97
0.6	76
0.3	53
0.212	34
0.15	23
0.063	10

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	89
Silt/Clay	10

Remarks:

See Summary of Soil Descriptions



PSL
Professional Soils Laboratory

Lickers Lane

Contract No:
PSL21/7701
Client Ref:
15-065

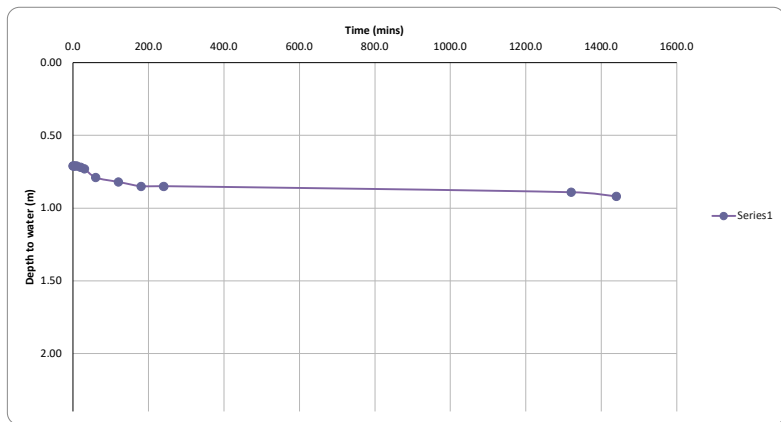
APPENDIX IX FALLING HEAD PERMEABILITY TEST CERTIFICATES

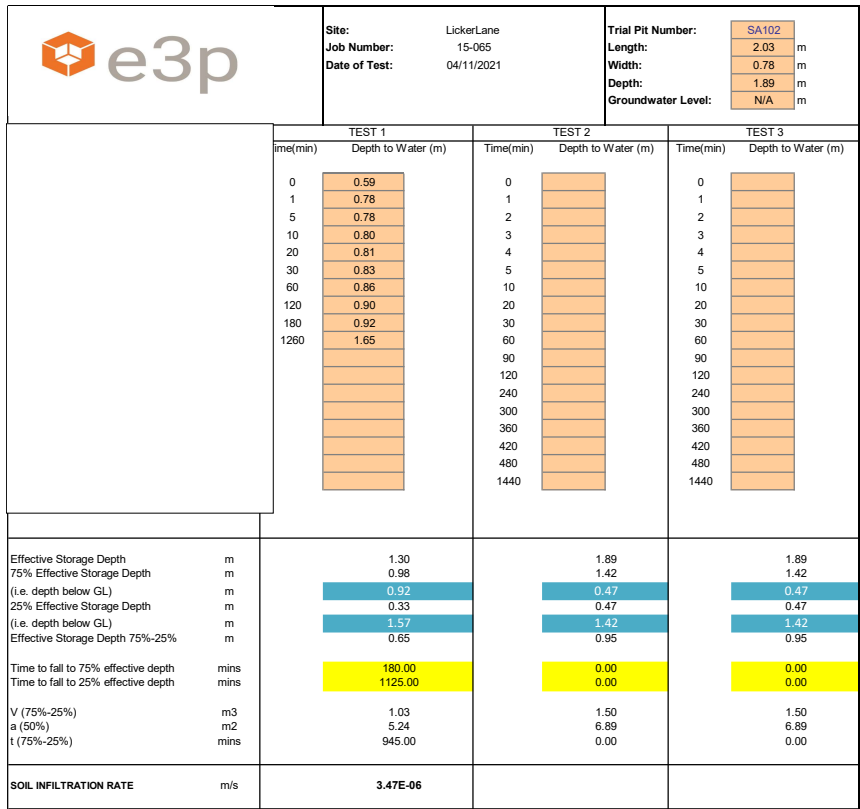


Site:	LickerLane	Trial Pit Number:	SA101
Job Number:	15-065	Length:	1.75 m
Date of Test:	04/11/2021	Width:	0.84 m
		Depth:	2.01 m
		Groundwater Level:	N/A m

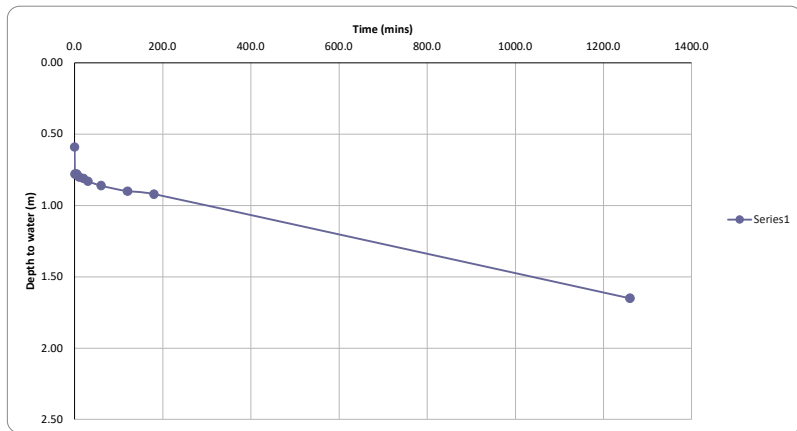
		TEST 1		TEST 2		TEST 3	
Insufficient fall in water level to calculate rate.		Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
		0	0.71	0		0	
		1	0.71	1		1	
		5	0.71	2		2	
		10	0.71	3		3	
		20	0.72	4		4	
		30	0.73	5		5	
		60	0.79	10		10	
		120	0.82	20		20	
		180	0.85	30		30	
		240	0.85	60		60	
		1320	0.89	90		90	
		1440	0.92	120		120	
				240		240	
				300		300	
				360		360	
				420		420	
				480		480	
		1440		1440			
Effective Storage Depth	m	1.30		2.01		2.01	
75% Effective Storage Depth	m	0.98		1.51		1.51	
(i.e. depth below GL)		1.04		0.50		0.50	
25% Effective Storage Depth	m	0.33		0.50		0.50	
(i.e. depth below GL)	m	1.69		1.51		1.51	
Effective Storage Depth 75%-25%	m	0.65		1.01		1.01	
Time to fall to 75% effective depth	mins	N/A		0.00		0.00	
Time to fall to 25% effective depth	mins	N/A		0.00		0.00	
V (75%-25%)	m3	0.96		1.48		1.48	
a (50%)	m2	4.84		6.68		6.68	
t (75%-25%)	mins	N/A		0.00		0.00	
SOIL INFILTRATION RATE	m/s	FAIL					

DESIGN SOIL INFILTRATION RATE, f FAIL





DESIGN SOIL INFILTRATION RATE, f	3.47E-06
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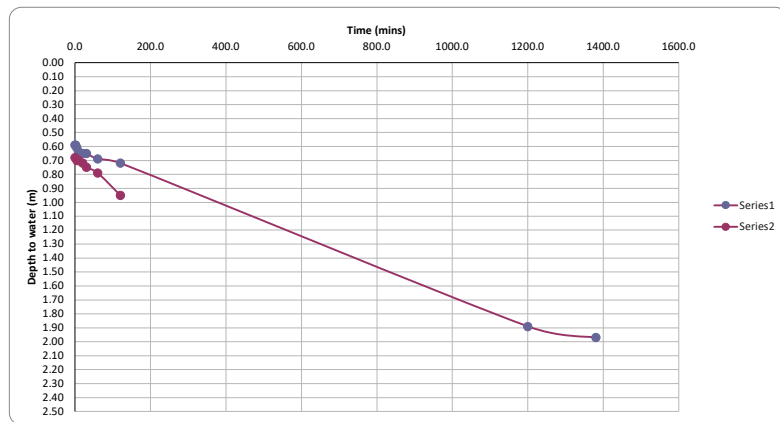




Site:	LickerLane	Trial Pit Number:	SA103
Job Number:	15-065	Length:	1.49 m
Date of Test:	04/11/2021	Width:	0.87 m
		Depth:	2.23 m
		Groundwater Level:	N/A m

		TEST 1		TEST 2		TEST 3	
		Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
		0	0.59	0	0.68	0	
		1	0.59	5	0.70	1	
		5	0.61	10	0.70	2	
		10	0.64	20	0.72	3	
		20	0.65	30	0.75	4	
		30	0.65	60	0.79	5	
		60	0.69	120	0.95	10	
		120	0.72			20	
		1200	1.89			30	
		1380	1.97			60	
						90	
						120	
						240	
						300	
						360	
						420	
						480	
						1440	
Effective Storage Depth	m		1.64		1.55		2.23
75% Effective Storage Depth	m		1.23		1.16		1.67
(i.e. depth below GL)	m		1.00		1.07		0.56
25% Effective Storage Depth	m		0.41		0.39		0.56
(i.e. depth below GL)	m		1.82		1.84		1.67
Effective Storage Depth 75%-25%	m		0.82		0.78		1.12
Time to fall to 75% effective depth	mins		375.00		0.00		0.00
Time to fall to 25% effective depth	mins		1110.00		0.00		0.00
V (75%-25%)	m3		1.06		1.00		1.45
a (50%)	m2		5.17		4.95		6.56
t (75%-25%)	mins		735.00		0.00		N/A
SOIL INFILTRATION RATE	m/s		4.67E-06		#DIV/0!		N/A

DESIGN SOIL INFILTRATION RATE, f	4.67E-06
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Site: Licker Lane
Job Number: 15-065
Date of Test: 04/11/2021

Trial Pit Number: SA104
Length: 1.65 m
Width: 0.87 m
Depth: 2.10 m
Groundwater Level: N/A m

		TEST 1		TEST 2		TEST 3	
Insufficient fall in water level to calculate rate.		Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
		0	0.67	0	0.65	0	
		1	0.67	1	0.66	1	
		5	0.69	5	0.70	2	
		10	0.69	10	0.73	3	
		20	0.72	20	0.73	4	
		30	0.73	30	0.86	5	
		60	0.85	60	0.90	10	
		120	0.89	120	0.98	20	
		1140	1.49	1140	1.21	30	
		1440	1.50	1440		60	
				90		90	
				120		120	
				240		240	
				300		300	
				360		360	
				420		420	
				480		480	
				1440		1440	
Effective Storage Depth	m	1.43		1.45		2.10	
75% Effective Storage Depth	m	1.07		1.09		1.58	
(i.e. depth below GL)		1.03		1.01		0.53	
25% Effective Storage Depth	m	0.36		0.36		0.53	
(i.e. depth below GL)	m	1.74		1.74		1.58	
Effective Storage Depth 75%-25%	m	0.72		0.73		1.05	
Time to fall to 75% effective depth	mins	300.00		0.00		0.00	
Time to fall to 25% effective depth	mins	0.00		0.00		0.00	
V (75%-25%)	m3	1.03		1.04		1.51	
a (50%)	m2	5.04		5.09		6.73	
t (75%-25%)	mins	-300.00		0.00		0.00	
SOIL INFILTRATION RATE	m/s	N/A					

DESIGN SOIL INFILTRATION RATE, f FAIL

