

SMITHY BRIDGE ROAD,
LITTLEBOROUGH

FINAL

PHASE 2 GEO-ENVIRONMENTAL
INVESTIGATION, RISK ASSESSMENT
AND REMEDIATION STRATEGY

Job Number: LKC 22 1183

Date: July 2022

Client: Taylor Wimpey Strategic Land (North)



INCREASING LAND VALUE

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Site Address	Smithy Bridge Road, Littleborough, OL16 2RY.		
Report Title	Final Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy		
Job Number	LKC 18 1005	Document Ref.	CL-602-LKC 18 1005-02
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Prepared By	Phillip Windslow	Prepared By	Emma Khadun
Reviewed By	Colin Wardle	Reviewed By	Colin Crompton

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EXECUTIVE SUMMARY

Site Details

Site Location:	Land off Smithy Bridge Road, Littleborough, OL16 2RY. National Grid Reference 392060E 415330N.
Site Area:	14.1Ha
Current Land Use:	Undeveloped agricultural land across the majority of the site with United Utilities plant in the east of the site.
Proposed Development:	Residential development including soft landscaping and car parking.
Purpose of Report:	Contamination and Geotechnical Assessment.

Preliminary Risk Assessment

PRA Details:	Undertaken by Betts Geo Environmental Ltd in August 2017. Ref: 17TAY040/DS
History:	Site undeveloped from 1851. Old Coal Pit 1893, Pumping Station 1910-1960.
Geology / Hydrogeology:	Till (Secondary Undifferentiated Aquifer) and Alluvium (Clay, Silt, Sand and Gravel) in the south (Secondary A Aquifer) over Milnrow Sandstone, Lower Pennine Coal Measures and Darwen Flags (Secondary A Aquifer). Site is located within a glacial channel.
Mining:	The far east of the site is within a DHRA. One shaft present offsite adj. east and Old Coal Pit seen on historical mapping in this area.
Relevant Environmental Setting:	Pond and spring present on site. River Roch adjacent the south of the site. Pollution incident on site, Septic Tank Effluent in stream, June 1997. Category 3 – Minor Incident. No surface or groundwater abstractions within 500m. Not within Source Protection Zone.
Preliminary Conceptual Model:	PL1 Direct Contact (Human Health): Moderate Risk (Asbestos, Metals, PAHs and Petroleum Hydrocarbons). PL2 Inhalation of Vapours: Moderate Risk (volatile contaminants). PL3 Gas: High Risk (hazardous and ground gas).
PL=Pollutant Linkage	PL4 Controlled waters: Moderate Risk (mobile contaminants). PL5 Water Pipelines: Moderate Risk (organic contaminants).
Recommendations:	Site Investigation was recommended to further assess all the above pollutant linkages.

Ground Investigation Work Undertaken

Date of Investigation:	19 th to 23 rd , 26 th to 28 th February and 8 th March 2018.
Intrusive Investigation Work Undertaken:	24no. window sample boreholes (ref. WS101 to WS124). 4no. follow on Dynamic Probes (ref. DP116 to DP119). 27no. trial pits (ref. TP101 to TP127). 15no. Dynamic Cone Penetration (ref. DCP101 to DC115). 1no large trench undertaken to expose the cap of the coal shaft.
Monitoring Wells:	Installed in WS101, WS103, WS104, WS107, WS109, WS111, WS112, WS115, WS119, WS120, WS123 and WS124.
Soil Sampling:	33no. samples tested for metals, speciated PAHs, pH, sulphate, asbestos and SOM. 2no. samples tested for metals, speciated PAHs, cyanide, pH, sulphate, asbestos, phenol, TPHCWG, BTEX, VOCs, SVOCs, PCBs and SOM.
Groundwater Sampling:	8no. samples tested for metals, speciated PAHs, cyanide, pH, sulphate, phenol, TPHCWG, BTEX and hardness.
Monitoring:	6no. gas monitoring visits over 3 months.
Insitu and Laboratory Geotechnical Testing:	SPTs, shear vanes, DCPs, PSDs, Plasticity, Single Stage Triaxial. 9no. samples tested for pH and sulphate.

Ground Conditions and Geotechnical Assessment

Proposed Development	Residential properties with associated landscaping and parking.
General Ground conditions / Geotechnical Testing	Maximum investigation depth 10.00mbgl. SPTs in natural sand at 1.00mbgl N = 0-27, at 2.00mbgl N = 8-50, at 3.00mbgl N = 10-50. Allowable bearing pressures (refer to Figure 5, Foundation Zone Plan): 100kN/m² to 120kN/m² at 1.00mbgl to 2.00mbgl in natural ground (i.e. medium dense sands and gravels and/or stiff clays). Bedrock (weathered sandstone and mudstone) was encountered at varying depths across the site. Generally at shallow depths in the north and deeper to the south. Evidence of water logged ground and shallow groundwater present in areas of the site.
Anticipated Foundation Type	Traditional strip or trench fill footings are considered acceptable based on ground conditions encountered during the site investigation. An outline foundation zoning plan is presented in Figure 5. Made ground on site is unsuitable as a founding stratum and all foundations should be founded in natural ground. Further assessment of the ground conditions at each plot location should be undertaken by a suitably qualified and competent person. If the soil at foundation level is found to be loose, soft or consisting of made ground, we recommend excavation and removal of this material and replacing with suitable granular material compacted to specification (or mass concrete). Consideration needs to be given for the potential for differential settlement due to the presence of both granular and cohesive deposits at foundation level. While a granular material may settle 'immediately' the cohesive material will settle over time leading to differential settlement. Additional reinforcement may be required where these ground conditions are encountered.
Shallow Groundwater	Shallow groundwater identified on the site which will present a constraint to the development. Water logged areas and pooling water was noted on the site surface. Suitable drainage should be considered in the proposed development layout. Lowering of the water table may be required to facilitate the construction work especially site level reductions. A discharge consent to release water to existing storm water or foul water drains may be required.
Concrete Requirements	Based on BRE Digest 2005 ¹ – DS-1 AC-1 recommended.
Services	Services – consideration to the presence of services running through the site. Services may need to re-routed.
Coal Mining	A mining investigation (TLC report ref. Mining Report (021018) - Rev G (081019), dated October 2019) and mine shaft risk assessment (LKC letter report ref. LKC 18 1005, dated 10 th December 2019) have been carried out as part of these works and is reported under a separate cover. It is recommended that this report is read in conjunction with the mining report and access road remedial strategy.
Temporary support of excavation	May be required; however, trial pits were generally recorded as stable but trench side collapse in granular ground was not uncommon.

¹ BRE (2005). "Concrete in Aggressive Ground." Special Digest 1.

Slope stability	An assessment of slope stability has been undertaken based on the proposed final development levels as provided by Taylor Wimpey. Please read the LKC Slope Stability Assessment (ref. CL-602-LKC 22 1183-01, dated August 2022) in conjunction with this report. Profiles were assessed at a number of locations across the site and the slopes across a majority of the development area were between 1v in 10h and 1v in 15h. There are not considered to be any stability issues for slopes of this gradient based on the proposed development unless any locally steeper and weaker ground is encountered during groundworks. The slopes in the south of the site closer to the river (not indicated to be developed on for housing) had slopes generally of around 1v in 5h, which are also not considered to pose a significant risk to the proposed development. An area of the lower part of the site, where the proposed slopes are the steepest, has a gradient of approximately 1v in 1.5h. Based on the ground conditions in this area, there is the potential for slope instability. However, the nearest housing plot to this slope is approximately 20m away and therefore is unlikely to be within the zone of influence from any potential slippage or slope collapse. Although the risk of slope instability in the localised area identified is low, the probability of any potential slippage can be further reduced by mitigation measures such as ensuring the slope is well drained (e.g. use of counterfort drains) and is permanently grassed or similarly vegetated.
Plasticity	Consideration will need to be given to the shrink / swell of the clay strata if it is to be used as a founding stratum, particularly where trees/hedges are present or planned in the future. Foundations may need to be deepened to avoid the risks associated with the effects of trees. A low to medium volume change potential has been calculated for the site, and guidance should be sought using NHBC for determination of the minimum founding depth.
Road / Pavement Design	A design CBR value of 5% should be adopted for the made ground, 3% for natural sand and 4% for natural clay.

Contamination Risk Assessment

The table below shows a summary of the risk assessments undertaken for each pollutant linkage, the revised conceptual model and recommendation for either remediation and / or further investigation.

Pollutant Linkage		Risk	Recommendations
1	Contaminants posing a risk to site users via dermal contact, ingestion and inhalation (of soil, dust, fibres and vegetables).	Low (ACMs, PAHs, Hydrocarbons)	– Recommendation: No further work required.
		Moderate / Low (Heavy Metals)	– Recommendation: Remediation required – likely to be the removal of made ground from gardens / soft landscaping in one location in proposed development area (TP119), and in the parcel of land to the east.
2	Volatile contaminants posing a risk to site users via the inhalation of vapours.	Low	– Recommendation: No further work required.
3	Gas posing a risk to buildings and site users via the migration of gas into building causing explosion and asphyxiation.	Moderate / Low	– Recommendation: No gas protection measures required.
4	Mobile contamination posing a risk to controlled waters via the migration through permeable strata.	Low	– Recommendation: No further work required.
5	Organic contaminants posing a risk to water pipes.	Moderate / Low	– Recommendation: Further risk assessment and consultation with UU once pipeline route and depths are known.

Recommendations and Remedial Strategy

PL	Remediation Requirements	Validation Requirements
ALL	<u>Earthworks Inspections / Unexpected Contamination</u> The relevant contractors should be briefed that during development works at the site should any unusual ground conditions and / or visual or olfactory evidence of contamination (including asbestos containing material) be encountered at the site, LKC and the Local Authority should be informed and further assessment of the material may be required. Should asbestos be identified during groundworks, precautions should be taken to ensure the safety of the construction workers and nearby land users. It would be advisable to introduce an asbestos management strategy in line with CIRIA C733².	Log of work undertaken including photographs. Details of any sampling undertaken and validation of any potential additional remedial work.
1	<u>Source Removal</u> Localised elevated heavy metals were identified in the vicinity of Plot 49/ TP119 (former pond). The following remediation option is given: Removal of all reworked topsoil / made ground from garden and soft landscaping and raise levels (as required) with suitably chemically validated subsoil and topsoil. <u>Environmental Cover System</u> If areas in the vicinity of TP124 and TP127 in the eastern parcel of the site are to be developed, given the deep made ground present (max. 1.50m thickness) then the following is recommended: Private Back Gardens: 600mm thick environmental cover system comprising: Either 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 500mm comprising clean inert fill and sufficient topsoil for a growing medium. Or geotextile membrane and at least 600mm comprising clean inert fill and sufficient topsoil for a growing medium. Private Front Gardens / Shared Landscaping: 300mm thick environmental cover system comprising: Either 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 200mm comprising clean inert fill and sufficient topsoil for a growing medium. Or geotextile membrane and at least 300mm comprising clean inert fill and sufficient topsoil for a growing medium. The subsoil layer can be replaced by additional topsoil. A diagram of a typical environmental cover system is shown in Appendix I	<u>Source Removal</u> Consignment notes confirming the removal of made ground. Photographic evidence of natural strata. Chemical validation of imported soils: See Table 9-2. <u>Environmental Cover System</u> Measuring depth of environmental cover system using a staff and providing photographic evidence. Photographic evidence of the granular physical break or geotextile layer will also be collected. Chemical validation of imported soils: See Table 9-2.
5	<u>Potable Water Pipes</u> It is recommended that a Water Pipeline Assessment is undertaken once the location and depth of potable water pipes are known. It is possible that barrier pipe will be required in the east of the site.	Delivery Notes of Pipe Material. Photographs of the Installed Pipe.

The table below shows the remediation and validation requirements for the site. This information should be documented in a Site Completion Report for submission to the local authority.

² CIRIA (2014). "Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks." C733.

The remediation recommended in the table above should be validated to ensure it has been carried out appropriately. This should be documented in a Completion/Validation Report and submitted to the local authority for completion.

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FIGURES

Figure 1: Site Location Plan

Figure 2: Site Boundary Plan

Figure 3: Proposed Development Plan

Figure 4: Site Investigation Location Plan

Figure 5: Foundation Zoning Plan

APPENDICES

Appendix A: Risk Matrix

Appendix B: Profile Logs / DCP Output Sheets

Appendix C: Certificate of Analysis - Soil

Appendix D: Certificate of Analysis - Water

Appendix E: Gas Monitoring Results

Appendix F: Certificate of Analysis - Geotechnical

Appendix G: Generic Assessment Criteria Values

Appendix H: HazWaste Online Output Sheets

Appendix I: Typical Environmental Cover System

1 INTRODUCTION

1.1 Background

LK Consult Ltd (LKC) has been commissioned by Taylor Wimpey Strategic Land (North) to carry out a Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy for land at Smithy Bridge Road, Littleborough. The investigation was undertaken in support of a future planning application to develop the site for residential use.

The following work has previously been undertaken:

- » Desk Study Report, undertaken by Betts Geo Environmental Ltd (Ref: 17TAY040/DS, dated August 2017).

Additionally, LKC have compiled the following reports for the site which should be read in conjunction with this report:

- » The Land Company (TLC) Report on Coal Mining Investigation Works undertaken on Land off Smithy Bridge Road, Littleborough, OL16 2RY, TLC report ref. Mining Report (021018) - Rev G (081019), dated October 2019.
- » LKC Letter, Subject 'Mine Shaft ref. 392415-005 off Smithy Bridge Road, Littleborough. Access Road Remediation Strategy, LKC letter report ref. LKC 18 1005, dated 10th December 2019.
- » LKC Slope Stability Risk Assessment, ref. CL-LKC 22 1183-01, dated August 2022.

This investigation has been undertaken to confirm the ground conditions below the site and to allow a contamination and geotechnical assessment to be undertaken. The investigation will aim to confirm the risks of the potential pollutant linkages identified in the PRA and recommend further assessment / remediation, as required.

The aims of this report are also to establish the feasibility of developing this site, to demonstrate to the Local Planning Authority that in accordance with the National Planning Policy Framework (NPPF)³ the site may be developed for a residential end use and that appropriate site investigation and risk assessment works are in place to allow conditional approval of any future planning application.

Please note, that version R5 of this report has been updated to reflect the most recent proposed development plan (source Drawing No. P.21-2628-003, Rev. Q) dated 31/08/2022.

³ National Planning Policy Framework." Ministry of Housing, Communities and Local Government. July 2021.

1.2 Site Details

A summary of the site details is presented in Table 1-1. Figures 1 and 2 indicate the site location and boundary. Figure 3 indicates the proposed development.

Location	Land off Smithy Bridge Road, Littleborough, OL16 2RY. National Grid Reference 392060E 415330N.
Area	14.1Ha
Topography	155 metres above ordnance datum (AOD) in the north to 131mAOD in the south. Site slopes steadily down to the south with a steep slope before a flat flood plain around the River Roch.
Land Use	<u>Site</u> Undeveloped agricultural land across the majority of the site with United Utilities plant in the east of the site. <u>Surrounding Area</u> North: Residential Properties. South: River Roch and agricultural land beyond that. East: Smithy Bridge Road. West: Residential Properties.
Proposed Development	Residential development including soft landscaping and car parking.

Table 1-1: Summary of site details.

2 PREVIOUS WORK

2.1 Summary of Existing Information

A PRA report (Ref: 17TAY040/DS, dated August 2017) has previously been undertaken by Betts Geo Environmental Ltd and is summarised in Section 2.2-2.6.

The conceptual model (Section 2.6) has been updated to be in line with LKC current risk assessment methodology.

2.2 Site History

The site history is summarised in Table 2-1.

Date First Shown	Land Uses
1851	130m NE – Lower Mill (Woollen) (shown as Calliards Mill circa 1931 - 1932. No longer shown circa 1967 – 1968. Residential circa 1999). 150m SW – Green Fields Mill (Cotton) (shown as disused circa 1910 – 1911. No longer shown circa 1956). 180m SE – Railway line (still present). 250m NW – Green Gate Mill and Reservoirs (Cotton) (Reservoirs no longer shown circa 1967 – 1968. Shown as works circa 1978 – 1979 and residential circa 1990. Residential still present). 350m NNE – Sandstone Quarry and Coal Pit (shown as Mill circa 1894, Oil Mill circa 1910 – 1911 and a works circa 1967 – 1968. Residential shown in place of works circa 2006. Residential still present). 370m W – St Johns Church (still present). 500m SW – Small Bridge Colliery (shown as Manor Mill Grease & co circa 1910 - 1911. No longer shown circa 1931 – 1932).
1894	15m ESE – Mill (shown as Hosiery Works circa 1910, candle works circa 1931 and works circa 2006. Works still present). 30m SE – Trafalger Mill (Woollen) (no longer shown circa 1999. Residential circa 2006. Residential still present). 250m SE – Santary Works (no longer shown circa 1999. Residential circa 2006. Residential still present). 325m NW – Greengate Brick Works (no longer shown circa 1910 – 1911). 370m NNW – Mill (shown as residential circa 1978. Residential still present). 400m N – Rochdale Union Workhouse Mills (shown as Poor Law Institution circa 1931 and Birch Hall Hospital circa 1956. No longer shown circa 2017).
1910 - 1911	140m N – Residential development (still present). 390m NNE – Dearnley Oil Mills (shown as works circa 1967 and residential circa 2006. Residential still present).
1931 - 1932	60m – 250m NE – Residential development (still present). 230m W – Filter Tanks (no longer shown circa 1967. Residential circa 2006. Residential still present). 250m SW – Cricket Ground (shown as Tennis Ground circa 1938. No longer shown circa 1967).
1938	300m NE – Sewage Works (no longer shown circa 1990).
1956	270m – 500m NW – Residential development (still present).
1967 - 1968	35m W – Springs (still present). 50m N – Allotment Gardens (no longer shown circa 1990). 135m NW – Allotment Gardens (shown as residential circa 2006. Residential still present). 150m NNE – Garage (still present).
1978 - 1979	0m – 200m NE – Residential development (still present). 40m – 270m E – Residential development (still present). 350m N – School (still present).
1990	300m – 500m NW – Residential development (still present).
1999	130m SE – Allotments (no longer shown circa 2006). 150m – 500m S – Large ponds (still present. On shown as Clegghall Fisheries circa 2017)
2006	No significant changes.
2017	No significant changes.

Table 2-1: Summary of significant historical features taken from report by Betts Geo Environmental Ltd.

2.3 Environmental Setting

The environmental setting is summarised in Table 2-2.

Categories			Details
Geology	Artificial		-None recorded on site.
	Superficial		-Till/Devensian (gravelly sandy CLAY) across the majority of the site. -Alluvium (Clay, Silt, Sand and Gravel) across the south of the site. -Landslip deposits against the southern boundary in the centre of the site. -Site located in glacial channel, see Plate 2-1.
	Bedrock		-Milnrow Sandstone (Sandstone) across the majority of the site. -Pennine Lower Coal Measures (Mudstone, Siltstone and Sandstone) and Darwen Flags (Sandstone) in the east of the site. -Upper Mountain (Hogards) Coal outcrops in the far east of the site. -Two faults run from northwest to southeast through the centre of the site
Hydro-geology	Aquifer Designation	Superficial	-Secondary Undifferentiated Aquifer across the majority of the site. -Secondary A Aquifer along the southern boundary.
		Bedrock	-Secondary A Aquifer.
	Source Protection Zone (SPZ)		-Site is not within an SPZ.
	Groundwater Abstractions		-None within 500m.
Hydrology	Nearest Surface Water		-Pond noted during walkover. Spring present. River Roch adj. to south.
	Water Quality Data		-River Roch onsite, River Quality B.
	Flooding		-South of the site along the River Roch lies within Flood Zone 3. -Potential for groundwater flooding at the surface across much of the site.
	Surface Water Abstractions		-None within 500m.
	Discharge Consent		-Three onsite, seven within 250m. -Nearest onsite, United Utilities Water Limited, Storm Tank discharging Public Sewage: Storm Sewage Overflow into the River Roch.
	Pollution Incidents		-Six within 250m. -Nearest onsite, Septic Tank Effluent in stream, June 1997. Category 3 – Minor Incident.
Minerals / Mining	Coal Mining Development High Risk Area (DHRA)		-The far east of the site is within a DHRA. -One shaft present adj. to eastern boundary.
	Coal Report		-The property is in a surface area that could be affected by underground mining in two seams of coal at 30m to 190m depth, and last worked in 1891. Any movement in the ground due to coal mining activity should have stopped. -Within, or within 20m of, the boundary of the property is one mine entry (offsite). There is no record of what steps, if any, have been taken to treat the mine entry. There may be additional mine entries in the local area the Coal Authority has no knowledge of.
	Surface Extractions		-No mineral extraction within 250m.
	Cheshire Brine Compensation District		-Not within site area.

Table 2-2: Summary of the environmental setting.

Categories		Details
Ground Stability ¹ (on-site)	Collapsible Ground	-Very low to low hazard.
	Compressible Ground	-No to moderate hazard.
	Landslide	-Very low to low hazard. -However, landslip deposits noted onsite on BGS mapping.
	Running Sand	-Very low to low hazard.
	Shrinking / Swelling Clay	-Very low hazard.
	Ground Dissolution	-No hazard.
Landfill sites	Known/Registered	-One within 250m. -243m northeast, Land at Stubley Mill Road deposited waste included inert waste. Last input December 1990.
	Potential	-Nine within 250m. -Nearest 92m east. Unknown filled ground on 1956 mapping.
Radon		-Probability of <1% of homes above Action Level. No further action required.
Designated Sites		-227m east, Rochdale Canal Site of Special Scientific Interest
Contemporary Trade Directory		-Four within 100m. -Nearest 49m east. Paragon Car Sales, car dealers. Status inactive.
Fuel Station Entries		-None within 100m. -Nearest 137m northeast. Gem Rochdale, Texaco Petrol Station. Status open.

Table 2-2(continued): Summary of the environmental setting.

Although not discussed in the Betts Geo Environmental Ltd (PRA Ref: 17TAY040/DS, dated August 2017), according to the BGS online 1:50,000 linear features and Sheet 76 1:50,000 BGS digital mapping dated 2008, the site is located within a glacial channel. This is shown in Plate 2-1 below.



Plate 2-1: Extract of superficial geology mapping.

Notes

Left: BGS 1:50,000 linear features over Google Earth Aerial Image. Red line = site boundary; light blue dots with short lines = extent of glacial channel.

2.4 Contamination Sources / Pathways and Receptors

Potential contamination sources as identified by Betts Geo Environmental Ltd are detailed in Table 2-3.

Source	Distance/ Direction	Details	Significant Risk
Current Land Use	On Site	Parcels 2 and 3 currently used as open grassland therefore limited contamination risk is anticipated from this source. A mound and depressions however were noted in Parcel 1. These could indicate potential Made Ground which could contain heavy metals, TPH's, PAH's and asbestos. This is also indicated by the colour of the water in the pond during the time of the walkover. Made Ground and ashy fill surrounding the pond are also a potential ground gas source. Parcel 4 is also anticipated to consist of Made Ground due to the water storage tanks located on site. Ground investigation and ground gas monitoring to confirm.	Yes in Parcels 1 and 4 Unlikely in Parcels 2 and 3
Historic Land Use – Majority of Site	On Site	Majority of site has remained undeveloped apart from a number of footpaths shown across site. Localised Made Ground anticipated in the vicinity of the footpaths however, anticipated cohesive superficial geology across the site limiting any contamination migration. Ground investigation to confirm.	Unlikely
Historic Land Use – Coal Mining	On Site	Coal shaft is located on site/in immediate area. Coal Authority report states there are 2 coal seams within 30m – 190m below site. There is therefore a high risk of historic shallow mine workings and ground gas. Possible acid mine drainage in area represented by orange pond water noted during site walkover though this may be related to the Made Ground on site. Ground investigation and ground gas monitoring to confirm.	Yes
Discharge Consents	On Site	Three Discharge Consents located on site, all for a sewerage storm tank into the River Roch. Due to the consent being for a storm tank, the system would only discharge to the river in periods of very high rainfall or during an emergency. Due to these conditions, and the dilution factor within the River Roch, this source is unlikely to be a significant risk.	Unlikely
Pollution Incidents	On Site	One pollution incident recorded on site. This incident was recorded as a Category 3 incident involving septic tank effluent into the River Roch and occurred in 1997. No impact is anticipated from this source due to the incidents classification and the date of the incident.	No
Potential Leachate in Pond/River	On Site	Orange sediment/water was noted within the pond indicating potential for leachate or heavy metals or drainage. Water testing required from the pond and up and downstream of the River Roch.	Yes

Table 2-3: Potential contamination sources.

Surrounding Land Uses – Mills/Works	Within 250m of Site	A number of historic mills/works were located within 250m of the site, the closest being 15m ESE between circa 1894 – present). Risk of heavy metals, TPH's, PAH's, asbestos, VOC's and SVOC's from these sources however anticipated cohesive superficial geology surrounds the majority of the site limiting any migration onto site. Majority of mills/works have also been redeveloped to residential. Band of alluvium to the south of the site is a possible contamination migration pathway however the River Roch binds the south of the site. Ground investigation and ground gas monitoring to confirm.	Possible
Allotment Gardens	50m N and 135m NW	Allotment gardens shown between circa 1967 – 1990/2006. Possible imported soils to the area which could contain heavy metals, TPH's, PAH's and asbestos. Due to the anticipated cohesive superficial geology surrounding the majority of the site, migration onto site is deemed unlikely. Ground investigation and ground gas monitoring to confirm.	Unlikely
Petrol Station	137m NE	Petrol station located 137m NE of site. Risk of fuel leakages from underground storage tanks or fuel run off the forecourt. Petrol Station holds a Contemporary Trade Directory Entry and is covered by hardstanding. If fuel leakages have occurred, possible heavy metals, TPH's and PAH's in the vicinity. Also a risk of ground gas. Due to the anticipated cohesive superficial geology surrounding the majority of the site, migration onto site is deemed unlikely. Site also surrounded by residential development. Ground investigation and ground gas monitoring to confirm.	Unlikely
Historical Landfill Site	243m NE	Historical landfill recorded 243m NE with the last date of input being 1990. Deposited wastes include inert waste. Possible source of contamination (heavy metals, TPH's, PAH's, asbestos and leachates) and ground gas. Risk of migration onto site lowered by the anticipated cohesive superficial geology surrounding the majority of the site. Ground investigation and ground gas monitoring to confirm.	Possible

Table 2-3 (continued): Potential contamination sources.

Potential receptors are detailed in Table 2-4.

Receptors	
Human Health	- Future site users (including residents, visitors and site workers). - Offsite land users.
Controlled Waters	- Pond and spring onsite. - River Roch adjacent to southern boundary. - Secondary Undifferentiated and A Aquifers.
Buildings and structures.	
Potable water pipes.	
Flora within future gardens/landscaping.	

Table 2-4: Potential receptors.

Potential pathways are detailed in Table 2-5.

Pathways		
Soil	Human Health ⁴ (residential land use: houses with private gardens).	- Ingestion of soil. - Ingestion of soil-derived indoor dust. - Ingestion of contaminated vegetables. - Ingestion of soil attached to vegetables . - Dermal contact with soil. - Dermal contact with soil-derived indoor dust. - Inhalation of soil-derived outdoor dust. - Inhalation of soil-derived indoor dust. - Inhalation of vapours outside. - Inhalation of vapours inside.
		- Windblown dust / fibres to adjacent receptors.
		- Direct contact with receptors (building foundations, services).
		- Root uptake.
Water		- Surface run-off down slope.
		- Infiltration into the ground, through potentially contaminated material (contamination possibly going into solution).
		- Migration through potentially permeable strata and preferential pathways. - Superficial (Till) likely to be low permeability, alluvium likely to be variably permeable. - Bedrock (mudstone, siltstone, sandstone) likely to be variably permeable. - Preferential pathways: services, possible shallow worked coal seams.
		- Migration through potentially permeable strata and preferential pathways. - Superficial (Till) likely to be low permeability, be variably permeable. - Bedrock (mudstone, siltstone, sandstone) likely to be variably permeable. Sandstone likely to be permeable. - Preferential pathways: services, possible shallow worked coal seams.
Gas		- Migration into buildings (e.g. via services) and accumulation of gases in confined spaces (potentially causing explosion if methane is present).

Table 2-5: Potential pathways.

2.5 LKC Preliminary Contamination Conceptual Model

The preliminary contamination conceptual model in the Betts Geo Environmental Ltd report has been updated to be in line with LKC current risk assessment methodology (detailed below). The model is based on the contamination sources, pathways and receptors identified in the original report. LKC also consider the following should be considered:

- Migration of water and gas through preferential pathways (services, worked coal seams).

The preliminary contamination conceptual model using contaminant-pathway-receptor linkages based on guidance in LCRM⁵ has been summarised in Table 2-6.

Each pollutant linkage is described along with an assessment of the risk based upon guidance on probabilities and consequences outlined in CIRIA C552⁶. The risk matrix is provided in Appendix A.

Due to the minor consequence associated with the phytotoxic effect to flora (i.e. loss of plants in a landscaping scheme), the overall risk for the majority of sites will be very low to low. Where soils contain significant concentrations of heavy metals, in general there will other pollutant linkages (i.e. the risk to human health) that will trigger the requirement for

⁴ EA (2008). "Updated Technical Background to the CLEA Model." Science Report – SC050021/SR3.

⁵ Land Contamination Risk Management (LCRM) <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>

⁶ CIRIA (2001). "Contaminated Land Risk Assessment: A Guide to Good Practice". C552.

remediation (e.g. a clean environmental cover system). As such the risk to flora associated with phytotoxic contaminants will not be considered further.

The risk to buildings associated with elevated sulphate will be considered as part of the geotechnical assessment and will not be included in the contamination risk assessment.

It should be noted that there may be risk from short term exposure from contaminated soil to site workers during development work. The Preliminary Contamination Conceptual Model deals with long term exposure to key receptors associated with the future use of the site. Acute risks can be easily mitigated by good environmental management of the site during site works. Standard health and safety precautions (as per HSE guidance⁷) should be adopted by all workers involved with site enabling and construction works. Therefore, this receptor is not considered in the contamination conceptual model.

2.6 Recommendations

Based upon the Preliminary Contamination Conceptual Model a site investigation was recommended to assess the potential pollutant linkages further.

⁷ HSE (1991). "Protection of Workers and the General Public During Development of Contaminated Land" London HMSO.

Pollutant Linkage	Pathway	Receptor	Contaminant (source)	Probability	Consequence	Risk	Assessment and Recommendations
PL1	-Dermal contact. -Inhalation of soil, fibres and dust. -Ingestion of soils, dust, vegetables, soil attached to vegetables. -Windblown dust.	-Future site users. -Offsite receptors.	-ACM -Heavy metals -PAHs -Heavy end hydrocarbons (potentially in made ground, historic coal mining, offsite mills).	Low	Medium	Moderate / Low	-Low probability as majority of the site has been undeveloped. -Moderate risk assumed due to sensitive nature of development (residential) and unknown mounds onsite. -Recommendation: Intrusive investigation required.
PL2	-Inhalation of vapours. -Migration through permeable strata and preferential pathways.	-Future site users. -Offsite receptors.	-Volatile Contaminants such as hydrocarbons, solvents (potentially in made ground, historic coal mining, offsite mills).	Low	Medium	Moderate / Low	-Low probability as significant leakages / spillages of volatile contamination not anticipated from contamination sources. -Moderate risk assumed due to sensitive nature of development (residential) and onsite preferential pathways. -Recommendation: Sampling required if evidence of volatile contaminants identified in the ground during investigations.
PL3	-Inhalation of gas. -Migration through permeable strata and preferential pathways. -Explosion in confined spaces.	-Future site users. -Buildings. -Offsite land users.	-Methane, carbon dioxide. (Historic coal mining beneath site, potentially infilled features onsite and within 250m of the site).	Likely	Severe	High	-Likely probability due to viable source of gas identified and sensitive nature of development (residential). -Recommendation: Gas monitoring required.
PL4	-Surface Run-off. -Migration through permeable strata and preferential pathways -Perched waters migration.	-Groundwater (Secondary Undifferentiated & A Aquifers). -Surface water (pond, spring, Adj. River Roch).	-Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds (potentially in made ground, historic coal mining, offsite mills).	Low	Medium	Moderate / Low	-Low probability as significant leakages / spillages of volatile contamination not anticipated from contamination sources. -Moderate risk assumed at this stage due to the sensitivity and permeability of the underlying aquifers and proximity of surface water. -Recommendation: Precautionary sampling required.
PL5	-Ingestion of tainted water supply.	-Future site users. -Water pipes.	-Organic Contaminants such as hydrocarbons, solvents (potentially in made ground, historic coal mining, offsite mills).	Low	Medium	Moderate / Low	-Low probability as significant contamination not anticipated at pipeline depth (0.75-1.35m). -Risk is considered moderate at this stage due to unknown depth of made ground. -Recommendation: Sampling required if made ground present at pipeline installation depths.

Table 2-6: Preliminary Contamination Conceptual Model.

3 GROUND INVESTIGATION

3.1 Site Investigation Design and Methodology

In order to assess the ground conditions at the site and to investigate the potential pollutant linkages identified in the preliminary contamination conceptual model an intrusive investigation was undertaken.

The investigation was carried out on 19th to 23rd, 26th to 28th February and 8th March 2018. This comprised the following:

- 24no. window sample boreholes drilled to 1.39 to 5.45 metres below ground level (mbgl) (ref. WS101 to WS124).
- 4no. follow on Dynamic Probes, drilled to 8.95 to 10.00mbgl through Window Sample WS116 to WS119 (ref. DP116 to DP119).
- 27no. trial pits (using JCB) excavated to 1.20 to 3.30mbgl (ref. TP101 to TP127).
- 15no. Dynamic Cone Penetration tests to 1.00mbgl (ref. DCP101 to DC115).
- 1no. large trench undertaken to expose the cap of the coal shaft.

The dynamic probes were undertaken to allow a quick assessment of the strength of the ground below 5.00mbgl. It should be noted that the type of strata cannot be confirmed during these tests.

The locations were chosen to allow a good spread across the site as well as target areas of concern. Table 3-1 details the targeted site investigation locations.

Site Investigation Locations	Rationale
WS101, WS102, WS103, WS104, WS114 and WS115	Along River Roch.
WS110, WS109, WS117, WS118 and TP119	Close to sunken features and possible workings.
WS113, TP126 and TP127	Vicinity of historic coal mine.
WS119	Close to existing embankment.

Table 3-1: Summary of sampling locations.

The targeted investigation locations as well as the non-targeted investigation locations allow a good spread across the site. The number of sampling points corresponds to one location per 50m square centres. This is considered appropriate given the size of the site, the historical land use and the relatively homogeneous ground conditions encountered.

All site investigation locations are shown in Figure 4. All profile logs are provided in Appendix B and are in line with BS14688-1⁸ and BS5930⁹.

3.2 Well Installations

Twelve window sample boreholes (WS101, WS103, WS104, WS107, WS109, WS111, WS112, WS115, WS119, WS120, WS123 and WS124) were installed with monitoring wells for gas and groundwater monitoring and groundwater sampling.

Monitoring wells were installed in accordance with BS10175 and CIRIA C665¹⁰ and generally comprised approximately 1.00m plain pipe over a length of slotted pipe surrounded by pea gravel and sealed at the top with bentonite and concrete.

Well installation details are provided in profile logs in Appendix B.

⁸ British Standards (2002). "Geotechnical investigation and testing – Identification and Classification of Soil. Part 1: Identification and description." BS EN ISO 14688-1:2002.

⁹ British Standard (2015). "Code of Practice for Ground Investigations." BS5930:2015.

¹⁰ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

3.3 Sampling Protocol

3.3.1 Soil Sampling (Contamination)

Standard sampling protocol and preservation of samples was undertaken as described in the EA guidance on site investigation¹¹.

Soil samples of approximately 500g were recovered in amber jars, amber vials for volatile analysis and plastic tubs. All the samples were labelled and stored in cool boxes prior to being collected by courier at the end of the day for delivery to the Chemtest laboratory in Newmarket for chemical testing. If collection was not possible the same day then samples were stored in the sample storage fridge at the LK Group offices below 4°C. Samples were tracked using appropriate Chain of Custody forms provided by Chemtest. Many of the contamination tests are UKAS or MCERTS accredited and further details are given in the Certificate of Analysis presented in Appendix C. Table 3-2 shows the soil testing undertaken.

Suites and Contaminants	No. Samples	Location & Depth		Justification
Metals / metalloids, pH, water soluble sulphate, speciated PAHs, SOM and asbestos screen.	33	WS101 0.00-0.35m WS104 0.00-0.30m WS106 0.20-0.70m WS107 0.00-0.30m WS110 0.00-0.20m WS111 0.00-0.30m WS112 0.00-0.40m WS113 0.00-0.50m WS115 0.00-0.80m WS117 0.00-0.30m WS119 0.00-0.20m WS120 0.00-0.30m WS121 0.00-0.30m WS121 0.30-1.30m WS123 0.00-0.30m WS124 0.00-0.40m	TP101 0.00-0.40m TP103 0.00-0.30m TP105 0.20-1.20m TP106 0.00-0.20m TP107 0.00-0.40m TP109 0.00-0.30m TP111 0.00-0.30m TP112 0.00-0.40m TP113 0.00-0.30m TP114 0.00-0.40m TP115 0.00-0.40m TP116 0.00-0.30m TP118 0.00-0.30m TP119 0.00-0.70m TP120 0.00-0.20m TP122 0.00-0.40m TP123 0.00-0.40m	A basic suite with a broad selection of contaminants tested on samples across the site where no significant evidence of contamination was identified.
Metals / metalloids, pH, water soluble sulphate, cyanide suite, phenol, TPHCWG, BTEX, MTBE, speciated PAHs, SOM and asbestos screen.	2	TP124 0.00-1.00m TP127 0.00-1.00m		Extensive suite as significant depth of made ground encountered in TP124 and TP127, with pottery, brick coal and fly ash identified.
pH and Water Soluble Sulphate	9	WS108 0.20-1.00m WS109 0.10-0.40m WS110 0.20-1.20m WS113 0.50-1.00m WS118 0.20-1.20m	TP102 0.20-1.00m TP108 0.00-0.20m TP113 0.30-1.30m TP119 0.70-1.40m	Tested to aid in concrete specification.

Table 3-2: Summary of soil sample testing undertaken.

Notes:

If asbestos present during screen identification and quantification will be undertaken.

Metal/metalloids = arsenic, cadmium, chromium, (total and hexavalent), copper, lead, mercury, nickel, selenium, vanadium, zinc and boron; TPHCWG = carbon banded and aromatic/aliphatic split petroleum hydrocarbons; PAH = polycyclic aromatic hydrocarbons; BTEX = benzene, toluene, ethylbenzene and xylenes; MTBE = Methyl tert-butyl ether; VOC = Volatile organic Compounds; SVOC = Semi Volatile Organic Compounds; SOM = Soil Organic Matter.

¹¹ EA (2000). "Technical Aspects of Site Investigation. Volumes 1 & 2 Text Supplements Research and Development Technical Report." P5-065/Tr.

3.3.2 Water Sampling

To establish the condition of shallow groundwater LKC will take groundwater samples from the installed boreholes and surface water samples from the River Roch adjacent to the south of the site.

The groundwater samples were collected a minimum of 1 week after drilling had finished and following well development. Sample collection was undertaken using disposable bailers. The boreholes were purged of all standing water and the samples collected from the recharged water in glass and plastic bottles and glass vials. A water meter was used to test the pH, temperature and conductivity before sampling until equilibrium conditions are met, as per BS10175¹² guidelines. Sampling was carried out in accordance with BS5930¹³ and BS5667-11¹⁴.

All water samples were placed in glass bottles, plastic bottles and septum topped vials and stored in ice packed cool boxes. The samples were sent to Chemtest on the same day for analysis. Many of the contamination tests are UKAS or MCERTS accredited and further details are given in the Certificate of Analysis presented in Appendix D. The sampling suite is presented in Table 3-3.

Suites and Contaminants	No. Samples	Location	Justification
Metals / metalloids, pH, sulphate, cyanide suite, TPHCWG, BTEX, MTBE, speciated PAHs, phenol and hardness.	8	WS104 WS107 WS109 WS112 WS123 SW101 upstream SW102 midstream SW103 downstream	Detailed suite undertaken across the site to confirm the absence of contamination. Detailed suite taken upstream, midstream and downstream of the River Roch adjacent to the site boundary.

Table 3-3. Summary of groundwater sampling tests undertaken.

Notes:

Metal/metalloids = arsenic, cadmium, chromium, (total and hexavalent), copper, lead, mercury, nickel, selenium, vanadium, zinc and boron; TPHCWG = carbon banded and aromatic/aliphatic split petroleum hydrocarbons; PAH = polycyclic aromatic hydrocarbons, BTEX = benzene, toluene, ethylbenzene and xylenes; MTBE = Methyl tert-butyl ether.

3.4 Gas Monitoring

Six gas monitoring visits have been undertaken over a 12-week period / 3-month period (22nd March 2014 to 24th May 2018) in all installed boreholes.

Monitoring was undertaken using a Geotechnical Instruments GA5000 in accordance with the monitoring protocol outlined in CIRIA C665¹⁵ (flow rate measured first). The monitoring was undertaken over a range of weather conditions (including low and falling barometric pressure and heavy rain) to demonstrate worst-case conditions.

The gas monitoring results are reproduced in full in Appendix E.

¹² British Standard (2011). "Investigation of Potentially Contaminated Sites – Code of Practice." BS10175:2011.

¹³ British Standard (2015). "Code of Practice for Ground Investigations". BS5930:2015.

¹⁴ British Standard (2009). "Water Quality – Sampling. Part 11: Guidance on Sampling of Groundwaters". BS ISO 5667-11:2009.

¹⁵ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

3.5 Geotechnical Testing

3.5.1 In-situ Onsite Geotechnical Testing

In-situ geotechnical tests were performed in the boreholes to further characterise the sub-soil conditions. The following tests were undertaken:

- Standard Penetration Tests (SPTs) were performed in the window sample boreholes at approximately 1.00m intervals, generally within the natural strata.
- Shear Vane tests (giving undrained shear strength) were performed in the window sample boreholes and trial pits (to a maximum depth of 3mbgl) at approximately 1.00m intervals, within the natural clay strata.
- Continuous equivalent SPTs were performed in the dynamic probes (strata not determined).

The SPT and shear vane readings are provided within the profile logs in Appendix B.

3.5.2 Laboratory Geotechnical Testing

Soil samples taken during the investigation were collected in tubs and bulk bags and sent to Murray Rix Laboratories for geotechnical testing. Many of the tests are UKAS accredited. Testing is currently on-going and the results will be presented once they have been received by LKC. Table 3-4 shows the geotechnical testing undertaken.

Suites and Contaminants	No. Samples	Location	Justification
pH and water soluble sulphate	2	WS102 0.40-1.40m WS108 1.00-2.00m	Additional samples of natural ground taken across the site to assess the pH and sulphate for geotechnical purposes. pH and water soluble sulphate is also included in contamination testing.
Atterberg Limits (plasticity testing)	7	WS104 0.30-1.30m WS109 0.40-1.00m WS113 0.50-1.00m WS117 1.00-2.00m WS122 1.00-2.00m TP101 0.40-1.40m TP116 0.30-1.30m	A selection of clay samples across the site were tested for Atterberg Limits to assess their shrinkability potential associated with current and proposed trees.
Single Stage Triaxial	8	WS108 0.20-1.00m WS110 1.50-2.50m WS111 1.80-2.80m WS116 0.50-1.50m WS118 2.00-3.00m WS120 0.30-1.30m WS124 0.40-1.40m TP103 1.20-1.70m	Undertaken to confirm the strength of the clay strata.
Particle Size Distribution (PSD)	10	WS101 0.35-1.35m WS106 0.70-1.70m WS111 0.30-1.30m WS115 1.00-2.00m WS123 2.00-3.00m WS124 1.40-2.00m TP105 0.20-1.20m TP111 0.30-1.30m TP115 0.40-1.40m TP118 0.80-1.80m	PSD undertaken to confirm grading of granular material.

Table 3-4: Summary of geotechnical testing undertaken.

3.5.3 *Dynamic Cone Penetrometer Tests*

15no. Dynamic Penetration Tests (DCP101-115) were undertaken to determine the characteristic strength of the shallow ground across the site to aid design of proposed roads. Equivalent CBR values can be calculated from the DCP tests.

The DCP was carried out adjacent to correspondingly numbered window sample boreholes (eg. DCP101 undertaken next to WS101) to allow correlation of the strata.

The DCP rig is a manually operated hand held rig which utilises an 8kg weight falling 575mm to strike an anvil. This in turn drives a 60 degree cone into the soil. The number of blows and penetration of each blow is recorded by the operative and the results used to calculate an equivalent CBR value. The test requires that a minimum 50mm diameter hole is cut through any hardstanding. The cone should be driven from a partial height until the cone is below the reference surface.

Prior to undertaking works in each sampling location, the scale is calibrated and a reference surface, normally a staff or other straight edge, placed on the ground.

DCP data sheets are presented in Appendix B and locations are presented in Figure 4. Corresponding profile logs are presented in Appendix B.

4 GROUND CONDITIONS

4.1 Geology – Generalised Sequence

The ground conditions beneath the site comprised thin reworked sandy topsoil underlain by natural sands and clays. A summary section of the logs is provided in Plate 4-1, with additional comments below.

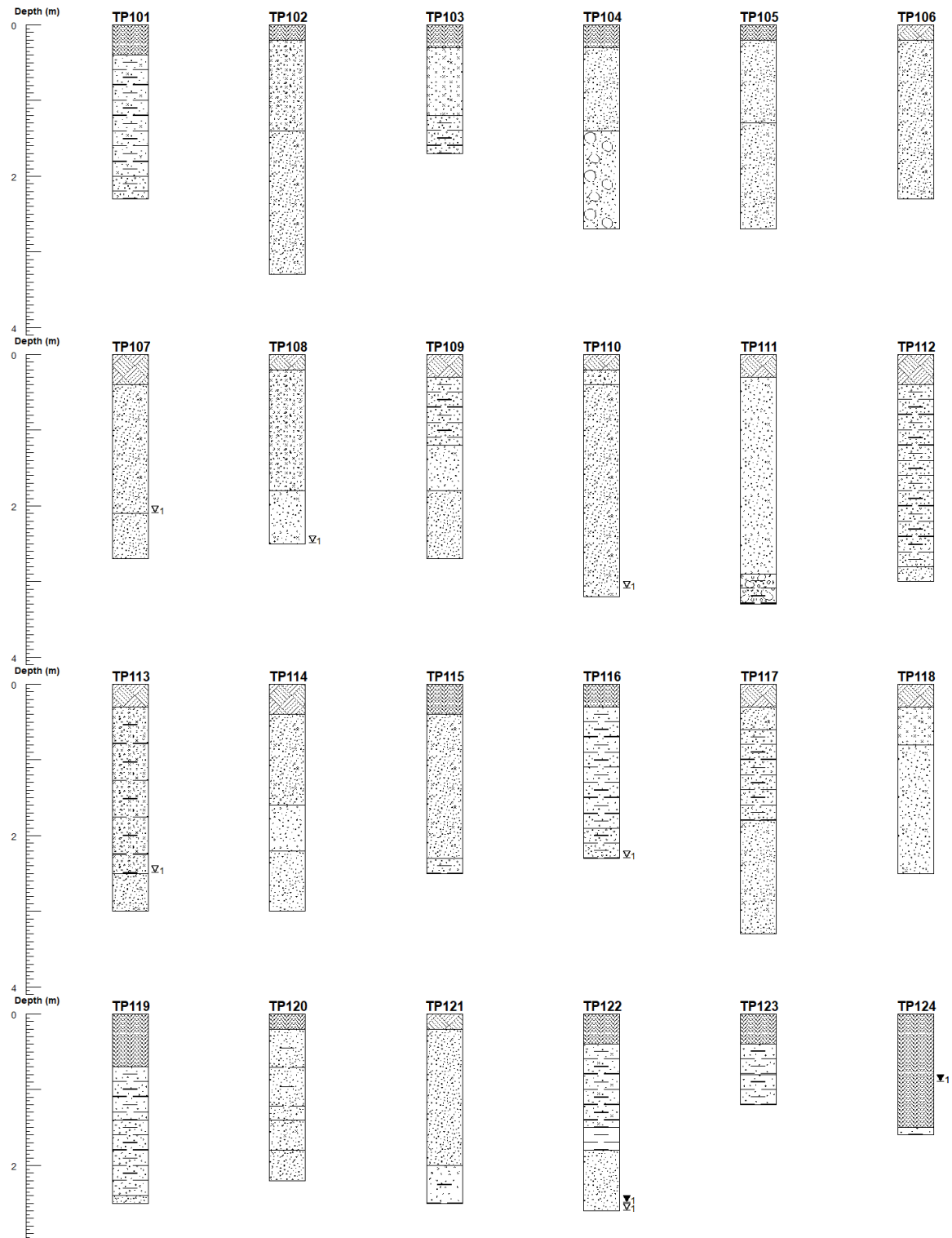


Plate 4-1: Summary of ground conditions.

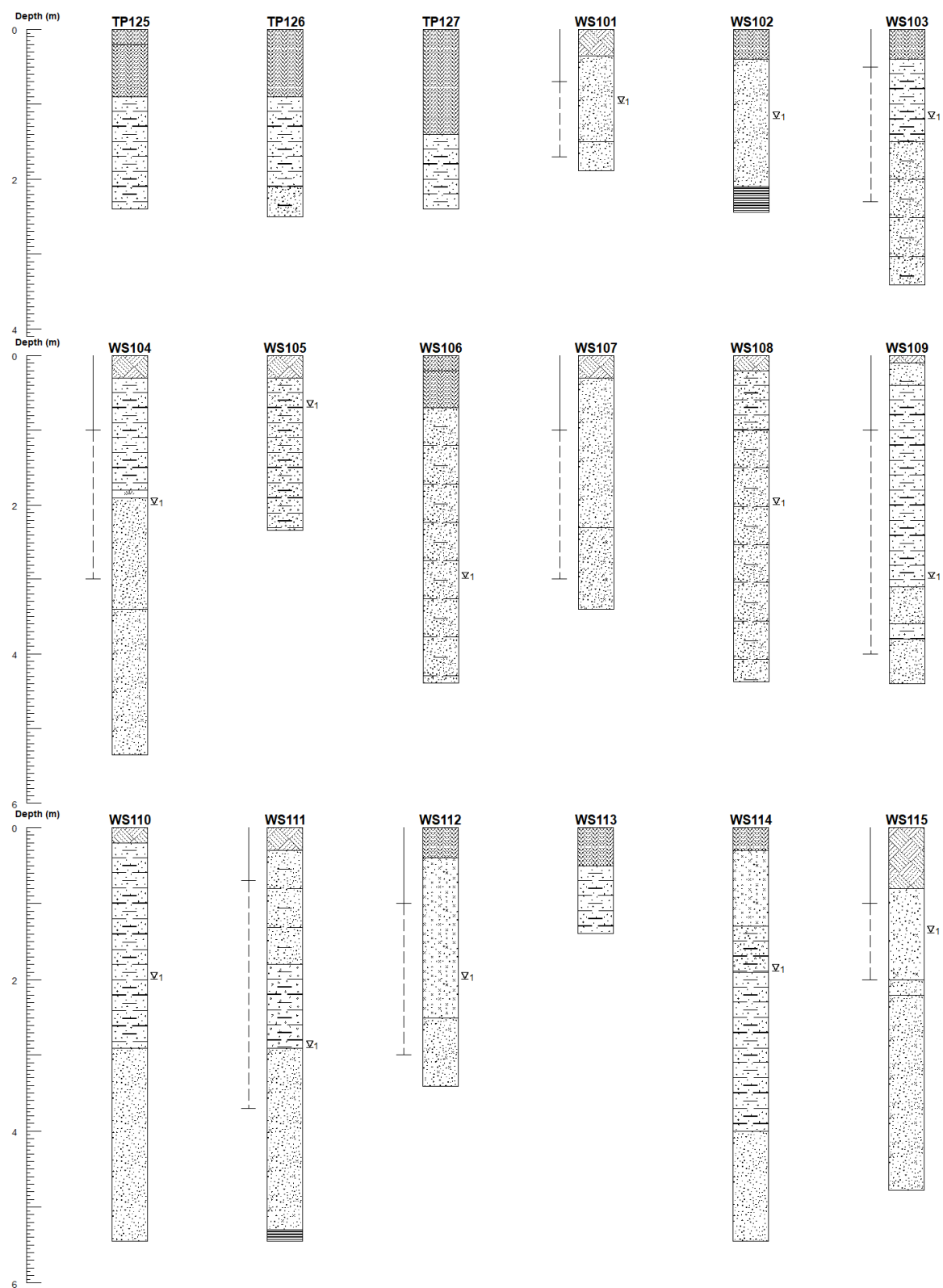


Plate 4-1(continued): Summary of ground conditions.

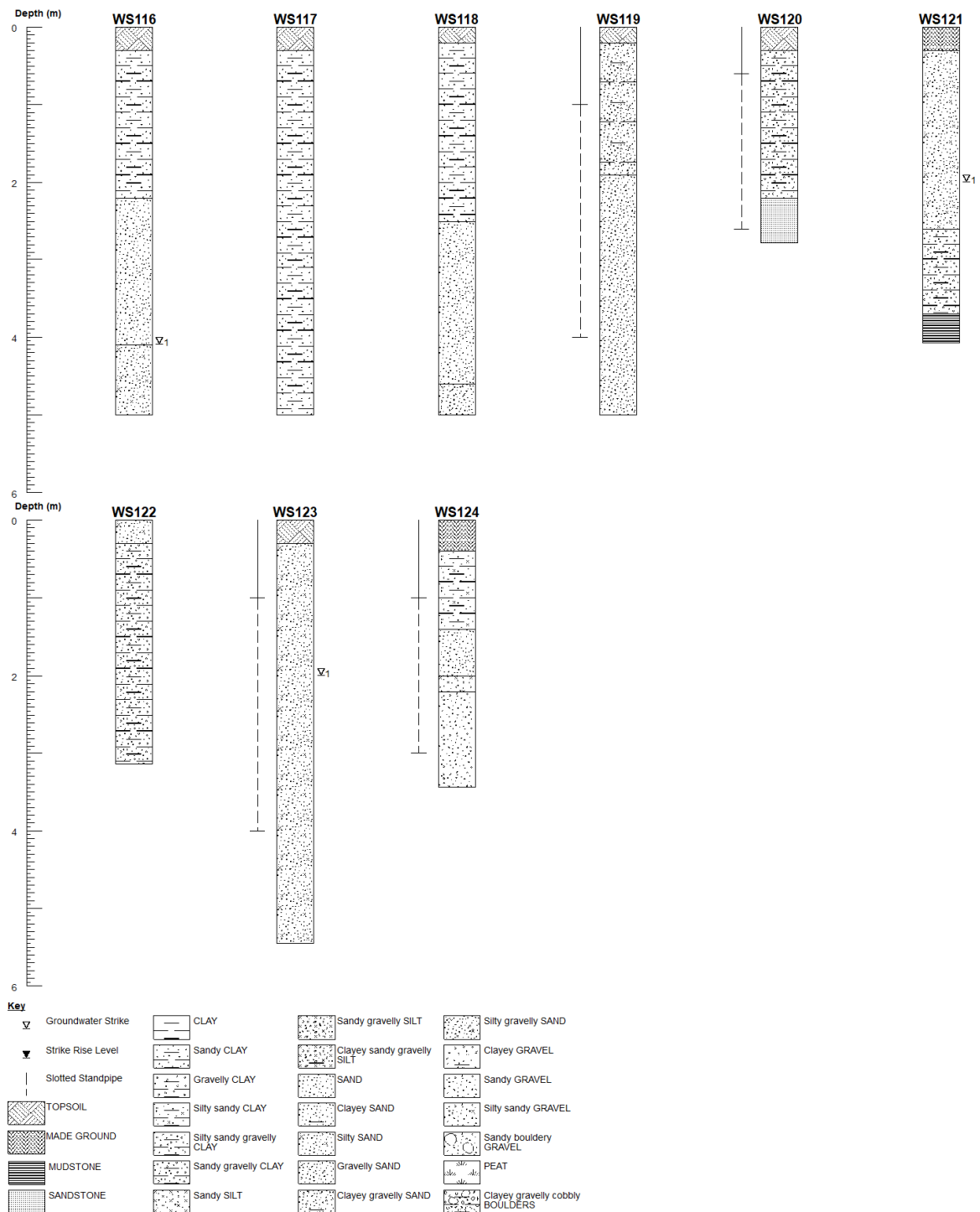


Plate 4-1(continued): Summary of ground conditions.

Additional information on ground conditions:

- Made ground of reworked topsoil was generally recorded to a depth of 0.20-0.40mbgl. Exceptions to this were in;
 - TP119 to 0.70mbgl – occasional brick, sandstone fragments and rare glass.
 - TP122 to 0.40mbgl – occasional concrete, whole brick and fragments.
 - TP123 to 1.00mbgl – frequent concrete and brick around a metal pipe in the north of the trial pit.
 - TP124 to TP127 inclusive to between 0.90-1.50mbgl – frequent pottery, brick fragments, coal and glass.

- No visual / olfactory evidence of hydrocarbons or volatile contaminants in any locations.
- The majority of trial pits were described as stable.
- Lenses of peat were encountered in WS104 only to a depth of 1.90mbgl.
- Superficial deposits comprised of clays and sands over bedrock of weathered sandstone and mudstone.

4.2 Groundwater

4.2.1 Groundwater Levels

Groundwater strikes were recorded during the investigation in trial pits and boreholes. In addition, groundwater monitoring within the borehole wells has been undertaken five occasions. An oil-water interface probe (approximately 1cm detection limit) was used to detect the presence of free phase hydrocarbons within each borehole. Results are presented on the borehole logs contained in Appendix B and the gas monitoring sheets contained in Appendix E and summarised below in Table 4-1.

BH/TP	Water Strike Depths (mbgl)	Well Response Zone (mbgl)	No. of Monitoring Visits	Monitoring Depths (mbgl)			Evidence of Contam?
				Min	Max	Base	
WS101	1.00	0.70-1.70 (S)	5	1.03	1.44	1.71	N
WS102	1.20	-	N/A	-	-	-	N
WS103	1.20	0.50-2.30 (C+S)	5	0.75	1.34	1.90	N
WS104	2.00	1.00-3.00 (C+P+S)	5	0.73	0.89	2.89	N
WS105	0.70	-	N/A	-	-	-	N
WS106	3.00	-	N/A	-	-	-	N
WS107	DRY	1.00-3.00 (S)	5	0.02	0.98	2.19	N
WS108	2.00	-	N/A	-	-	-	N
WS109	3.00	1.00-4.00 (C+S)	5	1.28	1.58	4.00	N
WS110	2.00	-	N/A	-	-	-	N
WS111	2.90	0.70-3.70 (S+C)	5	0.79	1.35	3.36	N
WS112	2.00	1.00-3.00 (Si+S)	5	1.54	1.85	3.01	N
WS113	DRY	-	N/A	-	-	-	N
WS114	1.90	-	N/A	-	-	-	N
WS115	1.40	1.00-2.00 (S)	5	0.71	1.03	2.05	N
WS116	4.10	-	N/A	-	-	-	N
WS117	DRY	-	N/A	-	-	-	N
WS118	DRY	-	N/A	-	-	-	N
WS119	DRY	1.00-4.00 (S)	5	4.06	DRY	4.11	N
WS120	DRY	0.60-2.60 (C+Sst)	5	2.70	DRY	2.70	N
WS121	2.00	-	N/A	-	-	-	N
WS122	DRY	-	N/A	-	-	-	N
WS123	2.00	1.00-4.00 (siS)	5	2.33	2.50	3.80	N
WS124	DRY	1.00-3.00 (C+S)	5	DRY	DRY	2.95	N
TP107	2.10	-	N/A	-	-	-	N
TP108	2.50	-	N/A	-	-	-	N
TP110	3.10	-	N/A	-	-	-	N
TP113	2.50	-	N/A	-	-	-	N
TP116	2.30	-	N/A	-	-	-	N
TP122	2.60	-	N/A	-	-	-	N
TP124	0.90	-	N/A	-	-	-	N

Table 4-1: Summary of water strike depths within boreholes and trial pits.

Response Zones:

C = Clay; Si = Silt; S = Sand; P=Peat; Sst = Sandstone.

Water logged areas and pooling water was noted on the site surface. Due to periods of water logging LKC advise this is taken into consideration for the development.

4.3 In-situ Geotechnical Testing

4.3.1 Standard Penetration Tests

In-situ standard penetration tests (SPTs) were undertaken, predominantly in the natural ground. The results are summarised in Table 4-2 and provided within the profile logs in Appendix B.

Approximate Depth (mbgl)	SPT 'N' Values					
	WS101	WS102	WS103	WS104	WS105	WS106
1.00-1.45	0 (S)	8 (S)	1 (C)	0 (C)	9 (C)	14 (S)
2.00-2.45	>50 (S)	>50 (S+Mst)	27 (S)	24 (S)	>50 (C)	16 (S)
2.70-3.15	-	-	-	12 (S)	-	-
3.00-3.45	-	-	>50 (S)	-	-	12 (S)
4.00-4.45	-	-	-	8 (S)	-	>50 (S)
4.45-4.90	-	-	-	16 (S)	-	-
4.90-5.35	-	-	-	34 (S)	-	-
GW Level	1.00	1.20	1.20	2.00	0.70	3.00

Approximate Depth (mbgl)	SPT 'N' Values					
	WS107	WS108	WS109	WS110	WS111	WS112
1.00-1.45	8 (S)	8 (S)	10 (C)	15 (C)	27 (S)	0 (Si)
2.00-2.45	21 (S)	26 (S)	14 (C)	16 (C)	14 (C)	5 (Si)
3.00-3.45	>50 (S)	23 (S)	17 (S)	26 (S)	28 (S)	>50 (S)
4.00-4.45	-	>50 (S)	>50 (S)	30 (S)	24 (S)	-
5.00-5.45	-	-	-	31 (S)	26 (S)	-
GW Level	DRY	2.00	3.00	2.00	2.90	2.00

Approximate Depth (mbgl)	SPT 'N' Values					
	WS113	WS114	WS115	WS116	WS117	WS118
1.00-1.45	>50 (C)	8 (Si)	1 (S)	8 (C)	12 (C)	13 (C)
2.00-2.45	-	5 (C)	17 (G+S)	18 (C+S)	15 (C)	16 (C)
3.00-3.45	-	8 (C)	12 (S)	21 (S)	18 (C)	14 (S)
3.45-3.90	-	-	17 (S)	-	-	-
4.00-4.45	-	20 (S)	22 (S)	18 (S)	18 (C)	27 (S)
5.00-5.45	-	24 (S)	-	-	-	-
GW Level	DRY	1.90	1.40	4.10	DRY	DRY

Approximate Depth (mbgl)	SPT 'N' Values					
	WS119	WS120	WS121	WS122	WS123	WS124
1.00-1.45	17 (S)	16 (C)	12 (S)	18 (C)	12 (S)	11 (C)
2.00-2.45	16 (S)	29 (C)	14 (S)	14 (C)	8 (S)	15 (Si+G)
2.60-2.78	-	>50 (Sst)	-	-	-	-
2.70-3.14	-	-	-	>50 (C)	-	-
3.00-3.45	14 (S)	-	30 (C)	-	10 (S)	>50 (G)
3.70-4.07	-	-	>50 (Mst)	-	-	-
4.00-4.45	27 (S)	-	-	-	12 (S)	-
5.00-5.45	12 (S)	-	-	-	18 (S)	-
GW Level	DRY	DRY	2.00	DRY	2.00	DRY

Table 4-2: Summary of SPT (N) values.

Notes:

C = Clay; Si = Silt; S = Sand; G = Gravel; Mst = Mudstone; Sst = Sandstone.

Groundwater level based on strikes during the investigation.

4.3.2 Dynamic Probing

Dynamic probing (DP) was carried out from around 5.00mbgl and recorded equivalent 'N' values (3 DP blows = 1 'N' values). Results are provided in Appendix B and summarised in Table 4-3.

Depth (mbgl)	Equivalent 'N' Values			
	DP116	DP117	DP118	DP119
5.20-5.50	14	6	41	-
5.50-5.80	13	7	Ref	12
5.80-6.10	19	8	-	20
6.10-6.40	17	13	-	24
6.40-6.70	16	15	-	16
6.70-7.00	18	20	-	19
7.00-7.30	23	29	-	22
7.30-7.60	19	25	-	25
7.60-7.90	23	35	-	32
7.90-8.20	27	55	-	34
8.20-8.50	39	28	-	35
8.50-8.80	42	28	-	37
8.80-9.10	Ref	29	-	35
9.10-9.40	-	37	-	32
9.40-9.70	-	42	-	19
9.70-10.00	-	38	-	29

Table 4-3: Summary of Dynamic Probe results.

4.3.3 Shear Vanes

Hand shear vane readings, recording undrained shear strength (USS), were taken within the clay strata. The results are summarised in Table 4-4 and provided within the profile logs in Appendix B.

Approximate Depth (mbgl)	Average Undrained Shear Strength (kN/m ²)					
	TP101	TP103	TP109	TP112	TP116	TP117
1.00	40	-	60	90	30	50
1.50	-	90	-	-	-	90
2.00	60	-	-	-	40	-
GW Level	DRY	DRY	DRY	DRY	2.30	DRY

Approximate Depth (mbgl)	Average Undrained Shear Strength (kN/m ²)					
	TP119	TP122	TP123	TP125	TP126	WS103
0.50	-	-	50	-	-	-
1.00	50	40	70	50	80	12
1.50	-	50	-	-	-	-
2.00	30	-	-	40	-	-
GW Level	DRY	2.60	DRY	DRY	DRY	1.20

Approximate Depth (mbgl)	Average Undrained Shear Strength (kN/m ²)					
	WS108	WS109	WS110	WS111	WS114	WS116
1.00	35	45	70	-	60	50
2.00	-	80	80	100	30	50
3.00	-	60	-	-	-	-
GW Level	2.00	3.00	2.00	2.90	1.90	4.10

Table 4-4: Summary of average hand shear vane readings.

Approximate Depth (mbgl)	Average Undrained Shear Strength (kN/m ²)			
	WS117	WS118	WS120	WS122
1.00	100	60	50	40
2.00	120	65	60	50
3.00	90	-	-	-
GW Level	DRY	DRY	DRY	DRY

Table 4-4 (continued): Summary of average hand shear vane readings.

Notes:

Groundwater level based on strikes during investigation works.

Shear vane readings can be influenced by coarse material including coarse silt.

4.3.4 Dynamic Cone Penetrometer Tests

Equivalent CBR values from the DCP results have been calculated using UK DCP v3.1 software provided by the Transport Research Laboratory. The DCP Logs and software output sheets are provided in Appendix B.

The software can also identify an assumed change in layers based upon changes in density and these are highlighted on the output sheets.

Exceptionally high or low CBR results which deviate from the expected best fit line are most likely due to the driving of coarse gravel or cobble sized particles, or encountering localised very loose or soft unconsolidated strata.

Equivalent CBR results are presented in Table 4-5.

DCP101		DCP102		DCP103		DCP104		DCP105	
Depth (mm)	CBR (%)	Depth (mm)	CBR (%)	Depth (mm)	CBR (%)	Depth (mm)	CBR (%)	Depth (mm)	CBR (%)
401 (S)	4	261 (MG)	5	432 (MG)	10	926 (C)	4	480 (Si)	7
931 (S)	3	927 (S)	5	925 (C)	4	-	-	967 (C)	5

DCP106		DCP107		DCP108		DCP109		DCP110	
Depth (mm)	CBR (%)	Depth (mm)	CBR (%)	Depth (mm)	CBR (%)	Depth (mm)	CBR (%)	Depth (mm)	CBR (%)
775 (MG)	5	440 (S)	9	774 (S)	6	530 (Si)	5	440 (S)	4
933 (S)	25	940 (S)	26	925 (C)	21	930 (C)	7	950 (C)	9

DCP111		DCP112		DCP113		DCP114		DCP115	
Depth (mm)	CBR (%)	Depth (mm)	CBR (%)	Depth (mm)	CBR (%)	Depth (mm)	CBR (%)	Depth (mm)	CBR (%)
440 (S)	5	590 (MG)	5	470 (MG)	14	950 (Si)	4	594 (Si)	4
940 (S)	4	952 (Si)	14	967 (C)	8	-	-	935 (S)	7

Table 4-5: Summary of Equivalent CBR (%) values

Notes

Depth = depth to layer bottom (mm), strata type given in brackets

MG=Made Ground; C = Clay; Si = Silt; S = Sand.

4.4 Geotechnical Laboratory Testing

4.4.1 Single Stage Triaxial Test

Single stage triaxial testing has been undertaken on eight samples of the natural clay strata. The results are presented in Appendix F and summarised in Table 4-6.

Location	Depth (mbgl)	Material Description	Undrained Shear strength (kPa)
WS108	0.20-1.00	Firm brown silty sandy CLAY with rare gravel.	52
WS110	1.50-2.50	Firm brown silty sandy CLAY with rare gravel	48
WS111	1.80-2.80	Stiff brown silty sandy CLAY with rare gravel	94
WS116	0.50-1.50	Firm brown silty sandy CLAY with rare gravel	58
WS118	2.00-3.00	Stiff brown silty sandy CLAY with rare gravel	80
WS120	0.30-1.30	Firm brown silty sandy CLAY with rare gravel	50
WS124	0.40-1.40	Firm brown silty sandy CLAY with rare gravel	42
TP103	1.20-1.70	Stiff brown silty sandy CLAY with rare gravel	126

Table 4-6: Summary of single stage triaxial results.

4.4.2 Particle Size Distribution

Particle size distribution (PSDs) tests were carried out on granular strata to confirm the material type. Full results are presented in Appendix F and summarised below in Table 4-7.

Location	Depth (mbgl)	Material	Percent passing through sieve		
			63mm	2mm	0.063mm
WS101	0.35-1.35	Brown silty SAND with rare gravel	100%	99%	20%
WS106	0.70-1.70	Stiff brown silty sandy CLAY with frequent gravel	100%	70%	33%
WS111	0.30-1.30	Brown silty SAND and GRAVEL	100%	58%	11%
WS115	1.00-2.00	Brown silty fine to coarse SAND with abundant gravel	100%	69%	11%
WS123	2.00-3.00	Brown silty fine to medium SAND	100%	100%	24%
WS124	1.40-2.00	Brown silty fine to coarse SAND with rare gravel	100%	98%	16%
TP105	0.20-1.20	Brown silty fine to medium SAND	100%	100%	17%
TP111	0.30-1.30	Brown silty fine to medium SAND with abundant gravel	100%	69%	31%
TP115	0.40-1.40	Brown silty fine to medium SAND with rare gravel	100%	90%	20%
TP118	0.80-1.80	Stiff brown silty sandy CLAY with frequent gravel	100%	73%	63%

Table 4-7: Summary of particle size distribution results.

Notes:

% passing: 63mm = cobble / gravel boundary; 2mm = gravel / sand boundary; 0.063mm = sand / silt boundary

4.4.3 Atterberg Limits

Representative samples of natural clay were subjected to Atterberg Limits (plasticity) and Moisture Content testing. Results are presented in Appendix F and summarised in Table 4-8.

Table 4-8 also includes the modified plasticity index as detailed in Chapter 4.2-D5 of the NHBC standards (modified plasticity index = plasticity index x % less than 425µm sieve / 100%).

Location	Depth (mbgl)	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Class	Passing 425 micron (%)	Modified Plasticity Index (%)
WS104	0.30-1.30	36	45	21	24	CI	89	21.36
WS109	0.40-1.00	33	50	24	26	CI/CH	94	24.44
WS113	0.50-1.00	20	40	18	22	CI	95	20.90
WS117	1.00-2.00	15	38	17	21	CI	90	18.90
WS122	1.00-2.00	13	35	15	20	CL/CI	64	12.80
TP101	0.40-1.40	28	40	20	20	CI	86	17.20
TP116	0.30-1.30	50	55	27	28	CH	98	27.44

Table 4-8: Summary of plasticity index testing.

The modified plasticity index is between 12.80% and 27.44%. This characterises the clay as having a low to medium volume change potential.

4.4.4 Sulphate and pH

Water soluble sulphate and pH tests were carried out on soil samples. Full results are presented in Appendices C and E, and summarised in Table 4-9.

Strata	pH	Sulphate (g/l)
Made Ground	5.6 to 8.3	<0.010 to 0.059
Natural	5.1 to 7.7	<0.010 to 0.350

Table 4-9: Summary of pH and sulphate results.

5 GEOTECHNICAL ASSESSMENT

Final foundation design will need to be confirmed once loadings of proposed buildings are known and details of ground works (i.e. potential cut and fill exercises) are known.

A preliminary foundation assessment is summarised in Table 5-1.

Proposed Development	Residential properties with associated landscaping and parking.
General Ground conditions / Geotechnical Testing	Maximum investigation depth 10.00mbgl. SPTs in natural sand at 1.00mbgl N = 0-27, at 2.00mbgl N = 8-50, at 3.00mbgl N = 10-50. Allowable bearing pressures (refer to Figure 5, Foundation Zone Plan): 100kN/m² to 120kN/m² at 1.00mbgl to 2.00mbgl in natural ground (i.e. medium dense sands and gravels and/or stiff clays). Bedrock (weathered sandstone and mudstone) was encountered at varying depths across the site. Generally, at shallow depths in the north and deeper to the south. Evidence of water logged ground and shallow groundwater present in areas of the site.
Anticipated Foundation Type	Traditional strip or trench fill footings are considered acceptable based on ground conditions encountered during the site investigation. An outline foundation zoning plan is presented in Figure 5. Made ground on site is unsuitable as a founding stratum and all foundations should be founded in natural ground. Further assessment of the ground conditions at each plot location should be undertaken by a suitably qualified and competent person. If the soil at foundation level is found to be loose, soft or consisting of made ground, we recommend excavation and removal of this material and replacing with suitable granular material compacted to specification (or mass concrete). Consideration needs to be given for the potential for differential settlement due to the presence of both granular and cohesive deposits at foundation level. While a granular material may settle 'immediately' the cohesive material will settle over time leading to differential settlement. Additional reinforcement may be required where these ground conditions are encountered.
Shallow Groundwater	Shallow groundwater identified on the site which will present a constraint to the development. Water logged areas and pooling water was noted on the site surface. Suitable drainage should be considered in the proposed development layout. Lowering of the water table may be required to facilitate the construction work especially site level reductions. A discharge consent to release water to existing storm water or foul water drains may be required.
Concrete Requirements	Based on BRE Digest 2005 ¹⁶ – DS-1 AC-1 recommended.
Services	Services – consideration to the presence of services running through the site. Services may need to re-routed.
Coal Mining	A mining investigation (TLC report ref. Mining Report (021018) - Rev G (081019), dated October 2019) and Access Road Remediation Strategy (LKC letter report ref. LKC 18 1005, dated 10 th December 2019) have been carried out as part of these works and are reported under a separate cover. It is recommended that this report is read in conjunction with the mining report and access road remediation strategy.
Temporary support of excavation	May be required; however, trial pits were generally recorded as stable but trench side collapse in granular ground was not uncommon.

Table 5-1: Summary geotechnical assessment.

¹⁶ BRE (2005). "Concrete in Aggressive Ground." Special Digest 1.

Slope stability	An assessment of slope stability has been undertaken based on the proposed final development levels as provided by Taylor Wimpey. Please read the LKC Slope Stability Assessment (ref. CL-602-LKC 22 1183-01, dated August 2022) in conjunction with this report. Profiles were assessed at a number of locations across the site and the slopes across a majority of the development area were between 1v in 10h and 1v in 15h. There are not considered to be any stability issues for slopes of this gradient based on the proposed development unless any locally steeper and weaker ground is encountered during groundworks. The slopes in the south of the site closer to the river (not indicated to be developed on for housing) had slopes generally of around 1v in 5h, which are also not considered to pose a significant risk to the proposed development. An area of the lower part of the site, where the proposed slopes are the steepest, has a gradient of approximately 1v in 1.5h. Based on the ground conditions in this area, there is the potential for slope instability. However, the nearest housing plot to this slope is approximately 20m away and therefore is unlikely to be within the zone of influence from any potential slippage or slope collapse. Although the risk of slope instability in the localised area identified is low, the probability of any potential slippage can be further reduced by mitigation measures such as ensuring the slope is well drained (e.g. use of counterfort drains) and is permanently grassed or similarly vegetated.
Plasticity	Consideration will need to be given to the shrink / swell of the clay strata if it is to be used as a founding stratum, particularly where trees/hedges are present or planned in the future. Foundations may need to be deepened to avoid the risks associated with the effects of trees. A low to medium volume change potential has been calculated for the site, and guidance should be sought using NHBC^[2] for determination of the minimum founding depth.
Road / Pavement Design	A design CBR value of 5% should be adopted for the made ground, 3% for natural sand and 4% for natural clay.

Table 5-1(continued): Summary geotechnical assessment.

^[2] NHBC (2018). "National House Building Council." Technical Standard, Part 4.

6 GENERIC RISK ASSESSMENT

6.1 Introduction

Current good practice requires that the findings from a site investigation should be evaluated on a site specific basis, using a risk based approach. Risk assessment involves identification and evaluation of the hazards presented by the concentrations of contaminants measured followed by an evaluation of the risks which are associated with these hazards (CLR11¹⁷). Information gathered from the risk assessment has been collated in the revised contamination conceptual model in Section 6.6.

6.2 Soil Risk Assessment

6.2.1 Methodology

With regards to the soil risk assessment LKC will use the following hierarchy:

- Category 4 Screening Levels (C4SLs).
- LQM Suitable 4 Use Levels (S4ULs).
- ATRISK Soil Screening Values (SSVs) and CL:AIRE Generic Assessment Criteria (GACs).

C4SLs were published in 2013^{18,19}. The recent change to the contaminated land guidance has changed the evaluation of risk from 'minimal' (referred to as Health Criteria values (HCVs))²⁰ used to generate Soil Guideline Values (SGVs) to 'low' (referred to as Lowest Level of Toxicological Concern (LLTCs)). The policy companion document and supporting letter by Defra, dated 3rd September 2014, states that C4SLs '*could be used under the planning regime, as well as within Part 2A*'. Based on these comments LKC considers the justifications and assumptions used to generate 'low' risk are suitable for the planning regime.

Where no C4SLs have been generated LKC will use the LQM S4ULs²¹. Similar assumptions and land uses to C4SLs have been used. However, toxicological information has been based on 'minimal risk' as per previous guidelines and assumptions^{22,23,24,25}.

If contaminants are not present as C4SLs and S4ULs then LKC will use ATRISK SSVs or CL:AIRE GACs²⁶. These follow the 'minimal' risk principle and more stringent exposure parameters and will be conservative.

LKC consider the main risk drivers for PAHs are benzo(a)pyrene (B(a)P) and naphthalene. This is due to B(a)P possibly being a carcinogen and most toxic of the PAHs^{27,28} and

¹⁷ EA (2004). "Model Procedures for the Management of Land Contamination." R&D Publication CLR 11.

¹⁸ Defra (2014). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Policy Companion Document."

¹⁹ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

²⁰ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

²¹ LQM (2014). "The LQM/CIEH S4ULs for Human Health Risk Assessment."

²² EA (2008). "Updated Technical Background to the CLEA Model." Science Report – SC050021/SR3.

²³ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

²⁴ EA (2008). "A Review of Body Weight and Height Data used within the Contaminated Land Exposure Assessment Model (CLEA)." Project SC050021/Technical Review 1.

²⁵ EA (2009). "Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values." Science report SC050021/SR7.

²⁶ CL:AIRE (2009). "The Soil Generic Assessment Criteria for Human Health Risk Assessment."

²⁷ EA (2002). "Contaminants in Soils: Collation of Toxicological Data and Intake Values for Humans. Benzo[a]pyrene." R&D Publication TOX2.

²⁸ USEPA (1984). "Health Effects Assessment of Polycyclic Aromatic Hydrocarbons (PAHs)." EPA 540/1-86-013."

naphthalene the most volatile and soluble²⁹. The new C4SLs indicate B(a)P as a surrogate marker for carcinogenic PAHs, if it falls within appropriate limits, since the risk from other non-carcinogenic PAHs are considered negligible³⁰. For B(a)P to be used as a surrogate marker it should follow the profile described by the HPA (2008)³¹ and CL:AIRE (2013). Naphthalene will be treated separately using the LQM S4ULs.

The proposed development is for residential houses with gardens, therefore the assessment criteria for residential with plant uptake has been used.

All criteria have been generated using the CLEA V1.06 model³² based either on 1%, 2.5% and 6% Soil Organic matter (SOM). Results will be compared to the nearest appropriate SOM.

A summary of the generic assessment criteria is provided in Appendix G. ATRISK SSVs and CL:AIRE GACs were not required for this dataset and have not been included.

B(a)P as Surrogate Marker

An assessment of the data should be undertaken to confirm B(a)P is a suitable surrogate marker by assessing the ratios of carcinogenic PAHs to B(a)P. However, as the majority of the PAHs were recorded as less than detection limits, the assessment could not be undertaken.

6.2.2 Soil Results Comparison against Assessment Criteria

All analysis sheets are presented in Appendix C. All the data has been compared to relevant assessment criteria. Elevated and pertinent results are presented in Table 6-1.

Contaminant	Units	No. of samples	Elevated Results	Sample Location	Criteria (1%/2.5%/6%)	Source of Criteria
Metals						
Arsenic	mg/kg	35	75	TP119 (0.00-0.70m)	37	C4SL
			51	TP124 (0.00-1.00m)		
			53	TP127 (0.00-1.00m)		
Lead	mg/kg	35	200	TP119 (0.00-0.70m)	200	C4SL
			1500	TP124 (0.00-1.00m)		
			1000	TP127 (0.00-1.00m)		
GENERAL						
pH	pH	46	Range 5.1 to 8.3			
SOM	%	30	Range 0.53 to 15			
Asbestos	N/A	30	None detected.			

Table 6-1: Summary of elevated and pertinent analytical results.

Notes:

Only results that exceeded assessment criteria have been shown and results from **all depths** are noted. Results have been compared to the nearest appropriate SOM.

No asbestos was identified in any soil samples analysed.

Elevated results have been identified for arsenic and lead in TP119 (0.00-0.70m), TP124 (0.00-1.00m) and TP127 (0.00-1.00m).

²⁹ EA (2003). "Review of the Fate and Transport of Selected Contaminants in the Soil Environment." Draft technical report P5-079/TR1.

³⁰ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

³¹ HPA (2010). "HPA Contaminated Land Information Sheet: Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)." Version 3.

³² EA (2008). "CLEA Software (Version 1.05) Handbook." Science Report – SC050021/SR4.

6.2.3 Direct Contact Risk – Pollutant Linkage 1

Asbestos

No asbestos was identified in any of the samples, therefore the probability of asbestos affected site users is considered to be unlikely. With a medium consequence, the risk is low, and remediation is not required. However, as a precaution, construction workers should be and vigilant for any suspected ACM during groundworks (discussed further in Section 9).

Metals

Elevated lead and arsenic have been identified in made ground in TP119 (0.00-0.70m), TP124 (0.00-1.00m) and TP127 (0.00-1.00m) in the east of the site. The source is anticipated to be ash, coal and pottery noted in the made ground. At the concentrations identified, the contaminants are considered to pose a risk to future site users (residents).

The principal pathways are the ingestion pathways (soil, dust and vegetables) and to a lesser degree dermal contact. It should however be noted that on the plans currently available to LKC, the parcel of land to the east where TP124 and TP127 were undertaken is not to be built on. TP119, located close to Plot 49 on the updated proposed development plan, appears to be a small, infilled pond within a depression and as such is considered localised.

Should the far eastern parcel of land be built on the probability of metal contamination affecting site users is likely. With a medium consequence, the risk is considered to be moderate and remediation in proposed garden and soft landscaping would be recommended in the east of the site. Localised remediation of the fill material in TP119 is recommended.

However, across the majority of the site no elevated levels have been identified and as such the probability of contamination affecting land users is unlikely. With a medium consequence, the risk is considered to be low, and no remediation will be required.

Petroleum Hydrocarbons and PAHs

No visual or olfactory evidence of hydrocarbon contamination was noted during the site works and confirmatory testing did not identify any elevated levels of hydrocarbons or PAH, therefore the probability of these contaminants posing a risk to site users is considered unlikely. With a medium consequence, the risk is considered to be low, and no remediation is recommended.

The risk associated with the inhalation of vapours is discussed in Section 6.2.5 below.

6.2.4 Risk from Inhalation of Vapours – Pollutant Linkage 2

No visual or olfactory evidence of volatile contaminants were identified during the investigation. Confirmatory soil analysis did not detect any VOCs / SVOCs above detection limits.

LKC therefore consider the probability of volatile contaminants affecting site users as unlikely. With a medium consequence, the risk is considered to be low, and no remediation is required.

6.3 Gas Risk Assessment

Six gas monitoring visits have been undertaken on the study site. Gas monitoring results are presented in full in Appendix E. Following guidance set out in CIRIA C665³³ and BS8485³⁴ peak methane and carbon dioxide concentrations have been used in the gas risk assessment. In addition, and as per guidance, flow rates were measured first. All gas concentrations, flow, pressure and groundwater levels are shown on Table 6-2.

Boreholes	Visit	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	H ₂ S (ppm)	CO (ppm)	Flow (l/h)	Groundwater (mbgl)	Pressure (mb)
WS101	1	<0.1	4.3	16.6	0.0	0.0	<0.1	1.32	999(f)
	2	<0.1	1.6	20.0	0.0	0.0	<0.1	1.03	990(r)
	3	<0.1	3.7	16.3	0.0	1.0	<0.1	1.35	995(r)
	4	<0.1	11.6	9.8	0.0	0.0	0.2	1.41	992(v)
	5	<0.1	7.2	9.8	0.0	0.0	<0.1	1.44	993(f)
	6	<0.1	6.2	17.5	0.0	0.0	<0.1	1.51	1009(r)
WS103	1	<0.1	0.6	20.6	0.0	0.0	<0.1	0.94	999(f)
	2	<0.1	0.7	20.4	0.0	0.0	<0.1	0.75	990(r)
	3	<0.1	0.9	20.7	0.0	0.0	<0.1	1.23	995(r)
	4	<0.1	1.1	20.6	0.0	0.0	0.1	1.34	995(v)
	5	<0.1	1.8	18.5	0.0	0.0	<0.1	1.06	993(f)
	6	<0.1	0.7	20.5	0.0	0.0	<0.1	1.08	1009(r)
WS104	1	<0.1	5.4	18.2	0.0	12.0	6.7	0.89	999(f)
	2	<0.1	4.3	18.9	0.0	15.0	6.4	0.73	990(r)
	3	0.1	2.0	20.5	0.0	21.0	6.6	0.78	995(r)
	4	<0.1	0.7	21.4	0.0	13.0	<0.1	0.86	996(v)
	5	<0.1	0.7	20.3	0.0	9.0	<0.1	Damaged	993(f)
	6	Borehole destroyed							
WS107	1	<0.1	1.0	20.7	0.0	1.0	<0.1	0.42	998(f)
	2	<0.1	0.2	21.1	0.0	14.0	6.9	0.02	988(r)
	3	<0.1	0.2	21.6	0.0	1.0	10	0.45	995(r)
	4	<0.1	1.1	20.5	0.0	4.0	0.4	0.98	992(v)
	5	<0.1	5.6	15.5	0.0	0.0	<0.1	0.95	990(f)
	6	<0.1	3.5	19.6	1.0	0.0	<0.1	1.27	1003(r)
WS109	1	<0.1	3.6	18.6	0.0	0.0	<0.1	1.58	999(f)
	2	<0.1	2.9	15.7	0.0	3.0	<0.1	1.28	989(r)
	3	<0.1	4.1	18.2	0.0	0.0	<0.1	1.40	995(r)
	4	<0.1	0.1	21.9	0.0	0.0	<0.1	1.53	995(v)
	5	<0.1	2.0	19.3	0.0	0.0	<0.1	1.46	990(f)
	6	<0.1	1.8	19.6	0.0	0.0	<0.1	1.78	1009(r)
WS111	1	<0.1	2.2	20.1	0.0	0.0	<0.1	1.28	1000(f)
	2	<0.1	0.5	20.8	0.0	2.0	<0.1	0.79	989(r)
	3	<0.1	2.1	19.4	0.0	0.0	<0.1	1.08	996(r)
	4	<0.1	4.7	14.6	0.0	0.0	0.3	1.12	993(v)
	5	<0.1	6.4	10.6	0.0	0.0	<0.1	1.35	990(f)
	6	<0.1	5.9	12.7	0.0	1.0	0.1	1.21	1009(r)
WS112	1	<0.1	1.6	21.0	0.0	0.0	<0.1	1.71	1000(f)
	2	<0.1	1.9	20.1	0.0	0.0	<0.1	1.54	991(r)
	3	<0.1	<0.1	21.4	0.0	0.0	0.1	1.85	995(r)
	4	<0.1	2.5	20.5	0.0	3.0	0.1	1.82	994(v)
	5	<0.1	2.0	19.5	0.0	0.0	<0.1	1.80	990(f)
	6	<0.1	2.2	20.3	0.0	1.0	<0.1	1.73	1009(r)

Table 6-2: Summary of gas monitoring.

³³ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

³⁴ BSI (2015). "Code of Practice for the Characterisation and Remediation from Ground Gas in Affected Developments." BS8485:2015.

Boreholes	Visit	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	H ₂ S (ppm)	CO (ppm)	Flow (l/h)	Groundwater (mbgl)	Pressure (mb)
WS115	1	<0.1	0.4	21.2	0.0	0.0	<0.1	0.90	1000(f)
	2	<0.1	0.1	20.3	0.0	3.0	<0.1	0.71	991(r)
	3	<0.1	0.1	21.1	0.0	0.0	<0.1	0.99	998(r)
	4	<0.1	0.2	21.7	4.0	0.0	0.2	0.95	996(v)
	5	<0.1	0.3	20.4	0.0	0.0	<0.1	1.03	993(f)
	6	Borehole destroyed							
WS119	1	<0.1	2.6	19.9	0.0	0.0	<0.1	DRY	1000(f)
	2	<0.1	1.6	19.7	0.0	0.0	<0.1	4.10	989(r)
	3	<0.1	1.4	19.7	0.0	0.0	<0.1	4.06	998(r)
	4	Borehole destroyed							
	5								
	6								
WS120	1	<0.1	0.7	20.1	0.0	0.0	<0.1	2.70	998(f)
	2	<0.1	0.8	20.5	0.0	0.0	<0.1	2.70	988(r)
	3	<0.1	0.4	21.2	0.0	0.0	<0.1	2.70	995(r)
	4	<0.1	2.2	18.9	0.0	0.0	<0.1	DRY	991(v)
	5	<0.1	2.4	19.2	0.0	0.0	<0.1	2.70	990(f)
	6	Borehole destroyed							
WS123	1	<0.1	4.9	14.7	0.0	0.0	<0.1	2.33	1000(f)
	2	<0.1	4.4	15.9	0.0	0.0	<0.1	2.42	988(r)
	3	<0.1	7.2	10.4	2.0	0.0	<0.1	2.38	995(r)
	4	<0.1	6.9	10.1	0.0	3.0	<0.1	DRY	991(v)
	5	<0.1	7.9	7.9	0.0	0.0	<0.1	2.46	990(f)
	6	<0.1	6.8	14.1	0.0	0.0	<0.1	2.70	1008(r)
WS124	1	<0.1	4.8	14.8	0.0	0.0	<0.1	DRY	1000(f)
	2	<0.1	4.5	15.5	0.0	0.0	<0.1	DRY	989(r)
	3	<0.1	0.5	21.0	0.0	0.0	0.1	DRY	995(r)
	4	<0.1	6.9	10.1	4.7	2.0	<0.1	DRY	994(v)
	5	<0.1	4.2	13.8	0.0	0.0	<0.1	DRY	990(f)
	6	<0.1	6.2	18.4	0.0	1.0	0.2	DRY	1009(r)

Table 6-2(continued): Summary of gas monitoring.

Notes:

If concentrations / flow are zero then equipment detection limits are assumed.

Table shows peak concentrations of CH₄, CO₂, O₂, H₂S and CO.**Bold** where CO₂ exceeds 5%v/v and CH₄ exceeds 1%v/v.

Atmospheric pressure (over past 24hrs): r = rising, f = falling, s = steady, v = variable.

High flow was recorded in WS104 (maximum 6.7l/hr) and in WS107 (maximum 10.0l/hr). However, from reviewing the depth of the groundwater during monitoring, high flow was only recorded when groundwater was high (i.e. above the response zone). Where groundwater was recorded below the response zone elsewhere across the site the flow was recorded as <0.1l/hr. Therefore, it is considered likely that the flow recorded in WS104 and WS107 are not true flow rates representative of site conditions, and these have been discounted from the gas risk assessment.

Only the first visit from WS104 had carbon dioxide above 5.0%v/v. LKC considers that this initial high result may be from a small volume of gas trapped into the borehole from the initial drilling. It is known, for example, that the bentonite could produce low concentrations of hazardous gas³⁵. It should also be noted that following visits recorded lower levels of CO₂ in this location even during worst case atmospheric conditions.

³⁵ CL:AIRE (2012). "A Pragmatic Approach to Ground Gas Risk Assessment." RB 17.

Gas Screening Value

In accordance with CIRIA C665³⁶, a Gas Screening Value (GSV) may be calculated. Assuming worst-case scenario maximum gas concentrations and flow for each borehole have been used to calculate the GSV. The GSV can be used to determine the characteristic situation (CS).

Table 6-3 shows the maximum GSV for each borehole and the appropriate characteristic situation (based on GSV only). An overall site assessment has also been included (worst case values across the site).

Boreholes	Max GSV (l/hr)	CS
WS101	2.3×10^{-2}	CS1
WS103	1.8×10^{-3}	CS1
WS104	5.4×10^{-3}	CS1
WS107	2.2×10^{-2}	CS1
WS109	4.1×10^{-3}	CS1
WS111	1.9×10^{-2}	CS1
WS112	2.5×10^{-3}	CS1
WS115	8.0×10^{-4}	CS1
WS119	1.0×10^{-4}	CS1
WS120	1.0×10^{-4}	CS1
WS123	7.9×10^{-3}	CS1
WS124	1.4×10^{-2}	CS1
WS101-124	0.464 (CO ₂)	CS2

Table 6-3: Summary of worst-case Gas Screening Values (GSV).

Notes:

CS = Characteristic Situation.

The source of the elevated carbon dioxide is considered likely to be the natural superficial alluvial and glacial deposits encountered across the site. In addition, in exploratory locations close to the river (WS101-WS104), some organic material was noted including a very thin band of peat which is also a potential source of gas. No evidence of significant organic material was noted in any other locations.

The CL:AIRE Research Bulletin (RB17)³⁷ states that carbon dioxide concentrations of up to 15%v/v may be recorded from glacial deposits but that this would not pose a risk to development. In addition, Table A1 in RB17 indicates that gas protection would not be required for sites with natural soils with a low organic content and less than 1m of made ground. This applies to the proposed development area at Smithy Bridge as made ground was generally encountered to a maximum depth of 0.4mbgl and organic material was only noted close to the river (outside of the area proposed for houses).

It should also be noted that the highest concentration of carbon dioxide (11.6%v/v) was recorded in WS101, which is located adjacent to the river and outside of the area proposed for houses.

Five out of the six visits were undertaken at low barometric pressure and several visits were carried out in wet and windy conditions. Therefore, LKC consider that worst-case conditions have been targeted and concentrations or flow rates higher than those already recorded are unlikely to be identified if monitoring continued.

³⁶ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

³⁷ CL:AIRE (2012). "A Pragmatic Approach to Ground Gas Risk Assessment." RB17.

Based on the above and as negligible flow rates were recorded in the majority of the boreholes,) LKC considers the probability of gas affecting site users as unlikely. Given the severe consequence, a moderate / low risk is anticipated for Pollutant Linkage 3. A low risk is considered appropriate based on ground conditions encountered and no remediation is considered necessary with respect to hazardous gas.

6.4 Controlled Water Assessment

The PRA identified a moderate risk with respect to controlled waters as although no significant source of mobile contamination was anticipated, the proximity and sensitivity of the surface water receptor called for precautionary sampling.

LKC considers the River Roch and the underlying Secondary Undifferentiated and A Aquifers as the primary receptors. The spring and pond identified in the PRA are considered to be seasonal features associated with high rainfall.

LKC have compared results above Limits of Detection (LOD). Where relevant the review of priority substances take precedence considering threshold values for groundwater cannot be used '*as part of site specific investigations*'. The hierarchy is as follows:

- River Basin District Standards³⁸ and updated Water Framework Directive³⁹ for Annual Average / Maximum Allowable Concentration Environmental Quality Standards (AA-MAC-EQS) for priority substances (surface water risk).
- 2001 Environment Agency Values for Environmental Quality Standards (EQS) and UK Drinking Water Standard (UKDWS)⁴⁰.
- 2009 UK Drinking Water Standard (UKDWS)⁴¹.
- Resource Protection Values (RPVs)⁴².
- Minimal Reporting Values (MRVs).

No criteria values have been presented for surface waters (EQS) except the odour, visual evidence and taste test for fish⁴³. With regards to hydrocarbon mixtures (TPHCWG) for UKDWS, LKC will use the CL:AIRE guidance on petroleum hydrocarbons in groundwater⁴⁴ based on WHO guidelines.

Confirmatory water sampling has not encountered any elevated levels of contaminants. Weathered diesel was detected in the surface water sample downstream. No hydrocarbons were detected onsite above the limit of detection, this suggests that the site is clear of any hydrocarbon contamination and that an offsite source may be influencing the River Roch.

Certificates of analysis for groundwater samples are presented in Appendix D.

Based on the above, LKC considers the probability of contaminants on site affecting the River Roch and Secondary A Aquifer as unlikely. Given the medium consequence, a low risk is anticipated for Pollutant Linkage 4.

³⁸ Defra (2010). "The River Basin Districts Typology, Standards and Groundwater Threshold Values." Water Framework Directive (England and Wales) Directions 2010.

³⁹ Defra (2015). "Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015."

⁴⁰ EA (2002). "Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the Environment Protection Act 1990."

⁴¹ Statutory Instruments (2009). "The Private Water Supplies Regulation 2009." No. 3101

⁴² SEPA (2010). "Assigning Groundwater Assessment Criteria for Pollutant Inputs." WAT-PS-10-01.

⁴³ EA (2009). "Petroleum Hydrocarbons in Groundwater: Supplementary Guidance for Hydrological Risk Assessment."

⁴⁴ CL:AIRE (2017). "Petroleum Hydrocarbons in Groundwater: Guidance on Assessing Petroleum Hydrocarbons Using Existing Hydrological Risk Assessment Methodologies."

6.5 Additional Risk Assessments

6.5.1 Potable Water Supply (Pollutant Linkage 5)

Soil results were compared to United Utilities (UU) guidelines for the selection of potable water pipes in land potentially affected by contamination⁴⁵. Only contaminants of concern, based on the preliminary conceptual model and ground conditions encountered, were analysed. The following contaminants were not considered to be a risk and therefore not included in the analysis suites: chlorinated compounds, cresols, ethers, nitrobenzene, ketones, aldehydes and amines.

Elevated naphthalene was identified in the following locations:

- 2.1mg/kg in WS106 (0.20-0.70mbgl), 0.98mg/kg in WS120 (0.00-0.30mbgl), 0.53mg/kg in TP105 (0.20-1.20mbgl), 0.56mg/kg in TP114 (0.00-0.40mbgl) and 0.68mg/kg in TP127 (0.00-1.00mbgl).

It should be noted that the assessment criteria for VOCs is 0.50mg/kg⁴⁶, making several of these exceedances very marginal.

It should also be taken into account that typical pipework depths are 0.75mbgl to 1.35mbgl. The pipework will likely be laid into the underlying natural strata. Once details of the pipeline location and depths are known a UU Risk Assessment should be undertaken.

At this stage, the probability of organic contaminants affecting potable water pipes is a low likelihood. Given the consequence is considered to be medium and the risk (pollutant linkage 6) is anticipated to be low / moderate risk. Given the marginal exceedances, the minimal depth of made ground encountered across the site, it is likely that any new pipe will be laid in natural material, and a low risk is considered appropriate. Further risk assessment and consultation with UU once pipeline route and depths are known.

6.6 Revised Contamination Conceptual Model

The preliminary contamination conceptual model (Table 2-6) has been revised following the risk assessments undertaken in Sections 6.1-6.5. The revised contamination conceptual model follows the same methodology and guidance used in the preliminary contamination conceptual model. The risk matrix is provided in Appendix A. The revised contamination conceptual model is presented in Table 6-4.

Where a very low risk is identified no specific remediation is required.

Where a low risk is identified, some form of remediation may be required depending on the pollutant linkage, the type and concentration of contaminants present and the proposed development.

Where there is a moderate/low risk is identified, an assessment will be undertaken to establish what category the pollutant linkage will fall into.

Where LKC identifies a moderate or higher risk, remediation or further investigation work is recommended.

Further details of the remedial proposals and a remedial option appraisal are given in Section 9.

⁴⁵ UU (2011). "United Utilities Water Supplementary Guidance for the Selection of Water Pipes in Land Potentially Affected by Contamination."

⁴⁶ https://www.unitedutilities.com/globalassets/documents/pdf/risk_assessment_acc16.pdf

Pollutant Linkage	Pathway	Receptor	Contaminant	Probability	Consequence	Risk	Assessment and Recommendations
PL1	- Dermal contact. - Inhalation of soil, fibres and dust. - Ingestion of soils, dust, vegetables, soil attached to vegetables. - Windblown dust.	- Future site users. - Offsite receptors.	- ACM. - Heavy end hydrocarbons. - PAHs	Unlikely	Medium	Low	- Low risk as no ACMs identified visually or in soil samples and no elevated levels of hydrocarbons or PAH found in soils. - Recommendation: No further work required.
			- Heavy metals.	Low	Medium	Moderate / Low	- Low probability as exceedances of generic assessment criteria only identified in one location in proposed development area (Plot 49 / TP119), with exceedances mainly in the parcel of land to the east - Moderate risk assumed in proposed garden and soft landscaped areas. - Recommendation: Remediation required – likely to be the removal of made ground from gardens/soft landscaping in these areas.
PL2	- Inhalation of vapours. - Migration through permeable strata and preferential pathways.	- Future site users. - Offsite receptors.	- Volatile Contaminants such as hydrocarbons, solvents.	Unlikely	Medium	Low	- Low risk as no exceedances based on the relevant assessment criteria. - Recommendation: No further work required.
PL3	- Inhalation of gas. - Migration through permeable strata and preferential pathways. - Explosion in confined spaces.	- Future site users. - Buildings. - Offsite land users.	- Methane, carbon dioxide.	Unlikely	Severe	Moderate / Low	- Unlikely probability as, although some marginally elevated (>5%v/v) carbon dioxide was identified, flow rates were generally negligible, and the source of the gas was considered to be natural superficial glacial deposits and alluvium. - The highest concentration of carbon dioxide recorded was outside of the area due to be developed for housing. - Low risk assumed based on the ground conditions encountered. - Recommendation: No gas protection measures required.
PL4	- Surface Run-off. - Migration through permeable strata and preferential pathways - Perched waters migration.	- Groundwater (Secondary A Aquifer). - Surface water (River Roch).	- Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds.	Unlikely	Medium	Low	- Low probability as significant leakages / spillages of volatile contamination not identified in soil or water samples. - Recommendation: No further work required.
PL5	- Ingestion of tainted water supply.	- Future site users. - Water pipes.	- Naphthalene.	Low	Medium	Moderate / Low	- Low risk assumed as it is likely that new potable water pipes will be laid in clean underlying natural ground. - Recommendation: Further risk assessment and consultation with UU once pipeline route and depths are known.

Table 6-4: Revised Contamination Conceptual Model.

Notes

*1 Although no ACM identified, contractors should be vigilant during earthworks of any potential ACM. This is discussed further in Section 9.

*2 Characteristics of the made ground should also be taken into account if it is to be used as a topsoil / growing medium for flora. The material should be assessed against the parameters outlined in Table 1 of BS3882 (not included within this assessment).

7 WASTE DISPOSAL ASSESSMENT

The soil contamination results as presented in Appendix C have been used to help determine the disposal route should any material be earmarked for off-site disposal.

As an initial screen the soil results were inputted into 'HazWasteOnline'. This is a web-based facility that allows an assessment of contaminant soils and classifies the soils as either hazardous or non-hazardous waste. It is understood that 'HazWasteOnline' has been designed to cover the European Waste Catalogue code number 17 05 03 "soil and stones containing dangerous substances" and follows current guidance^{47,48,49,50,51}.

Where less than limits of detection (LOD) were recorded, the value of the LOD was inputted. Where applicable relevant metal species were used such as metal oxides. This will provide a more realistic classification assessment. The output sheet is presented in Appendix H and exceedances summarised in Table 7-1.

Sampling Location	Hazardous Waste Y/N	Hazard (Risk Phrase)	Contaminants
TP124 / D1 (0.00-1.00m)	Y	HP7 (Carcinogenic)	Lead
TP127 / D1 (0.00-1.00m)	Y	HP7 (Carcinogenic)	Lead

Table 7-1: Summary HazWasteOnline findings.

Based on individual locations hazardous waste has been identified in the vicinity of TP124 / D1 (0.00-1.00m) and TP127 / D1 (0.00-1.00m), soils in these locations should be classified as **HAZARDOUS WASTE** based on carcinogenic properties. Waste soils from other locations tested is likely to be classified as non-hazardous.

Further testing including Waste Acceptance Criteria (WAC) testing is recommended before any soils are removed from site for disposal.

⁴⁷ EA (2013). "Hazardous Waste: Interpretation of the Definition and Classification of Hazardous Waste." Technical Guidance WM3. 1st Edition 2015.

⁴⁸ The Hazardous Waste Directive, (HWD, Council Directive 91/689/EC).

⁴⁹ European Waste Catalogue, 2002 (EWC 2002, Commission Decision 2000/532/EC) as amended by Commission Decision 2001/118/EC, 2001/119/EC and Council Decision 2001/573/E.

⁵⁰ List of Wastes (England) Regulations 2005.

⁵¹ Approved Supply List (Eighth Edition), 2002. ISBN: 0 7176 2368 8.

8 CONCLUSIONS

8.1 Geotechnical

The site slopes gently to the south in the northwest with the angle of slope increasing towards the south. The ground may require levelling or terracing prior to construction.

Ground conditions varied across the site with both sand and clay present. An Outline Foundation Zoning Plan is provided in Figure 5 but generally allowable bearing pressures of 100kN/m² to 120kN/m² are considered acceptable at 1.00mbgl to 1.2mbgl in natural ground (i.e. medium dense sands and gravels and/or stiff clays).

Consideration should be given to variable strata and groundwater levels across the site (waterlogged areas noted across the site and water identified in boreholes between 0.02mbgl to 4.10mbgl) which could affect the strength of the ground.

It should also be noted that some of the clays tested exhibited medium volume change potentials.

Traditional strip or trench fill footings are considered acceptable based on ground conditions encountered during the site investigation. Further assessment of the ground conditions at each plot location should be undertaken by a suitably qualified and competent person.

If the soil at foundation level is found to be loose or consisting of made ground, we recommend excavation and removal of this material and replacing with suitable granular material compacted to specification (or mass concrete).

Further advice on foundation design should be sought from a structural engineer.

Consideration should be given to relic foundation structures if any development takes place in the east of the site.

No sulphate resistant concrete is required (DS-1 AC-1).

Profiles were assessed at a number of locations across the site and the slopes across a majority of the development area were between 1v in 10h and 1v in 15h. Please read the LKC Slope Stability Assessment (ref. CL-602-LKC 22 1183-01, dated August 2022) in conjunction with this report. There are not considered to be any stability issues for slopes of this gradient based on the proposed development unless any locally steeper and weaker ground is encountered during groundworks.

A design CBR value of 5% should be adopted for the made ground, 3% for natural sand and 4% for natural clay.

A mining investigation has been undertaken and is reported under separate cover. Please read the TLC Report on Coal Mining Investigation Works undertaken on Land off Smithy Bridge Road, Littleborough, OL16 2RY, TLC report ref. Mining Report (021018) - Rev G (081019), dated October 2019) and Access Road Remediation Strategy (LKC letter report ref. LKC 18 1005, dated 10th December 2019) in conjunction with this report.

8.2 Contamination Assessment

A revised contamination conceptual model has been produced by LKC which is summarised in Table 8-1 below (more detailed model provided in Section 6).

Pollutant Linkage		Risk	Recommendations
1	Contaminants posing a risk to site users via dermal contact, ingestion and inhalation (of soil, dust, fibres and vegetables).	Low (ACMs, PAHs, Hydrocarbons)	– Recommendation: No further work required.
		Moderate / Low (Heavy Metals)	– Recommendation: Remediation required – likely to be the removal of made ground from gardens/soft landscaping in one location in proposed development area (Plot 49 / TP119), and in the parcel of land to the east.
2	Volatile contaminants posing a risk to site users via the inhalation of vapours.	Low	– Recommendation: No further work required.
3	Gas posing a risk to buildings and site users via the migration of gas into building causing explosion and asphyxiation.	Moderate / Low	– Recommendation: No gas protection measures required.
4	Mobile contamination posing a risk to controlled waters via the migration through permeable strata.	Low	– Recommendation: No further work required.
5	Organic contaminants posing a risk to water pipes.	Moderate / Low	– Recommendation: Further risk assessment and consultation with UU once pipeline route and depths are known.

Table 8-1: Summary Risk Table.

Remedial recommendations are presented in Section 9.

9 RECOMMENDATIONS AND REMEDIAL STRATEGY

The recommendations provided below are considered appropriate for the site based on the site investigation work undertaken. LKC should stress that no remediation, enabling works or designing works should take place until Regulatory approval has been obtained.

9.1 Remediation and Validation Recommendations

Table 9-1 details the further works and remedial recommendations / requirements. The table shows work required pre-construction (i.e. during earthworks) and during / post construction.

PL	Remediation Requirements	Validation Requirements
ALL	<u>Earthworks Inspections / Unexpected Contamination</u> The relevant contractors should be briefed that during development works at the site should any unusual ground conditions and / or visual or olfactory evidence of contamination (including asbestos containing material) be encountered at the site, LKC and the Local Authority should be informed and further assessment of the material may be required. Should asbestos be identified during groundworks, precautions should be taken to ensure the safety of the construction workers and nearby land users. It would be advisable to introduce an asbestos management strategy in line with CIRIA C733⁵².	Log of work undertaken including photographs. Details of any sampling undertaken and validation of any potential additional remedial work.
1	<u>Source Removal</u> Localised elevated heavy metals were identified in the vicinity of Plot 49/ TP119 (former pond). The following remediation option is given: Removal of all reworked topsoil / made ground from garden and soft landscaping and raise levels (as required) with suitably chemically validated subsoil and topsoil. <u>Environmental Cover System</u> If areas in the vicinity of TP124 and TP127 in the eastern parcel of the site are to be developed, given the deep made ground present (max. 1.50m thickness) then the following is recommended: Private Back Gardens: 600mm thick environmental cover system comprising: Either 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 500mm comprising clean inert fill and sufficient topsoil for a growing medium. Or geotextile membrane and at least 600mm comprising clean inert fill and sufficient topsoil for a growing medium.	<u>Source Removal</u> Consignment notes confirming the removal of made ground. Photographic evidence of natural strata. Chemical validation of imported soils: See Table 9-2. <u>Environmental Cover System</u> Measuring depth of environmental cover system using a staff and providing photographic evidence.

Table 9-1: Further work, remediation and validation requirements

Notes: See Table 6-4 for pollutant linkage (PL) details.

⁵² CIRIA (2014). "Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks." C733.

PL	Remediation Requirements	Validation Requirements
1	Private Front Gardens / Shared Landscaping: 300mm thick environmental cover system comprising: Either 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 200mm comprising clean inert fill and sufficient topsoil for a growing medium. Or geotextile membrane and at least 300mm comprising clean inert fill and sufficient topsoil for a growing medium. The subsoil layer can be replaced by additional topsoil. A diagram of a typical environmental cover system is shown in Appendix I	Photographic evidence of the granular physical break or geotextile layer will also be collected. Chemical validation of imported soils: See Table 9-2.
5	<u>Potable Water Pipes</u> It is recommended that a Water Pipeline Assessment is undertaken once the location and depth of potable water pipes are known. It is possible that barrier pipe will be required in the east of the site.	Delivery Notes of Pipe Material. Photographs of the Installed Pipe.
Further Considerations		
<u>Grubbing Out of In-Ground Structures</u> It is recommended that in-ground structures are grubbed out as part of the groundworks. In-ground structures expected in east of the site associated with the former coal mine and associated pumping building.		
<u>Re-use of site won material</u> Based on chemical testing data, there is the potential for the re-use of site won subsoil or topsoil in the proposed development. To ensure material is compliant with appropriate waste regulations, any site won material re-used onsite should be in recourse to appropriate exemptions. A U1 and T5 exemption should be registered. This will allow the following: 1,000 tonnes (c. 600m³) of non-hazardous soil 5,000 tonnes (c. 3,000m³) of natural sand and gravels. 50,000 tonnes (c. 25,000m³) of bituminous material to be used in roadways. 5,000 tonnes (c. 3,000m³) of crushed concrete / stone. A Materials Management Plan (MMP) with recourse to the CL:AIRE Code of Practice may be required if volumes exceed exemption limits. This must be registered before material movement starts onsite. If a MMP is required this needs to be registered by a Qualified Person (QP) and there must be 'certainty of use' for any material re-used onsite or exported to site to ensure there is no 'sham recovery'. For all the above material will need to be tested at the rate and analytical suites presented in Table 9-2.		
<u>Health and Safety Considerations</u> In working with, removing or treating any contaminating material it is important that any potential risks associated with the actual site works are mitigated by good environmental management of the site during the remedial phases. Standard health and safety precautions (as per HSE guidance⁵³) should be adopted by all workers involved with site enabling and construction works.		
<u>Shallow Coal Mining Investigation</u> Intrusive investigation is recommended to assess if the mine shaft in the east of the site has been treated and capped previously. Confirmatory rotary drilling is also recommended across the development area to assess the presence of shallow coal workings.		

Table 9-1 (continued): Further work, remediation and validation requirements

Notes: See Table 6-4 for pollutant linkage (PL) details.

⁵³ HSE (1991). "Protection of Workers and the General Public During Development of Contaminated Land" London HMSO.

9.2 Validation of Subsoil / Topsoil

Chemical validation of all imported or site won soils to be used on site in gardens and soft landscaping areas should be undertaken. Imported soils should be accompanied by a certificate of analysis and source details.

A summary of the required imported material sampling requirements are presented in Table 9-2. Ideally, the material should be sampled at source to prevent double handling if soil fails, with confirmatory sampling undertaken on importation to site. However, where this is not possible then material imported should be segregated based on source and soil type. Validation samples should be taken prior to placement in gardens to ensure suitability for use.

Material Type	Source	Suite of Analysis	Sampling Rate*
Topsoil	Greenfield	Suite A	1 sample per 50m³
	Brownfield / Unknown	Suite B	
Subsoil	Brownfield / Unknown	Suite B	1 sample per 50m³
	Site won natural material	Suite A	
	Physical Stone Break Layer	First Generation i.e. quarried sand (subsoil) or stone (break layer)	No testing is required. Certification of material provenance is required.
Recycled Stone (6F2 / screened)		Suite B	1 sample per 500m³

Table 9-2: Sampling requirements for imported soils.

Notes:

Suite A - Heavy metals, pH, water soluble sulphate, speciated PAH, soil organic matter and asbestos screen.

Suite B - Heavy metals, pH, water soluble sulphate, speciated PAH, phenol, total and free cyanide, soil organic matter, asbestos screen, banded petroleum hydrocarbons (TPH CWG), BTEX, MTBE.

*Minimum sampling rate of 3 samples per source.

Any soil with visual or olfactory evidence of hydrocarbons should be rejected.

In addition, it should be ensured that the matrix of the topsoil is suitable as a growing medium and no undesirable material is present (in line with BS3882⁵⁴). LKC advise this information is provided by the supplier before material is imported onto site.

Imported or site won material to be used in gardens will be compared against residential with plant uptake criteria (as used in the contamination risk assessment in Section 6-1). Appropriate remedial target criteria are presented in Appendix G.

9.3 Site Completion Report

All the remediation and validation work should be documented in a Site Completion Report. The following Completion Reports will be provided to satisfy the outstanding contaminated land planning conditions:

- **Pre-construction Phase Completion Report:** Site level reduction details, offsite disposal information, validation testing of site won subsoil or topsoil to be used in gardens and remediation of area around TP119 / Plot 49.
- **Build-phase Construction Completion Report:** Validation testing of any imported topsoil, completion of UU potable water supply document and/or discussion with UU.

If the area in the vicinity of TP124 and TP127 in the east of the site are to be developed, the following is required:

- Verification testing of all imported soil for garden and soft landscaping areas.

⁵⁴ BS (2015). "Specifications for Topsoil and Requirements for use." BS3882:2015.

The aim of the completion reports will be to demonstrate to the Local Authority that the site has been suitably remediated to the extent that construction works may commence and, in accordance with the National Planning Policy Framework (NPPF)⁵⁵:

- » The site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation;
- » After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990⁵⁶; and,
- » Adequate site investigation information, prepared by a competent person, is presented.

Once the above is satisfied the Local Authority should be able to discharge all the relevant contaminated land conditions.

⁵⁵ ⁵⁵ National Planning Policy Framework." Ministry of Housing, Communities and Local Government. July 2021.

⁵⁶ Defra (2006). "Environmental Protection Act 1990: Part 2A Contaminated land." Defra Circular 01/2006.

FIGURES

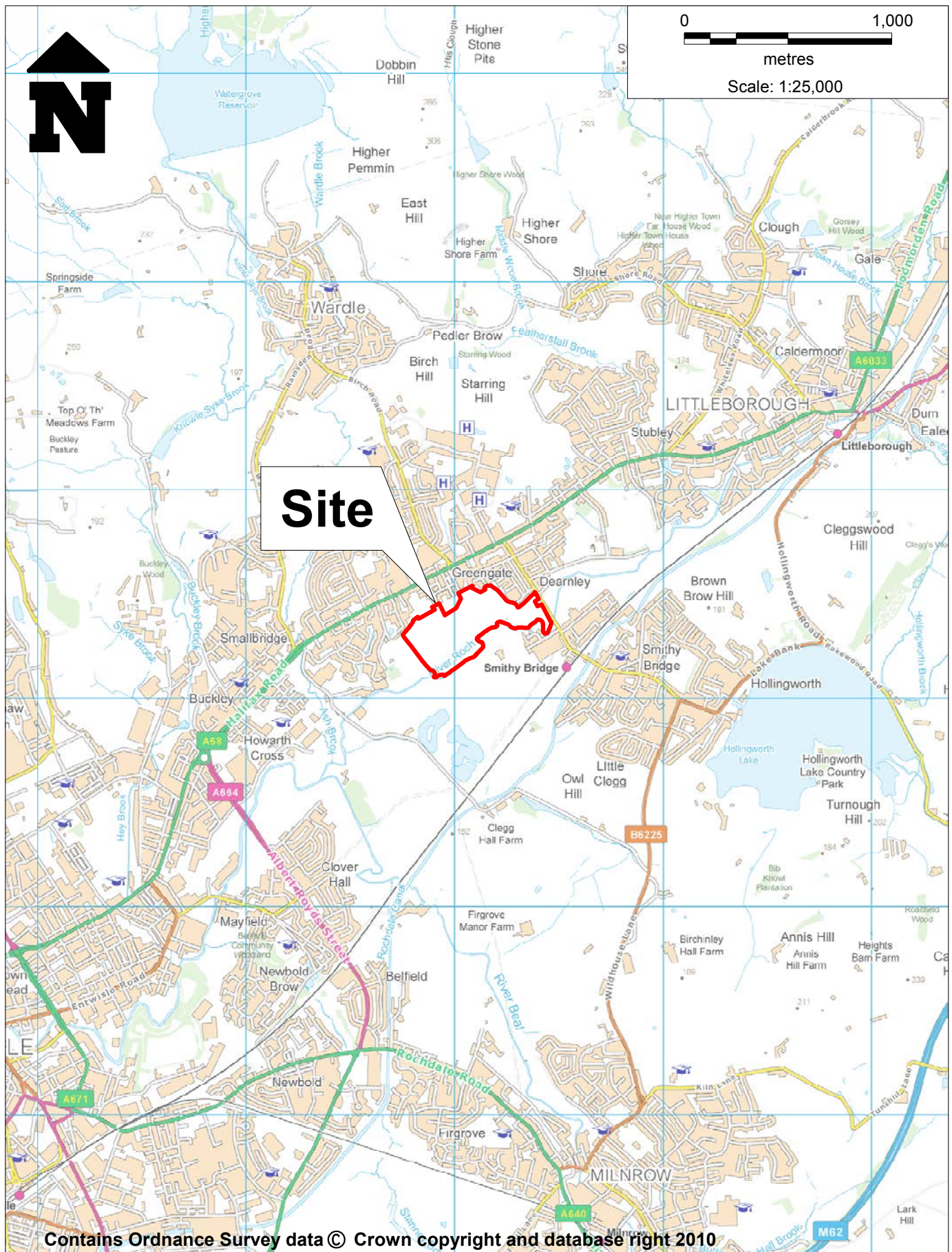
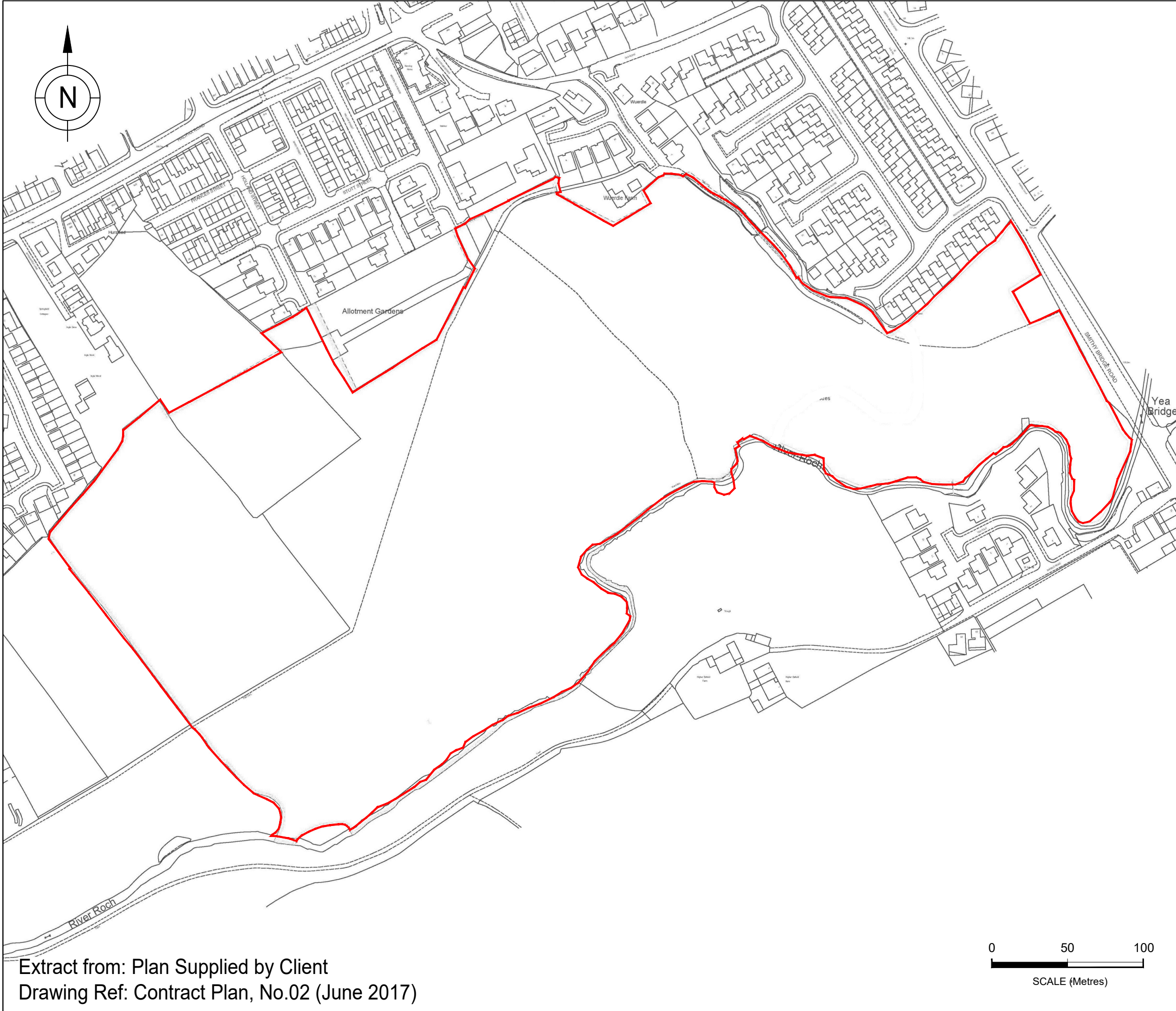


Figure 1: Site Location Plan, Smithy Bridge Road, Littleborough

Drawn: April 2018 Scale: 1:25,000 @ A4 (see scale bar)



KEY

 Site Boundary

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



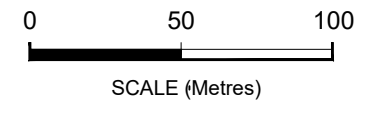
Client:
Taylor Wimpey Strategic Land (North)

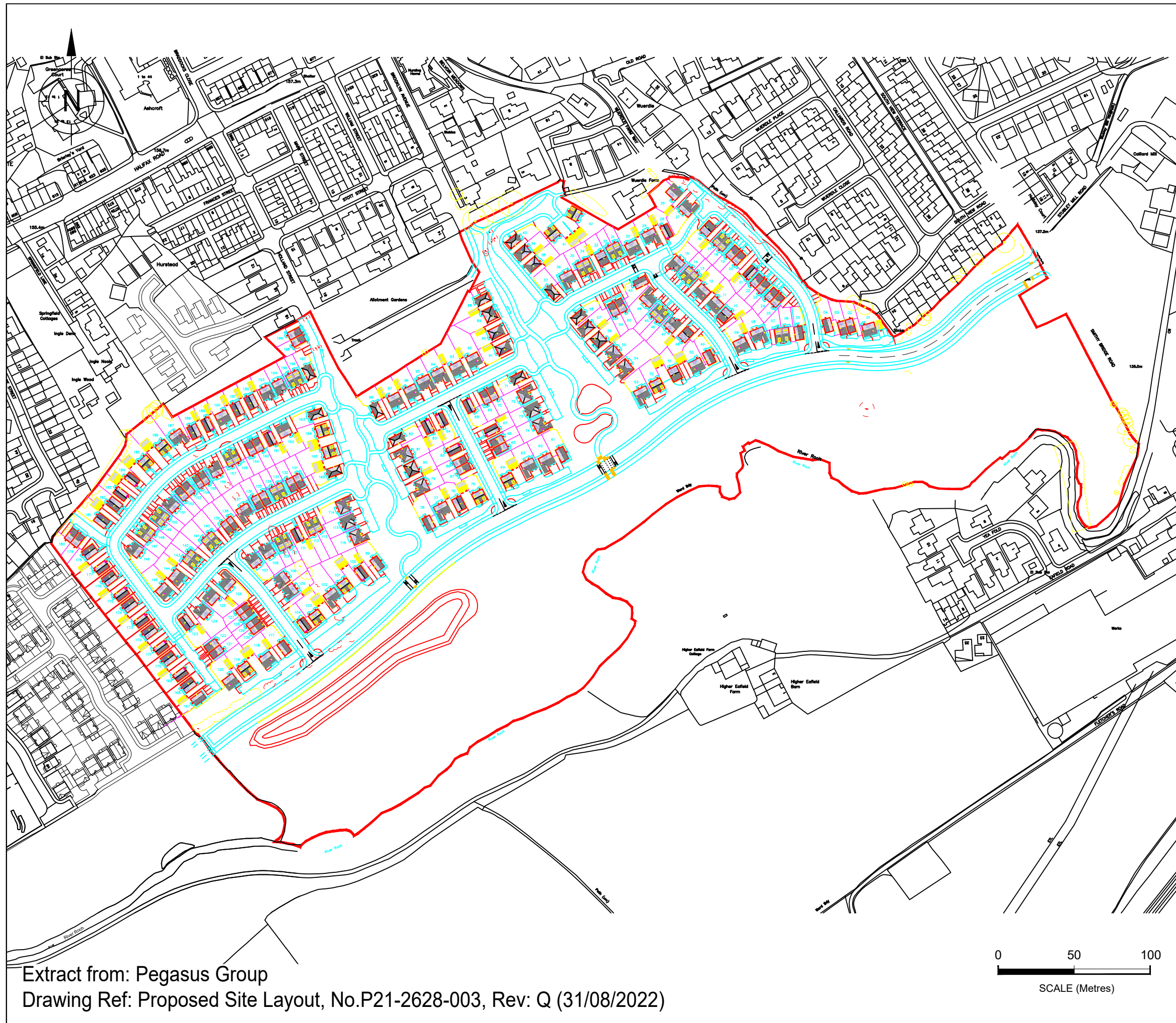
Site:
Smithy Bridge Road, Littleborough

Title:
Site Boundary Plan

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 22 1183	1:2500 @ A3	2	
Drawn By:	Checked By:	Drawn:	
AC	EK	Jun 2022	

Extract from: Plan Supplied by Client
Drawing Ref: Contract Plan, No.02 (June 2017)





KEY

 Site Boundary

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client:
Taylor Wimpey Strategic Land (North)

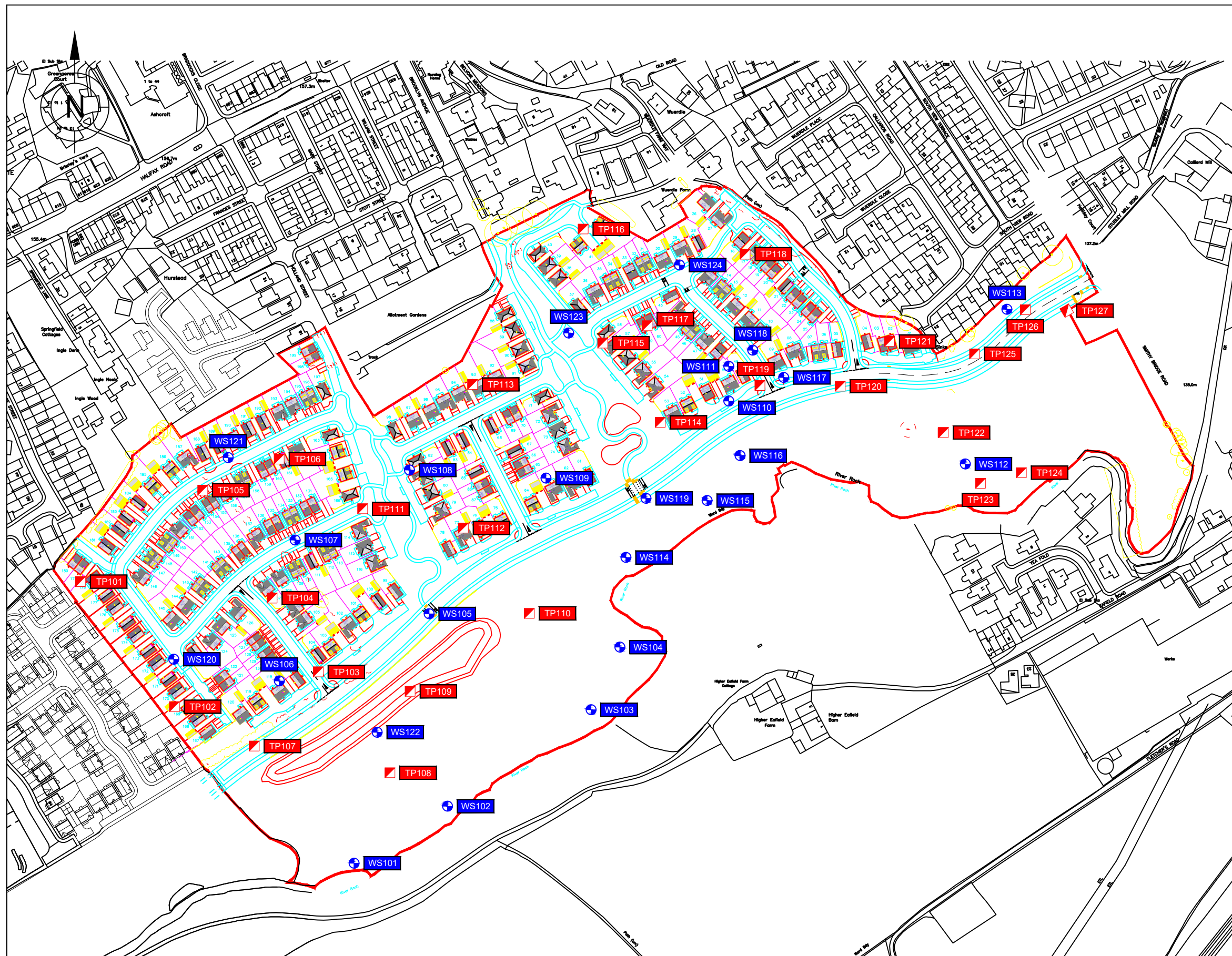
Site:
Smithy Bridge Road, Littleborough

Title:
Proposed Development Plan

Job No.: LKC 22 1183	Scale (See Scale Bar): 1:2500 @ A3	Figure: 3	Revision: 1
Drawn By: CC	Checked By: EK	Aug 2022	

Extract from: Pegasus Group
Drawing Ref: Proposed Site Layout, No.P21-2628-003, Rev: Q (31/08/2022)

0 50 100
SCALE (Metres)



KEY

- Site Boundary
- Window Sample Borehole (WS)
- Trial Pit (TP)

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client:
Taylor Wimpey Strategic Land (North)

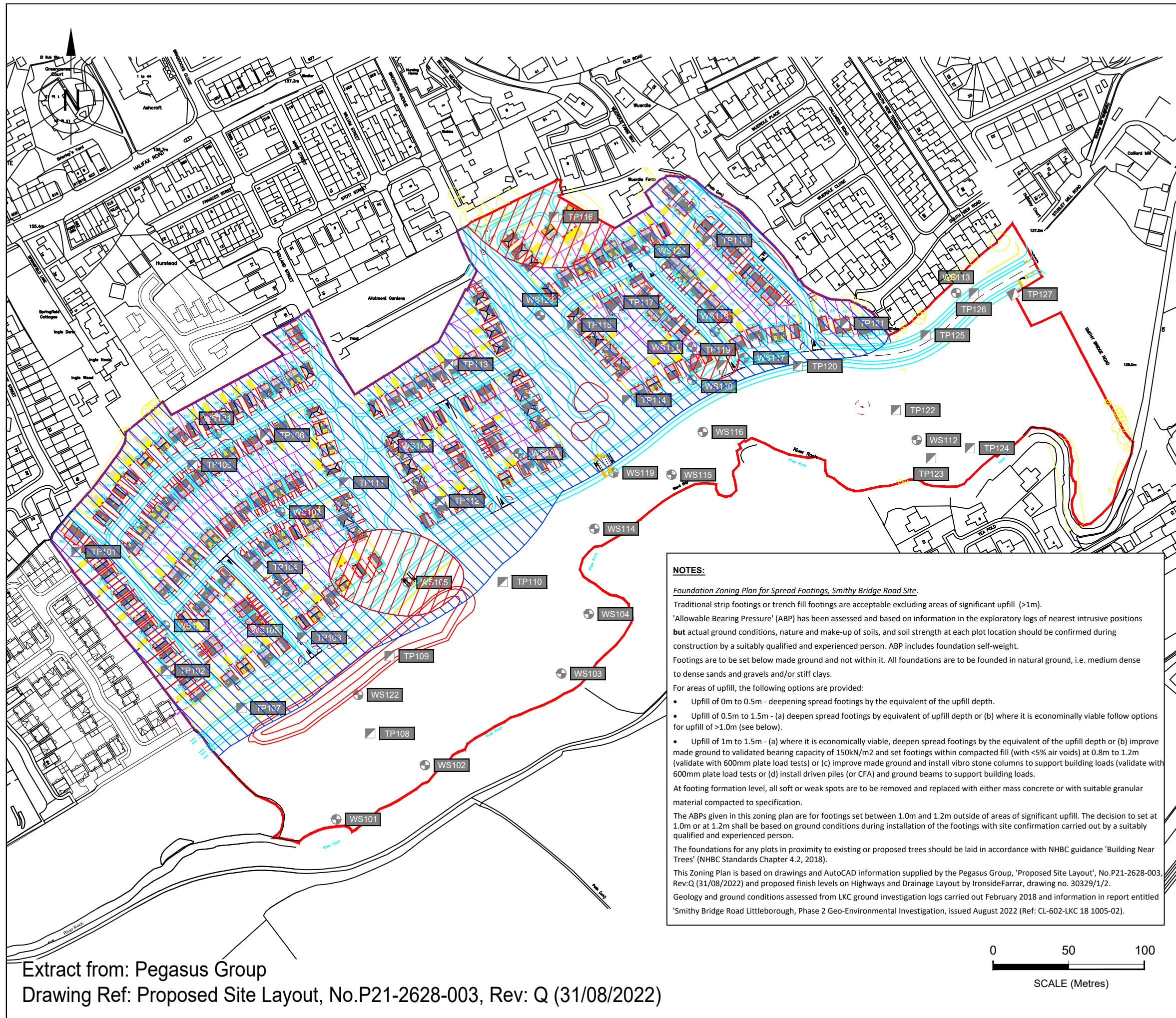
Site:
Smithy Bridge Road, Littleborough

Title:
Site Investigation Location Plan

Job No.: LKC 22 1183	Scale (See Scale Bar): 1:2500 @ A3	Figure: 4	Revision: 1
Drawn By: CC	Checked By: EK	Drawn: Aug 2022	

Extract from: Pegasus Group
Drawing Ref: Proposed Site Layout, No.P21-2628-003, Rev: Q (31/08/2022)

0 50 100
SCALE (Metres)



KEY

- Site Boundary
- Window Sample Borehole (WS)
- Trial Pit (TP)
- Allowable Bearing Pressure: $\leq 100\text{kN/m}^2$
Footings Set At or Below 1.0m to 1.2m (See Notes)
- Allowable Bearing Pressure: $100\text{kN/m}^2 - 120\text{kN/m}^2$
Footings Set At or Below 1.0m to 1.2m (See Notes)

NOTES:

Foundation Zoning Plan for Spread Footings, Smithy Bridge Road Site.

Traditional strip footings or trench fill footings are acceptable excluding areas of significant uplift ($>1\text{m}$).

'Allowable Bearing Pressure' (ABP) has been assessed and based on information in the exploratory logs of nearest intrusive positions **but** actual ground conditions, nature and make-up of soils, and soil strength at each plot location should be confirmed during construction by a suitably qualified and experienced person. ABP includes foundation self-weight.

Footings are to be set below made ground and not within it. All foundations are to be founded in natural ground, i.e. medium dense to dense sands and gravels and/or stiff clays.

For areas of uplift, the following options are provided:

- Uplift of 0m to 0.5m - deepening spread footings by the equivalent of the uplift depth.
- Uplift of 0.5m to 1.5m - (a) deepen spread footings by equivalent of uplift depth or (b) where it is economically viable follow options for uplift of $>1.0\text{m}$ (see below).
- Uplift of 1m to 1.5m - (a) where it is economically viable, deepen spread footings by the equivalent of the uplift depth or (b) improve made ground to validated bearing capacity of 150kN/m^2 and set footings within compacted fill (with $<5\%$ air voids) at 0.8m to 1.2m (validate with 600mm plate load tests) or (c) improve made ground and install vibro stone columns to support building loads (validate with 600mm plate load tests or (d) install driven piles (or CFA) and ground beams to support building loads.

At footing formation level, all soft or weak spots are to be removed and replaced with either mass concrete or with suitable granular material compacted to specification.

The ABPs given in this zoning plan are for footings set between 1.0m and 1.2m outside of areas of significant uplift. The decision to set at 1.0m or at 1.2m shall be based on ground conditions during installation of the footings with site confirmation carried out by a suitably qualified and experienced person.

The foundations for any plots in proximity to existing or proposed trees should be laid in accordance with NHBC guidance 'Building Near Trees' (NHBC Standards Chapter 4.2, 2018).

This Zoning Plan is based on drawings and AutoCAD information supplied by the Pegasus Group, 'Proposed Site Layout', No.P21-2628-003, Rev:Q (31/08/2022) and proposed finish levels on Highways and Drainage Layout by IronsideFarrar, drawing no. 30329/1/2.

Geology and ground conditions assessed from LKC ground investigation logs carried out February 2018 and information in report entitled 'Smithy Bridge Road Littleborough, Phase 2 Geo-Environmental Investigation, issued August 2022 (Ref: CL-602-LKC 18 1005-02).

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client:
Taylor Wimpey Strategic Land (North)

Site:
Smithy Bridge Road, Littleborough

Title:
Foundation Zone Plan

Job No.: LKC 22 1183	Scale (See Scale Bar): 1:2500 @ A3	Figure: 5	Revision: 1
Drawn By: CC	Checked By: PW	Drawn: Aug 2022	

APPENDIX A

RISK MATRIX

Risk Evaluation

The method for risk evaluation is a qualitative method of interpreting the output from the risk estimation stage of the assessment, based on CIRIA 552⁵⁷. It involves the classification of the:

- Magnitude of the potential consequence (severity) of the risk occurring (Table A).
- Magnitude of the probability (likelihood) of the risk occurring (Table B).

Consequence (Severity)		
Classification	Definition	Example
Severe	- Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. - Short term risk of pollution (note: water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. - Catastrophic damage to buildings/properties. - A short term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definition of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	- High Concentrations of cyanide on the surface of an informal recreation area. - Major spillage of contaminants from site into controlled waters. - Explosion, causing building collapse (can also equate to short term human health risk if buildings are occupied).
Medium	- Chronic damage to Human Health ('significant harm' as defined in DETR, 2000). - Pollution of sensitive water resources (note Water Resources Act contains no scope for considering significance of pollution). - A significant change in a particular ecosystem, or organism forming part of such ecosystem.	- Concentrations of a contaminant from site exceed generic, or site specific assessment criteria. - Leaching of contaminants from a site to a major or minor aquifer (Principal and Secondary). - Death of a species within a designated nature reserve.
Mild	- Pollution of non-sensitive water resources. - Significant damage to crops, buildings, structures and services ('significant harm' as defined in DETR, 2000). - Damage to sensitive buildings/structures/services or the environment.	- Pollution of non-classified groundwater. - Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	- Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. - Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc). - Easily repairable damage to buildings, structures and services.	- The presence of contaminants at such concentrations that protective equipment is required during site works. - The loss of plants in a landscaping scheme. - Discoloration of concrete.

Table A: Classification of Consequence.

Probability (Likelihood)	
Classification	Definition
High Likelihood	- There is a pollutant linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	- There is a pollutant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. - Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	- There is a pollutant linkage and circumstances are possible under which an event could occur. - However it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	- There is a pollutant linkage but circumstances are such that it is improbable that an event would occur in the very long term.

Table B: Classification of Probability.

⁵⁷ CIRIA C552 (2001). "Contaminated Land Risk Assessment - A guide to good practice."

These classifications are then compared to indicate the risk presented by each pollutant linkage (Table C). It is important that this classification is only applied where there is a possibility (which can range from high likelihood to unlikely) of a pollutant linkage existing.

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Table C: Comparison of Consequence against Probability.

Once the risk has been determined the corresponding action can be assessed (Table D).

Risk	Action Required
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not already undertaken) and remediation are likely to be required.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate Risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Table D: Description of the Classification and Likely Action Required.

Where a very low risk is identified no specific remediation is required.

Where a low risk is identified, some form of remediation may be required depending on the pollutant linkage, the type and concentration of contaminants present and the proposed development.

Where there is a moderate/low risk is identified, an assessment will be undertaken to establish what category the pollutant linkage will fall into.

Where LKC identifies a moderate or higher risk, remediation or further investigation work is recommended.

APPENDIX B

PROFILE LOGS / DCP OUTPUT SHEETS

Excavation Method

Machine excavated trial pit.

Dimensions
Location

391771.5 E 415290.7 N

Ground Level (mOD)

153.65

Dates

27/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	D1				(0.40)	MADE GROUND: Dark brown silty SAND with frequent rootlets and pore pottery. Sand is fine to medium. Becoming lighter with depth.		
0.40-1.40	B2			153.25	0.40	Medium dense firm consistency orange and grey mottled sandy silty CLAY. Becoming stiff with depth.		
1.00	SV 40kPa				(1.60)			
2.00	SV 60kPa			151.65	2.00	Firm to stiff consistency orange and grey mottled sandy gravelly CLAY. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.		
2.00-2.30	B3			151.35	(0.30)			
					2.30	Refusal at 2.30mbgl against possible weathered sandstone.		
						Complete at 2.30m		


Remarks

Trial pit stable.
Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP101

Excavation Method

Machine excavated trial pit.

Dimensions
Location

391830.6 E 415212.1 N

Ground Level (mOD)

145.63

Dates

27/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20)	TOPSOIL: Brown silty SAND with frequent rootlets. Sand is fine to medium.		
0.20-1.00	BD2			145.43	0.20	Brownish orange slightly gravelly sandy SILT. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone. Increasing gravel content with depth.		
					(1.20)			
				144.23	1.40	Brownish orange silty gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.		
2.00-3.00	B3				(1.90)			
				142.33	3.30	Complete at 3.30m		


Remarks

Trial pit stable.
Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP102

Excavation Method

Machine excavated trial pit.

Dimensions
Location

391921 E 415234 N

Ground Level (mOD)

143.86

Dates

27/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	MADE GROUND: Dark brown silty SAND with frequent rootlets and rare pottery. Sand is fine to medium.		
0.30-1.20	B2			143.56	0.30	Brownish orange very sandy SILT. Sand is fine to medium.		
					(0.90)			
1.20-1.70	B3			142.66	1.20	High strength firm to stiff grey and brown mottled sandy gravelly CLAY. Sand is fine to medium. Gravel is fine to coarse, angular of sandstone and mudstone. Very slight ingress of water at 1.20mbgl.		
1.50	SV 90kPa			142.16	1.70	Refusal at 1.70mbgl in very hard friable clay. Potentially weathered mudstone. Complete at 1.70m		


Remarks

Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP103

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

148.58

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**
LKC 18 1005

Location

391892 E 415280.3 N

Dates

27/02/2018

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	MADE GROUND: Dark brown silty SAND with frequent rootlets and rare pottery fragments. Sand is fine to medium.		
0.30-1.30	D2			148.28	0.30	Brownish orange silty SAND. Sand is fine to medium. Increasingly sandy with depth.		
					(1.10)			
1.40-2.40	B3			147.18	1.40	Brownish orange sandy GRAVEL with occasional boulders of sandstone. Potential weathered bedrock.		
					(1.30)			
				145.88	2.70	Refusal at 2.70mbgl against potential weathered sandstone. Complete at 2.70m		


Remarks

Trial pit stable.
Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP104

Excavation Method

Machine excavated trial pit.

Dimensions
Location

391848.4 E 415348.2 N

Ground Level (mOD)

155.42

Dates

27/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20)	MADE GROUND: Dark brown silty SAND with frequent rootlets and rare pottery fragments. Sand is fine to medium.		
0.20-1.20	DB2			155.22	0.20	Brownish orange slightly silty SAND. Sand is fine to medium.		
					(1.10)			
				154.12	1.30	Brownish orange silty SAND. Sand is fine to medium. Strata is damp from 1.30mbgl but no free water.		
					(1.40)			
						Collapse from 1.30mbgl infilling the pit to 2.30mbgl.		
				152.72	2.70	Complete at 2.70m		


Remarks
Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP105

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

154.95

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**

LKC 18 1005

Location

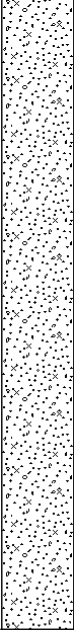
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Dates

27/02/2018

Engineer
Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20)	TOPSOIL: Dark brown silty SAND with frequent rootlets. Sand is fine to medium.		
0.20-1.20	B2			154.75	0.20	Brownish orange very silty gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone. Increasing gravel content with depth.		
					(2.10)			
				152.65	2.30	Refusal at 2.30mbgl against potential sandstone. Complete at 2.30m		


Remarks

Trial pit stable.
Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP106

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

140.75

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**
LKC 18 1005

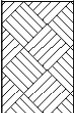
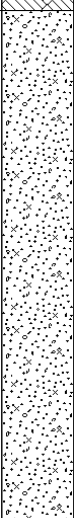
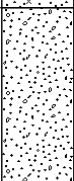
Location

391880.8 E 415187.3 N

Dates

27/02/2018

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	D1				(0.40)	TOPSOIL: Dark brown sandy SILT with frequent rootlets. Sand is fine to medium.		
0.40-1.40	B2			140.35	0.40	Brownish orange silty gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone. Increasing gravel content with depth.		
2.10-2.50	B3		Slow(1) at 2.10m.	138.65	2.10	Brown gravelly SAND. Sand is fine to coarse. Gravel is fine, subrounded of mudstone and shale.		▽1
					(0.60)			
				138.05	2.70	Complete at 2.70m		


Remarks

Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP107

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

135.01

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**
LKC 18 1005

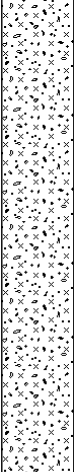
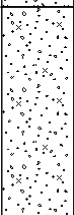
Location

391966.1 E 415170.5 N

Dates

27/02/2018

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20)	TOPSOIL: Dark brown sandy SILT with frequent rootlets. Sand is fine to medium.		
0.20-1.20	DB2			134.81	0.20	Brownish orange slightly gravelly sandy SILT. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone. Increasing gravel content with depth.		
					(1.60)			
				133.21	1.80	Brownish orange silty sandy GRAVEL with occasional sandstone boulders. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.		
					(0.70)			
			Slow(1) at 2.50m.	132.51	2.50	Complete at 2.50m		▽1


Remarks

Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP108

Excavation Method

Machine excavated trial pit.

Dimensions
Location

391978.8 E 415221.7 N

Ground Level (mOD)

140.89

Dates

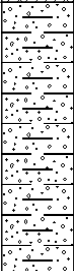
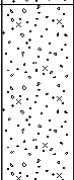
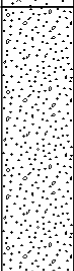
27/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	TOPSOIL: Black sandy SILT with frequent rootlets. Sand is fine to medium.		
0.30-1.20	B2			140.59	0.30	Medium strength firm to stiff consistency orange and grey mottled sandy gravelly CLAY with occasional boulders of sandstone. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded. Very friable. Increasing gravel content with depth.		
					(0.90)			
1.00	SV 60kPa			139.69	1.20	Orange and grey mottled silty sandy GRAVEL. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded of sandstone.		
					(0.60)			
				139.09	1.80	Brown and grey mottled gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone and mudstone.		
					(0.90)			
				138.19	2.70	Refusal at 2.70mbgl against potential sandstone. Complete at 2.70m		


Remarks

Trial pit stable.
Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP109

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

140.49

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**
LKC 18 1005

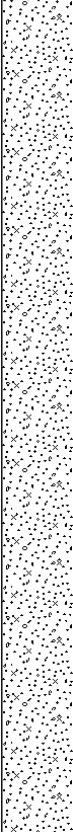
Location

392053.7 E 415270.7 N

Dates

27/02/2018

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20)	TOPSOIL: Dark brown silty SAND with frequent rootlets. Sand is fine to medium.		
				140.29	0.20			
					(0.20)	Orange slightly gravelly sandy SILT. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.		
0.40-1.40	B2			140.09	0.40			
						Brownish orange slightly silty gravelly SAND with occasional clay bands. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded of sandstone and shale. Increasing gravel content and boulders with depth.		
					(2.80)			
			Fast(1) at 3.10m.	137.29	3.20	Complete at 3.20m		▽1


Remarks

Trial pit stable.
Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP110

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

150.88

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**
LKC 18 1005

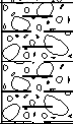
Location

391948.9 E 415336.5 N

Dates

28/02/2018

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	TOPSOIL: Dark brown silty SAND with frequent rootlets. Sand is fine to medium.		
0.30-1.30	B2			150.58	0.30	Brownish orange silty sandy GRAVEL. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded of sandstone. Increasing gravel content with depth.		
					(2.60)			
				147.98	2.90	Cobbles of grey sandy gravelly CLAY and of sandstone. Possibly weathered bedrock.		
					(0.40)			
				147.58	3.30	Complete at 3.30m		


Remarks

Trial pit stable.
Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP111

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

146.39

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**
LKC 18 1005

Location

392012.2 E 415324.4 N

Dates

28/02/2018

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	D1				(0.40)	TOPSOIL: Dark brown silty SAND with frequent rootlets. Sand is fine to medium.		
0.40-1.40	B2			145.99	0.40	High strength firm to stiff consistency brownish orange slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded of sandstone.		
1.00	SV 90kPa				(2.40)			
				143.59	2.80 (0.20)	Brownish grey very gravelly SAND with occasional iron staining. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded of sandstone.		
				143.39	3.00	Complete at 3.00m		


Remarks

Trial pit stable.
Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP112

Excavation Method

Machine excavated trial pit.

Dimensions
Location

392018 E 415414.7 N

Ground Level (mOD)

149.82

Dates

28/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	TOPSOIL: Dark brown sandy SILT with frequent rootlets. Sand is fine to medium.		
0.30-1.30	DB2			149.52	0.30	Brownish orange slightly gravelly sandy clayey SILT with occasional clay lenses. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded of sandstone.		
					(2.20)			
						Collapse from 2.00mbgl infilling the pit to 3.00mbgl.		
			Slow(1) at 2.50m.	147.32	2.50	Brown silty gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded of sandstone.		▽1
					(0.50)			
				146.82	3.00	Complete at 3.00m		


Remarks
Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP113

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

141.88

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**
LKC 18 1005

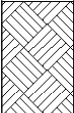
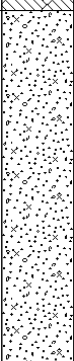
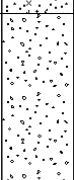
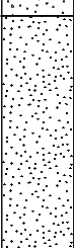
Location

392136 E 415390.8 N

Dates

28/02/2018

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	D1				(0.40)	TOPSOIL: Black silty SAND with frequent rootlets. Sand is fine to medium.		
0.40-1.40	B2			141.48	0.40	Brownish orange silty gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone. Increasing gravel content with depth.		
				140.28	1.60	Brownish orange sandy GRAVEL. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.		
				139.68	2.20	Brownish orange fine SAND.		
				138.88	3.00	Strata damp at 2.20mbgl but no free water. Complete at 3.00m		


Remarks

Trial pit stable.
Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP114

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

143.81

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**

LKC 18 1005

Location

392099.8 E 415440.6 N

Dates

28/02/2018

Engineer
Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	D1				(0.40)	MADE GROUND: Dark brown silty SAND with frequent rootlets and rare pottery. Sand is fine to medium.		
0.40-1.40	DB2			143.41	0.40	Brownish orange slightly silty slightly gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.		
					(1.90)			
				141.51	2.30	Collapse from 0.40mbgl infilling the pit to 2.20mbgl.		
				141.31	(0.20)	Stiff consistency orange sandy gravelly CLAY. Sand is fine to medium. Gravel is fine to medium, subangular of sandstone.		
					2.50	Complete at 2.50m		


Remarks

Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP115

Excavation Method

Machine excavated trial pit.

Dimensions
Location

392087.6 E 415512.3 N

Ground Level (mOD)

149.65

Dates

28/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	MADE GROUND: Black silty SAND with frequent rootlets and rare pottery. Sand is fine to medium.		
0.30-1.30	B2			149.35	0.30	Low strength firm consistency orange and grey slightly sandy CLAY. Sand is fine to medium.		
1.00	SV 30kPa				(1.60)			
2.00	SV 40kPa			147.75	1.90	Low to medium strength stiff consistency grey sandy gravelly CLAY with rare rootlets. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone, mudstone and shale. Very friable. Possibly weathered mudstone.		
2.00-3.00	B3			147.35	(0.40)			
			Slow(1) at 2.30m.		2.30	Refusal at 2.30mbgl against possible interbedded sandstone and mudstone. Complete at 2.30m		V1


Remarks

Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP116

Excavation Method

Machine excavated trial pit.

Dimensions
Location

392127.8 E 415451.5 N

Ground Level (mOD)

143.16

Dates

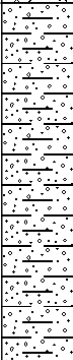
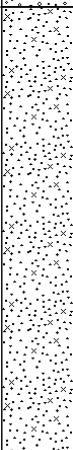
28/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	TOPSOIL: Dark brown sandy SILT with frequent rootlets. Sand is fine to medium.		
0.30-0.60	B2			142.86	0.30 (0.30)	Orange very silty gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.		
0.60-1.60	B3			142.56	0.60	Medium strength firm to stiff consistency orange and grey mottled slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.		
1.00	SV 50kPa				(1.20)			
1.50	SV 90kPa			141.36	1.80 (1.50)	Brownish orange silty SAND. Sand is fine to medium.		
				139.86	3.30	Complete at 3.30m		


Remarks

Trial pit stable.
Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP117

Excavation Method

Machine excavated trial pit.

Dimensions
Location

392189.4 E 415496.5 N

Ground Level (mOD)

146.70

Dates

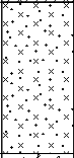
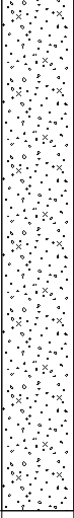
28/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	TOPSOIL: Dark brown sandy SILT with frequent rootlets. Sand is fine to medium.		
0.30-0.80	B2			146.40	0.30 (0.50)	Orange sandy SILT. Sand is fine to medium.		
0.80-1.80	B3			145.90	0.80 (1.70)	Brown silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium, subangular of sandstone and mudstone.		
				144.20	2.50	Refusal at 2.50mbgl against potential weathered sandstone. Complete at 2.50m		


Remarks

Trial pit dry.
Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP118

Excavation Method

Machine excavated trial pit.

Dimensions
Location

392198.7 E 415414 N

Ground Level (mOD)

137.74

Dates

28/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.70	D1					MADE GROUND: Brown sand with frequent rootlets occasional brick fragments, sandstone fragments, clumps of black silty topsoil and rare glass. Sand is fine to medium.		
0.70-1.40	D2			137.04	0.70	Medium strength soft to firm consistency orange and brown mottled slightly sandy CLAY. Sand is fine to medium.		
1.00	SV 50kPa				(0.70)			
1.40-2.40	B3			136.34	1.40	Low strength soft consistency dark brown sandy gravelly silty CLAY. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded of sandstone. Stagnant base of pond odour.		
2.00	SV 30kPa				(1.00)			
				135.34	2.40	Orange slightly gravelly SAND. Sand is fine to medium.		
				135.24	(0.10) 2.50	Complete at 2.50m		


Remarks

Trial pit stable.
Trial pit dry.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP119

Excavation Method

Machine excavated trial pit.

Dimensions
Location

392249.2 E 415413.5 N

Ground Level (mOD)

137.58

Dates

08/03/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20)	MADE GROUND: Dark brown silty SAND with frequent rootlets and rare glass. Sand is fine to medium.		
0.20-1.20	B2			137.38	0.20	Brownish orange very clayey SAND. Sand is fine to medium.		
					(1.20)			
				136.18	1.40	Brownish orange slightly silty SAND. Sand is fine to medium.		
					(0.40)			
				135.78	1.80	Orange gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.		
					(0.40)			
				135.38	2.20	Complete at 2.20m		


Remarks

Trial pit dry.
Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP120

Excavation Method

Machine excavated trial pit.

Dimensions
Location

392280.1 E 415441.7 N

Ground Level (mOD)

138.54

Dates

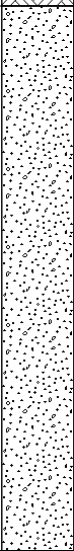
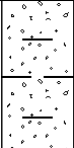
08/03/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20)	TOPSOIL: Dark brown slightly sandy SILT with frequent rootlets. Sand is fine to medium.		
0.20-1.20	DB2			138.34	0.20	Brownish orange gravelly SAND with occasional boulders. Sand is fine to medium. Gravel is fine to coarse, rounded of sandstone.		
					(1.80)			
				136.54	2.00	Stiff consistency dark grey clayey GRAVEL. Gravel is fine to medium, angular of shale. Iron stained and friable. Possible weathered mudstone.		
					(0.50)			
				136.04	2.50	Complete at 2.50m		


Remarks

Trial pit dry.
Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP121

Excavation Method

Machine excavated trial pit.

Dimensions
Location

392313.9 E 415384.4 N

Ground Level (mOD)

133.98

Dates

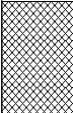
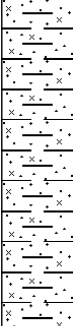
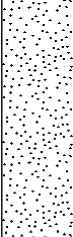
08/03/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	D1				(0.40)	MADE GROUND: Black slightly gravelly silty SAND with occasional concrete, whole brick and fragments. Sand is fine to medium. Gravel is fine to coarse, subangular.		
0.40-1.40	B2			133.58	0.40	Brownish grey sandy silty CLAY. Sand is fine to medium.		
1.00	SV 40kPa				(1.10)			
1.50	SV 50kPa			132.48	1.50	Firm to stiff orange and grey mottled CLAY.		
				132.18	1.80	Orange and grey mottled fine to coarse SAND.		
					(0.80)			
				131.38	2.60	Complete at 2.60m		▼1 ▽1
			Moderate(1) at 2.60m, rose to 2.50m in 10 mins.					


Remarks

Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP122

Excavation Method

Machine excavated trial pit.

Dimensions
Location

392337.3 E 415352.5 N

Ground Level (mOD)

133.78

Dates

08/03/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	D1				(0.40)	MADE GROUND: Black sandy SILT with rare brick fragments and ash. Sand is fine to medium.		
0.40-0.80	B2			133.38	0.40	Firm consistency slightly sandy CLAY. Sand is fine to medium.		
0.50	SV 50kPa				(0.40)			
0.80-1.20	B3			132.98	0.80	Stiff consistency orange and grey mottled sandy CLAY. Sand is fine to medium.		
1.00	SV 70kPa				(0.40)	Metal pipe unearthed in the north of the trial pit at 1.00mbgl. Pipe surrounded by clayey gravel with frequent concrete and brick fragments.		
				132.58	1.20	Complete at 1.20m		


Remarks

Trial pit dry.
Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP123

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

133.28

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**
LKC 18 1005

Location

392363 E 415359.2 N

Dates

08/03/2018

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	D1		Water strike(1) at 0.90m, no rise after 10 mins.		(1.50)	MADE GROUND: Dark brown silty sandy GRAVEL with frequent pottery, brick fragments and glass. Sand is fine to medium. Gravel is fine to coarse, angular.		
				131.78	1.50 (0.10)	Land drain encountered at 0.90mbgl. Large drain made of sandstone slabs. Base of the drain at 1.50mbgl.		
				131.68	1.60	Soft consistency sandy CLAY. Sand is fine to medium.		
						Complete at 1.60m		


Remarks

Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP124

Excavation Method

Machine excavated trial pit.

Dimensions
Location

392333.6 E 415433.9 N

Ground Level (mOD)

136.50

Dates

08/03/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
**Job
Number**
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.90	D1			136.30	(0.20) 0.20	MADE GROUND: Black slightly gravelly sandy SILT with frequent rootlets, occasional shale and brick fragments. Sand is fine to medium. Gravel is fine to coarse, subangular.		
1.00 1.00-2.00	SV 50kPa DB2			135.60	(0.70) 0.90	MADE GROUND: Brown sandy gravelly CLAY with frequent whole brick and fragments, sandstone and pottery. Sand is fine to medium. Gravel is fine to coarse, subangular.		
2.00	SV 40kPa			134.10	(1.50) 2.40	Firm to stiff consistency brownish orange and grey mottled sandy CLAY. Sand is fine to medium. Increasingly grey and sandy with depth.		
						Complete at 2.40m		


Remarks

Trial pit dry.
Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP125

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

137.28

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**
LKC 18 1005

Location

392365.5 E 415461.6 N

Dates

08/03/2018

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.90	D1					MADE GROUND: Dark brown sandy gravelly CLAY with occasional brick fragments, sandstone, shale, rare glass and coal. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.		
1.00	SV 80kPa			136.38	0.90	Firm consistency greyish brown sandy CLAY. Sand is fine to medium. Increasingly orange an sandy with depth.		
				135.18	2.10	Brownish orange clayey gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, rounded of sandstone.		
				134.78	2.50	Complete at 2.50m		


Remarks

Trial pit dry.
Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP126

Excavation Method

Machine excavated trial pit.

Dimensions
Ground Level (mOD)

136.52

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**
LKC 18 1005

Location

392365.5 E 415461.6 N

Dates

08/03/2018

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	D1					MADE GROUND: Dark brown sandy gravelly CLAY with occasional brick fragments, shale, coal, timber and bands of fly ash. Sand is fine to medium. Gravel is fine to coarse, subangular.		
1.40-2.40	B2			135.12	1.40	Stiff consistency brownish grey sandy CLAY. Increasingly orange with depth.		
				134.12	2.40	Complete at 2.40m		


Remarks

Trial pit dry.
Trial pit stable.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.TP127

Excavation Method

Drive-in Windowless Sampler

Dimensions
Location

391943.5 E 415113.6 N

Ground Level (mOD)

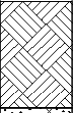
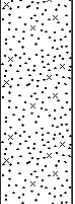
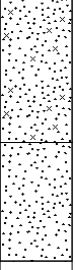
131.10

Client

Taylor Wimpey Strategic Land (North)

Job
Number
LKC 18 1005

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.35	D1				(0.35)	TOPSOIL: Brown silty SAND with frequent rootlets. Sand is fine to medium.			
0.35-1.70	DB2			130.75	0.35	Very loose orangish brown silty SAND. Sand is fine to medium.			
1.00-1.45	SPT N=0		Water strike(1) at 1.00m. 0,0/0,0,0,0		(1.15)			Σ1	
1.70-1.89	SPT 25*/90 50/95		20,5/23,27	129.60	1.50	Grey coarse SAND.			
				129.21	1.89	Refusal at 1.89mbgl against buff coarse SANDSTONE. Complete at 1.89m			

Remarks
Scale
(approx)

1:25

Logged
By

PW

Figure No.

LKC 18 1005.WS101

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS102**Excavation Method**

Drive-in Windowless Sampler

Dimensions**Ground Level (mOD)**

131.11

Client

Taylor Wimpey Strategic Land (North)

Job
Number
LKC 18 1005**Location**

392002.2 E 415149.5 N

Dates

19/02/2018

Engineer**Sheet**
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	D1				(0.40)	MADE GROUND: Brown very silty SAND with frequent rootlets and rare brick fragments. Sand is fine to medium.		
0.40-1.40	DB2			130.71	0.40	Loose orange and grey mottled clayey silty SAND with occasional organic inclusions. Sand is fine to medium. Sand becomes coarse with depth.		
1.00-1.45	SPT N=8		1,2/1,1,3,3 Water strike(1) at 1.20m.		(1.70)			
2.00-2.44	SPT 50/285		4,6/12,10,10,18	129.01	2.10	Very weak interbedded grey and buff weathered MUDSTONE and SANDSTONE.		
				128.67	2.44	Refusal at 2.44mbgl in competent SANDSTONE. Complete at 2.44m		

Remarks**Scale**
(approx)

1:25

Logged
By

PW

Figure No.

LKC 18 1005.WS102

Excavation Method

Drive-in Windowless Sampler

Dimensions
Location

392092.4 E 415210.1 N

Ground Level (mOD)

131.68

Client

Taylor Wimpey Strategic Land (North)

Job
Number
LKC 18 1005

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.40	D1				(0.40)	MADE GROUND: Greyish brown clayey SAND with frequent rootlets and rare brick fragments. Sand is fine to medium.			
0.40-1.50	B2			131.28	0.40	Very low strength soft to firm consistency orange and grey mottled very sandy CLAY. Sand is fine to medium			
1.00-1.45	SPT N=1		1,0/0,0,0,1		(1.10)				
1.00	SV 12kPa		Water strike(1) at 1.20m.						
1.50-2.50	B3			130.18	1.50	Medium dense to dense grey slightly gravelly clayey SAND with occasional organic inclusions and rare limestone gravel. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone. Potentially reworked material.			
2.00-2.45	SPT N=27		4,5/5,6,6,10		(1.91)				
3.00-3.41	SPT 50/255		13,12/12,12,18,8						
				128.27	3.41	Refusal at 3.41mbgl in grey coarse SANDSTONE. Complete at 3.41m			

Remarks

Borehole collapse to 2.30mbgl while installing well.

Scale
(approx)

1:25

Logged
By

PW

Figure No.

LKC 18 1005.WS103

Excavation Method

Drive-in Windowless Sampler

Dimensions
Location

392110.6 E 415249.4 N

Ground Level (mOD)

132.06

Dates

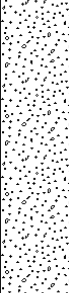
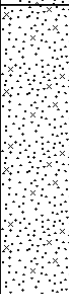
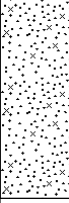
19/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
Job
Number
LKC 18 1005

Sheet
1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.30	D1				(0.30)	TOPSOIL: Dark brown sandy SILT with frequent rootlets. Sand is fine to medium.			
0.30-1.80	DB2			131.76	0.30	Firm consistency orange and brown mottled very sandy CLAY with thin (<10mm) lenses of PEAT. Soft consistency and higher clay content with depth.			
1.00-1.45	SPT N=0		0,0/0,0,0,0		(1.50)				
2.00-3.00	B3			130.26	1.80				
2.00-2.45	SPT N=24		Water strike(1) at 2.00m. 4,5/6,6,6,6	130.16	(0.10) 1.90	Brown plastic amorphous PEAT.			
						Medium dense grey gravelly SAND. Sand is fine to coarse. Gravel is fine to medium, subrounded of sandstone.		Σ1	
2.70-3.15	SPT N=12		8,7/3,3,3,3		(1.50)				
4.00-4.45	SPT N=8		2,2/2,2,2,2						
4.45-4.90	SPT N=16		3,3/3,4,4,5		(1.95)				
4.90-5.35	SPT N=34		5,6/7,7,10,10						

Remarks

On taking the SPT at 4.00mbgl the borehole collapses to 3.00mbgl. SPT is overdriven to 5.35mbgl in an attempt to find bedrock.

Scale
(approx)

1:25

Logged
By

PW

Figure No.

LKC 18 1005.WS104

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS104**Excavation Method**

Drive-in Windowless Sampler

Dimensions**Ground Level (mOD)**

132.06

Client

Taylor Wimpey Strategic Land (North)

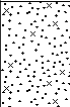
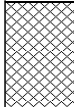
Job
Number
LKC 18 1005**Location**

392110.6 E 415249.4 N

Dates

19/02/2018

Engineer**Sheet**
2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				126.71	5.35	Complete at 5.35m			

Remarks

On taking the SPT at 4.00mbgl the borehole collapses to 3.00mbgl. SPT is overdriven to 5.35mbgl in an attempt to find bedrock.

Scale
(approx)

1:25

Logged
By

PW

Figure No.

LKC 18 1005.WS104



LK CONSULT LTD

Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site

Smithybridge, Littleborough

Number
WS105

Excavation Method

Drive-in Windowless Sampler

Dimensions

Location

391990.6 E 415270.4 N

Ground Level (mOD)

143.34

Client

Taylor Wimpey Strategic Land (North)

Job
Number
LKC 18 1005

Engineer

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	TOPSOIL: Dark brown sandy SILT with frequent rootlets. Sand is fine to medium.		
0.30-1.30	DB2		Water strike(1) at 0.70m.	143.04	0.30	Firm consistency orange sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded of sandstone. Increasing gravel content with depth.		▽1
1.00-1.45	SPT N=9		1,2/2,2,2,3		(2.04)			
2.00-2.34	SPT 50/190		14, 10/16, 20, 14	141.00	2.34	Refusal at 2.34mbgl against competent orange SANDSTONE. Complete at 2.34m		

Remarks

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS105

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS106**Excavation Method**

Drive-in Windowless Sampler

Dimensions**Location**

391896.5 E 415228.3 N

Ground Level (mOD)

144.15

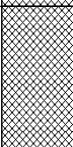
Dates

19/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer**Job**
Number
LKC 18 1005**Sheet**
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00-1.45	SPT N=14		4,4/3,3,4,4	143.95	(0.20) 0.20 (0.50) 143.45 0.70	MADE GROUND: Dark brown silty SAND with occasional rootlets and rare brick fragments. Sand is fine to medium. MADE GROUND: Dark brown silty gravelly SAND with rare ash. Sand is fine to medium. Gravel is fine to medium, subangular of sandstone. Medium dense firm consistency brown and orange mottled very clayey gravelly SAND with occasional coal fragments. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone. Increasingly sandy with depth.	  	
2.00-2.45	SPT N=16		4,4/4,4,4,4		(3.69)		                     	
3.00-3.45	SPT N=12		Water strike(1) at 3.00m. 4,2/3,3,3,3				                     	
4.00-4.39	SPT 50/240		10,11/12,12,20,6	139.76	4.39	Refusal at 4.39mbgl against brown micaceous iron stained fine to medium SANDSTONE. Complete at 4.39m	                     	

Remarks**Scale (approx)**

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS106

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS107**Excavation Method**

Drive-in Windowless Sampler

Dimensions**Location**

391906.5 E 415316.8 N

Ground Level (mOD)

150.90

Client

Taylor Wimpey Strategic Land (North)

Job
Number
LKC 18 1005**Engineer****Sheet**
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
1.00-1.45	SPT N=8		1,2/2,2,2,2	150.60	0.30 (0.30)	TOPSOIL: Brown and orange slightly gravelly silty SAND with occasional rootlets. Sand is fine to medium. Loose to medium dense orangish brown slightly silty SAND with rare rootlets. Sand is fine.			
2.00-2.45	SPT N=21		2,4/6,5,5,5	148.60	2.30 (2.00)				
3.00-3.40	SPT 50/245		5,18/20,14,10,6	147.50	3.40 (1.10)	Orangish brown slightly silty gravelly SAND. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded of sandstone. Refusal at 3.40mbgl against buff micaceous fine to medium SANDSTONE. Complete at 3.40m			
Remarks							Scale (approx) 1:25	Logged By PW	Figure No. LKC 18 1005.WS107

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS108

Excavation Method Drive-in Windowless Sampler	Dimensions	Ground Level (mOD) 149.57	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 391978.3 E 415360.8 N	Dates 20/02/2018	Engineer	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20)	TOPSOIL: Brown clayey silty SAND with frequent rootlets. Sand is fine to medium.		
0.20-1.00	DB2			149.37	0.20	Low strength firm consistency orangish brown sandy gravelly CLAY. Sand is fine to medium. Gravel is fine to medium, subangular of sandstone. Increasing sand content with depth.		
					(0.80)			
1.00-1.45 1.00 1.00-2.00	SPT N=8 SV 35kPa B3		2,1/2,2,2,2	148.57	1.00	Loose to medium dense orangish brown slightly gravelly clayey SAND. Sand is fine to medium. Gravel is fine to coarse, subangular to subrounded of sandstone.		
2.00-2.45	SPT N=26		Water strike(1) at 2.00m. 4,6/8,6,6,6					
					(3.37)			
3.00-3.45	SPT N=23		3,4/5,6,6,6					
4.00-4.37	SPT 50/220		6,10/11,20,19	145.20	4.37	Refusal at 4.37mbgl against weathered dark grey MUDSTONE and micaceous SANDSTONE. Complete at 4.37m		

Remarks**Scale (approx)**

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS108

Excavation Method

Drive-in Windowless Sampler

Dimensions
Location

392064.1 E 415355.8 N

Ground Level (mOD)

143.40

Dates

20/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
Job Number
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.10-0.40	D1			143.30	(0.10)	TOPSOIL: Brown sandy SILT with frequent rootlets. Sand is fine to medium.			
0.40-1.00	B2			143.00	(0.30)	Orange and brown mottled clayey SAND with frequent subrounded cobbles of sandstone.			
1.00-1.45	SPT N=10 SV 45kPa		1,2/2,2,3,3		0.40	Medium to high strength firm consistency orange and grey mottled sandy CLAY. Sand is fine to medium. Stiff consistency by 2.00mbgl.			
1.00-2.00	B3								
2.00-2.45	SPT N=14 SV 80kPa		1,2/3,3,4,4		(2.70)				
2.00									
3.00	SV 60kPa		Water strike(1) at 3.00m.						
3.00-3.45	SPT N=17		3,3/4,4,4,5	140.30	3.10	Medium dense orangish brown silty SAND. Sand is fine to medium.			
					(0.50)				
				139.80	3.60	Firm consistency orange and grey mottled sandy CLAY. Sand is fine to medium.			
				139.60	3.80	Brown silty SAND. Sand is fine to coarse.			
4.00-4.40	SPT 50/250		8,10/12,13,13,12		(0.60)				
				139.00	4.40	Refusal at 4.40mbgl against grey coarse SANDSTONE.			
						Complete at 4.40m			

Remarks

Borehole collapse to 4.00mbgl while installing well.

Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS109

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS110

Excavation Method Drive-in Windowless Sampler	Dimensions	Ground Level (mOD) 139.98	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392179.1 E 415404.2 N	Dates 20/02/2018	Engineer	Sheet 1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20)	TOPSOIL: Brown silty SAND with frequent rootlets. Sand is fine to medium.		
0.20-1.20	DB2			139.78	0.20	High strength firm consistency orange and grey mottled sandy CLAY. Sand is fine to medium. Increasing clay content with depth.		
1.00-1.45 1.00	SPT N=15 SV 70kPa		2,3/3,4,4,4					
1.50-2.50	B3				(2.70)			
2.00 2.00-2.45	SV 80kPa SPT N=16		Water strike(1) at 2.00m. 2,3/4,4,4,4					∇1
3.00-3.45 3.00-4.00	SPT N=26 B4		5,5/5,7,7,7	137.08	2.90	Medium dense to dense orangish brown fine SAND.		
4.00-4.45	SPT N=30		7,7/7,7,8,8		(2.55)			
5.00-5.45	SPT N=31		6,7/7,8,8,8					

Remarks**Scale (approx)**

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS110

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS110**Excavation Method**

Drive-in Windowless Sampler

Dimensions**Ground Level (mOD)**

139.98

Client

Taylor Wimpey Strategic Land (North)

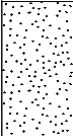
Job Number
LKC 18 1005**Location**

392179.1 E 415404.2 N

Dates

20/02/2018

Engineer**Sheet**
2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				134.53	5.45	Complete at 5.45m		

Remarks**Scale (approx)**

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS110

Excavation Method

Drive-in Windowless Sampler

Dimensions
Location

392179.1 E 415425.8 N

Ground Level (mOD)

140.38

Dates

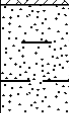
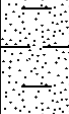
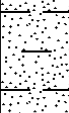
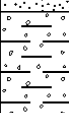
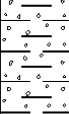
20/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
Job
Number
LKC 18 1005

Sheet
1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.30	D1				(0.30)	TOPSOIL: Dark brown silty SAND with occasional rootlets. Sand is fine to medium.			
0.30-1.30	B2			140.08	0.30	Medium dense orangish brown clayey SAND. Sand is fine to medium.			
1.00-1.45	SPT N=27		6,7/8,7,6,6		(1.50)				
1.80-2.80	B3			138.58	1.80	High strength stiff consistency brown gravelly CLAY. Gravel is fine to coarse, subangular of sandstone.			
2.00-2.45 2.00	SPT N=14 SV 100kPa		4,4/3,3,4,4		(1.10)				
3.00-3.45	SPT N=28		Water strike(1) at 2.90m. 4,5/6,7,7,8	137.48	2.90	Medium dense brown slightly silty SAND. Sand is fine to medium.		√1	
4.00-4.45	SPT N=24		5,5/6,6,7,7		(2.40)				
5.00-5.45	SPT N=26		5,5/6,6,7,7						

Remarks

Borehole collapse to 3.70mbgl while installing well.

Scale
(approx)

1:25

Logged
By

PW

Figure No.

LKC 18 1005.WS111

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS111**Excavation Method**

Drive-in Windowless Sampler

Dimensions**Ground Level (mOD)**

140.38

Client

Taylor Wimpey Strategic Land (North)

Job
Number
LKC 18 1005**Location**

392179.1 E 415425.8 N

Dates

20/02/2018

Engineer**Sheet**
2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				135.08	5.30 (0.15)	Weathered very weak grey shaley MUDSTONE.			
				134.93	5.45	Complete at 5.45m			

Remarks

Borehole collapse to 3.70mbgl while installing well.

Scale
(approx)

1:25

Logged
By

PW

Figure No.

LKC 18 1005.WS111

Excavation Method

Drive-in Windowless Sampler

Dimensions
Location

392327.8 E 415364.6 N

Ground Level (mOD)

134.05

Dates

20/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
Job
Number
LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.40	D1				(0.40)	MADE GROUND: Dark brown silty SAND with frequent rootlets and rare brick fragments. Sand is fine to medium.			
0.40-1.40	DB2			133.65	0.40	Brown sandy SILT. Sand is fine to medium. Orange with depth.			
1.00-1.45	SPT N=0		1,0/0,0,0,0		(2.10)				
2.00-2.45	SPT N=5		Water strike(1) at 2.00m. 1,1/1,1,2,1						
				131.55	2.50	Grey slightly silty SAND. Sand is fine to coarse.			
3.00-3.41	SPT 50/260		10,14/10,14,16,10		(0.91)				
				130.64	3.41	Refusal at 3.41mbgl against light grey micaceous SANDSTONE. Complete at 3.41m			

Remarks
Scale
(approx)

1:25

Logged
By

PW

Figure No.

LKC 18 1005.WS112

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS113

Excavation Method Drive-in Windowless Sampler		Dimensions		Ground Level (mOD) 136.95		Client Taylor Wimpey Strategic Land (North)		Job Number LKC 18 1005	
		Location 392353.9 E 415461.9 N		Dates 20/02/2018		Engineer		Sheet 1/1	

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	D1				(0.50)	MADE GROUND: Black silty gravelly SAND with occasional shale, coal fragments and rare pottery fragments. Sand is fine to medium. Gravel is fine to coarse, subangular.		
0.50-1.00	DB2			136.45	0.50	Stiff consistency orangish brown slightly sandy CLAY. Sand is fine to medium.		
1.00-1.39	SPT 50/235		3,4/10,10,26,4		(0.89)			
				135.56	1.39	Refusal at 1.39mbgl on orange SANDSTONE. Complete at 1.39m		

Remarks**Scale (approx)**

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS113

Excavation Method Drive-in Windowless Sampler	Dimensions	Ground Level (mOD) 132.54	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392114.4 E 415305.9 N	Dates 21/02/2018	Engineer	Sheet 1/2

[illegible]

Remarks	Scale (approx)	Logged By
	1:25	PW
	Figure No. LKC 18 1005.WS114	

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS114**Excavation Method**

Drive-in Windowless Sampler

Dimensions**Ground Level (mOD)**

132.54

Client

Taylor Wimpey Strategic Land (North)

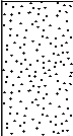
Job
Number
LKC 18 1005**Location**

392114.4 E 415305.9 N

Dates

21/02/2018

Engineer**Sheet**
2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				127.09	5.45	Complete at 5.45m		

Remarks**Scale**
(approx)

1:25

Logged
By

PW

Figure No.

LKC 18 1005.WS114

Excavation Method

Drive-in Windowless Sampler

Dimensions
Location

392165.4 E 415341.6 N

Ground Level (mOD)

131.97

Dates

21/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
Job
Number

LKC 18 1005

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.80	D1					TOPSOIL: Brown and orange mottled sandy SILT with occasional rootlets. Sand is fine to medium. Potentially reworked topsoil.			
1.00-1.45	SPT N=1		1,0/0,0,0,1	131.17	(0.80)				
1.00-2.00	B2		Water strike(1) at 1.40m.		0.80	Brownish grey silty SAND. Sand is fine to coarse.			
2.00-2.45	SPT N=17		5,6/6,4,4,3	129.97	2.00	Brownish grey silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium, subangular of sandstone.			
				129.77	(0.20)	Brownish grey silty SAND. Sand is fine to coarse.			
3.00-3.45	SPT N=12		3,3/3,3,3,3						
3.45-3.90	SPT N=17		3,4/4,4,4,5		(2.58)				
3.90-4.35	SPT N=22		4,5/5,5,5,7						
4.35-4.78	SPT 50/275		8,10/12,13,15,10	127.19	4.78	Refusal at 4.78mbgl in silty SAND. Complete at 4.78m			

Remarks

On taking the SPT at 3.00mbgl the borehole collapses to 2.00mbgl. SPT is overdriven to 4.78mbgl in an attempt to find bedrock.

Scale
(approx)

1:25

Logged
By

PW

Figure No.

LKC 18 1005.WS115

Excavation Method

Window sample undertaken to 5.00mbgl. Continued with DP to 8.95mbgl.

Dimensions
Location

392186.1 E 415369.9 N

Ground Level (mOD)

132.59

Dates

23/02/2018

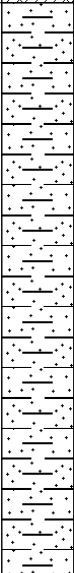
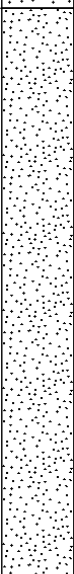
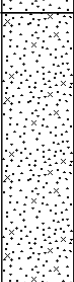
Client

Taylor Wimpey Strategic Land (North)

Engineer
Job Number
LKC 18 1005

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	TOPSOIL: Brown silty SAND. Sand is fine to medium.		
0.50-1.50	B2			132.29	0.30	Medium dense firm consistency orange and grey mottled sandy CLAY. Sand is fine to medium. Increasing fine sand content with depth.		
1.00-1.45 1.00	SPT N=8 SV 50kPa		1,2/1,2,2,3		(1.90)			
2.00-2.45 2.00	SPT N=18 SV 50kPa		2,4/4,4,5,5	130.39	2.20	Medium dense brown fine SAND.		
3.00-3.45	SPT N=21		5,5/5,5,5,6		(1.90)			
4.00-4.45	SPT N=18		2,3/3,4,5,6 Water strike(1) at 4.10m.	128.49	4.10	Brown very silty SAND.		▽1
					(0.90)			
				127.59	5.00			

Remarks
Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS116

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS117**Excavation Method**

Window sample undertaken to 5.00mbgl. Continued with DP to 10.00mbgl.

Dimensions**Location**

392213.5 E 415419 N

Ground Level (mOD)

139.97

Dates

23/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer**Job Number**
LKC 18 1005**Sheet**
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1			139.67	(0.30) 0.30	TOPSOIL: Dark brown silty SAND. Sand is fine to medium.		
1.00-1.45 1.00 1.00-1.50	SPT N=12 SV 100kPa B2 2		2,3/3,3,3,3			High strength firm consistency orange and grey mottled sandy CLAY. Sand is fine to medium.		
2.00-2.45 2.00	SPT N=15 SV 120kPa		3,4/4,3,4,4		(4.70)			
3.00-3.45 3.00	SPT N=18 SV 90kPa		3,3/3,5,5,5					
4.00-4.45	SPT N=18		3,4/4,4,5,5	134.97	5.00			

Remarks**Scale (approx)**

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS117

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS118**Excavation Method**

Window sample undertaken to 5.00mbgl. Continued with DP to 5.38mbgl.

Dimensions**Location**

392194.1 E 415436.2 N

Ground Level (mOD)

141.49

Dates

23/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer**Job Number**
LKC 18 1005**Sheet**
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1				(0.20)	TOPSOIL: Black sandy SILT with frequent rootlets. Sand is fine to medium.		
0.20-1.20	DB2			141.29	0.20	Medium dense firm consistency brown and grey mottled sandy CLAY with rare coal fragments. Sand is fine to medium. Becoming more clayey with depth.		
1.00-1.45 1.00	SPT N=13 SV 60kPa		2,2/3,3,3,4		(2.30)			
2.00-2.45 2.00 2.00-3.00	SPT N=16 SV 65kPa B3		3,4/4,4,4,4		2.50	Medium dense brownish orange fine to medium SAND.		
3.00-3.45	SPT N=14		3,4/4,4,3,3	138.99	(2.10)			
4.00-4.45	SPT N=27		4,4/6,6,6,9		4.60	Brown and orange mottled gravelly SAND. Sand is fine to coarse. Gravel is fine to medium, subangular. Very iron stained.		
				136.89	(0.40)			
				136.49	5.00			

Remarks**Scale (approx)**

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS118

Excavation Method

Window sample undertaken to 5.45mbgl. Continued with DP to 10.00mbgl.

Dimensions
Location

392127 E 415343 N

Ground Level (mOD)

141.37

Dates

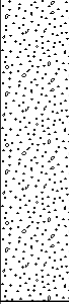
23/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
Job Number
LKC 18 1005

Sheet
1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.20	D1				(0.20)	TOPSOIL: Dark brown sandy SILT with frequent rootlets. Sand is fine to medium.			
0.20-1.20	B2			141.17	0.20	Medium dense brown clayey gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.			
1.00-1.45	SPT N=17		4,5/4,4,5,4		(1.70)				
2.00-2.45	SPT N=16		4,5/4,4,4,4	139.47	1.90	Medium dense brown slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to medium, subangular of sandstone. Iron stained.			
3.00-3.45	SPT N=14		4,4/3,3,4,4		(3.10)				
4.00-4.45	SPT N=27		5,5/5,7,7,8						
5.00-5.45	SPT N=12		7,7/3,3,3,3	136.37	5.00				

Remarks
Scale (approx)
1:25

Logged By
PW

Figure No.
LKC 18 1005.WS119

Excavation Method

Drive-in Windowless Sampler

Dimensions
Location

391830.1 E 415241.9 N

Ground Level (mOD)

148.65

Client

Taylor Wimpey Strategic Land (North)

Job
Number

LKC 18 1005

Engineer
Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.30	D1				(0.30)	TOPSOIL: Brown silty SAND with frequent rootlets. Sand is fine to medium.			
0.30-1.30	B2			148.35	0.30	Medium dense firm consistency brown and grey mottled slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.			
1.00-1.45 1.00	SPT N=16 SV 50kPa		3,4/4,4,4,4		(1.90)				
2.00-2.45 2.00	SPT N=29 SV 60kPa		5,5/6,6,7,10	146.45	2.20	Buff weathered fine to medium SANDSTONE recovered as gravel.			
2.60-2.78	SPT 25*/70 50/110		25/30,20	145.87	2.78	Refusal at 2.78mbgl against competent buff coarse SANDSTONE. Complete at 2.78m			

Remarks
Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS120

Excavation Method

Drive-in Windowless Sampler

Dimensions
Location

391864.3 E 415368.6 N

Ground Level (mOD)

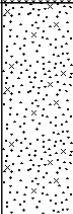
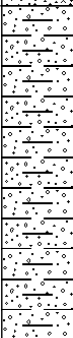
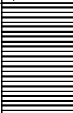
155.40

Client

Taylor Wimpey Strategic Land (North)

Job Number
LKC 18 1005

Engineer
Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	MADE GROUND: Dark brown sandy SILT with frequent rootlets and rare brick fragments. Sand is fine to medium.		
0.30-1.30	DB2			155.10	0.30	Medium dense brownish orange silty SAND. Sand is fine to medium.		
1.00-1.45	SPT N=12		3,3/3,3,3,3		(2.30)			
2.00-2.45	SPT N=14		Water strike(1) at 2.00m. 2,3/3,3,3,5					
				152.80	2.60	Firm consistency grey slightly gravelly very sandy CLAY. Sand is fine to medium. Gravel is fine to medium, subangular of sandstone and mudstone.		
3.00-3.45	SPT N=30		5,6/7,7,7,9		(1.10)			
3.70-4.07	SPT 50/220		8,9/15,15,20	151.70	3.70	Grey weathered MUDSTONE.		
				151.33	4.07	Refusal at 4.07mbgl against weathered MUDSTONE. Complete at 4.07m		

Remarks
Scale (approx)

1:25

Logged By

PW

Figure No.

LKC 18 1005.WS121

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS122**Excavation Method**

Drive-in Windowless Sampler

Dimensions**Location**

391958 E 415196 N

Ground Level (mOD)

135.20

Dates

26/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer**Job**
Number
LKC 18 1005**Sheet**
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1			134.90	(0.30) 0.30	TOPSOIL: Dark brown silty SAND. Sand is fine to medium.		
1.00-1.45 1.00 1.00-2.00	SPT N=18 SV 40kPa B2		3,3/4,4,5,5		(2.84)	Medium strength firm consistency brown and grey mottled sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular sandstone and mudstone.		
2.00-2.45 2.00	SPT N=14 SV 50kPa		2,2/3,3,4,4					
2.70-3.14	SPT 50/290		7,8/11,12,14,13	132.06	3.14	Refusal at 3.14mbgl in sandy gravelly CLAY. Complete at 3.14m		

Remarks**Scale**
(approx)

1:25

Logged
By

PW

Figure No.

LKC 18 1005.WS122

Excavation Method

Drive-in Windowless Sampler

Dimensions
Location

392078.4 E 415446.9 N

Ground Level (mOD)

145.28

Dates

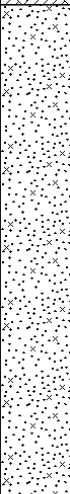
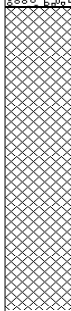
26/02/2018

Client

Taylor Wimpey Strategic Land (North)

Engineer
Job
Number
LKC 18 1005

Sheet
1/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.30	D1			144.98	(0.30) 0.30	TOPSOIL: Brown silty SAND with frequent rootlets. Sand is fine to medium.			
1.00-1.45 1.00-2.00	SPT N=12 B2		3,2/3,3,3,3			Loose to medium dense brown very silty SAND. Sand is fine to medium. Becoming sandier with depth.			
2.00-3.00 2.00-2.45	B3 SPT N=8		Water strike(1) at 2.00m. 3,3/2,2,2,2					Σ1	
3.00-3.45	SPT N=10		3,2/2,2,3,3		(5.15)				
4.00-4.45	SPT N=12		2,2/3,3,3,3						
5.00-5.45	SPT N=18		3,4/4,4,5,5						

Remarks
Scale
(approx)
1:25

Logged
By
PW

Figure No.
LKC 18 1005.WS123

Excavation Method Drive-in Windowless Sampler	Dimensions	Ground Level (mOD) 145.28	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392078.4 E 415446.9 N	Dates 26/02/2018	Engineer	Sheet 2/2

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				139.83	5.45	Complete at 5.45m			

Remarks	Scale (approx)	Logged By
	1:25	PW
	Figure No. LKC 18 1005.WS123	

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Number
WS124**Excavation Method**

Drive-in Windowless Sampler

Dimensions**Ground Level (mOD)**

147.09

Client

Taylor Wimpey Strategic Land (North)

Job
Number
LKC 18 1005**Location**

392148 E 415489.7 N

Dates

26/02/2018

Engineer**Sheet**
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.40	D1				(0.40)	MADE GROUND: Dark brown silty SAND with frequent rootlets and rare brick fragments. Sand is fine to medium.			
0.40-1.40	B2			146.69	0.40	Soft consistency brownish orange sandy silty CLAY. Sand is fine to medium. Increasing sand and silt content with depth.			
1.00-1.45	SPT N=11		2,2/3,3,3,3		(1.00)				
1.40-2.00	B3			145.69	1.40	Brownish orange fine to medium SAND with occasional coal fragments.			
					(0.60)				
2.00-2.45	SPT N=15		2,3/3,3,4,5	145.09	2.00	Brownish orange sandy SILT. Sand is fine to medium.			
					(0.20)				
				144.89	2.20	Very dense brown sandy GRAVEL with occasional coal fragments. Sand is fine to medium. Gravel is fine to coarse, subangular of sandstone.			
					(1.24)				
3.00-3.44	SPT 50/290		4,7/10,12,13,15						
				143.65	3.44	Refusal at 3.44mbgl in gravel. Complete at 3.44m			

Remarks**Scale (approx)**
1:25**Logged By**
PW**Figure No.**
LKC 18 1005.WS124

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

**Probe
Number****DP116**

Method Window sample undertaken to 5.00mbgl. Continued with DP to 8.95mbgl.	Cone Dimensions	Ground Level (mOD) 132.59	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392186.1 E 415369.9 N	Dates 23/02/2018	Engineer	Sheet 1/5

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment													
					0	2	4	6	8	10	12	14	16	18	20			
			132.59	0.00														
			132.09	0.50														
			131.59	1.00														
			131.09	1.50														
			130.59	2.00														

Remarks**Scale (approx)**

1:10

Logged By

PW

Figure No.

LKC 18 1005.DP116

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

**Probe
Number****DP116****Method**Window sample undertaken
to 5.00mbgl. Continued with
DP to 8.95mbgl.**Cone Dimensions****Ground Level (mOD)**

132.59

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**

LKC 18 1005

Location

392186.1 E 415369.9 N

Dates

23/02/2018

Engineer**Sheet**

2/5

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment													
					0	2	4	6	8	10	12	14	16	18	20			
			130.59	2.00														
			130.09	2.50														
			129.59	3.00														
			129.09	3.50														
			128.59	4.00														

Remarks**Scale
(approx)**

1:10

**Logged
By**

PW

Figure No.

LKC 18 1005.DP116

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

**Probe
Number****DP116**

Method Window sample undertaken to 5.00mbgl. Continued with DP to 8.95mbgl.	Cone Dimensions	Ground Level (mOD) 132.59	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392186.1 E 415369.9 N	Dates 23/02/2018	Engineer	Sheet 3/5

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment														
					0	2	4	6	8	10	12	14	16	18	20				
			128.59	4.00															
			128.09	4.50															
5.00-5.10	3		127.59	5.00															
5.10-5.20	3																		
5.20-5.30	4																		
5.30-5.40	5																		
5.40-5.50	5																		
5.50-5.60	5		127.09	5.50															
5.60-5.70	4																		
5.70-5.80	4																		
5.80-5.90	6																		
5.90-6.00	7																		
			126.59	6.00															

Remarks**Scale (approx)**

1:10

Logged By

PW

Figure No.

LKC 18 1005.DP116

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

Probe Number**DP116**

Method Window sample undertaken to 5.00mbgl. Continued with DP to 8.95mbgl.	Cone Dimensions	Ground Level (mOD) 132.59	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392186.1 E 415369.9 N	Dates 23/02/2018	Engineer	Sheet 4/5

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment															
					0	2	4	6	8	10	12	14	16	18	20					
6.00-6.10	6		126.59	6.00																
6.10-6.20	6																			
6.20-6.30	6																			
6.30-6.40	5																			
6.40-6.50	6																			
6.50-6.60	4		126.09	6.50																
6.60-6.70	6																			
6.70-6.80	6																			
6.80-6.90	6																			
6.90-7.00	6																			
7.00-7.10	7		125.59	7.00																
7.10-7.20	8																			
7.20-7.30	8																			
7.30-7.40	9																			
7.40-7.50	5																			
7.50-7.60	5		125.09	7.50																
7.60-7.70	5																			
7.70-7.80	9																			
7.80-7.90	9																			
7.90-8.00	8																			
		124.59	8.00																	

Remarks**Scale (approx)**

1:10

Logged By

PW

Figure No.

LKC 18 1005.DP116



LK CONSULT LTD

Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site

Smithybridge, Littleborough

Probe Number

DP116

Method Window sample undertaken to 5.00mbgl. Continued with DP to 8.95mbgl.	Cone Dimensions	Ground Level (mOD) 132.59	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392186.1 E 415369.9 N	Dates 23/02/2018	Engineer	Sheet 5/5

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment
8.00-8.10	8		124.59	8.00	0 2 4 6 8 10 12 14 16 18 20
8.10-8.20	11				
8.20-8.30	12				
8.30-8.40	13				
8.40-8.50	14				
8.50-8.60	13		124.09	8.50	
8.60-8.70	14				
8.70-8.80	15				
8.80-8.90	20				20
8.90-8.95	15				
8.95	0				
			123.59	9.00	
			123.09	9.50	
			122.59	10.00	

Remarks

Scale (approx)	Logged By
1:10	PW
Figure No.	
LKC 18 1005.DP116	

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

**Probe
Number****DP117**

Method Window sample undertaken to 5.00mbgl. Continued with DP to 10.00mbgl.	Cone Dimensions	Ground Level (mOD) 139.97	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392213.5 E 415419 N	Dates 23/02/2018	Engineer	Sheet 1/2

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment														
					0	2	4	6	8	10	12	14	16	18	20				
			139.97	0.00															
			139.47	0.50															
			138.97	1.00															
			138.47	1.50															
			137.97	2.00															
			137.47	2.50															
			136.97	3.00															
			136.47	3.50															
			135.97	4.00															
			135.47	4.50															
			134.97	5.00															

Remarks**Scale (approx)** **Logged By**

1:25 PW

Figure No.

LKC 18 1005.DP117

Method Window sample undertaken to 5.00mbgl. Continued with DP to 10.00mbgl.	Cone Dimensions	Ground Level (mOD) 139.97	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392213.5 E 415419 N	Dates 23/02/2018	Engineer	Sheet 2/2

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment
5.00-5.10	2		134.97	5.00	
5.10-5.20	2				
5.20-5.30	2				
5.30-5.40	2				
5.40-5.50	2		134.47	5.50	
5.50-5.60	2				
5.60-5.70	2				
5.70-5.80	3				
5.80-5.90	2				
5.90-6.00	2		133.97	6.00	
6.00-6.10	4				
6.10-6.20	4				
6.20-6.30	4				
6.30-6.40	5				
6.40-6.50	5		133.47	6.50	
6.50-6.60	5				
6.60-6.70	5				
6.70-6.80	6				
6.80-6.90	6				
6.90-7.00	8		132.97	7.00	
7.00-7.10	10				
7.10-7.20	11				
7.20-7.30	8				
7.30-7.40	9				
7.40-7.50	9		132.47	7.50	
7.50-7.60	7				
7.60-7.70	11				
7.70-7.80	11				
7.80-7.90	13				
7.90-8.00	17		131.97	8.00	
8.00-8.10	20				20
8.10-8.20	18				
8.20-8.30	11				
8.30-8.40	9				
8.40-8.50	8		131.47	8.50	
8.50-8.60	9				
8.60-8.70	10				
8.70-8.80	9				
8.80-8.90	9				
8.90-9.00	10		130.97	9.00	
9.00-9.10	10				
9.10-9.20	11				
9.20-9.30	12				
9.30-9.40	14				
9.40-9.50	14		130.47	9.50	
9.50-9.60	14				
9.60-9.70	14				
9.70-9.80	15				
9.80-9.90	11				
9.90-10.00	12		129.97	10.00	

Remarks
Scale (approx) **Logged By**

1:25

PW

Figure No.

LKC 18 1005.DP117



LK CONSULT LTD
Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site Smithybridge, Littleborough	Probe Number DP118
--	-------------------------------------

Method Window sample undertaken to 5.00mbgl. Continued with DP to 5.38mbgl.	Cone Dimensions	Ground Level (mOD) 141.49	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392194.1 E 415436.2 N	Dates 23/02/2018	Engineer	Sheet 1/2

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment											
					0	3	6	9	12	15	18	21	24	27	30	
			141.49	0.00												
			140.99	0.50												
			140.49	1.00												
			139.99	1.50												
			139.49	2.00												
			138.99	2.50												
			138.49	3.00												
			137.99	3.50												
			137.49	4.00												
			136.99	4.50												
			136.49	5.00												

Remarks	Scale (approx)	Logged By
	1:25	PW
	Figure No. LKC 18 1005.DP118	

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

**Probe
Number****DP118****Method**Window sample undertaken
to 5.00mbgl. Continued with
DP to 5.38mbgl.**Cone Dimensions****Location**

392194.1 E 415436.2 N

Ground Level (mOD)

141.49

Client

Taylor Wimpey Strategic Land (North)

**Job
Number**

LKC 18 1005

Dates

23/02/2018

Engineer**Sheet**

2/2

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment												
					0	3	6	9	12	15	18	21	24	27	30		
5.00-5.10	5		136.49	5.00													
5.10-5.20	13																
5.20-5.30	23																
5.30-5.38	14																
			135.99	5.50													
			135.49	6.00													
			134.99	6.50													
			134.49	7.00													
			133.99	7.50													
			133.49	8.00													
			132.99	8.50													
			132.49	9.00													
			131.99	9.50													
			131.49	10.00													

Remarks**Scale
(approx)**

1:25

**Logged
By**

PW

Figure No.

LKC 18 1005.DP118

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Smithybridge, Littleborough

**Probe
Number****DP119**

Method Window sample undertaken to 5.45mbgl. Continued with DP to 10.00mbgl.	Cone Dimensions	Ground Level (mOD) 141.37	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392127 E 415343 N	Dates 23/02/2018	Engineer	Sheet 1/2

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment														
					0	2	4	6	8	10	12	14	16	18	20				
			141.37	0.00															
			140.87	0.50															
			140.37	1.00															
			139.87	1.50															
			139.37	2.00															
			138.87	2.50															
			138.37	3.00															
			137.87	3.50															
			137.37	4.00															
			136.87	4.50															
			136.37	5.00															

Remarks**Scale
(approx)**

1:25

**Logged
By**

PW

Figure No.

LKC 18 1005.DP119

Method Window sample undertaken to 5.45mbgl. Continued with DP to 10.00mbgl.	Cone Dimensions	Ground Level (mOD) 141.37	Client Taylor Wimpey Strategic Land (North)	Job Number LKC 18 1005
	Location 392127 E 415343 N	Dates 23/02/2018	Engineer	Sheet 2/2

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment
			136.37	5.00	
5.50-5.60	2		135.87	5.50	
5.60-5.70	5				
5.70-5.80	5				
5.80-5.90	6				
5.90-6.00	7				
6.00-6.10	7		135.37	6.00	
6.10-6.20	9				
6.20-6.30	8				
6.30-6.40	7				
6.40-6.50	4				
6.50-6.60	5		134.87	6.50	
6.60-6.70	7				
6.70-6.80	8				
6.80-6.90	6				
6.90-7.00	5				
7.00-7.10	7		134.37	7.00	
7.10-7.20	7				
7.20-7.30	8				
7.30-7.40	9				
7.40-7.50	7				
7.50-7.60	9		133.87	7.50	
7.60-7.70	11				
7.70-7.80	11				
7.80-7.90	10				
7.90-8.00	11				
8.00-8.10	13		133.37	8.00	
8.10-8.20	10				
8.20-8.30	10				
8.30-8.40	12				
8.40-8.50	13				
8.50-8.60	14		132.87	8.50	
8.60-8.70	12				
8.70-8.80	11				
8.80-8.90	12				
8.90-9.00	13				
9.00-9.10	10		132.37	9.00	
9.10-9.20	12				
9.20-9.30	10				
9.30-9.40	10				
9.40-9.50	7				
9.50-9.60	5		131.87	9.50	
9.60-9.70	7				
9.70-9.80	8				
9.80-9.90	10				
9.90-10.00	11		131.37	10.00	

Remarks

Scale (approx)	Logged By
1:25	PW
Figure No.	
LKC 18 1005.DP119	

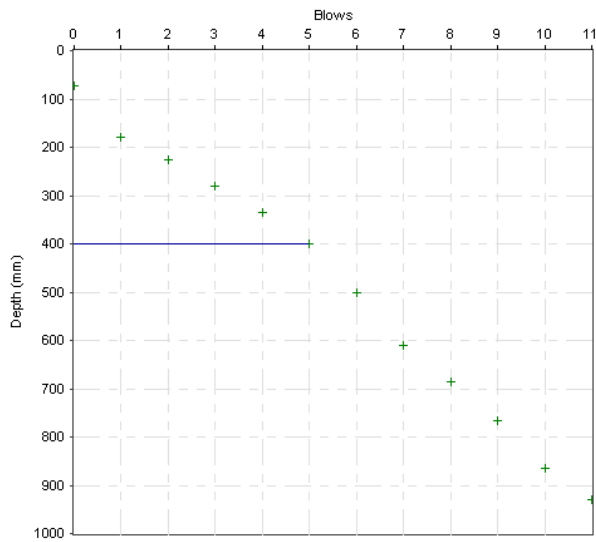
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

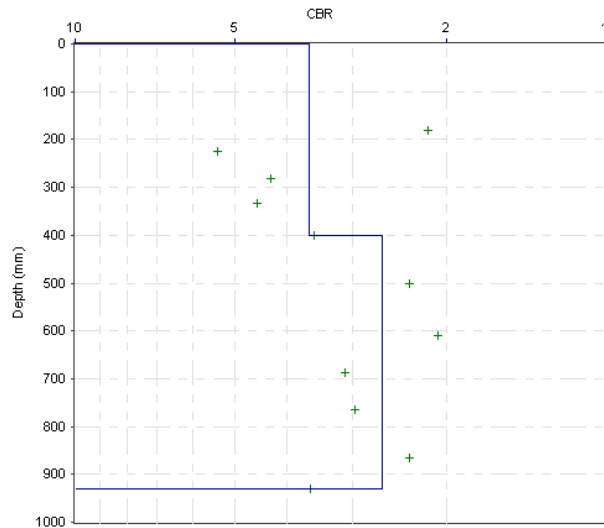
Chainage (km): 1.000
 Direction: WS101
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 26/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 1.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	65.60	4	401	401	Subgrade	--	--	--	--
2	88.33	3	530	931	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.00	0.00
Pavement Strength	--	0.00	0.00

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

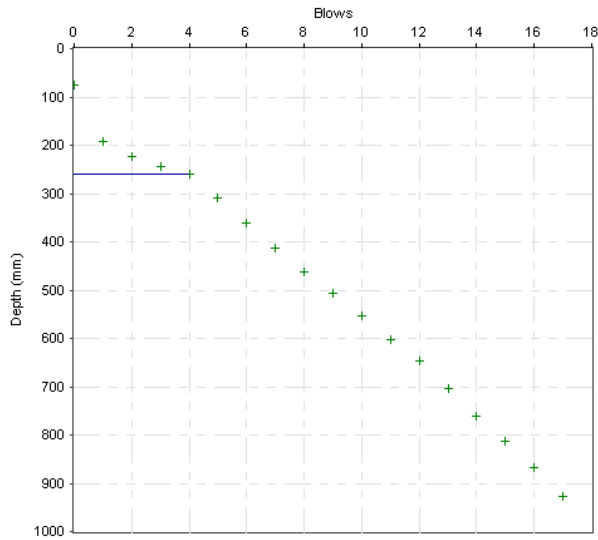
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

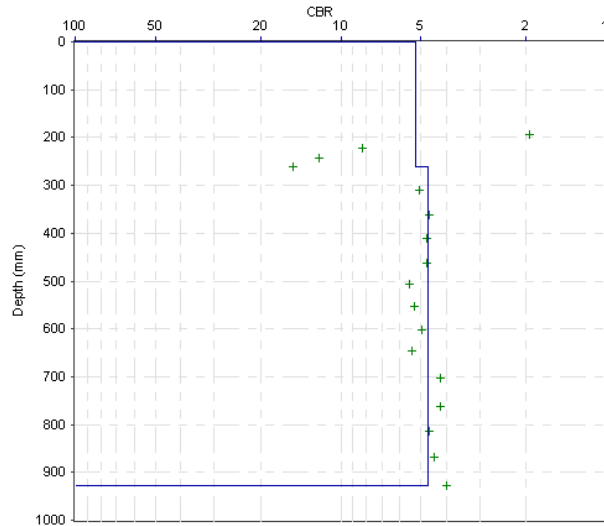
Chainage (km): 2.000
 Direction: WS102
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 26/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 2.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	46.50	5	261	261	Subgrade	--	--	--	--
2	51.23	5	666	927	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.55	0.55
Pavement Strength	--	0.55	0.55

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

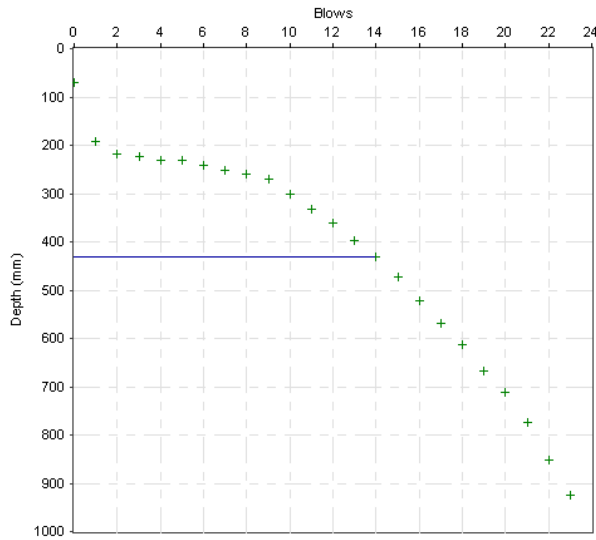
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

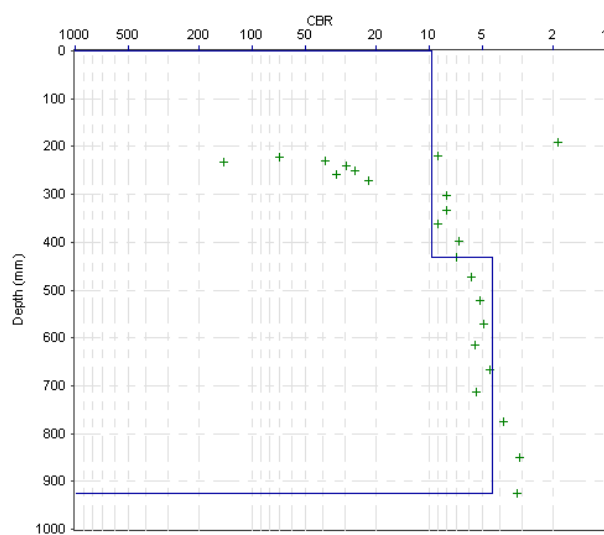
Chainage (km): 3.000
 Direction: WS103
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 26/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 3.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	25.93	10	432	432	Subgrade	--	--	--	--
2	54.78	4	493	925	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.47	0.47
Pavement Strength	--	0.47	0.47

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

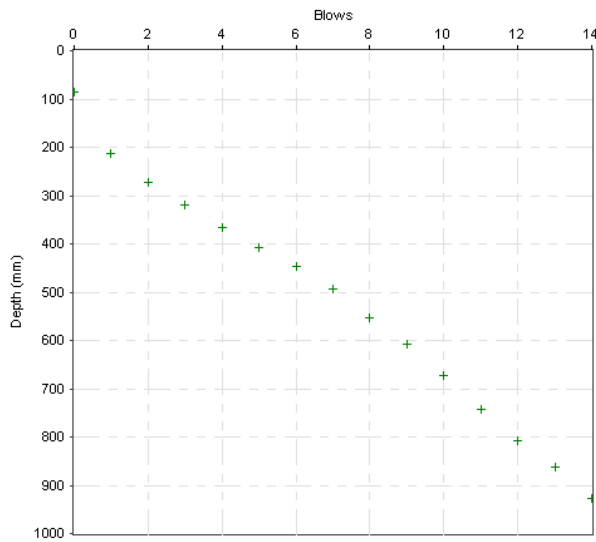
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

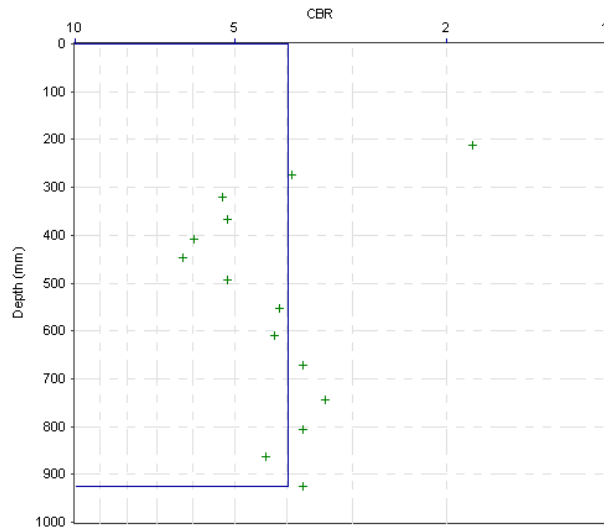
Chainage (km): 4.000
 Direction: WS104
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 26/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 4.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	60.07	4	926	926	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.37	0.37
Pavement Strength	--	0.37	0.37

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

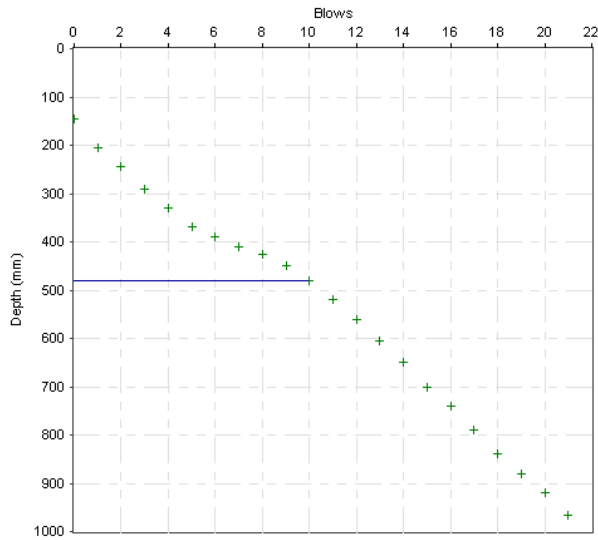
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

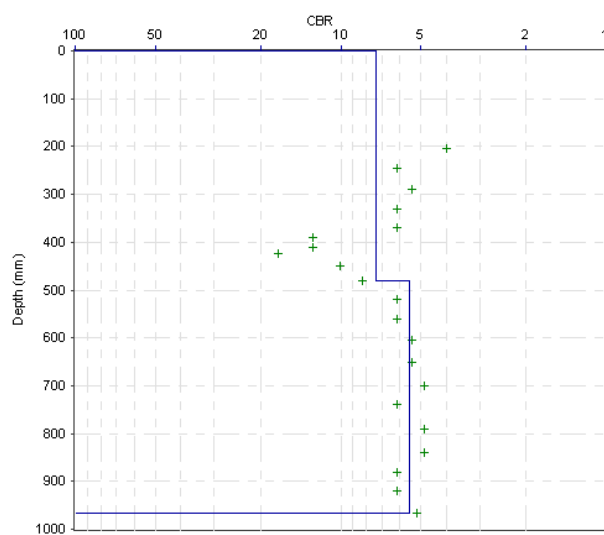
Chainage (km): 5.000
 Direction: WS105
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 21/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 5.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	33.50	7	480	480	Subgrade	--	--	--	--
2	44.27	5	487	967	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.70	0.70
Pavement Strength	--	0.70	0.70

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

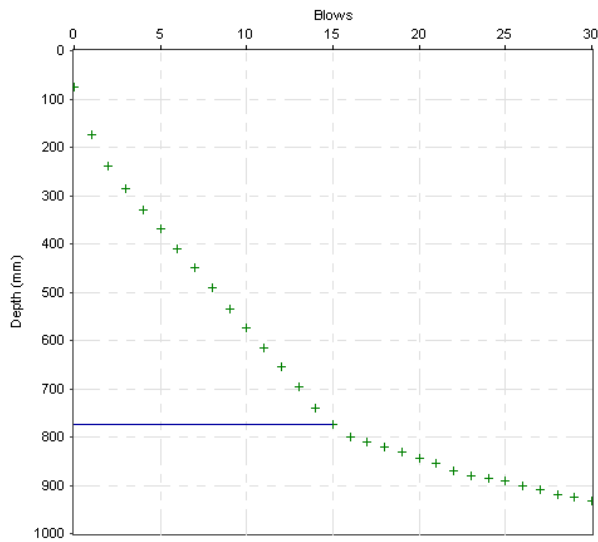
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

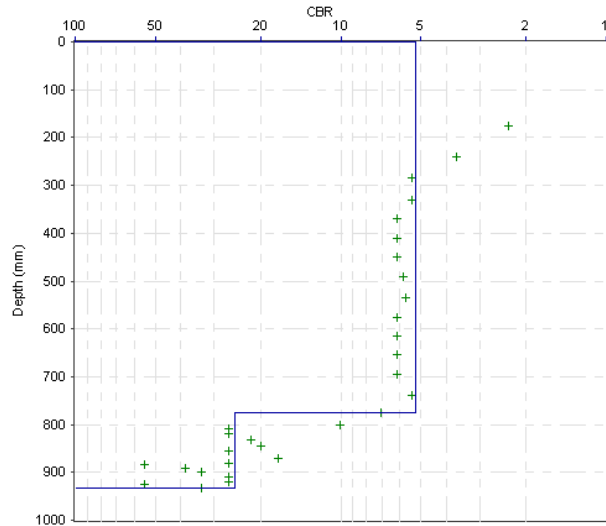
Chainage (km): 6.000
 Direction: WS106
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 21/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 6.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	46.67	5	775	775	Subgrade	--	--	--	--
2	10.53	25	158	933	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.65	0.65
Pavement Strength	--	0.65	0.65

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

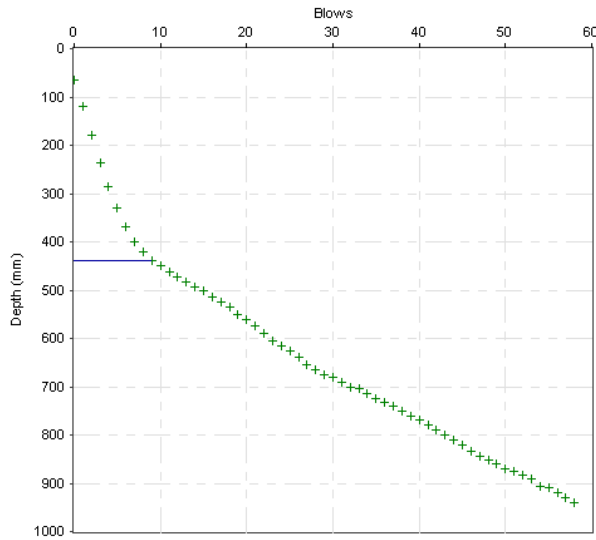
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

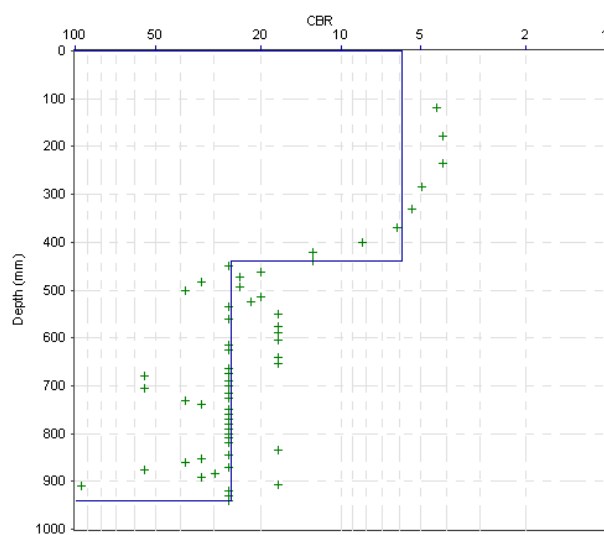
Chainage (km): 7.000
 Direction: WS107
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 21/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 7.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	41.67	6	440	440	Subgrade	--	--	--	--
2	10.20	26	500	940	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.76	0.76
Pavement Strength	--	0.76	0.76

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

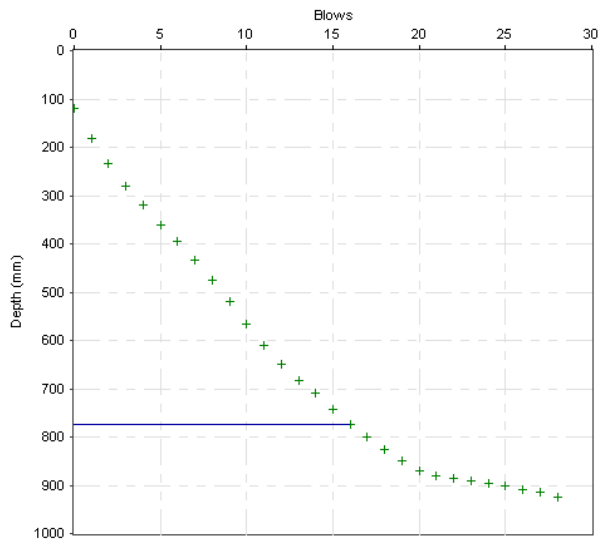
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

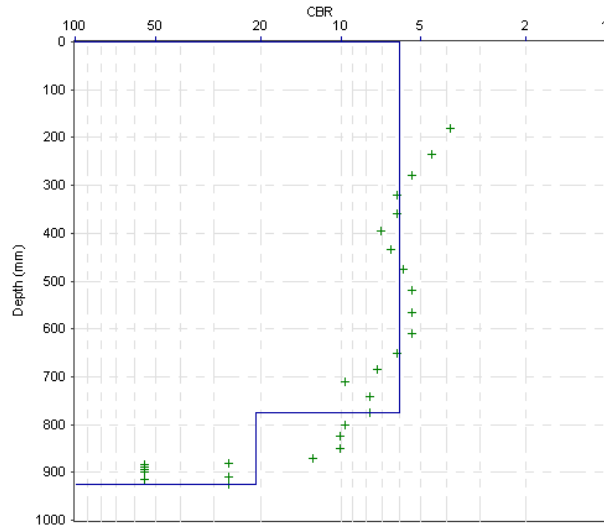
Chainage (km): 8.000
 Direction: WS108
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 26/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 8.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	40.88	6	774	774	Subgrade	--	--	--	--
2	12.58	21	151	925	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.78	0.78
Pavement Strength	--	0.78	0.78

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

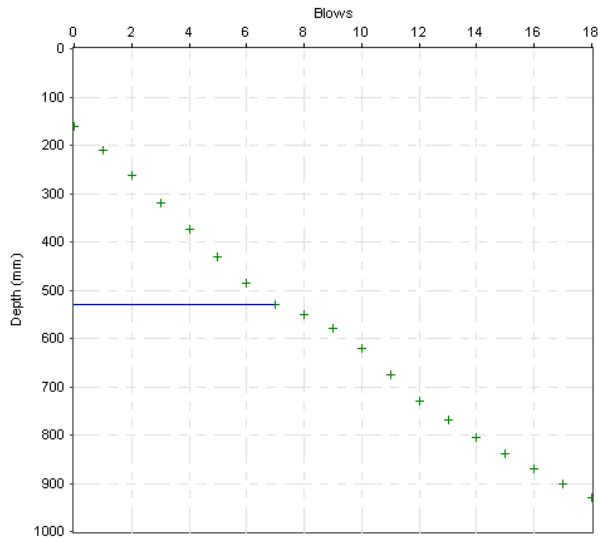
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

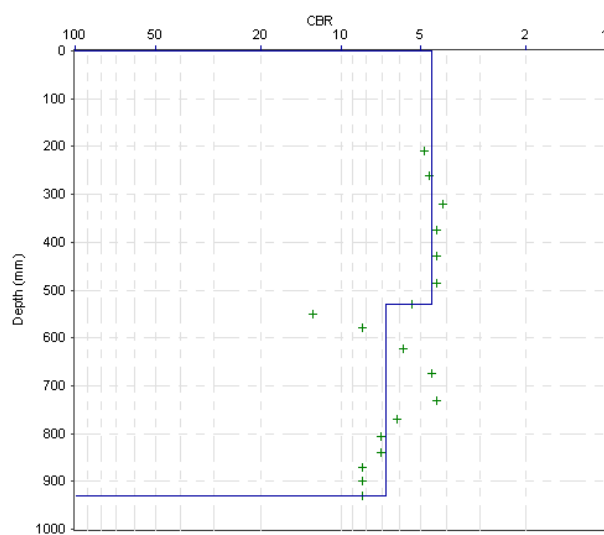
Chainage (km): 9.000
 Direction: WS109
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 26/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 9.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	52.86	5	530	530	Subgrade	--	--	--	--
2	36.36	7	400	930	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.51	0.51
Pavement Strength	--	0.51	0.51

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

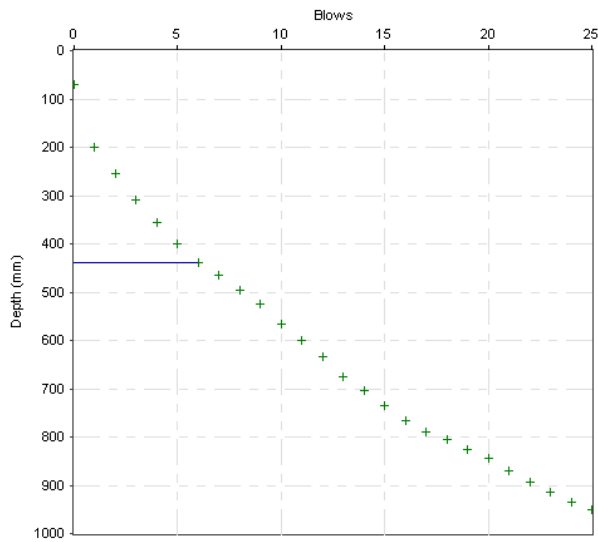
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

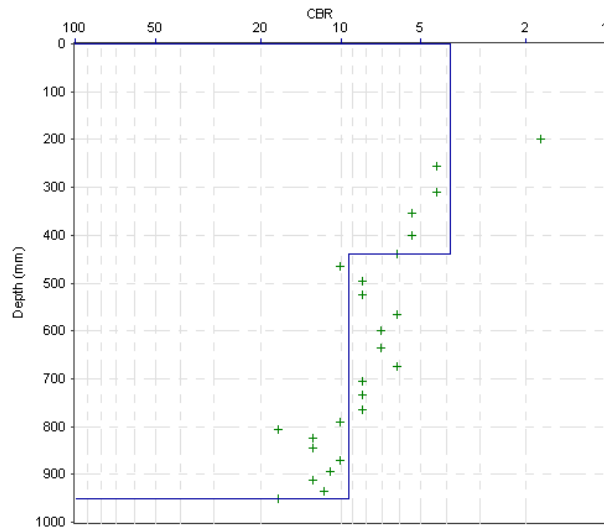
Chainage (km): 10.000
 Direction: WS110
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 26/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 10.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	61.67	4	440	440	Subgrade	--	--	--	--
2	26.84	9	510	950	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.34	0.34
Pavement Strength	--	0.34	0.34

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

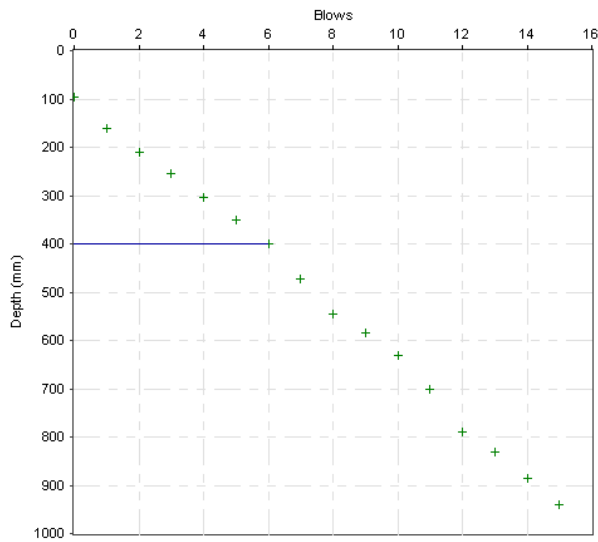
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

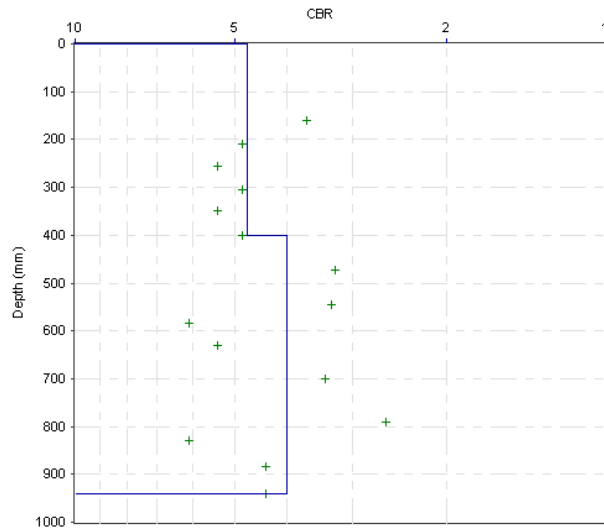
Chainage (km): 11.000
 Direction: WS111
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 21/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 11.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	50.83	5	400	400	Subgrade	--	--	--	--
2	60.00	4	540	940	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.37	0.37
Pavement Strength	--	0.37	0.37

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

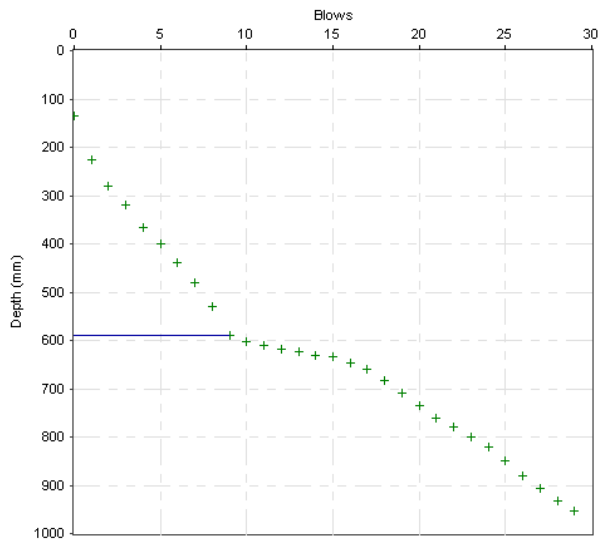
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

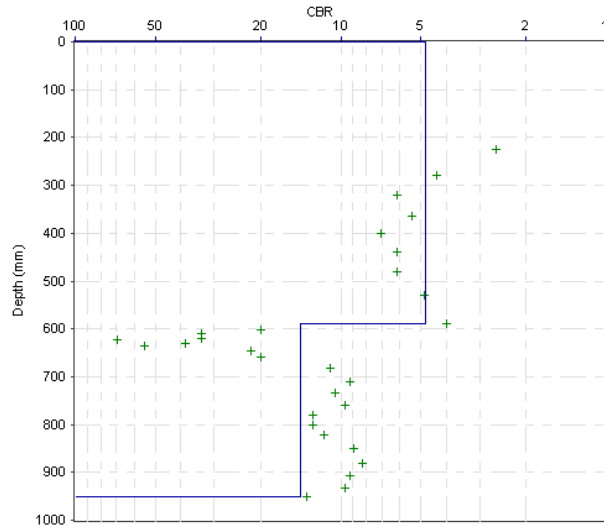
Chainage (km): 12.000
 Direction: WS112
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 21/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 12.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	50.56	5	590	590	Subgrade	--	--	--	--
2	18.10	14	362	952	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.56	0.56
Pavement Strength	--	0.56	0.56

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

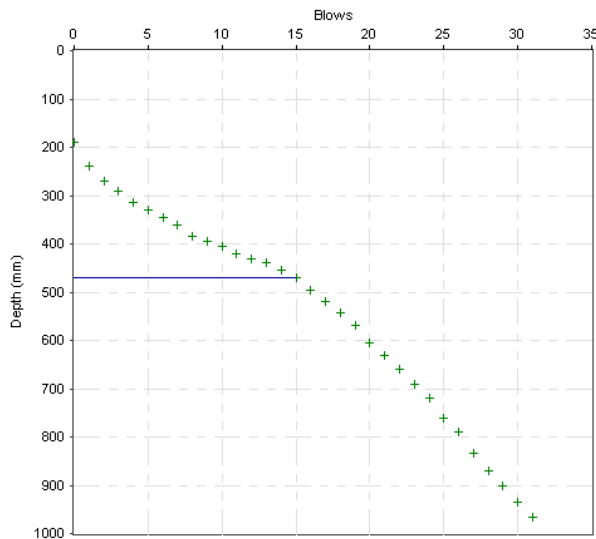
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

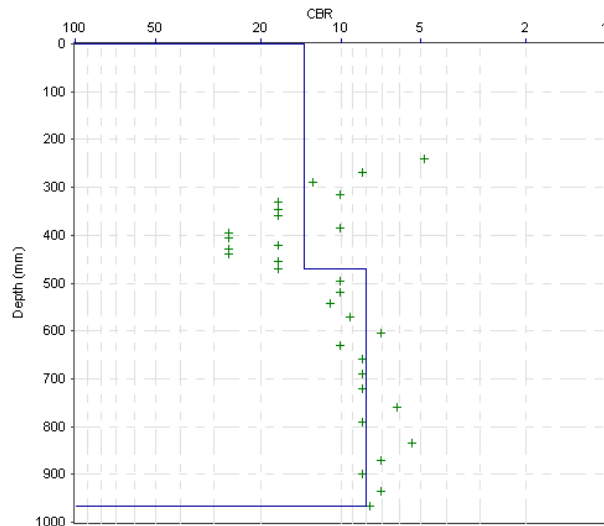
Chainage (km): 13.000
 Direction: WS113
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 21/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 13.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	18.67	14	470	470	Subgrade	--	--	--	--
2	31.06	8	497	967	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	1.05	1.05
Pavement Strength	--	1.05	1.05

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

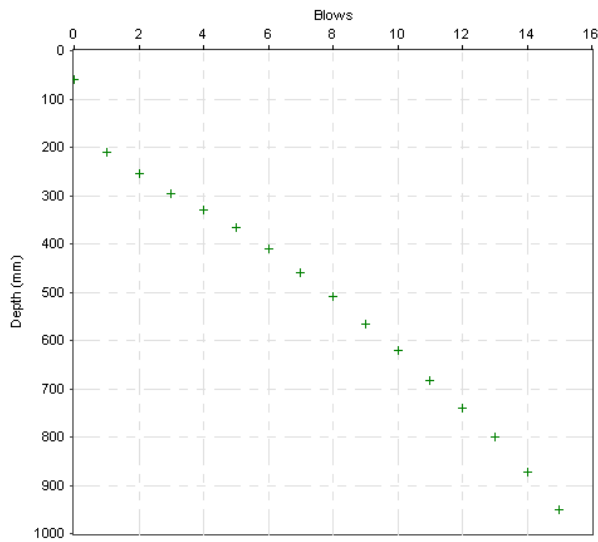
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

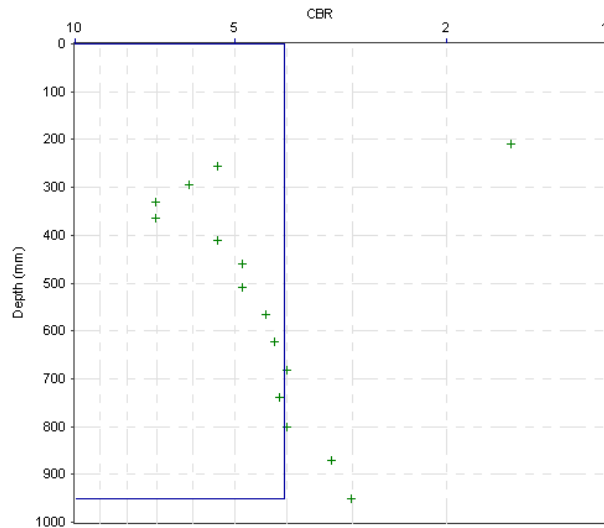
Chainage (km): 14.000
 Direction: WS114
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 26/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 14.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	59.33	4	950	950	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.38	0.38
Pavement Strength	--	0.38	0.38

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

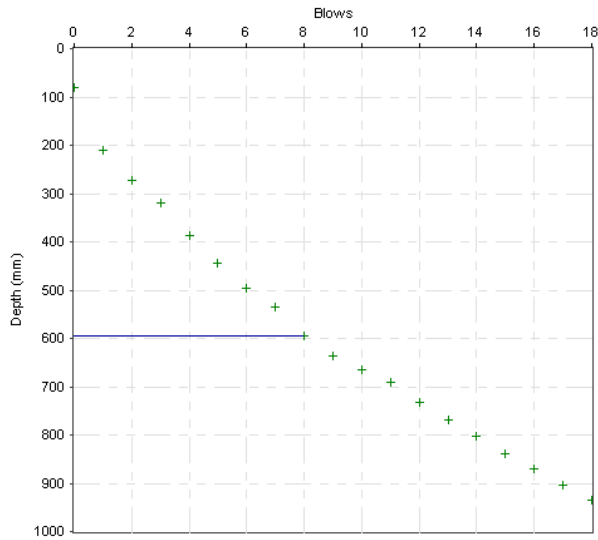
DCP Layer Strength Analysis Report

Project Name: DCP LKC 18 1005

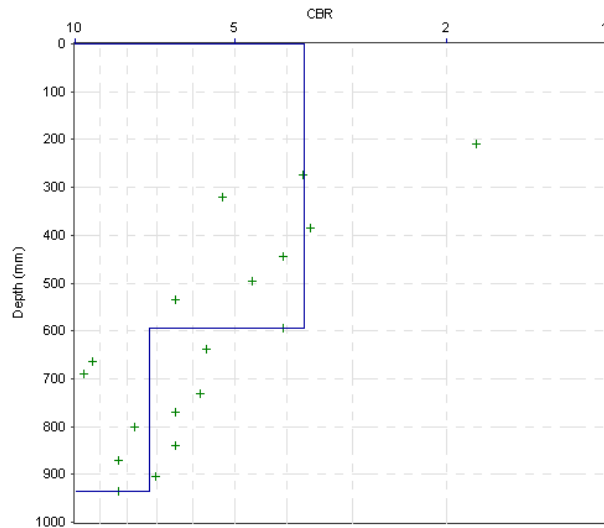
Chainage (km): 15.000
 Direction: WS115
 Location/Offset: Verge
 Cone Angle: 60 degrees
 Zero Error (mm): 0
 Test Date: 26/02/2018

Surface Type: Unpaved
 Thickness (mm): 0
 Base Type:
 Thickness (mm):
 Surface Moisture: Wet
 Moisture adjustment factor: Not adjusted

Layer Boundaries: Chainage 15.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	Penetration Rate (mm/blow)	CBR (%)	Thickness (mm)	Depth to layer bottom (mm)	Position	Strength Coefficient	SN	SNC	SNP
1	64.25	4	594	594	Subgrade	--	--	--	--
2	34.10	7	341	935	Subgrade	--	--	--	--

Pavement Strength

Layer	Layer Contribution		
	SN	SNC	SNP
Surface	--	--	--
Base	--	--	--
Sub-Base	--	--	--
Subgrade	--	0.29	0.29
Pavement Strength	--	0.29	0.29

CBR Relationship:

TRL equation: $\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{Strength})$

Report produced by

APPENDIX C

CERTIFICATE OF ANALYSIS - SOIL



Final Report

Report No.: 18-05357-1

Initial Date of Issue: 01-Mar-2018

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Chris Hughes
Contaminated Land

Project LKC 18 1005 - Smithybridge,
Littleborough

Quotation No.: **Date Received:** 23-Feb-2018

Order No.: 735965 **Date Instructed:** 23-Feb-2018

No. of Samples: 13

Turnaround (Wkdays): 5 **Results Due:** 01-Mar-2018

Date Approved: 01-Mar-2018

Approved By:



Details: Glynn Harvey, Laboratory Manager

Results - Soil

Client: LK Consult	Chemtest Job No.:				18-05357	18-05357	18-05357	18-05357	18-05357	18-05357	18-05357	18-05357	18-05357
Quotation No.:	Chemtest Sample ID.:				583778	583783	583787	583788	583791	583792	583793	583794	583795
	Client Sample ID.:				WS101 / D1	WS104 / D1	WS106 / D1	WS107 / D1	WS108 / D2	WS109 / D1	WS110 / D1	WS110 / D2	WS111 / D1
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.00	0.20	0.00	0.20	0.10	0.00	0.20	0.00
	Bottom Depth (m):				0.35	0.30	0.70	0.30	1.00	0.40	0.20	1.20	0.30
	Date Sampled:				19-Feb-2018	19-Feb-2018	19-Feb-2018	19-Feb-2018	20-Feb-2018	20-Feb-2018	20-Feb-2018	20-Feb-2018	20-Feb-2018
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY			COVENTRY		COVENTRY
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192		N/A	-	-	-	-			-		-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected			No Asbestos Detected		No Asbestos Detected
Moisture	N	2030	%	0.020	27	32	20	20	15	22	27	17	23
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Grey	Brown	Brown	Black	Brown
Other Material	N	2040		N/A	Roots	Stones	Stones	NONE	Stones	Stones, Roots, 1	Roots, Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Clay	Clay	Loam	Loam	Clay	Sand	Sand
pH	M	2010		N/A	5.4	5.4	5.9	5.9	6.4	6.2	6.0	5.1	5.7
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Arsenic	M	2450	mg/kg	1.0	25	23	14	12			23		23
Cadmium	M	2450	mg/kg	0.10	0.51	0.67	0.31	0.23			0.44		0.47
Chromium	M	2450	mg/kg	1.0	26	31	22	23			24		27
Copper	M	2450	mg/kg	0.50	43	38	23	26			59		54
Mercury	M	2450	mg/kg	0.10	0.27	0.21	0.16	0.15			0.29		0.31
Nickel	M	2450	mg/kg	0.50	23	24	19	21			29		34
Lead	M	2450	mg/kg	0.50	81	80	46	37			92		140
Selenium	M	2450	mg/kg	0.20	0.82	0.73	0.59	0.44			0.67		0.75
Vanadium	U	2450	mg/kg	5.0	36	36	34	32			55		53
Zinc	M	2450	mg/kg	0.50	99	95	56	61			96		100
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50			< 0.50		< 0.50
Organic Matter	M	2625	%	0.40	6.2	6.9	3.1	2.6			11		13
Naphthalene	M	2800	mg/kg	0.10	0.11	< 0.10	2.1	< 0.10			0.16		0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	0.28	< 0.10			< 0.10		< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.77	< 0.10			0.15		< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.40	< 0.10			0.13		< 0.10
Phenanthrene	M	2800	mg/kg	0.10	0.38	0.33	4.0	0.31			1.9		1.4
Anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.64	< 0.10			0.22		0.20
Fluoranthene	M	2800	mg/kg	0.10	0.72	0.65	4.5	0.53			2.7		2.2
Pyrene	M	2800	mg/kg	0.10	0.66	0.72	3.8	0.47			2.3		2.0
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.22	0.21	1.5	0.11			0.96		0.90
Chrysene	M	2800	mg/kg	0.10	0.28	0.27	1.8	0.13			1.2		1.0
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	0.40	0.27	1.8	< 0.10			1.2		1.1
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.12	< 0.10	0.70	< 0.10			0.38		0.40
Benzo[a]pyrene	M	2800	mg/kg	0.10	0.24	0.25	1.4	< 0.10			0.95		0.74
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.20	0.18	0.88	< 0.10			0.60		0.53
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	0.17	< 0.10			0.12		< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.24	0.22	0.88	< 0.10			0.69		0.63

Results - Soil

Client: LK Consult	Chemtest Job No.:				18-05357	18-05357	18-05357	18-05357	18-05357	18-05357	18-05357	18-05357
Quotation No.:	Chemtest Sample ID.:				583778	583783	583787	583788	583791	583792	583793	583794
	Client Sample ID.:				WS101 / D1	WS104 / D1	WS106 / D1	WS107 / D1	WS108 / D2	WS109 / D1	WS110 / D1	WS110 / D2
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.00	0.20	0.00	0.20	0.10	0.00	0.20
	Bottom Depth (m):				0.35	0.30	0.70	0.30	1.00	0.40	0.20	1.20
	Date Sampled:				19-Feb-2018	19-Feb-2018	19-Feb-2018	19-Feb-2018	20-Feb-2018	20-Feb-2018	20-Feb-2018	20-Feb-2018
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY			COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD								
Total Of 16 PAH's	N	2800	mg/kg	2.0	3.6	3.1	26	< 2.0			14	11

Results - Soil

Client: LK Consult	Chemtest Job No.:				18-05357	18-05357	18-05357	18-05357
Quotation No.:	Chemtest Sample ID.:				583796	583798	583799	583802
	Client Sample ID.:				WS112 / D1	WS113 / D1	WS113 / D2	WS115 / D1
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.00	0.50	0.00
	Bottom Depth (m):				0.40	0.50	1.00	0.80
	Date Sampled:				20-Feb-2018	20-Feb-2018	20-Feb-2018	21-Feb-2018
	Asbestos Lab:				COVENTRY	COVENTRY		COVENTRY
Determinand	Accred.	SOP	Units	LOD				
ACM Type	U	2192		N/A	-	-		-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected		No Asbestos Detected
Moisture	N	2030	%	0.020	29	19	22	26
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Roots, Stones	Roots, Stones	NONE	NONE
Soil Texture	N	2040		N/A	Sand	Sand	Clay	Sand
pH	M	2010		N/A	5.8	6.6	6.9	6.2
Sulphate (2:1 Water Soluble) as SO ₄	M	2120	g/l	0.010	< 0.010	< 0.010	0.020	0.011
Arsenic	M	2450	mg/kg	1.0	21	20		18
Cadmium	M	2450	mg/kg	0.10	0.39	0.43		0.56
Chromium	M	2450	mg/kg	1.0	22	23		42
Copper	M	2450	mg/kg	0.50	42	53		44
Mercury	M	2450	mg/kg	0.10	0.35	0.29		0.28
Nickel	M	2450	mg/kg	0.50	26	36		30
Lead	M	2450	mg/kg	0.50	96	120		88
Selenium	M	2450	mg/kg	0.20	0.51	0.63		0.42
Vanadium	U	2450	mg/kg	5.0	36	38		32
Zinc	M	2450	mg/kg	0.50	91	91		120
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50		< 0.50
Organic Matter	M	2625	%	0.40	9.5	15		4.0
Naphthalene	M	2800	mg/kg	0.10	< 0.10	0.38		< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10
Acenaphthene	M	2800	mg/kg	0.10	0.16	0.13		< 0.10
Fluorene	M	2800	mg/kg	0.10	0.14	0.11		< 0.10
Phenanthrene	M	2800	mg/kg	0.10	1.5	2.6		0.39
Anthracene	M	2800	mg/kg	0.10	0.19	0.38		< 0.10
Fluoranthene	M	2800	mg/kg	0.10	2.4	4.1		0.67
Pyrene	M	2800	mg/kg	0.10	2.2	3.6		0.61
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.95	1.7		0.14
Chrysene	M	2800	mg/kg	0.10	1.1	1.9		0.18
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	1.4	2.1		0.25
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.44	0.81		< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	0.94	1.5		0.15
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.63	0.93		< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	0.18		< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.66	1.1		< 0.10

Results - Soil

Project: LKC 18 1005 - Smithybridge, Littleborough

Client: LK Consult	Chemtest Job No.:				18-05357	18-05357	18-05357	18-05357
Quotation No.:	Chemtest Sample ID.:				583796	583798	583799	583802
	Client Sample ID.:				WS112 / D1	WS113 / D1	WS113 / D2	WS115 / D1
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.00	0.50	0.00
	Bottom Depth (m):				0.40	0.50	1.00	0.80
	Date Sampled:				20-Feb-2018	20-Feb-2018	20-Feb-2018	21-Feb-2018
	Asbestos Lab:				COVENTRY	COVENTRY		COVENTRY
Determinand	Accred.	SOP	Units	LOD				
Total Of 16 PAH's	N	2800	mg/kg	2.0	13	22		2.4

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

Report Information

Key

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- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk



Final Report

Report No.: 18-05771-1

Initial Date of Issue: 12-Mar-2018

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Chris Hughes
Contaminated Land

Project LKC 18 1005 Smithybridge,
Littleborough

Quotation No.: **Date Received:** 28-Feb-2018

Order No.: 735965 **Date Instructed:** 06-Mar-2018

No. of Samples: 8

Turnaround (Wkdays): 5 **Results Due:** 12-Mar-2018

Date Approved: 12-Mar-2018

Approved By:

Details: Robert Monk, Technical Manager

Results - Soil

Client: LK Consult	Chemtest Job No.:				18-05771	18-05771	18-05771	18-05771	18-05771	18-05771	18-05771	18-05771
Quotation No.:	Chemtest Sample ID.:				585422	585424	585425	585426	585427	585428	585430	585431
	Client Sample ID.:				WS117/D1	WS118/D2	WS119/D1	WS120/D1	WS121/D1	WS121/D2	WS123/D1	WS124/D1
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.20	0.00	0.00	0.00	0.30	0.00	0.00
	Bottom Depth (m):				0.30	1.20	0.20	0.30	0.30	1.30	0.30	0.40
	Date Sampled:				23-Feb-2018	23-Feb-2018	23-Feb-2018	26-Feb-2018	26-Feb-2018	26-Feb-2018	26-Feb-2018	26-Feb-2018
	Asbestos Lab:				COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD								
ACM Type	U	2192		N/A	-		-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	19	13	25	16	29	18	22	17
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Roots	NONE	Roots	Roots,	Roots	NONE	Roots	Roots
Soil Texture	N	2040		N/A	Sand	Clay	Sand	Sand	Sand	Clay	Sand	Sand
pH	M	2010		N/A	6.3	6.4	6.1	5.9	5.7	6.2	5.7	5.6
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.013	< 0.010	< 0.010	< 0.010	0.012	< 0.010	< 0.010	< 0.010
Arsenic	M	2450	mg/kg	1.0	23		19	20	17	6.0	20	18
Cadmium	M	2450	mg/kg	0.10	0.35		0.27	0.26	0.43	< 0.10	0.26	0.30
Chromium	M	2450	mg/kg	1.0	23		26	26	23	17	30	25
Copper	M	2450	mg/kg	0.50	59		59	45	42	16	38	42
Mercury	M	2450	mg/kg	0.10	0.34		0.23	0.23	0.41	< 0.10	0.29	0.36
Nickel	M	2450	mg/kg	0.50	26		27	26	20	10	30	28
Lead	M	2450	mg/kg	0.50	140		82	99	130	29	97	97
Selenium	M	2450	mg/kg	0.20	0.80		0.60	0.44	0.71	< 0.20	0.62	0.67
Vanadium	U	2450	mg/kg	5.0	47		41	47	38	25	46	44
Zinc	M	2450	mg/kg	0.50	110		90	91	110	21	95	100
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	9.7		9.0	12	9.5	1.2	7.2	11
Naphthalene	M	2800	mg/kg	0.10	0.28		< 0.10	0.98	0.17	< 0.10	0.10	0.15
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	0.23		< 0.10	1.2	0.38	< 0.10	< 0.10	0.45
Fluorene	M	2800	mg/kg	0.10	0.14		< 0.10	0.75	0.28	< 0.10	< 0.10	0.29
Phenanthrene	M	2800	mg/kg	0.10	2.0		0.41	7.2	2.7	0.11	0.44	3.1
Anthracene	M	2800	mg/kg	0.10	0.41		< 0.10	1.3	0.57	< 0.10	< 0.10	0.54
Fluoranthene	M	2800	mg/kg	0.10	3.1		0.97	7.8	4.8	0.16	0.56	5.7
Pyrene	M	2800	mg/kg	0.10	2.9		0.88	6.6	3.9	0.22	0.60	4.5
Benzo[a]anthracene	M	2800	mg/kg	0.10	1.4		0.34	3.3	1.9	< 0.10	0.18	1.7
Chrysene	M	2800	mg/kg	0.10	1.7		0.42	4.3	2.0	< 0.10	0.26	2.6
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	1.8		0.50	4.2	2.5	< 0.10	0.23	2.2
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.71		0.15	1.8	0.90	< 0.10	< 0.10	1.1
Benzo[a]pyrene	M	2800	mg/kg	0.10	1.2		0.33	3.0	1.8	< 0.10	0.16	2.2
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.90		< 0.10	2.0	1.4	< 0.10	0.12	1.0
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.13		< 0.10	0.35	0.19	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.75		< 0.10	2.0	1.1	< 0.10	< 0.10	1.8
Total Of 16 PAH's	N	2800	mg/kg	2.0	18		4.0	47	25	< 2.0	2.7	27

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

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- I/S Insufficient Sample
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- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk



Final Report

Report No.: 18-06053-1

Initial Date of Issue: 12-Mar-2018

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Chris Hughes
Contaminated Land

Project LKC 18 1005 - Smithybridge,
Littleborough

Quotation No.: **Date Received:** 05-Mar-2018

Order No.: 735965 **Date Instructed:** 06-Mar-2018

No. of Samples: 18

Turnaround (Wkdays): 5 **Results Due:** 12-Mar-2018

Date Approved: 12-Mar-2018

Approved By:

Details: Robert Monk, Technical Manager

Results - Soil

Client: LK Consult	Chemtest Job No.:				18-06053	18-06053	18-06053	18-06053	18-06053	18-06053	18-06053	18-06053	18-06053
Quotation No.:	Chemtest Sample ID.:				586673	586675	586676	586680	586681	586682	586683	586685	586687
	Client Sample ID.:				TP101 / D1	TP102 / D2	TP103 / D1	TP105 / D2	TP106 / D1	TP107 / D1	TP108 / D1	TP109 / D1	TP111 / D1
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.20	0.00	0.20	0.00	0.00	0.00	0.00	0.00
	Bottom Depth (m):				0.40	1.00	0.30	1.20	0.20	0.40	0.20	0.30	0.30
	Date Sampled:				27-Feb-2018	27-Feb-2018	27-Feb-2018	27-Feb-2018	27-Feb-2018	27-Feb-2018	27-Feb-2018	27-Feb-2018	28-Feb-2018
	Asbestos Lab:				COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY		COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192		N/A	-		-	-	-	-		-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	25	13	13	20	8.8	13	12	12	18
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones	NONE	Stones	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Clay	Clay	Clay	Sand	Sand	Sand	Sand	Sand	Sand
pH	M	2010		N/A	5.8	6.4	5.8	7.1	6.5	5.8	6.5	5.8	5.5
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.011	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.016	< 0.010	< 0.010
Arsenic	M	2450	mg/kg	1.0	18		19	4.7	6.9	13		16	20
Cadmium	M	2450	mg/kg	0.10	0.22		0.16	< 0.10	< 0.10	< 0.10		0.17	0.19
Chromium	M	2450	mg/kg	1.0	20		23	12	18	20		21	23
Copper	M	2450	mg/kg	0.50	33		37	12	17	26		27	33
Mercury	M	2450	mg/kg	0.10	0.30		0.27	< 0.10	< 0.10	< 0.10		0.14	0.15
Nickel	M	2450	mg/kg	0.50	22		20	11	18	18		23	20
Lead	M	2450	mg/kg	0.50	94		90	8.7	18	48		56	100
Selenium	M	2450	mg/kg	0.20	0.44		0.44	< 0.20	< 0.20	0.40		0.40	0.69
Vanadium	U	2450	mg/kg	5.0	37		40	17	24	32		35	37
Zinc	M	2450	mg/kg	0.50	76		82	29	46	58		67	80
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50		< 0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	7.4		4.8	0.53	1.5	3.6		6.6	5.3
Naphthalene	M	2800	mg/kg	0.10	0.46		0.53	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	0.71		1.8	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	0.54		1.2	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	4.8		11	< 0.10	0.12	0.24		0.31	0.48
Anthracene	M	2800	mg/kg	0.10	0.89		2.3	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	5.6		13	< 0.10	0.20	0.46		0.52	0.72
Pyrene	M	2800	mg/kg	0.10	4.4		11	< 0.10	0.20	0.39		0.50	0.68
Benzo[a]anthracene	M	2800	mg/kg	0.10	1.9		5.1	< 0.10	< 0.10	< 0.10		0.10	0.22
Chrysene	M	2800	mg/kg	0.10	2.8		6.2	< 0.10	< 0.10	< 0.10		0.14	0.26
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	1.9		5.5	< 0.10	< 0.10	< 0.10		< 0.10	0.22
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	1.2		2.7	< 0.10	< 0.10	< 0.10		< 0.10	0.11
Benzo[a]pyrene	M	2800	mg/kg	0.10	1.7		4.7	< 0.10	< 0.10	< 0.10		< 0.10	0.15
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.69		2.3	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10		0.33	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.68		2.0	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0	28		70	< 2.0	< 2.0	< 2.0		< 2.0	2.8

Results - Soil

Client: LK Consult	Chemtest Job No.:				18-06053	18-06053	18-06053	18-06053	18-06053	18-06053	18-06053	18-06053	18-06053
Quotation No.:	Chemtest Sample ID.:				586688	586689	586690	586691	586692	586694	586696	586697	586698
	Client Sample ID.:				TP112 / D1	TP113 / D1	TP113 / D2	TP114 / D1	TP115 / D1	TP116 / D1	TP118 / D1	TP119 / D1	TP119 / D2
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.70
	Bottom Depth (m):				0.40	0.30	1.30	0.40	0.40	0.30	0.30	0.70	1.40
	Date Sampled:				28-Feb-2018	28-Feb-2018	28-Feb-2018	28-Feb-2018	28-Feb-2018	28-Feb-2018	28-Feb-2018	28-Feb-2018	28-Feb-2018
	Asbestos Lab:				COVENTRY	COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192		N/A	-	-		-	-	-	-	-	
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	
Moisture	N	2030	%	0.020	17	16	12	17	20	17	22	21	15
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Clay	Sand	Sand	Sand	Sand	Sand	Clay
pH	M	2010		N/A	5.7	7.7	7.6	5.7	5.8	6.1	5.7	6.2	6.3
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Arsenic	M	2450	mg/kg	1.0	18	21		20	21	10	19	75	
Cadmium	M	2450	mg/kg	0.10	0.22	0.12		0.32	0.29	< 0.10	0.30	0.23	
Chromium	M	2450	mg/kg	1.0	24	21		25	29	25	28	48	
Copper	M	2450	mg/kg	0.50	32	45		40	41	31	43	140	
Mercury	M	2450	mg/kg	0.10	0.15	0.24		0.17	0.32	0.20	0.34	0.40	
Nickel	M	2450	mg/kg	0.50	25	28		28	28	20	28	39	
Lead	M	2450	mg/kg	0.50	73	94		84	120	67	110	210	
Selenium	M	2450	mg/kg	0.20	0.46	0.33		0.56	0.67	0.37	0.61	1.6	
Vanadium	U	2450	mg/kg	5.0	36	41		39	45	40	44	71	
Zinc	M	2450	mg/kg	0.50	89	75		90	99	59	110	100	
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	
Organic Matter	M	2625	%	0.40	6.0	12		7.6	8.5	7.2	9.8	15	
Naphthalene	M	2800	mg/kg	0.10	< 0.10	0.24		0.56	0.11	0.11	0.21	0.37	
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	0.49		1.5	< 0.10	< 0.10	0.21	0.40	
Fluorene	M	2800	mg/kg	0.10	< 0.10	0.36		1.0	< 0.10	< 0.10	0.11	0.24	
Phenanthrene	M	2800	mg/kg	0.10	0.77	3.2		6.8	0.67	0.71	1.7	3.0	
Anthracene	M	2800	mg/kg	0.10	0.14	0.54		1.4	0.12	0.15	0.34	0.64	
Fluoranthene	M	2800	mg/kg	0.10	1.0	4.0		7.0	1.3	0.91	2.5	4.0	
Pyrene	M	2800	mg/kg	0.10	0.98	3.8		5.6	1.1	0.85	2.1	3.4	
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.32	1.9		2.6	0.46	0.33	0.92	1.6	
Chrysene	M	2800	mg/kg	0.10	0.36	2.3		3.2	0.65	0.44	1.2	2.0	
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	0.31	2.1		2.7	0.59	0.40	1.1	1.9	
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.12	0.80		1.2	0.27	0.15	0.42	0.76	
Benzo[a]pyrene	M	2800	mg/kg	0.10	0.21	1.5		1.8	0.40	0.23	0.82	1.2	
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	0.81		1.2	< 0.10	0.17	0.42	0.86	
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	0.14		0.18	< 0.10	< 0.10	< 0.10	0.13	
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	0.84		0.97	< 0.10	0.20	0.45	0.50	
Total Of 16 PAH's	N	2800	mg/kg	2.0	4.2	23		38	5.7	4.7	13	21	

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk



Final Report

Report No.: 18-06719-1

Initial Date of Issue: 22-Mar-2018

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Chris Hughes
Contaminated Land

Project LKC 18 1005 - Smithybridge,
Littleborough

Quotation No.: **Date Received:** 12-Mar-2018

Order No.: 735965 **Date Instructed:** 15-Mar-2018

No. of Samples: 5

Turnaround (Wkdays): 5 **Results Due:** 21-Mar-2018

Date Approved: 22-Mar-2018

Approved By:



Details: Glynn Harvey, Laboratory Manager

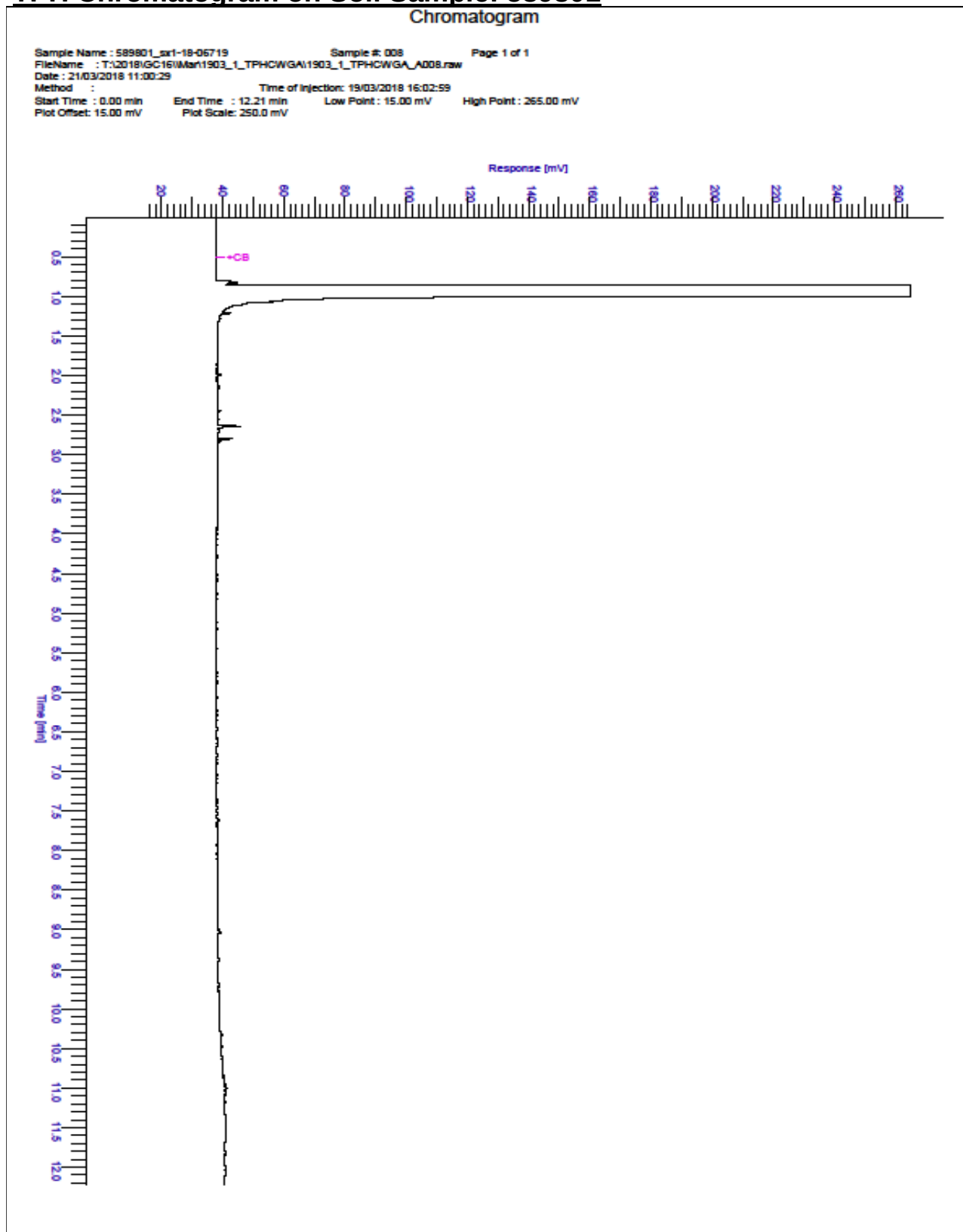
Results - Soil

Client: LK Consult	Chemtest Job No.:				18-06719	18-06719	18-06719	18-06719	18-06719
Quotation No.:	Chemtest Sample ID.:				589796	589799	589800	589801	589805
	Client Sample ID.:				TP120 / D1	TP122 / D1	TP123 / D1	TP124 / D1	TP127 / D1
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.00	0.00	0.00	0.00
	Bottom Depth (m):				0.20	0.40	0.40	1.00	1.00
	Date Sampled:				08-Mar-2018	08-Mar-2018	08-Mar-2018	08-Mar-2018	08-Mar-2018
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD					
ACM Type	U	2192		N/A	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	22	22	24	35	22
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones, Roots2	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Loam	Loam	Loam	Sand	Loam
Chromatogram (TPH)	N			N/A				See Attached	See Attached
pH	M	2010		N/A	5.8	7.3	6.5	6.7	8.3
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40				< 0.40	1.2
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.059
Cyanide (Free)	M	2300	mg/kg	0.50				< 0.50	< 0.50
Cyanide (Total)	M	2300	mg/kg	0.50				< 0.50	< 0.50
Arsenic	M	2450	mg/kg	1.0	22	20	27	51	53
Cadmium	M	2450	mg/kg	0.10	0.36	0.38	0.55	0.28	0.83
Chromium	M	2450	mg/kg	1.0	22	23	26	26	30
Copper	M	2450	mg/kg	0.50	54	52	85	180	81
Mercury	M	2450	mg/kg	0.10	0.26	0.32	0.40	0.59	0.29
Nickel	M	2450	mg/kg	0.50	32	33	36	49	49
Lead	M	2450	mg/kg	0.50	110	120	150	1500	1000
Selenium	M	2450	mg/kg	0.20	0.29	< 0.20	0.56	0.28	1.9
Vanadium	U	2450	mg/kg	5.0	44	37	46	46	76
Zinc	M	2450	mg/kg	0.50	100	110	150	220	150
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	13	11	12	41	19
Fuel Type	N	2670		N/A				PAH	PAH
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0				< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0				< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0				< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0				< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0				< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0				< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0				< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0				< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0				< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0				< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0				< 1.0	< 1.0

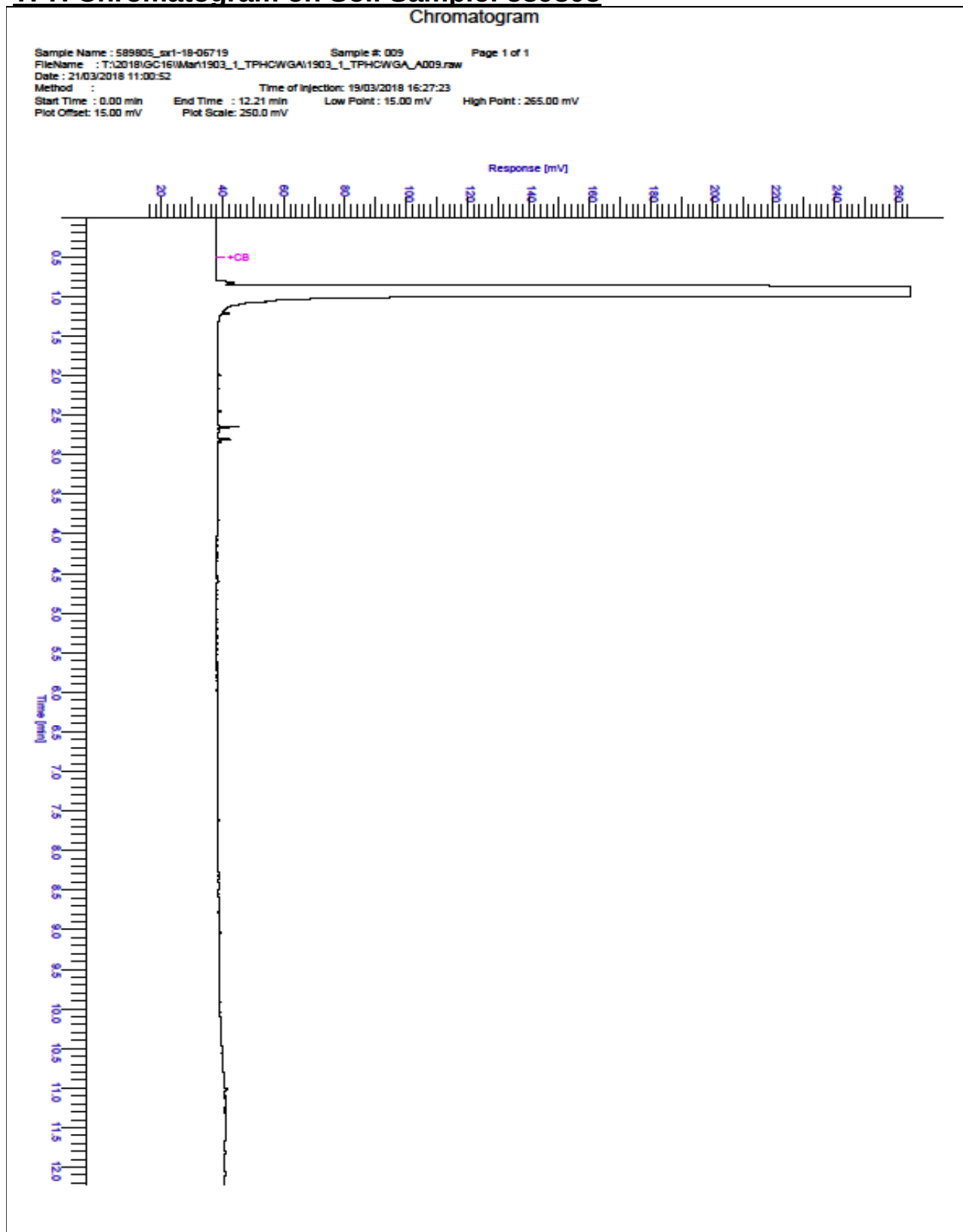
Results - Soil

Client: LK Consult	Chemtest Job No.:					18-06719	18-06719	18-06719	18-06719	18-06719
Quotation No.:	Chemtest Sample ID.:					589796	589799	589800	589801	589805
	Client Sample ID.:					TP120 / D1	TP122 / D1	TP123 / D1	TP124 / D1	TP127 / D1
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.00	0.00	0.00	0.00	0.00
	Bottom Depth (m):					0.20	0.40	0.40	1.00	1.00
	Date Sampled:					08-Mar-2018	08-Mar-2018	08-Mar-2018	08-Mar-2018	08-Mar-2018
	Asbestos Lab:					COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD						
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0					< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0					< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0					1.7	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0					6.2	3.6
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0					8.6	9.6
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0					< 1.0	1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0					17	15
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0					17	15
Benzene	M	2760	µg/kg	1.0					< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0					< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0					< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0					< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0					< 1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0					< 1.0	< 1.0
Naphthalene	M	2800	mg/kg	0.10	0.14	0.27	0.40	0.25	0.68	
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	0.17	< 0.10	< 0.10	
Acenaphthene	M	2800	mg/kg	0.10	0.17	0.21	0.48	< 0.10	0.27	
Fluorene	M	2800	mg/kg	0.10	< 0.10	0.11	0.41	0.11	0.16	
Phenanthrene	M	2800	mg/kg	0.10	1.6	2.4	6.7	2.3	1.3	
Anthracene	M	2800	mg/kg	0.10	0.29	0.33	1.2	0.93	0.19	
Fluoranthene	M	2800	mg/kg	0.10	2.4	4.7	11	4.7	1.3	
Pyrene	M	2800	mg/kg	0.10	2.2	4.3	9.8	4.2	1.3	
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.95	2.4	5.0	2.5	0.37	
Chrysene	M	2800	mg/kg	0.10	1.3	2.6	5.8	2.7	0.40	
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	1.4	3.1	6.8	2.8	< 0.10	
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.46	1.1	2.2	1.1	< 0.10	
Benzo[a]pyrene	M	2800	mg/kg	0.10	1.0	2.2	5.0	2.1	< 0.10	
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.63	1.6	3.5	1.2	< 0.10	
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.12	0.24	0.65	0.22	< 0.10	
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.75	1.4	3.1	1.2	< 0.10	
Total Of 16 PAH's	N	2800	mg/kg	2.0	13	27	62	26	6.0	
Total Phenols	M	2920	mg/kg	0.30				< 0.30	< 0.30	

TPH Chromatogram on Soil Sample: 589801



TPH Chromatogram on Soil Sample: 589805



SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

- U UKAS accredited
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- N Unaccredited
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- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk

APPENDIX D

CERTIFICATE OF ANALYSIS - WATER



2183

Final Report

Report No.: 18-10623-1

Initial Date of Issue: 25-Apr-2018

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Chris Hughes
Contaminated Land

Project LKC 18 1005 Smithy Bridge Road

Quotation No.: **Date Received:** 19-Apr-2018

Order No.: 736056 **Date Instructed:** 19-Apr-2018

No. of Samples: 8

Turnaround (Wkdays): 5 **Results Due:** 25-Apr-2018

Date Approved: 25-Apr-2018

Approved By:



Details: Robert Monk, Technical Manager

Results - Water

Client: LK Consult	Chemtest Job No.:				18-10623	18-10623	18-10623	18-10623	18-10623	18-10623	18-10623	18-10623
Quotation No.:	Chemtest Sample ID.:				609493	609494	609495	609496	609497	609498	609499	609500
	Client Sample ID.:				WS107	WS104	WS109	WS123	WS112	SW101-UP	SW102-MID	SW103-DOWN
	Sample Type:				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	Date Sampled:				17-Apr-2018	17-Apr-2018	17-Apr-2018	17-Apr-2018	17-Apr-2018	17-Apr-2018	17-Apr-2018	17-Apr-2018
Determinand	Accred.	SOP	Units	LOD								
pH	U	1010		N/A	8.6	8.3	8.6	8.3	8.0	8.0	8.0	8.0
Sulphate	U	1220	mg/l	1.0	24	14	75	12	13	46	36	36
Cyanide (Total)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Cyanide (Free)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Total Hardness as CaCO3	U	1270	mg/l	15	180	100	250	120	67	67	64	68
Arsenic (Dissolved)	U	1450	µg/l	1.0	1.5	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 1.0
Boron (Dissolved)	U	1450	µg/l	20	23	< 20	20	< 20	< 20	< 20	26	29
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080	0.091	< 0.080	< 0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	1.5	< 1.0	1.1	12	< 1.0	< 1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0	1.6	1.2	< 1.0	1.1	2.6	1.1	1.0	1.1
Nickel (Dissolved)	U	1450	µg/l	1.0	< 1.0	1.4	1.3	1.1	2.1	3.1	3.3	3.4
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Selenium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (Dissolved)	U	1450	µg/l	1.0	3.7	5.1	4.9	3.4	5.2	7.4	7.9	8.6
Mercury Low Level	U	1460	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Chromium (Hexavalent)	U	1490	µg/l	20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Total Organic Carbon	U	1610	mg/l	2.0	9.9	7.2	5.1	4.9	4.9	7.3	5.9	7.9
Fuel Type	N	1670		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	W.Diesel
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	7.7
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	280
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	210
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	490
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	5.8
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	25
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	31
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	530
Benzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Water

Client: LK Consult	Chemtest Job No.:				18-10623	18-10623	18-10623	18-10623	18-10623	18-10623	18-10623	18-10623
Quotation No.:	Chemtest Sample ID.:				609493	609494	609495	609496	609497	609498	609499	609500
	Client Sample ID.:				WS107	WS104	WS109	WS123	WS112	SW101-UP	SW102-MID	SW103-DOWN
	Sample Type:				WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	Date Sampled:				17-Apr-2018	17-Apr-2018	17-Apr-2018	17-Apr-2018	17-Apr-2018	17-Apr-2018	17-Apr-2018	17-Apr-2018
Determinand	Accred.	SOP	Units	LOD								
m & p-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthylene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Acenaphthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluorene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Phenanthrene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[a]anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Chrysene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	1800	µg/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Of 16 PAH's	N	1800	µg/l	0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Total Phenols	U	1920	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l ⁻¹ CaCO ₃ equivalent.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazine.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35–C44 Aromatics: >C5–C7, >C7–C8, >C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35–C44	Pentane extraction / GCxGC FID detection
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[a,h]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk

APPENDIX E

GAS MONITORING RESULTS



LK CONSULT LTD

GAS MONITORING RECORD

SITE	Smithy Bridge, Littleborough
REF	LKC 18 1005
DATE	22-Mar-2018
STAFF	PW
VISIT	1 of 6

EQUIPMENT* ¹		
Instrument / Model Type	Serial Number	Comments
Geotechnical Instruments GA5000	G502417	Serviced, calibrated & gas checked.
Solinst Interface Meter	122008632	Operating Normally

ATMOSPHERIC / GROUND CONDITIONS	
Atmospheric Pressure Trend on Site	Rising
Atmospheric Pressure (Prev 24hrs)	Falling
Weather Conditions	Cold with showers
Ground Conditions	Wet

Borehole ID	Date/Time	CH4 (% v/v)	CO2 (% v/v)	O2 (% v/v)	Peak CH4 (% v/v)	Peak CO2 (% v/v)	% of Lower Explosive Limit* ²	CO Pod (ppm)	H2S Pod (ppm)	Balance (%)	Barometric Pressure (mb)	Internal Flow * ³ (ltr/hr)	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Notes
WS101	22/03/2018 08:22	0.0	4.1	16.7	0.0	4.3	0.0	0.0	0.0	79.2	999	0.0	1.32	1.71	
WS103	22/03/2018 08:31	0.0	0.6	20.6	0.0	0.6	0.0	0.0	0.0	78.8	999	0.0	0.94	1.90	
WS104	22/03/2018 08:43	0.0	5.4	18.2	0.0	5.4	0.0	11.0	0.0	76.4	1000	6.7	0.89	2.89	
WS107	22/03/2018 09:13	0.0	1.0	20.7	0.0	1.1	0.0	1.0	0.0	78.3	998	0.0	0.42	2.19	Stopped by water intake at 80sec.
WS109	22/03/2018 09:35	0.0	3.6	18.6	0.0	3.6	0.0	0.0	0.0	77.8	999	0.0	1.58	4.00	
WS111	22/03/2018 10:30	0.0	2.2	20.1	0.0	2.2	0.0	0.0	0.0	77.7	1000	0.0	1.28	3.36	
WS112	22/03/2018 11:07	0.0	0.1	20.9	0.0	1.6	0.0	0.0	0.1	79.0	1000	0.0	1.71	3.01	
WS115	22/03/2018 10:43	0.0	0.1	21.7	0.0	0.4	0.0	0.0	0.4	78.2	1001	0.0	0.90	2.05	
WS119	22/03/2018 09:51	0.0	2.6	19.9	0.0	2.6	0.0	0.0	0.0	77.5	1000	0.0	DRY	4.11	
WS120	22/03/2018 08:59	0.0	0.8	20.1	0.0	0.8	0.0	0.0	0.0	79.1	998	0.0	2.70	2.70	
WS123	22/03/2018 10:08	0.0	4.9	14.7	0.0	4.9	0.0	0.0	0.0	80.4	1000	-0.1	2.42	3.80	
WS124	22/03/2018 10:15	0.0	4.8	14.8	0.0	4.8	0.0	0.0	0.0	80.4	1000	0.0	DRY	2.95	

ABBREVIATIONS

* ¹	Refer to Note 1
ND	Not detected
NR	Not recorded
UR	Unable to record
OS	Off recordable scale
N/A	Not applicable
% v/v	Percentage volume by total volume

ppm	Parts per million
mb	Millibars
ltr/hr	Litres per hour
mbgl	Metres below ground level
LEL	Lower explosive limit in air
OEL	Occupational exposure limit

NOTES

- Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records and service certificates.
- CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
- Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
- After CIRIA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
- Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents



LK CONSULT LTD

GAS MONITORING RECORD

SITE	Smithy Bridge, Littleborough
REF	LKC 18 1005
DATE	6-Apr-2018
STAFF	PP
VISIT	2 of 6

EQUIPMENT* ¹		
Instrument / Model Type	Serial Number	Comments
Geotechnical Instruments GA5000	G502417	Serviced, calibrated & gas checked.
Geotech oil in water meter	81454-14	Operating Normally

ATMOSPHERIC / GROUND CONDITIONS	
Atmospheric Pressure Trend on Site	Variable
Atmospheric Pressure (Prev 24hrs)	Rising
Weather Conditions	Cloudy, cool, windy.
Ground Conditions	Boggy

Borehole ID	Date/Time	CH4 (% v/v)	CO2 (% v/v)	O2 (% v/v)	Peak CH4 (% v/v)	Peak CO2 (% v/v)	% of Lower Explosive Limit*2	CO Pod (ppm)	H2S Pod (ppm)	Balance (%)	Barometric Pressure (mb)	Internal Flow *3 (ltr/hr)	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Notes
WS101	06-04-18 9:25	0.0	1.6	20.0	0.0	1.6	0.0	0.0	0.0	78.4	990	0.0	1.03	1.72	
WS103	06-04-18 9:35	0.0	0.7	20.4	0.0	0.7	0.0	0.0	0.0	78.9	990	0.0	0.71	1.85	
WS104	06-04-18 9:42	0.0	4.3	18.9	0.0	4.3	0.0	15.0	0.0	76.8	990	6.4	0.73	2.82	
WS107	06-04-18 8:50	0.0	0.2	21.1	0.0	0.2	0.0	14.0	0.0	78.7	988	6.9	0.02	2.17	Water being sucked up after 2 seconds.
WS109	06-04-18 10:37	0.0	2.9	15.7	0.0	2.9	0.0	3.0	0.0	81.4	989	0.0	1.28	4.01	
WS111	06-04-18 10:02	0.0	0.5	20.8	0.0	0.5	0.0	2.0	0.0	78.7	989	-2.9	0.79	3.40	
WS112	06-04-18 10:13	0.0	1.9	20.1	0.0	1.9	0.0	0.0	0.0	78.0	991	0.0	1.54	3.07	
WS115	06-04-18 9:51	0.0	0.1	20.7	0.0	0.1	0.0	3.0	0.0	79.2	991	0.0	0.71	2.06	
WS119	06-04-18 10:28	0.0	1.6	19.7	0.0	1.6	0.0	0.0	0.0	78.7	989	0.0	4.10	4.14	
WS120	06-04-18 9:13	0.0	0.8	20.5	0.0	0.8	0.0	0.0	0.0	78.7	988	0.0	2.70	2.72	
WS123	06-04-18 8:33	0.0	4.4	15.9	0.0	4.4	0.0	0.0	0.0	79.7	988	0.0	2.33	3.80	
WS124	06-04-18 10:52	0.0	4.5	15.5	0.0	4.5	0.0	0.0	0.0	80.0	989	0.0	Dry	3.00	

ABBREVIATIONS

* ¹	Refer to Note 1
ND	Not detected
NR	Not recorded
UR	Unable to record
OS	Off recordable scale
N/A	Not applicable
% v/v	Percentage volume by total volume

ppm	Parts per million
mb	Millibars
ltr/hr	Litres per hour
mbgl	Metres below ground level
LEL	Lower explosive limit in air
OEL	Occupational exposure limit

NOTES

- Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records. and service certificates.
- CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
- Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
- After CIRIA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
- Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents



LK CONSULT LTD

GAS MONITORING RECORD

SITE	Smithy Bridge Road, Littleborough
REF	LKC 18 1005
DATE	17-Apr-2018
STAFF	HM
VISIT	3 of 6

EQUIPMENT*1		
Instrument / Model Type	Serial Number	Comments
Geotechnical Instruments GA2000+	GA10350	Serviced, calibrated & gas checked.
Geotech oil in water meter	81454-14	Operating Normally

ATMOSPHERIC / GROUND CONDITIONS	
Atmospheric Pressure Trend on Site	Steady then rising
Atmospheric Pressure (Prev 24hrs)	Rising
Weather Conditions	Rain, mild, strong winds
Ground Conditions	Wet

Borehole ID	Date/Time	CH4 (% v/v)	CO2 (% v/v)	O2 (% v/v)	Peak CH4 (% v/v)	Peak CO2 (% v/v)	% of Lower Explosive Limit*2	CO Pod (ppm)	H2S Pod (ppm)	Balance (%)	Barometric Pressure (mb)	Relative Pressure (mb)	Internal Flow *3 (ltr/hr)	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Notes
WS101	17/04/2018 12:51	0.0	3.7	16.3	0.0	4.4	0.0	1.0	0.0	80.0	995	-0.5	0.0	1.35	1.72	
WS103	17/04/2018 13:05	0.0	0.9	20.7	0.0	0.9	0.0	0.0	0.0	78.4	995	-0.6	0.0	1.23	1.85	
WS104	17/04/2018 13:16	0.1	2.0	20.5	0.1	2.0	0.0	21.0	0.0	77.5	995	-0.6	6.6	0.78	2.72	
WS107	17/04/2018 12:33	0.0	0.2	21.6	0.0	0.2	0.0	1.0	0.0	78.2	995	-0.5	10.0	0.45	0.94	Water in tube after 60 seconds
WS109	17/04/2018 13:37	0.0	4.1	18.2	0.0	4.2	0.0	0.0	0.0	77.7	995	-23.3	0.0	1.40	2.75	
WS111	17/04/2018 15:03	0.0	2.1	19.4	0.0	2.1	0.0	0.0	0.0	78.5	996	-0.5	0.0	1.08	3.40	
WS112	17/04/2018 14:41	0.0	0.0	21.4	0.0	0.5	0.0	0.0	0.0	78.6	995	-0.5	0.1	1.85	3.08	
WS115	17/04/2018 15:32	0.0	0.1	21.1	0.0	0.2	0.0	0.0	0.0	78.8	998	-0.5	-0.1	0.99	1.12	
WS119	17/04/2018 15:45	0.0	1.4	19.7	0.0	1.4	0.0	0.0	0.0	78.7	998	-0.56	0.0	4.06	4.12	
WS120	17/04/2018 12:22	0.0	0.4	21.2	0.0	0.5	0.0	0.0	0.0	78.4	995	-0.5	0.0	2.70	2.70	Damp at base of borehole
WS123	17/04/2018 14:11	0.0	7.2	10.4	0.0	7.2	0.0	2.0	0.0	83.4	995	-0.5	0.0	2.38	3.80	
WS124	17/04/2018 14:09	0.0	0.5	21.0	0.0	0.5	0.0	0.0	0.0	78.5	995	-0.5	0.1	-	2.98	Borehole dry

ABBREVIATIONS

*1	Refer to Note 1
ND	Not detected
NR	Not recorded
UR	Unable to record
OS	Off recordable scale
N/A	Not applicable
% v/v	Percentage volume by total volume

ppm	Parts per million
mb	Millibars
ltr/hr	Litres per hour
mbgl	Metres below ground level
LEL	Lower explosive limit in air
OEL	Occupational exposure limit

NOTES

- Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records and service certificates.
- CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
- Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
- After CIRIA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
- Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents