



Land at Chapel Lane, Widnes

FLOOD RISK ASSESSMENT



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PREPARED BY John Marshall



Flood Risk Assessment

Prepared for Taylor Wimpey UK Ltd

Land at Chapel Lane, Widnes - Taylor Wimpey UK Ltd

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Land at Chapel Lane, Widnes

Flood Risk Assessment

1.0 Introduction

This Flood Risk Assessment (FRA) report has been prepared by AJP Ltd on behalf of Taylor Wimpey UK Ltd to assist the local planning authority's consideration of an outline planning application for a site at Chapel Lane, Widnes for:

Outline planning application (with all matters other than access reserved) (to be determined by Halton Borough Council only) for the development of up to 350 dwellings, public open space, landscaping and associated infrastructure works. Full details for site access arrangements via a new junction on Chapel Lane (to be determined by Knowsley Borough Council only) and emergency access via Sandy Lane (to be determined by Halton Borough Council).

The proposed development site is located to the north-west of the Widnes urban area. The site is situated within the boundary of two separate allocations for residential development within the adopted Halton Delivery and Allocations Local Plan [DALP] (March 2022) under Policy RD1 (Residential Development Allocations). The allocations comprise two separate land parcels separated by Sandy Lane, (Site Ref. W4 to the west of Sandy Lane and Site Ref. W5 to the east). The application red line boundary does not extend to the full extent of the allocation.

The site has few notable features and currently comprises approximately 14 hectares (ha) of agricultural land in low intensity uses such as grazing and pasture.

The proposed application site is bounded to the:

- 1 North by Alder Brook which is marked by mature trees and a hedgerow. There is open countryside beyond the brook.
- 2 To the east by an area of young woodland situated adjacent to Queensbury Way;
- 3 The site is bounded to the south by the curtilage of residential properties along Old Upton Lane.
- 4 To the west by Chapel Lane and a group of modern and traditional farm buildings fronting onto Chapel Lane (Rose Farm).

This FRA has been prepared in accordance with the general requirements of the National Planning Policy Framework and the Technical Guidance to the National Planning Policy Framework, both published by the Department for Communities and Local Government. This involves the identification of flood risk to new development(s) on the site, the possible effect of this development on flood risk elsewhere and the investigation of the impact on the development as a result of increased sea levels, fluvial flows and larger pluvial events due to increased impermeable areas and climate change. This report is also written with consideration of the Halton Borough Council Strategic Flood Risk Assessment and its requirements.

The purpose of this report is to present a site-specific assessment of flood risk based on available information, to identify relevant flood levels affecting the site with respect to a particular probability of flooding. The flood levels identified are dependent on the correctness of the current conditions, as stated in this report and the prediction of future climatic conditions implicit in the National Planning Policy Framework.

For any size of storm event, the procedure will always yield a probability that the event will occur in any year, albeit the probability is smaller for larger events. The predicted storm event has a probability of occurrence in any year and the derived flood level has an associated probability of exceedance. This means that there is always a risk that property flooding could occur one or more times in any year.

Therefore, this report should not be interpreted or relied upon as providing a guarantee against flooding. There is always a residual risk that flooding will occur, and it is not possible to predict a zero risk of flooding.

In accordance with National Planning Policy Framework (NPPF) and the associated Technical Guidance document, flood risk must be assessed for all sources including tidal (from the sea), fluvial (from rivers), pluvial (from land), groundwater, sewer and artificial water bodies (e.g. reservoirs, canals, major water supply infrastructure etc.).

More specifically, the development of any site must be carried out in such a way as to mitigate any potential flood risk, both on and off site from all sources of flooding.

2.0 Site description

The proposed development site is located in Widnes, to the east Chapel Lane and Rose Farm and to the west of Queensbury Way at National Grid Reference SJ 500878. To the

south is existing housing, while the north of bounded by a tributary of Dog Clog Brook. The highway Sandy Road that is subject to a Traffic Regulation Order (TRO) bisects the site.

The red line for the development is shown within Appendix A.

The total site area available is 13.97ha with the boundaries being met by a heavily wooded areas, housing and highways. The site location and surroundings are as shown in Appendix A. The level has a general fall from east to west, with the eastern boundary being circa 37.3-38.0m AOD and the western boundary being 30.30m AOD at its lowest point.

An aerial photo is included in Appendix B to illustrate the site at the present day and the topographical survey is included in Appendix C.

2.1 Geology

The British Geological Survey (BGS) “Geology Viewer” is an open-source UK wide assessment of local geology. The information provided by the BGS shows that the development site is underlain superficial deposits comprising of Till Devensian Diamicton, which consists of Sandy gravelly cobbly deposits, the underlying bedrock is reported to be of Chester formation, comprising of Sandstone

A more explicit assessment of the site geology has been carried out by E3P as part of a Phase II Geotechnical Report (REF:13-759-R1-1) as shown in Appendix H. The geology summary from the report identifies the top soil to depths of 0.70m below ground level (bgl) with the Drift deposit underlying, comprising of clay.

Of the 44 trial pits and 36 window sample Boreholes, two had evidence of sands in place of clay, six soakaway tests were carried out to understand the infiltration potential of the ground, which was found to have no infiltration potential.

Bedrock was encountered at a minimum depth of 2m bgl for parts of the site and ground water was encountered at a minimum depth of 0.40m bgl.

2.2 Hydrogeology

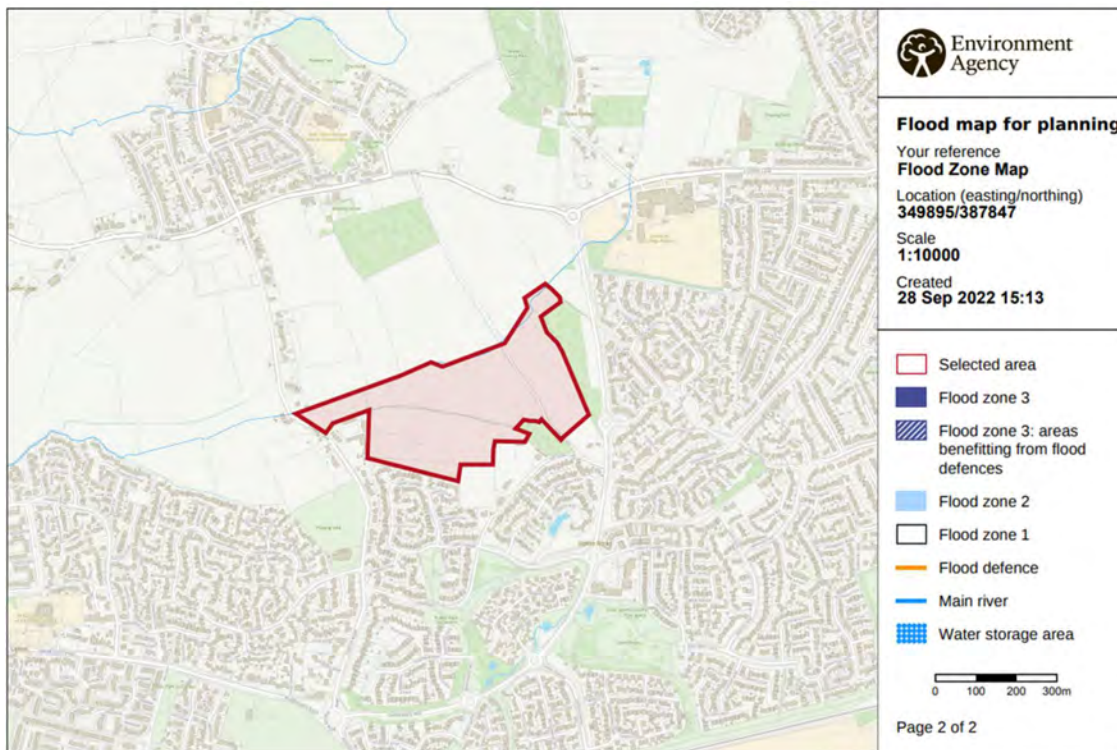
The DEFRA groundwater magic maps show that the Glacial Till superficial deposits are classified as a secondary undifferentiated aquifer, the groundwater maps also show that the underlying Chester Formation is classed as a Primary Aquifer and that the site area lies in a medium-low area of Groundwater vulnerability.

There are no recorded groundwater / potable water abstraction licenses within 500m of the site and the site is not recorded to be within a Groundwater Source Protection Zone.

The development site is shown to be within an area of low-medium Groundwater vulnerability,

The Phase II geotechnical report has determined that based on the local geology and six number percolation tests, that infiltration to ground is not viable within this development area. Cohesive clays and a high-water table, prevent the transmission of surface water to the local aquifers.

The nearest watercourse feature is on the northern boundary, identified as Dog Clog Brook on the northern boundary of the development area. The site is located in Flood Zone 1, as an area identified by the Environment Agency (EA) not at risk of flooding from rivers and streams.



3.0 Proposed development

The Outline planning application (with all matters other than access reserved) for the development of up to 350 dwellings, public open space, landscaping and associated infrastructure works. Site access proposals are situated within Knowsley Borough Council authority area (emergency access in Halton Borough Council authority area via Sandy Lane). Full planning permission for the access arrangements only, via a new junction on Chapel Lane (to be determined by Knowsley Borough Council only) and emergency access

via Sandy Lane (to be determined by Halton Borough Council). All of the outline proposals are situated within Halton Borough Council authority area and are to be determined by Halton Borough Council only.

The proposed development site covers a total area of approximately 13.97ha (App D), the development illustrative Masterplan is shown within Appendix D indicating the proposed highway network, areas of Public Open Space and SuDS features, including new ponds.

The total impermeable area from the proposed development is to be set at 60% of the total site area, impermeable area that actively discharges surface water flows, encompasses, the proposed houses and apartment buildings, alongside the associated driveways and proposed highway to facilitate the development

Within the middle of the development area is an existing ditch, that shall be maintained during the development's lifespan.

To enable a viable scheme, the proposed site levels are constrained by the surrounding highways, housing estates and local farm lane.

4.0 Planning Policy

The National Planning Policy Framework (NPPF) sets out the Government's policy on meeting the challenges of climate change, flooding and coastal change. The NPPF states that:

"Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impact of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development. Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change taking full account of flood risk, coastal change and water supply and demand consideration."

This Flood Risk Assessment proposes recommendations to facilitate the proposed development so that it takes into account flood risk at all stages of the development.

4.1 Sequential Test

Based on the site's location in outside a flood zone, the development is deemed appropriate according to NPPF therefore the development is appropriately situated and the Sequential Test is not required.

4.2 Exception Test

NPPF classifies the residential element of the development as 'More Vulnerable' but as the site is located outside a flood zone the Exception Test is not required.

5.0 ASSESSMENT OF FLOOD RISK

The Technical Guidance to the National Planning Policy Framework requires all forms of flooding to be considered.

5.1 Flooding from Rivers

The Flood Risk map is included in Appendix E.

It can be seen from the map that the site is located in Flood Zone 1 with a chance of flooding of less than 0.1% (or 1 in 1000).

The nearest designated main river is Dog Clog Brook tributary to the northern boundary of the development, the brook is not identified as breaking its banks on the EA Flood Risk Maps, therefore the risk of flooding to the new development from river is considered to be low.

Correspondence from the LLFA included in Appendix E, also confirms that there are no records of flooding from this watercourse and the risk of flooding from Fluvial sources isn't present.

5.2 Flooding from the Sea

The site is not at risk of flooding from the sea. The lowest level of the site is approximately 30.820m AOD, i.e., well above tidal flood levels, as demonstrated in Appendix E.

5.3 Flooding from Land

Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding.

The Surface Water Flooding map is included in Appendix E. It can be seen from the map that the site is classified as having a low risk of surface water flooding at various points within the site area.

Identified are the ponds at which existing ponds may produce localised S.W flood risk and a general flow path of S.W flows occurring from within the development area, running from east to west.

The Low risk identified within the site area shall be mitigated through the development, by actively draining 60% of the development area into an appropriate drainage system, which shall reduce the volume of S.W ponding. In tandem with creating a suitable flow path within the site's green buffer zone on the northern boundary to ensure any remaining S.W is kept away from the proposed developable area and shaped to discharge into the local watercourse.

The existing pond S.W flood risk shall be eliminated ensuring that surrounding developed areas are suitably drained.

5.4 Flooding from Groundwater

As set out within the Phase II Geotechnical report, ground water was encountered within the boreholes and the below ground strata was likely to contain perched water, with poor infiltration capacity.

As per the magic maps, the risk of groundwater flooding can be considered to be low to medium, the medium flood risk suggests that there is a risk of flooding to property where there are proposed basements and finished floor levels are set below the existing ground level.

To mitigate the flood risk from groundwater the development shall ensure that it has no proposals for basements and finished floor levels are to be set at or above existing ground levels, during detailed design the development, with adequate S.W drainage systems ensuring the surface run off from the development does not discharge to ground and end up perched in the local strata.

5.5 Flooding from Sewers

A record of Public Sewers surrounding and serving the development site has been obtained from United Utilities and this is included in Appendix F.

There are no S.W sewers within the development area and therefore their flood risk is to be not considered.

The only local sewers within the site area are a 225 mm diameter Foul Water (FW) crossing the north west corner of the development. As a F.W sewer it is considered to be of low flood risk.

Therefore, as a result of the public sewers being located outside the site itself, is considered to be at low risk of flooding from sewers.

5.6 Flooding from Reservoirs, Canals and Other Artificial Sources

The Reservoir Flood Risk map is included in Appendix E. It can be seen from the map that the site is at risk of flooding from reservoirs.

The reservoir flood maps are used to identify the extent of flooding caused in the event of a catastrophic failure event and therefore the site is considered to be at low risk of flooding from reservoirs.

6.0 DEVELOPMENT AND DRAINAGE STRATEGY

6.1 Effect of Proposed Development on Flood Risk

As previously outlined in Section 2.0, the existing site covers a total area of 13.97ha and is a Greenfield site. As the existing site is open space with no active drainage systems positively connecting to the UU sewer system, the new built development will lead to an increase in impermeable area.

For the proposed development, the changes to the existing site will increase the volume of impermeable areas and as such, the proposed development in these areas will lead to an increase in the;

- Volume of surface water ponding on the site
- Volume of surface water runoff leaving the site or discharging into surrounding areas
- Peak discharge rate from the site.

Accordingly, site-wide drainage systems are required to drain the foul and surface water flows arising from the proposed development. Where possible, any existing drainage networks should be utilised. Appropriate design and construction of these systems as set out in Section 6.3 should ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

6.2 Existing Drainage Systems

As can be seen from the United Utilities maps, attached in Appendix F, there is an existing 225mm Foul Water sewer located within the north wester corner of the site. The sewer runs from MH 5703 to MH 5702 within the boundaries of the site. No invert information for the sewer is available on the UU records.

There are no local adopted surface water drainage systems or highway drains within the development.

6.3 Proposed Drainage Strategy

As outlined above in section 6.1, site-wide drainage systems are required to drain the foul and surface water flows arising from the proposed development. The proposed drainage systems must ensure that there is no increase in offsite flood risk, for all storms up to the 1:100-year event with an allowance for climate change; that would otherwise impact downstream areas.

6.3.1 Surface Water Drainage

The Building Regulations - Approved Document H (2002) details a hierarchy of potential methods for disposing of surface water as shown below in order of preference:

- Discharge via infiltration
- Discharge to watercourse
- Discharge to sewer

Considering the hierarchy above, the surface water network for the proposed site should infiltrate to ground where viable.

As laid out within section 2.2 the site investigation information and the British Geological Survey (BGS) information show that the site is underlain Till Devensian Diamicton of cohesive clays. Six number soakaways tests were carried out in accordance with BRE 365, which demonstrated that the ground has no viable infiltration rate for discharge of S.W flows to local aquifers.

Therefore, the discharge of S.W flows via infiltration is not considered for the development and its proposed drainage strategy and utilisation in any SuDS systems.

As the possibility of infiltration is ruled out, the intention for the development would be to discharge to watercourse/ waterbody. The nearest waterbody is the Dog Clog Brook tributary on the northern boundary of the site.

As this watercourse is accessible to the development under Riparian ownership and its level falls in accordance with the generalised site level, it should be utilised as a point of discharge for the surface water flows generated by the development, this is dependent upon determining a route down the bank to the reservoir that can be installed in accordance with safe working requirements and approval to discharge to the watercourse from the Environment Agency.

While every effort to utilise, any suitable existing systems should be made, the drainage systems should be designed to suit the proposed site layout and topography which aims to provide an efficient design.

In line with the Design & Construction Guidance (DCG) the requirements for the design of new surface water drainage systems are as follows:

Below ground piped drainage to be sized to accommodate the 1 in 2-year (50% AEP) design storm without surcharge.

System to be designed not to flood any part of the site in a 1 in 30-year (3% AEP) design storm.

For events in exceedance of the 1 in 30-year design storm and up to and including the 1 in 100-year event, site drainage and topography should be designed where practicable to route surface water run-off away from buildings to safe above-ground storage areas on site, thereby removing flood risk to properties and preventing this run-off from leaving the site and increasing flood risk elsewhere.

For each design case described above, the design storm is the critical storm duration for the site conditions. In the case of the 1 in 100-year design storm, a 45% increase in the peak rainfall intensity is applied to allow for the estimated worst-case impacts of climate change. This is in accordance with the DEFRA Climate Change Allowances map.

Suitable systems of below ground drainage will be required to contain as a minimum requirement, the 1 in 30-year event. Additionally, any surface water run-off from events that exceed the design capacity of the new drainage system, up to and including the 1 in 100-year (+45%) event, will be contained within the drainage network or retained on-site in safe storage areas.

Should they be required, measures to prevent oil and other contaminants being passed forward to the existing surface water sewer should also be incorporated into the design of the surface water system, through the use of appropriate oil separators or other appropriate pre-treatment methods.

In line with common practice and Halton Borough LLFA guidelines, it is proposed the surface water discharge from the proposed development should discharge at rates not in excess of a value equivalent to the Greenfield Qbar rate or the minimum practicable rate of discharge, whichever is the greater; for all respective storm periods.

An assessment of the existing Greenfield surface water run-off from the existing site area has been carried out and demonstrates that it is greater than the minimum practicable rate of 5l/s. Therefore, in accordance with reducing flood risk and compliance with Halton Borough LLFA requirements, a restricted flow rate equivalent to Qbar is recommended for the proposed development area for all storms up to and including the 1 in 100-year return period, with an allowance for climate change.

This value is equivalent to 44.7 l/s based upon the existing Greenfield Qbar run off rate, the calculations evidencing this rate of discharge being allowable into the local watercourse, can be seen in Appendix G.

Based on the above discharge limit, there shall be a new S.W network to serve the proposed development that shall discharge into the watercourse, at a point in the western extents of the development. Discharge into this watercourse shall be agreed under with the EA under an Environmental Permit.

As set out above the proposed S.W Network shall discharge no more than 44.7l/s, this network shall consist of oversized pipes and manholes with an online SuDS Pond providing additional attenuation.

The attenuation criteria for a SUDS pond are noted below based upon the Quick Storage Estimate as shown in Appendix G.

Impermeable Area (Ha)	Return Period	Lower end storage requirement m ³	Higher end storage requirement m ³
8.38 (60% of total)	1 in 100 year + 45% Climate Change	5512	7439

Based on an effective storage depth of 1.2m, the SUDS pond shall be positioned within Brook Green occupying a plan area of a maximum plan area of 6200m², providing effective storage equivalent to the upper threshold level, to accommodate all storm events. This will be subject to control by a vortex flow control system prior to discharging to the watercourse via a newly constructed headwall at the standing water level and be subject to the UU SuDS adoption requirements.

The surface water drainage systems are to be designed to restrict the discharge to the required rate, up to and including a 1 in 100-year return period plus 45% climate change design storm, while ensuring that no flooding occurs within the 100-year return period and that any flood water for extreme events shall be appropriately accommodated away from proposed and existing dwellings.

The surface water drainage strategy and discharge rate should be confirmed via more detailed discussions with United Utilities, the EA and the Lead Local Flood Authority prior to the commencement of any works.

6.3.2 Foul Water Drainage

Foul water drainage disposal is set out in Part H of the Building Regulations in order of priority the preferred methods are;

- Public sewer
- Septic tank
- Cesspool.

The foul water system shall be designed in accordance with;

BS EN 752:2008 (Drain and sewer systems outside buildings)

The Design & Construction Guidance (DCG)

Technical Guidance to the National Planning Policy Framework document (Department for Communities and Local Government, March 2012).

BS EN 12056-2:2000 (Drainage systems inside buildings)

Building Regulations Approved Document H, Drainage and waste disposal. (Office of the Deputy Prime Minister, December 2010).

Foul water shall discharge to the existing F.W sewer to the north west corner of the development at existing manhole 5702, at an unrestricted rate.

Due to insufficient information available on the UU records, a CCTV survey of these sewers shall be carried out to ensure that the invert levels are sufficient for discharge of foul water flows by gravity.

The F.W shall discharge into the local F.W Sewer under a Section 104 Agreement, The foul water drainage strategy and discharge rate should be confirmed via more detailed discussions with United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

6.3.3 Water Quality Assessment

Managing the water quality of the surface water runoff from the proposed development is important to ensure that the receiving surface waters or groundwater are well protected. Generally, this can be achieved through the use of well-designed SuDS systems which provide treatment and pollution removal to the surface water runoff.

Standard S3 of the Statutory National Standards for Sustainable Drainage Systems (2018) details the water quality management and addresses the drainage design requirements to minimise the potential pollution risk.

As the proposed development consists of roof areas, car park areas and low traffic roads, in accordance within Table G3.2 of the Statutory National Standards for Sustainable Drainage Systems (2018) the pollution hazard level is low and as such the simple index approach can be used to assess the treatment requirements for the low risk of pollution.

The simple index approach is outlined within Chapter 26 of CIRIA Report C753 - The SuDS Manual. Therefore, using Table 26.2 and applying the proposed site description above, results in a low pollution hazard level, with the pollution hazard indices being; **TSS - 0.5, Metals - 0.4 and Hydrocarbons - 0.4.**

Assessing this against Table 26.3 of CIRIA Report C753 - The SuDS Manual using the SuDS treatment train of a SUDS pond results in the mitigation indices outweighing the pollution hazard indices identified above. The use of a porous paving itself results in mitigation indices of; **TSS - 0.7, Metals - 0.7 and Hydrocarbons - 0.5**, which would be sufficient.

Therefore, as the mitigation indices are equal to or greater than each of the pollution hazard indices the use of permeable paving is deemed acceptable from a pollution mitigation perspective and as such complies with the water quality requirements of Standard S3 of the Statutory National Standards for Sustainable Drainage Systems (2018).

6.4 Compliance with LASOO Non-Statutory Technical Standards for SUDS

In compliance with the runoff destinations guidance within the LASOO Non-Statutory Technical Standards for Sustainable Drainage: Best Practice Guidance, infiltration is not feasible; therefore, the surface water runoff is designed to discharge to the public sewer.

S1. Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface

water body (e.g., the sea or a large estuary) the peak flow control Standards (S2 and S3) and volume control Standards (S4 to S5) need not apply.

The site does not discharge to a surface water body that can accommodate uncontrolled surface water discharges, as it has only previously received greenfield run off and the culvert has been sized appropriately; therefore, Standards S2 - S5 shall apply.

6.4.1 Peak Flow Control

S2. For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1-year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event.

The sites considered greenfield and the discharge rate for the 1 in 100-year return period has been restricted to the existing greenfield Qbar discharge rate of 44.7l/s for a site this size, utilising a hydrobrake control unit.

S3. For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100-year rainfall event should be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

The site is Greenfield and this standard does not apply.

6.4.2 Volume Control

S4. Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100-year, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event.

S5. Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100-year, 6-hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

S6. Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

SuDS components such as infiltration have not been confirmed as feasible due to the ground conditions. Other SUDS measures including green roofs or rainwater harvesting may

assist in constraining the volume of surface water runoff, these have not been feasible due to proposed construction methods and space considerations for the development, therefore S5 cannot be complied with.

As the system will be designed with a SuDS pond attenuating all flows for the up to and including the 1:100-year return period (including climate change), the volume discharge rate shall not adversely affect the flood risk, in compliance with S6

6.4.3 Flood Risk Within Development

S7. The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on part of the site for a 1 in 30-year rainfall event.

S8. The drainage system must be designed so that, unless an is designated to hold and/or convey as part of the design, flooding does not occur during a 1 in 100-year rainfall event in any part of: a building (including a basement) or in any utility plant susceptible to water (e.g., pumping station or electricity substation within the development)

S9. The design of the site must ensure that so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100-year rainfall event are managed in exceedance routes that minimise the risks to people or property.

The drainage system proposed in service of this development shall attenuate the Surface water flows for up to the 100-year storm event without any flooding occurring in compliance with S7 & S8.

The levels of the proposed highways and properties are such that flooding in excess of the 100-year storm event provide exceedance flow routes away from properties to proposed and existing highways; satisfying the requirements of S9.

6.5 Future Maintenance

It is proposed that the surface and foul water drainage systems and Surface water systems will be adopted, therefore the drainage elements will be the responsibility of United Utilities; in accordance with the CIRIA SUDS Manual C753.

Accordingly the S.W run off from the roofs and hard surfaces shall discharge by gravity to S.W sewers adopted and maintained by UU, prior to discharging to a SUDS Pond.

Accordingly, as stated in the SUDS Manual the operation and maintenance of the SuDS system shall be as the modified version of tables 22.1 below.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass - for spillways and access routes	Monthly (during growing season)
	Cut grass - meadow grass immediately surrounding basin	Half yearly (spring - before nesting season)
	Inspect inlets and outlets for blockages and clear if required	Every six months
	Inspect banksides and headwalls for evidence of physical damage	Every six months
	Inspect water body for signs of poor quality water	Monthly (May-October)
	Inspect silt accumulation rates in any forebay and in main body of pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half Yearly
	Check any mechanical devices e.g penstocks.	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base ; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season	Annually
	Remove sediment from any forebay	Every 1-5 years / as required
Remedial Action	Repair inlets and outlets	As required
	Replant/ repair erosion when necessary	As required
	Aerate pond when signs of Eutrophication are detected.	As required
Monitoring/Occasional maintenance	Remove sediment from main body of pond when the pool volume is reduced by 20% of design value.	With effective treatment this should only be required every 25-30 years

The remaining drainage systems (Hydrobrake unit) will be maintained in accordance with manufacturer's requirements which will be provided within the O&M manual which will be issued as a compliance requirement to UU on completion of the works.

The hard surfaces proposed for the development that are not the responsibility of the householder shall be maintained accordingly with the appointed management company for the site. An annual inspection of control chamber, ACO channels and the inspection chambers shall be necessary to remove any silt build up and check the free flow use of the hydrobrake.

6.6 Managing Residual Flood Risk

With the impermeable area surface water run off explicitly considered and accommodated by the proposed drainage system a consideration must be given to the remaining permeable area within the bounds of the site, comprised of private garden areas. For the private garden areas surface water run-off will be mitigated by ensuring the top soil is freely draining and that at the lowest point of the garden a gravel trench should be in place to capture surface water for extreme events; with the surface water slowly dissipating post the storm event. Any P.O.S shall be shaped and appropriately banded to capture surface water runoff in extreme storm events, preventing discharge to the proposed dwellings, temporarily storing surface water run off prior to dissipating slowly to ground post the storm event or shaped appropriately to discharge to the local watercourse.

There is a finite risk that the design flood conditions required by current design standards are exceeded by an extreme and rare event. However, with the design measures reported such a risk is low and the exceedance flow path routes required to channel flows around the development buildings will be such that no specific flood risk management procedures are envisaged to be necessary.

7.0 CONCLUSIONS

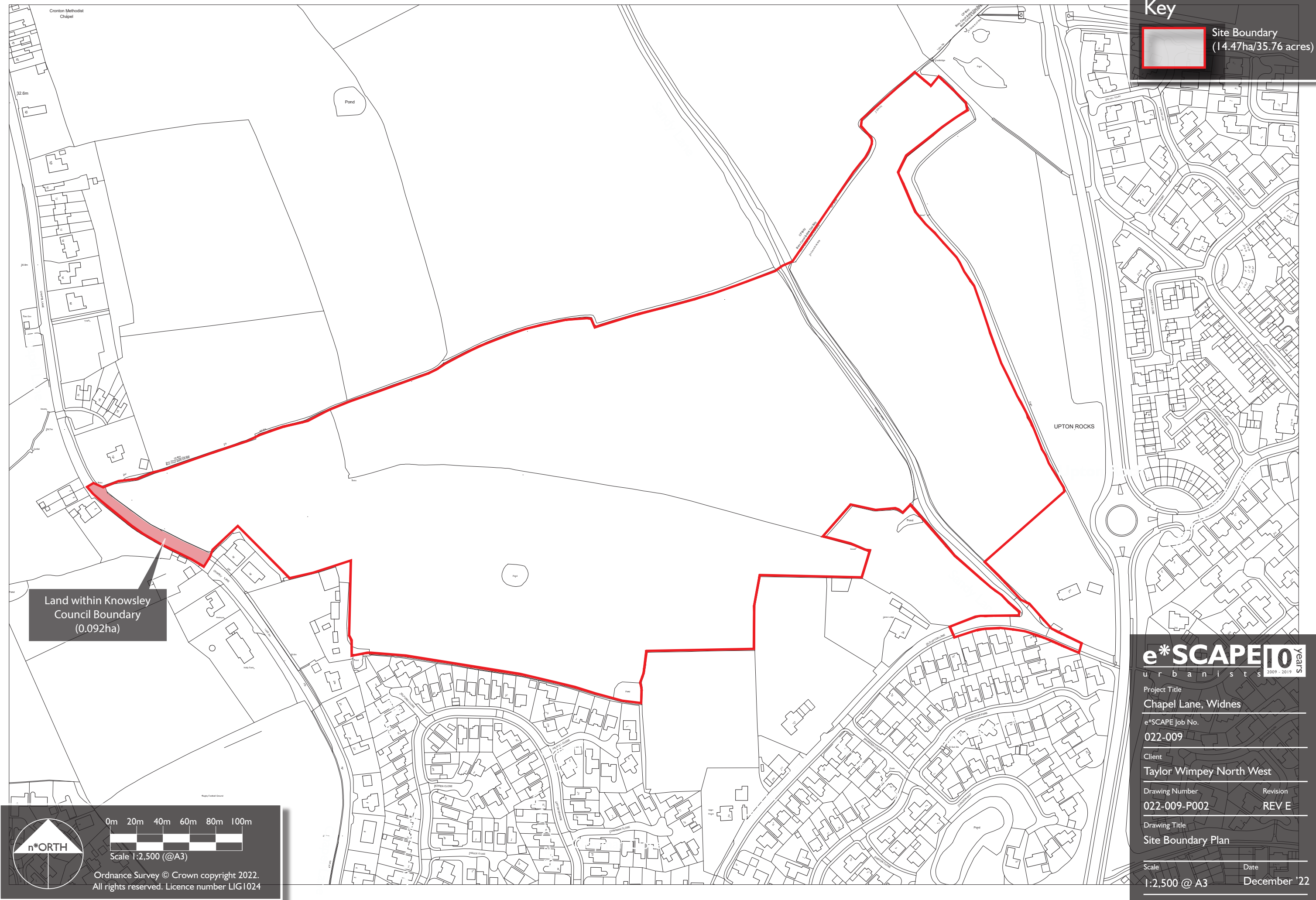
- The site is located within flood zone 1 and has been deemed to have a low risk of flooding from rivers.
- The site is at a low-medium risk of flooding from Groundwater at the surface.
- The site is at low risk of flooding from Surface water that's shall be mitigated through development.

- The ground conditions and infiltration testing in accordance with BRE 365, demonstrate that discharge to ground of pluvial flows is not viable.
- The surface water discharge from the proposed site should discharge at no more than the 44.7 l/s value for all storm events up to and including the 1 in 100-year event (+ CC)
- The Surface water shall be contained within the attenuation system for the 1 in 100-year return period (+ 45% climate Change), ensuring that no properties are at risk of flooding and all flows are contained on site.
- The S.W network shall discharge into the local watercourse, under an Environmental Permit.
- Foul water discharge from the proposed site should discharge, at unrestricted rate to the existing United Utilities Foul Water Sewer in Prescott Road via MH5703.
- The proposed drainage systems comply with Standards contained within the LASOO Non-Statutory Technical Standards for Sustainable Drainage: Best Practice Guidance.

8.0 RECOMMENDATIONS

- The development shall have a S.W network consisting of oversized pipes, manholes with a SUDS pond, a vortex flow control device should be utilised to restrict the surface water runoff and prevent any flooding for rainfall events up to and including the 1 in 100 year plus 45% climate change event.
- A CCTV survey of the existing F.W Sewer within the bounds of the site should be completed to confirm its depth and condition.
- The EA Should be contacted to obtain an Environmental Permit for discharge of S.W flows to the Local watercourse.
- The existing ditch bisecting the site shall be maintained except at highway crossing points, where a suitably sized culvert shall be installed. Subject to agreement with the LLFA.
- The external ground levels around the proposed buildings shall fall away from the proposed building with any new levels being designed to ensure overland flood routes, for events in excess of the 100 Year + 45% CC, exit towards the highway, allowing for surface water risk mitigation and groundwater risk mitigation.
- Specific and detailed mitigation measures shall be brought forward during design development and be subject to final review at Reserved Matters stage.

Appendix A Site Location Plan



Key

 Site Boundary
(14.47ha/35.76 acres)

 n*ORTH

0m 20m 40m 60m 80m 100m

Scale 1:2,500 (@A3)

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e*SCAPE 10 years
urbanists 2009 - 2019

Project Title
Chapel Lane, Widnes

e*SCAPE Job No.
022-009

Client
Taylor Wimpey North West

Drawing Number
022-009-P002

Revision
REV E

Drawing Title
Site Boundary Plan

Scale
1:2,500 @ A3

Date
December '22

Appendix B Aerial Photograph



REV	DATE	DESCRIPTION	BY	APP
PROJECT: CHAPEL LANE, WIDNES				
TITLE: SITE AERIAL PHOTOGRAPH				
STATUS: -		PROJECT No: 219-114	DRAWING No: APPENDIX B	REV: -

SCALE @ A3: NTS	DESIGNED: -	DRAWN: -	CHECKED: -	APPROVED: -	DATE: MAY 2022
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consulting engineers

0151 227 1462 info@ajpltd.co.uk 1 Dale Street, Liverpool, L2 2ET

Appendix C Topographic Survey



SURVEY ORIENTED TO OS GRID (OSGB36-15)

SURVEY LEGEND

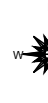
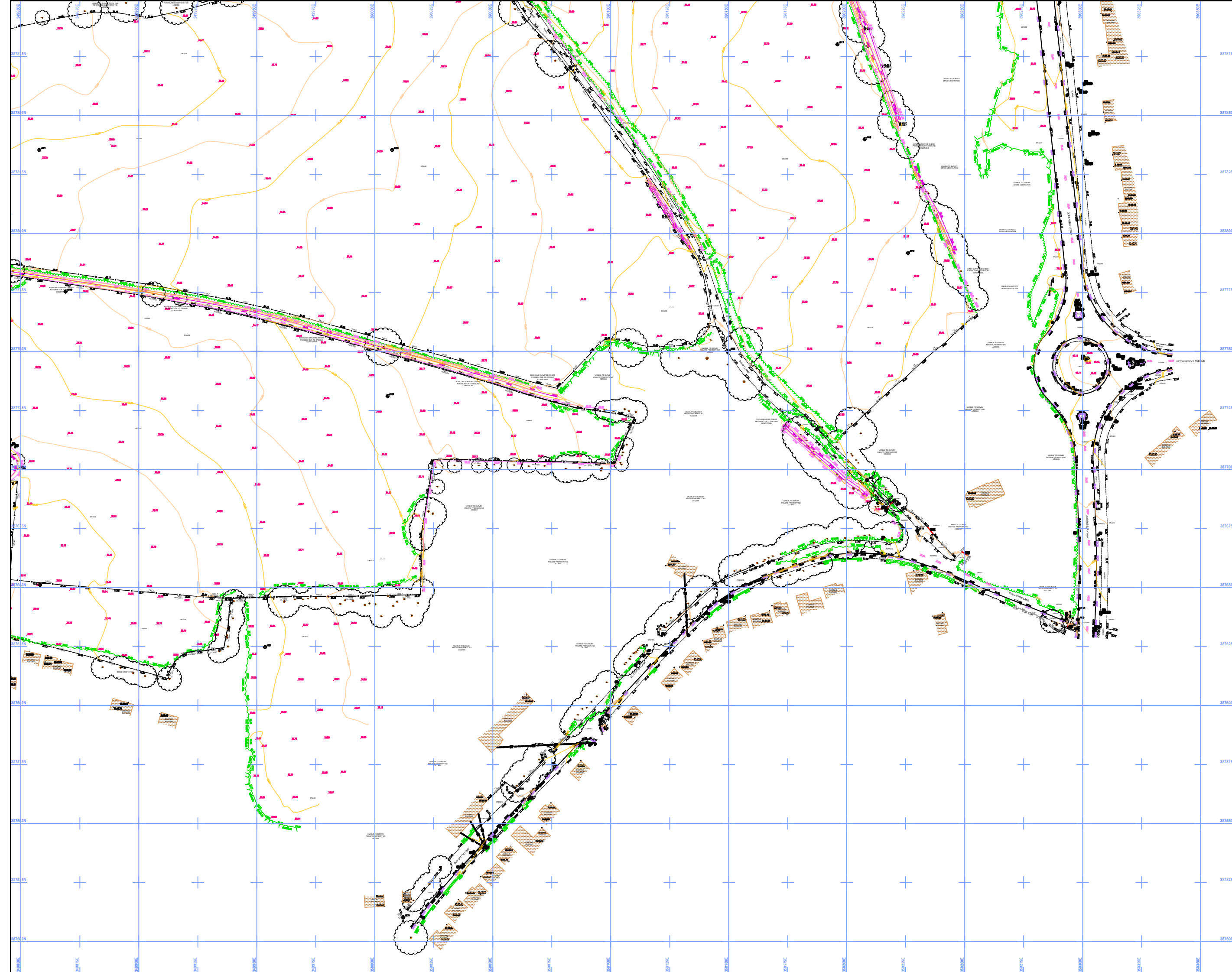
FEATURES	SURVEY ANNOTATIONS
TOP OF BANK	AV AIR VALVE
BOTTOM OF BANK	BS BUS STOP
SURVEY STATION	BT BATTERY TELECOM IC
CATCH PIT	CPS CONCRETE PAVING SLABS
TREE	DR DRAIN
TREE CANOPY	EC ELECTRIC CONTROL BOX
ROCKS	EL ELECTRICAL IC
VEGETATION	EP ELECTRICITY POLE
	EW EARTH ROD
	FW FIREWORKS
	G Gully
	GP GATE POST
	GV GATE VALVE
	IC INSPECTION COVER
	IN INJECTION POINT
	JW JAPANESE POST WOOD
	KD KID OUTLET
	LH LAMP HOLE
	LP LAMP POST LIGHT COLUMN
	MR MANHOLE
	NP NAME PLATE
	OC OVERHEAD CABLES
	PS POST BOX
	PM PAVING MASTER
	PS POST
	PYL ELECTRICITY Pylon
	RE RIDDING EYE
	RD ROAD SIGN
	RWP MAIN WATER PIPE
	ST STOP LAP
	SM SERVICE MANHOLE
	SP SIGN POST
	SV STOP VALVE / SERVICE VALVE
	SW SWAL TANK PILE
	TF TELEPHONE BOX
	TL TELEPHONE MAST
	TL TRAFFIC LIGHTS
	TP TELEPHONE POLE
	UP UP PIPE
	UR WATER METER
	WD WASH OUT
	WU WATER TO LIFT
	WTS UNABLE TO SURVEY

DISCLAIMER:
ONLY MANHOLES AND SERVICES SHOWN WERE VISIBLE AT THE TIME OF SURVEY.
MAN ENTRY TO SERVICES HAS NOT BEEN UNDERTAKEN. DEPTHS, PRESSURES ETC
ARE MEASURED FROM SURFACE LEVELS.
DRAINAGE INFORMATION MUST BE CHECKED AND VERIFIED PRIOR TO ANY WORK
CONDUCTED.
BOUNDARIES SHOWN ARE PHYSICAL AND MAY NOT REPRESENT LEGALLY CONVEYED
OWNERSHIP.
THIS SURVEY IS SHOWN ONLY AND IS REPRESENTATIVE OF THE
AVERAGE SPREADS. THE TREE CANOPY AND SERVICE LINES ARE NOT TO SCALE.

SURVEY NOTES

ALL LEVELS ARE RELATED TO OS DATUM (OSGB36-15)
ESTABLISHED AT SE1 USING THE LEICA SMARTNET GPS NETWORK

OSGB36 OSGB36			
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A24	54670.22	54701.22	55.663
A25	54670.23	54701.23	55.663
A26	54670.24	54701.24	55.663
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A29	54670.27	54701.27	55.663
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A31	54670.29	54701.29	55.663
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A99	54670.97	54701.97	55.663
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SURVEY ORIENTATED TO OS GRID (OSG)

SURVEY LEGEND

[illegible]

DISCLAIMER:

DISCLAIMER:

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DRAINAGE INFORMATION MUST BE CHECKED AND VERIFIED PRIOR TO ANY WORK COMMENCING.

BOUNDARIES SHOWN ARE PHYSICAL AND MAY NOT REPRESENT LEGALLY CONVEYED OWNERSHIP.

THREE SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE STRENGTH ASSUMED. THE THREE CANADA RIVER DRAINAGE ARE THE PROPERTY OF THE

SURVEY NOTES

ALL LEVELS ARE RELATED TO O.S. DATUM (08GB36-15)
ESTABLISHED AT SE1 USING THE LEICA SMARTNET GPS NETWORK

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AG50	104602.847	105389.891	20.458
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AG2130	104610.127	105389.891	-21.350
AG2140	104610.162	105389.891	-21.551
AG2150	104610.197	105389.891	-21.752
AG2160	104610.232	105389.891	-21.953
AG2170	104610.267	105389.891	-22.154
AG2180	104610.302	105389.891	-22.355
AG2190	104610.337	105389.891	-22.556
AG2200	104610.372	105389.891	-22.757
AG2210	104610.407	105389.891	-22.958
AG2220	104610.442	105389.891	-23.159
AG2230	104610.477	105389.891	-23.360
AG2240	104610.512	105389.891	-23.561
AG2250	104610.547	105389.891	-23.762
AG2260	104610.582	105389.891	-23.963
AG2270	104610.617	105389.891	-24.164
AG2280</			

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CLIENT
TAYLOR WIMPEY NORTH WEST

PROJECT TITLE
CHAPEL LANE, WIDNES

DRAWING DETAIL

TOPOGRAPHICAL LAND SURVEY
SHEET 3 OF 3

PROJECT ENGINEER	AS/JW/JLP	DATE	10.05.2019
DRAWN	BM	SCALE	1:500@A0

DRAWING NUMBER	REVISION
TWNW TS 26	

Appendix D Development Plan

Accommodation Schedule

Site Area (excl. Sandy Lane/Chapel Lane/Old Upton Lane Improvements): 14.11 ha
Undeveloped Land: 5.26 ha
Development Parcels: 8.85 ha
Number of Homes: 350 homes
Gross Density: 25 homes/ha
Net Density: 40 homes/ha

Homes on rural interface not exceeding 25 homes/hectare to create soft incremental transition.

Potential future link to adjoining allocated land

Key

- Site Boundary
- Existing Trees
- Existing Hedgerows
- Existing Wetlands & Watercourses
- Indicative Attenuation Basins
- Green Infrastructure
- Development Parcels
- Public Right of Way
- Footpath
- Footpath/Cycleway
- Avenue
- Streets/Lanes
- Shared Drives
- Feature Buildings
- Vehicle gateways/
Pedestrian gateways

e*SCAPE 10 years
urbanists 2009 - 2019

Project Title
Chapel Lane, Widnes

e*SCAPE Job No.
022-009

Client
Taylor Wimpey North West

Drawing Number
022-009-P004

Revision
REV F

Drawing Title
Parameters Masterplan

Scale
1:2,500 @ A3

Date
December '22



0m 20m 40m 60m 80m 100m
Scale 1:2,500 (@A3)

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Appendix E Flood Risk Maps

Flood map for planning

Your reference
Flood Zone Map

Location (easting/northing)
349895/387847

Created
28 Sep 2022 15:13

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

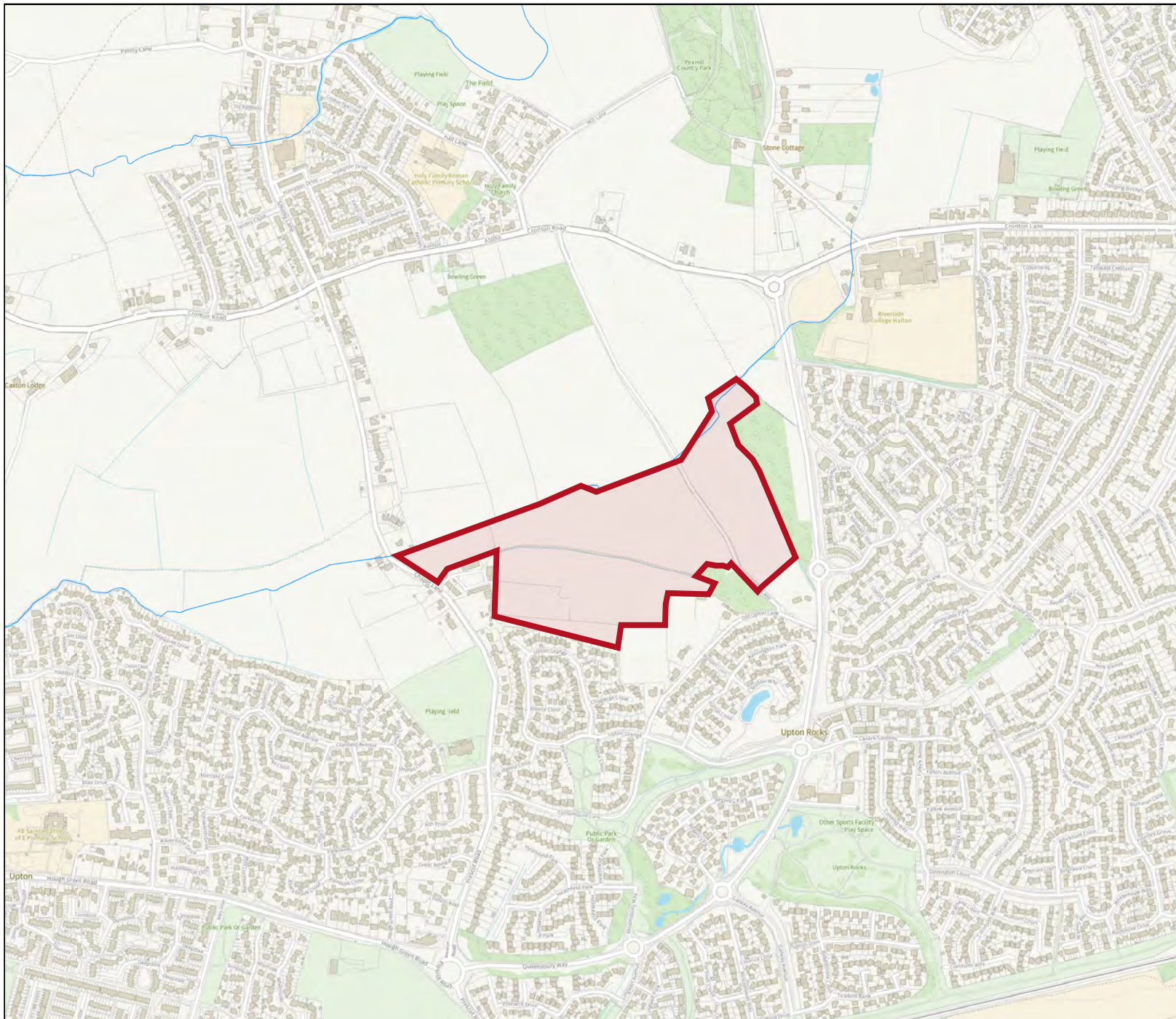
Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2021 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference
Flood Zone Map

Location (easting/northing)
349895/387847

Scale
1:10000

Created
28 Sep 2022 15:13

-  Selected area
-  Flood zone 3
-  Flood zone 3: areas benefiting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area

0 100 200 300m

Flood risk

Extent of flooding



Location

Enter a place or postcode



Extent of flooding from surface water

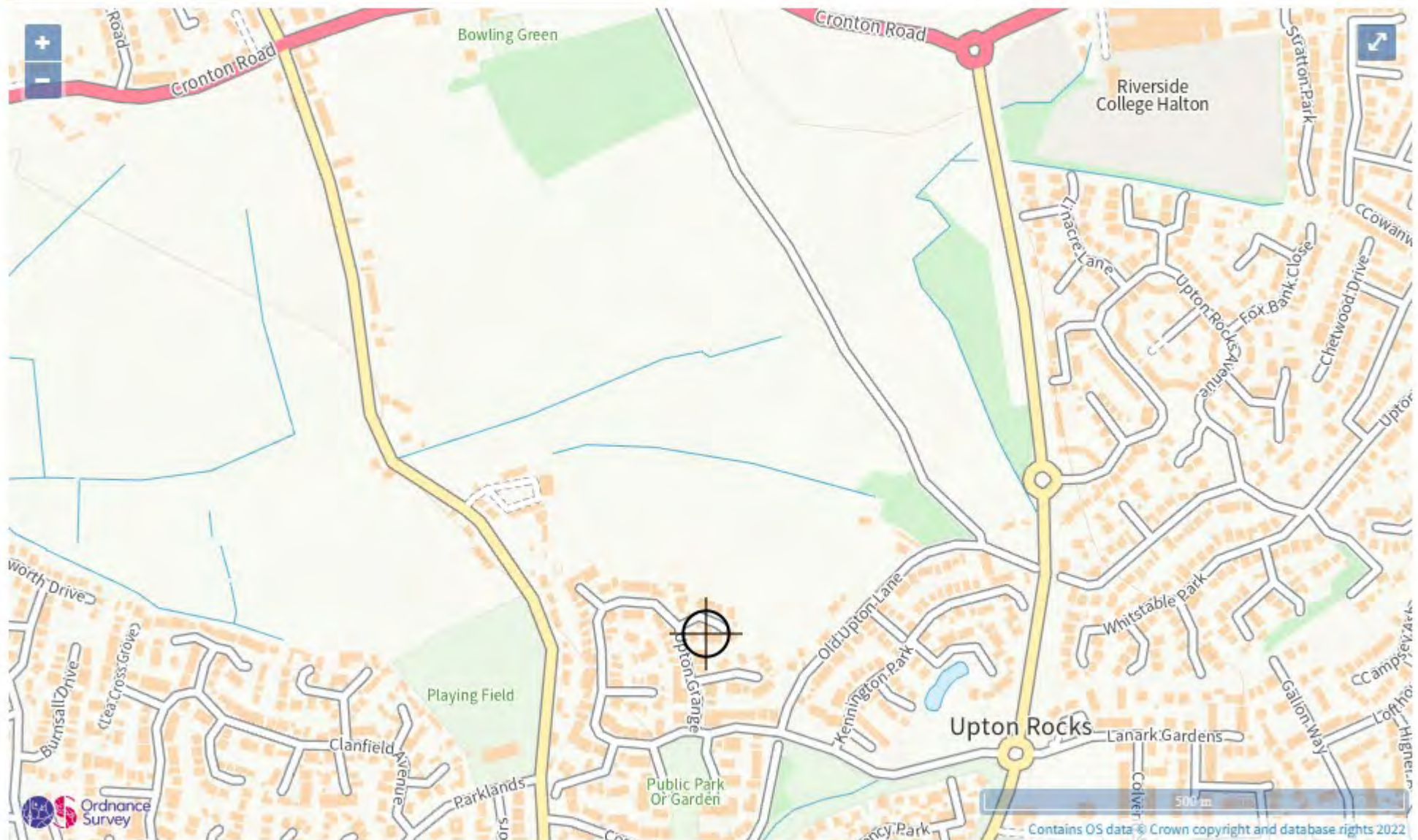
● High ● Medium ● Low ○ Very low ⊕ Location you selected

Flood risk

Location

Extent of flooding

Enter a place or postcode



Extent of flooding from rivers or the sea

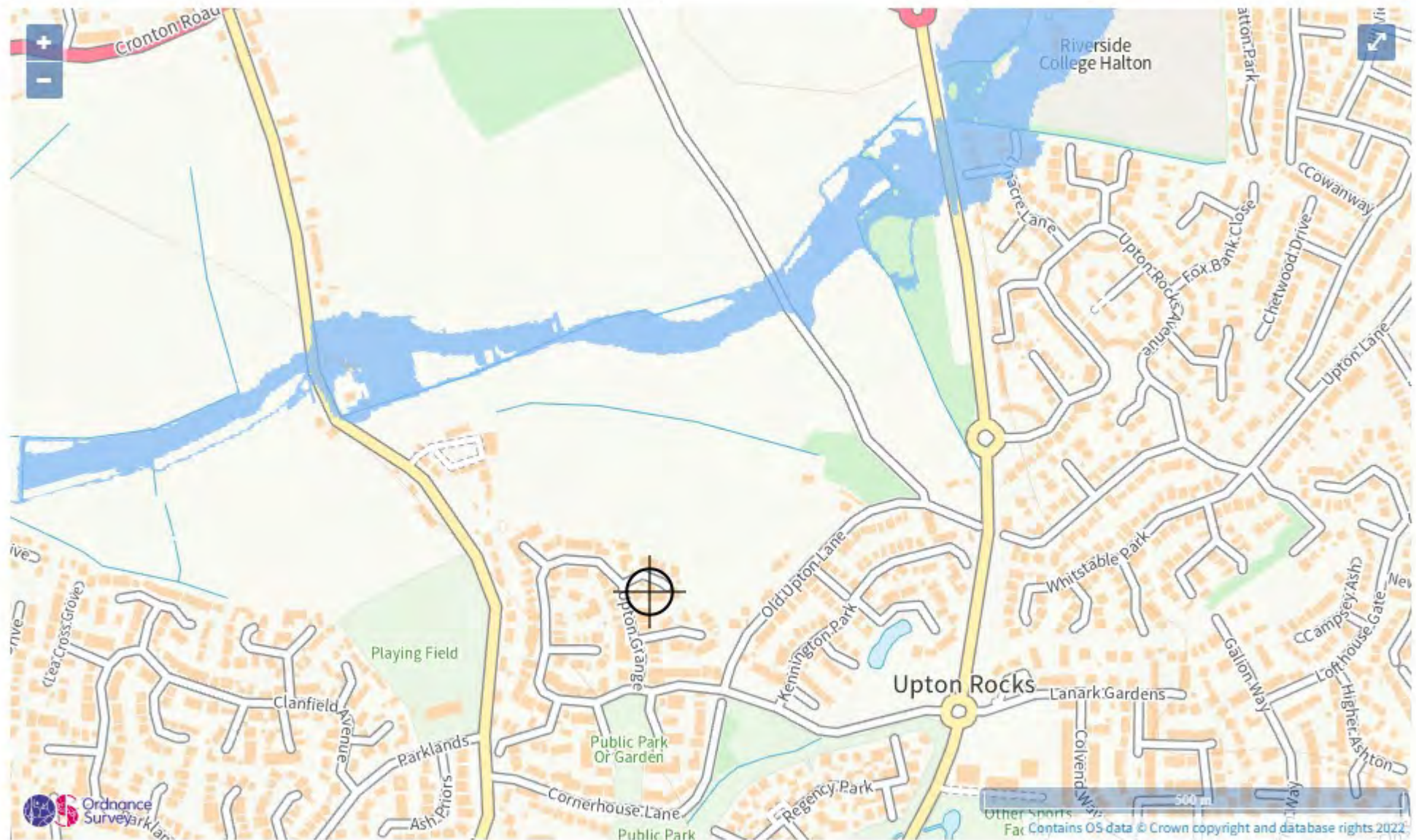
● High ● Medium ● Low ● Very low ⊕ Location you selected

Flood risk

Location

Extent of flooding

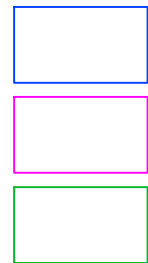
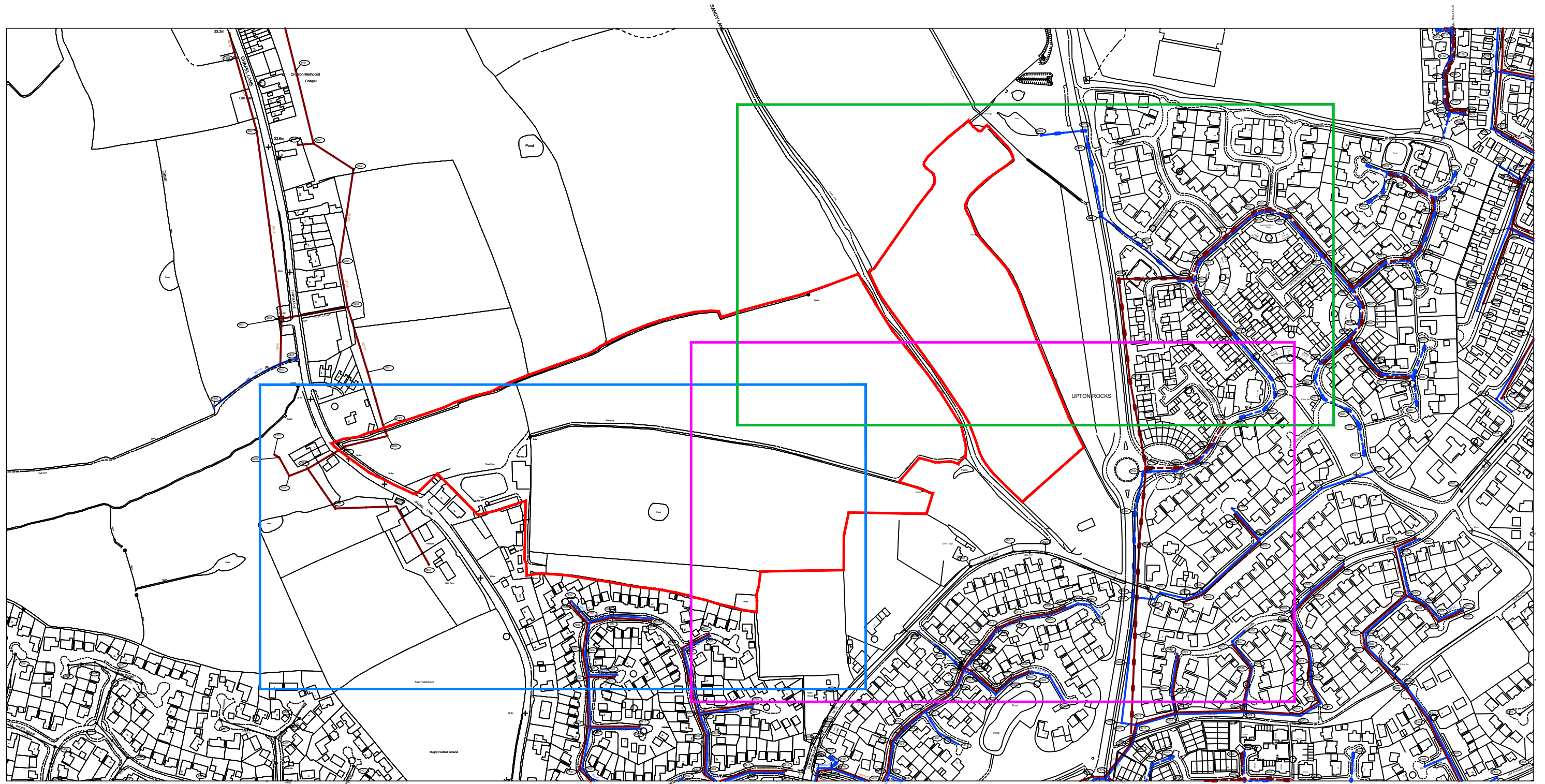
Enter a place or postcode



Maximum extent of flooding from reservoirs:

● when river levels are normal ● when there is also flooding from rivers ⊕ Location you selected

Appendix F UU Maps & Correspondence

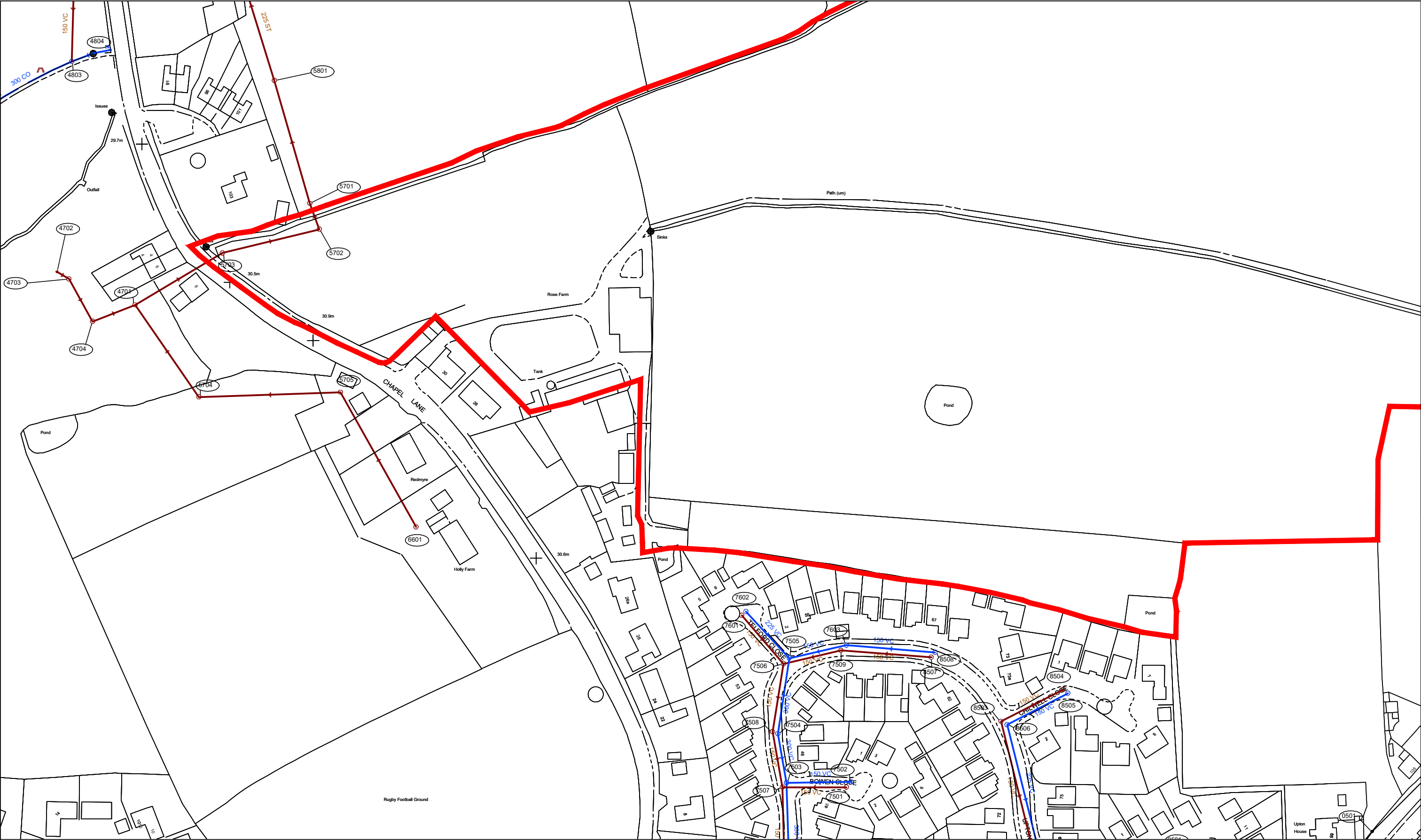


APPENDIX F-1

APPENDIX F-2

APPENDIX F-3

REV	DATE	DESCRIPTION	BY	APP	SCALE @ A3:	DESIGNED:	DRAWN:	CHECKED:	APPROVED:	DATE:
PROJECT: CHAPEL LANE, WIDNES					NTS	-	-	-	-	MAY 2022
TITLE: EXISTING UU RECORDS - MASTER					AJP est. 1978 consulting engineers 0151 227 1462 info@ajpltd.co.uk 91 Dale Street, Liverpool, L2 2ET					
STATUS:	PROJECT No:	DRAWING No:	REV:							
-	219-114	APPENDIX F	-							



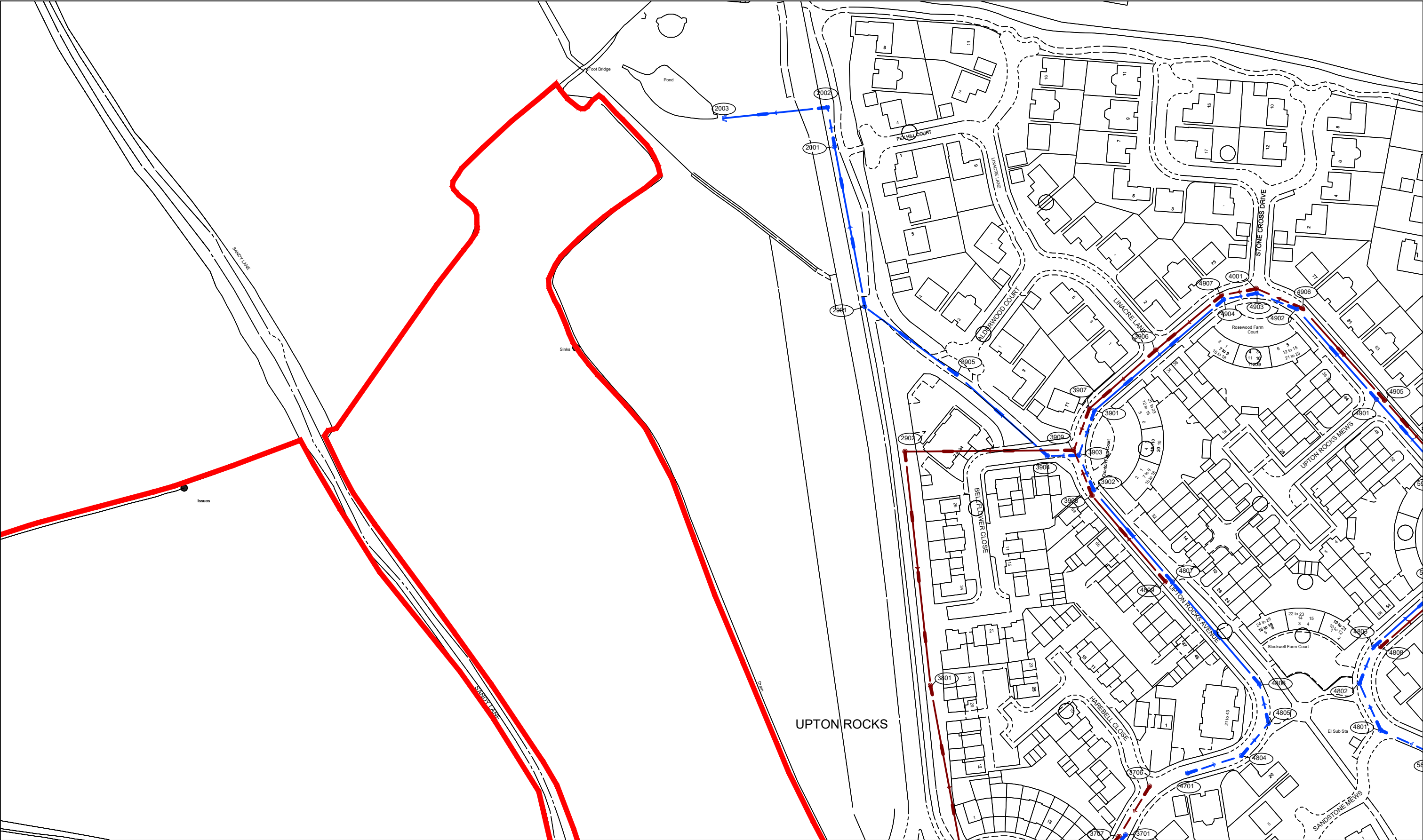
REV	DATE	DESCRIPTION	BY	APP
PROJECT: CHAPEL LANE, WIDNES				
TITLE: EXISTING UU RECORDS				
STATUS: -		PROJECT No: 219-114	DRAWING No: APPENDIX F-1	REV: -

SCALE @ A3: NTS	DESIGNED: -	DRAWN: -	CHECKED: -	APPROVED: -	DATE: MAY 2022
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AJP consulting engineers

est. 1978 0151 227 1462 info@ajpltd.co.uk 1 Dale Street, Liverpool, L2 2ET



REV	DATE	DESCRIPTION	BY	APP
PROJECT: CHAPEL LANE, WIDNES				
TITLE: EXISTING UU RECORDS				
STATUS: -		PROJECT No: 219-114	DRAWING No: APPENDIX F-3	REV: -

SCALE @ A3: NTS	DESIGNED: -	DRAWN: -	CHECKED: -	APPROVED: -	DATE: MAY 2022
-----------------	-------------	----------	------------	-------------	----------------



consulting engineers

0151 227 1462 info@ajpltd.co.uk 1 Dale Street, Liverpool, L2 2ET

Appendix G Proposed Hydraulic Calculations

Alan Wood & Partners		Page 1
1 Dale Street Liverpool L2 2ET	219-114 Chapel lane Widnes Greenfield Run off Rev A	
Date 22/01/2024 15:35 File	Designed by JCM Checked by JLS	
Innovyze Source Control 2020.1.3		
ICP SUDS Mean Annual Flood Input Return Period (years) 2 Soil 0.450 Area (ha) 8.380 Urban 0.000 SAAR (mm) 826 Region Number Region 10 Results l/s QBAR Rural 44.7 QBAR Urban 44.7 Q2 years 41.6 Q1 year 38.9 Q30 years 75.8 Q100 years 92.9		
©1982-2020 Innovyze		

Quick Storage Estimate

Micro Drainage

Variables

FSR Rainfall

Return Period (years)

Region

Map

Ratio R

Cv (Summer)

Cv (Winter)

Impermeable Area (ha)

Maximum Allowable Discharge (l/s)

Infiltration Coefficient (m/hr)

Safety Factor

Climate Change (%)

Analyse OK Cancel Help

Enter Climate Change between -100 and 600

Quick Storage Estimate

Micro Drainage

Results

Global Variables require approximate storage of between 5512 m³ and 7439 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Climate Change between -100 and 600

Appendix H Phase II Geotechnical Report



e3p

Phase II Geoenvironmental Site Assessment
Chapel Lane, Widnes

Reference: 13-759-R1-1
Date: December 2020



PHASE II GEOENVIRONMENTAL SITE ASSESSMENT

Land off Chapel Lane
Widnes
WA8 4NX

Prepared for:

Taylor
Wimpey

Report Ref: 13-759-R1-1
Date Issued: December 2020

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<https://e3p.co.uk/>

Registered in England
CRN: 807255262

QUALITY ASSURANCE

PROJECT NUMBER	13-759-R1		
VERSION	Version 1		
REMARKS	Draft for Comment		
DATE	18 th December 2020		
PREPARED BY	V Wilkinson		
QUALIFICATIONS	MESci (Hons), FGS		
SIGNATURE			
CHECKED BY	J Sheridan		
QUALIFICATIONS	MeSci, FGS		
SIGNATURE			
AUTHORISED BY	S Cox		
QUALIFICATIONS	BSc (Hons), FGS, PIEMA, MIEEnvSci, CEnv		
SIGNATURE			

EXECUTIVE SUMMARY

Site Address	Land off Chapel Lane, Widnes, WA8 4NX	
Grid Reference	E 349898, N 387838	
Site Area	21.68 Ha.	
Current Site Use	The site is roughly divided into two areas; land to the east of Sandy Lane, which comprises a field with an area of overgrown vegetation along the east boundary; and, the land to the west of Sandy Lane which comprises fields and Rose Farm (active) in the far west, containing large silos, farming machinery and above ground storage tanks. A footpath orientated roughly East – West connects Rose Farm with Sandy Lane. The site is generally flat with the undulations/depressions in the southern field.	
Proposed Development	Taylor Wimpey NW intends to construct a low-rise residential development comprising residential dwellings with associated gardens, estate roads and infrastructure. The proposed layout has not yet been finalised.	
Environmental Setting	Drift Geology	Till (Devensian – CLAY) across the site.
	Bedrock Geology	Chester Formation - SANDSTONE
	Faults	Two faults present to the east of site.
	Hydrogeology	Secondary Undifferentiated aquifer (drift), underlain by a Principal aquifer (bedrock). There are no licenced water abstractions within 250 m of site.
	Hydrology	An unnamed brook is present adjacent to the northern boundary.
	Flood Risk	Unaffected by flooding from rivers.
Site History	Historically, the site is shown to be utilised as agricultural fields with several ponds and field boundaries present throughout. Sandy Lane (formerly known as Upton Lane) is present in the east, orientated roughly north-south, bisecting the site. A public footpath is also present oriented roughly east-west from Chapel Lane to Sandy Lane. No significant changes occurred on the site until Pre 1989 when Rose Farm is shown on mapping with associated farm buildings in the west, with all ponds now infilled with the exception of one located in the south.	
Previous Reports	E3P has been provided with a Phase 1 desk study 'Desk Study Report for Chapel Lane, Widnes' by Betts Geo Consulting Engineers (report number: 19TAY046/DS). A full summary is provided in Section 2.1, with the key contaminant sources, receptors and human health risk assessment summarised below: Possible Contamination Sources; Current/Historical Site Use Ponds Agricultural use Pathways and Receptors Aquifers – Significant Risk; Low probability. The Shropshire Union Canal is also listed as a potential receptor, however, on review of the surroundings, this is considered to be well outside of influencing distance. The qualitative risk assessment concludes a generally Low – Moderate (Localised) risk for contamination and ground gas.	



Utility Locations	Online plans show a sewer present in the western sector of site with a trunk main present though Chapel lane to the west of site. Anecdotal information from the agricultural tenant also indicates presence of the following: - Private water pipes in the west of site supplying all farm buildings. - Electricity in the farmyard creating a loop from the cattle shed, south, then back north towards the farm buildings. - A foul drainage pipe is also present in the west, orientated north-south, fed from the farm to a septic tank near the access track, then out falling at the northern boundary. - A surface water drain roughly orientated east-west is also present within the central and eastern field.
Landfill Sites and Ground Gases	There are no present or historical landfill sites located within 500 m of site.
Radon	Unaffected – no special precautions required.
Coal Mining/Land Stability	The site is located within a Coal Mining Reporting Area; however, it is not located within an area deemed as high risk.
Brine Workings	The proposed development is not located within the Cheshire Brine Compensation District; therefore, is unaffected by brine workings.
Hazardous Installations	No hazardous installations that could potentially prejudice the proposed construction of highly sensitive residential dwellings have been identified within influencing distance of the subject site.

SITE INVESTIGATION

Ground Investigation Works	E3P has completed an intrusive ground investigation comprising: 44 No Mechanically excavated trial pits 36 No Window sample boreholes 2 No Cable percussion boreholes 10 No Dynamic cone penetrometer tests 6 No BRE365 soakaway tests 1 No hand excavated pit to investigate existing surface water drain Selected window sample boreholes were fitted with environmental monitoring installations to enable gas and groundwater monitoring.
Ground Conditions	MADE GROUND – 0.00 m bgl to 1.80 m bgl Made Ground deposits were encountered within thirteen exploratory hole locations to depths of between 0.30 m and 1.80 m bgl although, in general, Made Ground was encountered to a depth of less than 0.80 m bgl. Made Ground deposits comprise a reworked topsoil of dark brown sandy clay with gravel of mudstone and sandstone with selected areas containing fragments of occasional brick and concrete. The majority of locations were underlain by a black sandy mudstone gravel (land drain bedding). A hand excavated pit was conducted to investigate existing surface water drain. The top of the drain was located 0.40 m bgl. The material above comprised of a reworked topsoil underlain by brown mottled grey slightly gravelly sandy clay.



	TOPSOIL – 0.00 m bgl to 0.70 m bgl Topsoil was encountered within the majority of location between 0.00 m bgl and 0.70 m bgl, comprising dark brown slightly gravelly sandy clay with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone. DRIFT – 0.30 m bgl to 16.95 m bgl Drift generally comprises firm brown mottled grey slightly gravelly sandy CLAY with gravel of mudstone, underlain by a stiff brown slightly gravelly sandy CLAY where gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Some locations encountered occasional cobbles of subrounded to rounded mudstone and sandstone. Low strength clays were encountered within 8 locations across the site. Seven locations were between a depth of 1.00 m and 1.65 m bgl (CP101, CP102, WS101, WS105, WS121, WS128 and WS132) with WS114 recording soft clays between 2.00 m and 3.45 m bgl. Medium dense SAND was encountered within two locations WS104 (0.30 m–0.40 m bgl) and WS136 (1.00 m–3.40 m bgl) Gravel with sand bands was encountered between 12.00 m and 13.10 m bgl within CP102.
	SOLID – 2.00 m bgl to 5.30 m bgl Weathered bedrock comprising reddish brown SANDSTONE was encountered within the east of the site between 2.00 m (WS101) and 5.30 m bgl (CP101). Bedrock was not encountered in the central or western areas of site, with one location (CP102) advancing to 16.95 m bgl in Clay drift deposits, indicating the bedrock is significantly deeper within these areas.
	GROUNDWATER – Groundwater was encountered between 0.40 m bgl and 12.00 m bgl during the site investigation with monitoring recording groundwater levels between ground level and 3.43 m bgl

CONTAMINATED LAND ASSESSMENT

Human Health	The Tier 1 human health risk assessment identified the concentrations of the following in exceedance of screening criteria relevant to a residential end use with plant uptake: ▪ Chromium VI – TP125 Made Ground at 0.1 m bgl; ▪ Lead – TP138 Made Ground at 0.1 m bgl; and, ▪ Asbestos (<0.001%) – TP145 Made Ground at 0.80 m bgl Which present unacceptable degrees of theoretical risk to the identified receptors associated with ingestion of soils and inhalation of particulate, respectively. Delineation and segregation of this impacted material will be required to ensure it is placed in an area of reduced sensitivity such as: ▪ Beneath 600 mm clean cover within private gardens;
----------------------------	---



	- Within POS – Material from TP125 and TP138 will be suitable for use as topsoil within areas of POS. However, asbestos impacted material would need to be placed below 300 mm clean cover); or, - Beneath plots/hardstanding/roads. With the exception of the locations noted above, topsoil and subsoil deposits on site are considered suitable for re-use, subject to further chemical validation testing. Further post-demolition investigations are required in the farmyard area in the west of the site to confirm the findings of this initial assessment as and when full and unrestricted access is available.
Controlled Waters	Exceedances of EQS and DWS values have been detected within leachate and water samples analysed including arsenic, copper, total cyanide, lead, nickel and zinc. M-BAT and Pb assessment has confirmed the determinands to be of low bioavailability and thus do not pose a risk to surface water courses. Soakaway testing undertaken at the site has confirmed that the infiltration rate is very low, and the low permeability of the material will therefore significantly reduce the potential for downward or lateral migration. Based on the above, there is considered to be no unacceptable level of risk to the controlled waters receptors.
Ground Gas	Current assessment based on initial monitoring visit confirms one area of the site (WS102) identifies levels of CO₂ that would require CS2/Amber 1 classification. The monitoring well is located within Made Ground strata; therefore, delineation of the Made Ground would remove the source of CO₂ decreasing the classification to CS1/Green. WS114 has encountered levels of methane that have been assessed as CS4/Red classification. This area was historically a pond; therefore, the infill material is thought to be the source of high methane levels, although the monitoring well was noted to be flooded on recent occasions and thus results be not be reflective of the true gassing regime. Completion of ground gas monitoring is required, ensuring water is removed from wells beforehand. If high concentrations persist, delineation and removal of the source of elevated carbon dioxide and methane (made ground/pond) within the vicinity of these locations may be required to mitigate the risk to end users.
Potable Water Infrastructure	Based on the assessment of current site conditions it is likely that PE pipe can be used at the proposed development. This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.

GEOTECHNICAL ASSESSMENT

Underground Obstructions	No obstructions were encountered during site investigations; however, there is potential for obstructions to be present below current farm buildings and hard standing areas in the west. Further investigation will be required post-demolition.
---------------------------------	--



	During a phase of cut-and-fill enabling works to create a developable platform, all below-ground obstructions (if encountered) will require grubbing out to the base of the Made Ground to enable the construction of proposed plots.
Allowable Bearing Pressure	The underlying cohesive deposits generally comprise firm to very stiff brown slightly gravelly CLAY circa 0.5 m bgl – 4.0 m bgl which would provide a net ABP in the order of >100 kN/m². Localised areas of soft/firm (low strength) clays were encountered in 8 locations across site (CP101, CP102, WS101, WS105, WS115, WS121, WS128 and WS132) with an ABP of 10–40 kN/m² which will require removal and replacement with suitable engineered fill. The weathered SANDSTONE if encountered at foundation depth is anticipated to provide an ABP >400 kN/m².
Foundation Options	Based on existing levels is considered that the optimum foundation solution for the proposed residential development would be as follows: - Standard strip/trench foundations bearing onto firm/stiff CLAY or weathered SANDSTONE (suitably deepened in areas of tree influence and locally softer clays); - Piles in areas of soft/loose soils and in close proximity of trees. However, a programme of remediation and enabling works may be required to provide suitable development platform levels. Therefore, upon completion of these enabling works, it is possible that a deeper/abnormal foundation solution may be required in areas of the site where levels have been raised.
Building Floor Slabs	Suspended floor slabs considered most suitable.
Heave Precautions	Given that the underlying clay is of low volume change potential, heave precautions will not be required to the internal face of a foundation less than 1.5 m in depth. Heave precautions will be required to the underside of floor slabs (where there is no 200 mm void).
Soakaway Drainage	Soakaway tests indicate the underlying CLAY soils will not be suitable for soakaway drainage and alternative means of suitable surface water disposal will be required.
Sulphate Assessment	Concrete classification will be DS1 AC1s.
CBR Design %	Natural clay soils will provide a CBR in the order of 3–5% during drier climatic periods; however, if water is allowed to shed onto the formation, the CBR will reduce to < 2%, which will require specialist engineering of the subgrade.
Cut/Fill	A phase of cut-and-fill enabling works may be required in order to create a proposed development platform suitable for a residential development. Proposed levels are currently unknown but are expected to remain similar to current.
Civil Engineering Excavations	Shallow bedrock has been identified within the east at a minimum depth of 2.0 m bgl, which may impede foundations/service excavations if levels are to be reduced or deep installations are proposed.
Waste Characterisation	Any material that is to be disposed off-site should undergo assessment using Technical Guidance WM3: <i>Waste Classification – Guidance on the classification and assessment of waste</i> .

RECOMMENDATIONS

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

-  Further post-demolition investigation in the farmyard area in the west of the site;



-  Plot-specific foundation schedule (upon receipt of the final development levels and layout);
-  Arboricultural survey;
-  Materials management plan;
-  Geotechnical earthworks strategy (infrastructure);
-  Remediation and enabling works strategy; and,
-  Full three-dimensional earthworks cut/fill model.



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DRAWING LIST

13-759-R1-001 - Site Location Plan
13-759-R1-002 - Proposed Development Plan
13-759-R1-003 - Historical Features Plan
13-759-R1-004 - Site Features Plan
13-759-R1-005 - Exploratory Hole Location Plan
13-759-R1-007 - Depth of Topsoil Plan
13-759-R1-010 - Conceptual Site Model
13-759-R1-012 - Depth to Bedrock Plan
13-759-R1-015 - Development Constraints Plan



1. INTRODUCTION

1.1. BACKGROUND

E3P has been commissioned by Taylor Wimpey NW to undertake a detailed Phase II Geoenvironmental Site Assessment for a parcel of agricultural land to the east of Chapel Lane, Widnes.

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

The scope of work includes the following elements:

- ✿ Detailed review of historic information;
- ✿ Design of suitable intrusive ground investigation;
- ✿ 36 no. window sample probeholes with 24 no. environmental monitoring installations;
- ✿ 2 no. deep cable percussive boreholes;
- ✿ 45 no. mechanically excavated trial pits;
- ✿ 6 no. BRE365 soakaway tests;
- ✿ 10 no. dynamic Cone Penetrometer (DCP) tests to determine in-situ CBR % using a TRL probe;
- ✿ 1 no. hand dig pit to confirm the location and condition of an existing surface water drain;
- ✿ Chemical and geotechnical laboratory analysis;
- ✿ Groundwater monitoring and sampling;
- ✿ Ground gas monitoring;
- ✿ Contamination risk assessment and conceptual site model;
- ✿ Geotechnical assessment and interpretation; and,
- ✿ Factual and interpretive reporting.

1.2. PROPOSED DEVELOPMENT

Taylor Wimpey NW intends to construct a low-rise residential development comprising residential dwellings with associated gardens, estate roads and infrastructure. Drawing 13-759-002 (Appendix III) presents the proposed development layout.

A snapshot of the proposed development layout is indicated in Figure 1.1.



FIGURE 1.1 SNAPSHOT OF PROPOSED DEVELOPMENT MASTERPLAN



1.3. OBJECTIVES

The objectives of the geoenvironmental assessment are as follows:

- ✳ Undertake a preliminary stage of sampling and analysis to provide an overview of environmental issues identified.
- ✳ Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors.
- ✳ Assess the geotechnical information and provide preliminary recommendations in relation to foundations, pavement construction and floor slabs.
- ✳ Provide recommendations regarding future works required.

1.4. LIMITATIONS

The limitations of this report are presented in Appendix I.

1.5. CONFIDENTIALITY

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



2. GROUND INVESTIGATION

2.1. PHASE I DESK STUDY SUMMARY

E3P has been provided with a Phase 1 desk study 'Desk Study Report for Chapel Lane, Widnes' by Betts Geo Consulting Engineers (report number: 19TAY046/DS). A summary of the report is provided below.

CURRENT SITE

- ✿ The site is roughly divided into two areas, the first area lies to the East of Sandy lane and comprises a field with an area of overgrown vegetation along the east boundary. The second area lies to the west of Sandy lane and comprises the active Rose Farm in the far west of site containing large silos, potential fuel storage.
- ✿ A footpath orientated roughly East – West connects Rose Farm with Sandy Lane at an area of overgrown vegetation fronting Sandy Lane.
- ✿ Depressions were noted in the surface potentially indicating infilled ponds.
- ✿ Site is generally flat with the previously mentioned undulations/depressions in the southern field.

SITE HISTORY

- ✿ 1849-1850 – The site comprises agricultural fields. Two footpaths, five ponds and field boundaries are also shown across site. Upton Lane is present in the east oriented roughly north-south, dissecting the agricultural fields.
- ✿ 1891 – Many of the field boundaries are no longer present and Upton Lane is now marked as Sandy Lane.
- ✿ 1925-1926 – A watercourse is shown running along the north boundary of site from east to west. A possible watercourse/ditch line is also shown through the centre of site, possibly culverted to the west.
- ✿ 1985-1989 – Rose Farm is shown in the west of site with buildings and glasshouse. To the east of site, a watercourse is shown with Sinks. A pond in the centre of site is no longer shown.
- ✿ 2002 – Additional Issues and Sinks are marked along the north boundary of site. No further major changes occur on-site until the 2010 1:10,000 map when a new pond is also shown in the north east of site.

HYDROGEOLOGY AND HYDROLOGY

- ✿ The superficial deposits (Glacial Till) are designated as Secondary (Undifferentiated) aquifer.
- ✿ The bedrock deposits (Chester Sandstone Formation) are designated as Principal aquifer.
- ✿ The site lies within Groundwater Source Protection Zone 3 – Total Catchment as defined by the Environment Agency.
- ✿ There are no licenced water abstractions within 250 m of site.



RADON PROTECTION

- ✳ The site lies within a low risk area of radon less than 1% of homes are estimated to be above the action level, therefore no radon protection measures are required for new dwellings or extensions.

SUMMARY OF ENVIRONMENTAL DATA

- ✳ Possible Contamination Sources;
 - Current/Historical Site Use
 - Ponds
 - Agricultural use

PATHWAYS AND RECEPTORS

- ✳ Aquifers – Significant Risk; Low likelihood.
- ✳ *Shropshire Union Canal, Adjacent to Site – Significant Risk; Possible.

*The Shropshire Union Canal is listed as a potential receptor, however, on review of the surroundings, this is considered to be well outside of influencing distance and has therefore not been considered further.

QUALITATIVE RISK ASSESSMENT

- ✳ In this qualitative risk assessment, a generally Low - Moderate (Localised) risk for contamination.

2.2. GENERAL OVERVIEW

A ground investigation has been designed based on the findings of the desk study, with exploratory holes advanced to target specific potential contaminant sources summarised in Table 2.1. The investigation has also been used to collect geotechnical information to assist in the design and construction of the proposed development.

Exploratory fieldwork was completed between 24th August 2020 and 26th August 2020. The works are summarised in Table 2.1.



TABLE 2.1 SUMMARY OF FIELDWORK

POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
General Ground Conditions Including the Presence/Nature of Obstructions	WS101	Window Sample Probehole	2.45	0.50–2.00
	WS102		2.30	0.50–1.50
	WS103		4.61	1.00–4.00
	WS105		3.30	N/A
	WS106		4.40	1.0–4.0
	WS107		4.45	N/A
	WS109		4.40	0.50–2.50
	WS110		5.45	N/A
	WS111		5.45	1.00–4.00
	WS112		5.45	1.00–4.00
	WS113		5.45	1.00–5.00
	WS115		5.45	1.00–5.00
	WS116		5.45	N/A
	WS117		5.45	1.00–5.00
	WS118		5.45	N/A
	WS119		5.45	1.00–4.00
	WS120		5.45	1.00–5.00
	WS121		5.45	1.00–5.00
	WS122		5.45	N/A
	WS124		5.45	1.00–5.00
	WS125		5.45	1.00–5.00
	WS126		5.45	1.00–4.00
	WS127		5.45	1.00–5.00
	WS128		5.45	1.00–5.00
	WS129		5.45	1.00–5.00
	WS130		3.40	1.00–3.00
	WS131		5.45	1.00–5.00
	WS132		5.45	1.00–5.00
	WS133		5.45	N/A
	WS134		5.45	N/A
	WS135		3.10	N/A
	WS136		3.40	N/A
	TP102	Mechanically Excavated Trial Pit	2.10	N/A
	TP109		2.00	N/A
	TP110		2.00	N/A
	TP111		2.10	N/A



POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
General Ground Conditions Including the Presence/Nature of Obstructions	TP112	Mechanically Excavated Trial Pit	1.90	N/A
	TP113		2.20	N/A
	TP114		2.20	N/A
	TP115		2.10	N/A
	TP116		2.20	N/A
	TP117		2.00	N/A
	TP118		2.10	N/A
	TP119		2.40	N/A
	TP120		2.00	N/A
	TP121		2.40	N/A
	TP122		2.40	N/A
	TP123		2.20	N/A
	TP124		2.30	N/A
	TP125		2.20	N/A
	TP126		2.20	N/A
	TP127		2.10	N/A
	TP128		2.20	N/A
	TP129		2.30	N/A
	TP130		2.20	N/A
	TP131		2.30	N/A
	TP132		2.50	N/A
	TP133		2.40	N/A
	TP134		2.40	N/A
	TP135		1.70	N/A
	TP136		2.00	N/A
	TP137		2.80	N/A
	TP138		2.00	N/A
	TP139		0.90	N/A
	TP140		2.00	N/A
	TP141		0.90	N/A
	TP142		2.00	N/A
	TP143		0.80	N/A
	TP144		2.00	N/A
	TP145		1.00	N/A
Investigation of Historically Infilled Ponds	WS104	Window Sample Probehole	3.80	1.00–3.00



POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
Investigation of Historically Infilled Ponds	WS108	Window Sample Probehole	2.70	0.50–1.50
	WS114		5.45	1.00–4.00
	TP103	Mechanically Excavated Trial Pit	2.30	N/A
	TP111		2.10	
Investigation of Above Ground Storage Tank and General Ground Conditions Including the Presence/Nature of Obstructions	WS123	Window Sample Probehole	5.45	1.00–5.00
General Deep Ground Conditions Including the Presence/Nature of Obstructions	CP101	Cable Percussive Boreholes	5.95	N/A
	CP102		16.95	N/A
Inspection of surface water drain	HP101	Hand Excavated Pit	0.40	N/A
General Ground Conditions /Investigation of Soakaway Potential	TP101/SA101	Mechanically Excavated Trial Pits	1.80	N/A
	TP104/SA102		1.80	
	TP105/SA103		1.80	
	TP106/SA104		1.70	
	TP107/SA105		1.90	
	TP108/SA106		1.80	

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

Soakaway tests were conducted within TP101/SA101, TP104/SA102, TP105/SA103, TP106/SA104, TP107/SA105 and TP108/SA106 generally in accordance with BRE365 methodology.

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

A hand excavated pit was conducted to investigate the existing surface water drain that is present in the central and eastern fields.

The sampling locations are illustrated in Drawing 13-759-005 (Appendix III). The ground conditions encountered are indicated on the logs, which are provided in Appendix V.

Return visits were made to monitor installations for groundwater level and gas concentrations. In addition, selected wells were purged and samples of groundwater recovered for chemical analysis.

2.3. IN-SITU STANDARD PENETRATION TESTING (SPT)

In-situ geotechnical testing was conducted using the standard penetration test (SPT) and, where the ground is granular, a 60° cone (SPT(C)) was used instead of the sampling tube.



The results are shown in the probehole logs in Appendix V and presented in Table 3.5 and discussed in Section 5.

2.4. IN-SITU CALIFORNIA BEARING RATIO (CBR)

In-situ CBR tests were undertaken at selected locations using a TRL probe. Tests were undertaken at depths of between 0.3 m and 1.0 m below ground level in order to intersect the likely pavement sub formation level.

The results are presented in Table 3.9 and test certificates are included within Appendix VIII.

2.5. PERMEABILITY TESTS

Six soakaway tests were undertaken (SA101–SA106) in order to assess the likely permeability of the underlying strata to determine the potential suitability for soakaway drainage within the proposed development.

The results are presented in Table 3.7 and the test certificates are included within Appendix IX.

2.6. LABORATORY ANALYSIS

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

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

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

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

- ✳ Atterberg limits determinations;
- ✳ Moisture content;
- ✳ Particle Size Density tests;
- ✳ 2.5kg Compaction Tests;
- ✳ One Dimensional Consolidation Test;



-  Multistage triaxial test; and,
-  Single-stage triaxial tests.

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



3. GROUND AND GROUNDWATER CONDITIONS

3.1. SUMMARY OF GROUND CONDITIONS

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

TABLE 3.1 SUMMARY OF STRATA

HOLE	DEPTH TO STRATUM (m bgl)						
	TOPSOIL	MADE GROUND	FIRM TO STIFF CLAY	VERY STIFF CLAY	SAND	VERY SOFT TO SOFT CLAY	BED ROCK
TP101	0.00–0.40	–	0.40–0.80	–	–	–	–
TP102	0.00–0.30	–	0.30–2.10	–	–	–	–
TP103	0.00–0.30	–	0.30–2.30	–	–	–	–
TP104	0.00–0.40	–	0.40–1.80	–	–	–	–
TP105	0.00–0.30	–	0.30–1.80	–	–	–	–
TP106	0.00–0.30	–	0.30–1.70	–	–	–	–
TP107	0.00–0.30	–	0.30–1.90	–	–	–	–
TP108	0.00–0.40	–	0.40–1.80	–	–	–	–
TP109	0.00–0.60	–	0.60–2.00	–	–	–	–
TP110	0.00–0.30	–	0.30–2.00	–	–	–	–
TP111	0.00–0.40	–	0.40–2.10	–	–	–	–
TP112	0.00–0.30	–	0.30–1.90	–	–	–	–
TP113	0.00–0.40	–	0.40–2.20	–	–	–	–
TP114	0.00–0.30	–	0.30–2.20	–	–	–	–
TP115	0.00–0.30	–	0.30–2.10	–	–	–	–
TP116	0.00–0.40	–	0.40–2.20	–	–	–	–
TP117	0.00–0.40	–	0.30–2.10	–	–	–	–
TP118	0.00–0.30	–	0.30–2.10	–	–	–	–
TP119	0.00–0.30	–	0.30–2.40	–	–	–	–
TP120	0.00–0.30	–	0.30–2.00	–	–	–	–
TP121	0.00–0.40	–	0.40–2.40	–	–	–	–
TP122	0.00–0.30	–	0.30–2.40	–	–	–	–
TP123	0.00–0.40	–	0.40–2.20	–	–	–	–
TP124	–	0.00–0.70	0.70–2.30	–	–	–	–
TP125	0.00–0.30	–	0.30–2.20	–	–	–	–
TP126	0.00–0.30	–	0.30–2.20	–	–	–	–
TP127	0.00–0.30	–	0.60–2.10	–	–	–	–
TP128	0.00–0.60	–	0.70–2.20	–	–	–	–
TP129	0.00–0.30	–	0.40–0.80	–	–	–	–
TP130	0.00–0.20	–	0.20–2.30	–	–	–	–
TP131	0.00–0.20	–	0.20–2.30	–	–	–	–



HOLE	DEPTH TO STRATUM (m bgl)						
	TOPSOIL	MADE GROUND	FIRM TO STIFF CLAY	VERY STIFF CLAY	SAND	VERY SOFT TO SOFT CLAY	BED ROCK
TP132	0.00–0.30	–	0.30–2.50	–	–	–	–
TP133	–	0.00–1.80	1.80–2.40	–	–	–	–
TP134	0.00–0.20	–	0.20–2.40	–	–	–	–
TP135	0.00–0.20	–	0.20–1.70	–	–	–	–
TP136	0.00–0.30	–	0.30–2.00	–	–	–	–
TP137	0.00–0.70	–	0.70–2.80	–	–	–	–
TP138	0.00–0.20	–	–	–	–	–	–
TP139	–	0.00–0.90 full depth not proven	–	–	–	–	–
TP140	0.00–0.30	–	0.30–2.00	–	–	–	–
TP141	–	0.00–0.90 full depth not proven	–	–	–	–	–
TP142	0.00–0.30	–	0.30–2.00	–	–	–	–
TP143	–	0.00–0.80 full depth not proven	–	–	–	–	–
TP144	0.00–0.30	–	0.30–2.00	–	–	–	–
TP145	–	0.00–1.00 full depth not proven	–	–	–	–	–
WS101	0.00–0.50	–	0.50–2.00	–	–	–	2.00–2.45
WS102	–	0.00–1.80	–	1.80–2.30	–	–	–
WS103	0.00–0.70	–	0.70–4.61	–	–	–	–
WS104	0.00–0.30	–	0.40–3.40	3.00–3.40	0.30–0.40	–	3.40–3.80
WS105	0.00–0.40	–	0.40–2.00	2.00–3.30	–	–	–
WS106	0.00–0.30	–	0.40–2.00	2.00–4.40	–	–	–
WS107	0.00–0.30	–	0.30–4.00	4.00–4.45	–	–	–
WS108	0.00–0.40	–	–	1.50–2.50	–	0.40 – 1.50	2.50–2.70
WS109	0.00–0.30	–	0.30–2.00	2.00–4.00	–	–	–
WS110	0.00–0.40	–	0.40–2.00	2.00–5.45	–	–	–
WS111	0.00–0.30	–	0.30–3.00	3.00–5.45	–	–	–
WS112	0.00–0.30	–	0.30–2.00	2.00–5.45	–	–	–
WS113	0.00–0.30	–	0.30–0.40 0.60–3.00	3.00–5.45	–	0.40–0.60	–
WS114	–	0.00–1.50	1.50–5.45	–	–	–	–
WS115	0.00–0.35	–	0.35–3.00	3.00–5.45	–	–	–
WS116	0.00–0.30	–	0.30–2.00	2.00–5.45	–	–	–
WS117	–	0.00–0.80	2.00–3.00	0.80–2.00 3.00–5.45	–	–	–
WS118	0.00–0.30	–	0.30–1.00	1.00–3.50	–	–	–



HOLE	DEPTH TO STRATUM (m bgl)						
	TOPSOIL	MADE GROUND	FIRM TO STIFF CLAY	VERY STIFF CLAY	SAND	VERY SOFT TO SOFT CLAY	BED ROCK
WS119	–	0.00–0.70	0.70–2.00	2.00–5.45	–	–	–
WS120	–	0.00–0.40	0.40–2.00	2.00–5.45	–	–	–
WS121	0.00–0.50	–	0.50–2.00	2.00–5.45	–	–	–
WS122	0.00–0.30	–	0.30–2.00	2.00–5.45	–	–	–
WS123	–	0.00–0.50	0.50–2.00	2.00–5.45	–	–	–
WS124	0.00–0.40	–	0.40–2.00	2.00–5.45	–	–	–
WS125	0.00–0.50	–	0.50–4.00	4.00–5.45	–	–	–
WS126	0.00–0.40	–	0.40–2.00	2.00–5.45	–	–	–
WS127	0.00–0.40	–	0.40–3.00	3.00–5.45	–	–	–
WS128	0.00–0.35	–	0.35–3.00	3.00–4.00	–	–	–
WS129	0.00–0.30	–	0.30–3.00	3.00–5.45	–	–	–
WS130	0.00–0.30	–	0.30–3.00	3.00–3.40	–	–	–
WS131	–	0.00–0.80	0.80–3.00	3.00–5.45	–	–	–
WS132	0.00–0.40	–	0.40–2.00 4.00–5.00	2.00–4.00 5.00–5.45	–	–	–
WS133	0.00–0.40	–	0.40–2.00 4.00–5.00	2.00–4.00 5.00–5.45	–	–	–
WS134	0.00–0.30	–	0.30–3.00	3.00–5.45	–	–	–
WS135	0.00–0.30	–	0.40–3.00	3.00–3.10	–	–	–
WS136	–	0.00–1.00	–	–	1.00–3.40	–	–
CP101	0.00–0.50	–	1.80–5.30	–	–	0.50–1.80	5.30–5.95
CP102	0.00–0.60	–	0.60–12.00	13.10–16.95	12.00–13.10	–	–
HP101		0.00–0.40					

3.2. MADE GROUND

Made Ground deposits were encountered within thirteen exploratory hole locations to depths of between 0.30 m and 1.80 m bgl although, in general, Made Ground was encountered to a depth of less than 0.80 m bgl.

Made Ground deposits comprise a reworked topsoil of dark brown sandy clay with gravel of mudstone and sandstone with selected areas containing fragments of occasional brick and concrete. The majority of locations were underlain by a black sandy mudstone gravel (land drain bedding).

A hand excavated pit was conducted to investigate existing surface water drain. The top of the drain was located 0.40 m bgl. The material above comprised of a reworked topsoil underlain by brown mottled grey slightly gravely sandy clay.

A Depth of Made Ground Plan is presented as drawing no. 13-759-007 in Appendix III.



3.3. TOPSOIL

Topsoil was encountered within the majority of location between ground level and 0.70 m bgl, comprising dark brown slightly gravelly sandy clay with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.

A Depth of Topsoil Plan is presented as drawing no. 13-759-007 in Appendix III.

3.4. DRIFT DEPOSITS

Drift deposits were encountered within the majority of exploratory locations with the exception of four locations where the full depth of Made Ground could not be proven due to fast water ingress from land drains.

Drift generally comprises firm brown mottled grey slightly gravelly sandy CLAY with gravel of mudstone, underlain by a stiff brown slightly gravelly sandy CLAY where gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Some locations encountered occasional cobbles of subrounded to rounded mudstone and sandstone.

Low strength clays were encountered within 8 locations across the whole site. Seven locations were between a depth of 1.00 m and 1.65 m bgl (CP101, CP102, WS101, WS105, WS121, WS128 and WS132) with WS114 experiencing soft clays between 2.00 m and 3.45 m bgl.

Medium dense SAND was encountered within two locations WS104 (0.30 m–0.40 m bgl) and WS136 (1.00 m–3.40 m bgl)

Gravel with sand bands was encountered between 12.00 m and 13.10 m bgl within CP102.

3.5. SOLID GEOLOGY

Weathered bedrock comprising reddish brown SANDSTONE was encountered within the east of the site between 2.00 m within WS101 and 5.30 m bgl within CP101.

Bedrock was not encountered in the central or western areas of site, with one location (CP102) advancing to 16.95 m bgl in Clay drift deposits, indicating the bedrock is significantly deeper within these areas.

3.6. GROUNDWATER

Groundwater strikes were encountered as seepages. The depth of the seepages are shown on the exploratory hole records in Appendix V and are summarised in Table 3.2.

TABLE 3.2 SUMMARY GROUNDWATER STRIKES

LOCATION	DEPTH TO STRIKE (m)	NOTES
WS103	2	N/A
WS105	2.2	N/A
WS108	1	N/A
WS122	3.8	N/A
WS126	4	N/A
WS131	3.5	N/A
TP132	0.4	Steady seepage
TP139	0.9	Inflow from land drain



LOCATION	DEPTH TO STRIKE (m)	NOTES
TP141	0.9	Inflow from land drain
TP143	0.8	Inflow from land drain
CP102	11.8	N/A
CP102	12	N/A

Monitoring was undertaken using an electronic dip meter and interface probe to record the depth to groundwater and the thickness of any free-phase hydrocarbon product if present. These results are summarised in Table 3.12.

3.7. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

Visual and olfactory evidence of potential contamination has not been identified within exploratory hole locations on site; however, remains of a bonfire and burnt animal carcase were observed in the west of the site. The location of this is indicated on Drawing 13-759-004 in Appendix III.

There is a potential for animal burial to present elsewhere on-site; however, no evidence of this was identified during intrusive investigations.

3.8. SOIL CONSISTENCY

Undrained shear strength values were measured using both field hand shear vane tests and laboratory undrained triaxial tests. Results of the tests are presented in Table 3.3 and Table 3.4, which indicate the clay soils to vary between stiff and very stiff. Strength test data is generally consistent with the field descriptions of the aforementioned soils.

TABLE 3.3 SUMMARY OF HAND SHEAR VANE TESTS

LOCATION	DEPTH	SHEAR STRENGTH (kPA)	CALCULATED ALLOWABLE BEARING PRESSURE (kN/m ²)
TP102	1.50	74	170
TP110	1.00	140	322
TP110	1.50	64	147
TP112	1.20	83	191
TP115	1.00	64	147
TP115	1.50	70	161
TP116	1.00	45	104
TP117	1.20	64	147
TP122	1.20	83	191
TP124	1.50	64	147
TP124	2.00	70	161
TP125	1.20	108	248
TP125	1.60	83	191
TP126	1.00	95	219
TP126	1.50	83	191



LOCATION	DEPTH	SHEAR STRENGTH (kPA)	CALCULATED ALLOWABLE BEARING PRESSURE (kN/m ²)
TP126	1.80	76	175
TP128	1.20	70	161
TP128	1.50	76	175
TP129	0.40	105	242
TP129	1.00	101	232
TP133	2.00	64	147
TP129	0.40	105	242
TP129	2.00	101	232
TP133	2.00	64	147
TP142	1.20	103	237

Soils were noted to be soft at shallow depth (0.30 m bgl) in TP133.

TABLE 3.4 SUMMARY OF UNDRAINED SHEAR STRENGTH TEST RESULTS

LOCATION	SAMPLE DEPTH (m)	LAB DESCRIPTION	UNDRAINED SHEAR STRENGTH (kN/m ²)	CONSISTENCY
WS108	0.50–1.00	Stiff brown slightly gravelly sandy CLAY.	79	Stiff
WS125	2.50–3.00	Firm brown slightly gravelly sandy CLAY.	47	Firm
WS133	2.50–3.00	Very stiff brown slightly gravelly very sandy CLAY.	225	Very stiff
CP101	2.00–2.50	Soft brown slightly gravelly very sandy CLAY.	41	Soft

Results of the standard penetration tests, including undrained shear strengths derived from SPTs are included in Table 3.5.

3.9. SIDE STABILITY AND EASE OF EXCAVATION

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation.

One trial pit (TP132) was observed to be unstable where the natural subsoils were saturated.



TABLE 3.5 STANDARD/CONE PENETRATION TEST RESULTS

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
CP101	1.20	Slightly gravelly sandy CLAY	4	4	N/A	Very low strength	Soft	20	40
CP101	3.00	Slightly gravelly sandy CLAY	35	30	N/A	Very high strength	Very Stiff	152	313
CP101	5.00	Slightly gravelly sandy CLAY	50	41	N/A	Very high strength	Very Stiff	207	426
CP101	5.30	SANDSTONE	50	41	Dense	N/A	N/A	N/A	413
CP102	1.20	Slightly gravelly sandy CLAY	6	6	N/A	Low strength	Firm	29	61
CP102	3.00	Slightly gravelly sandy CLAY	38	33	N/A	Very high strength	Very Stiff	165	340
CP102	5.00	Slightly gravelly sandy CLAY	17	14	N/A	Medium strength	Stiff	71	145
CP102	7.50	Slightly gravelly sandy CLAY	22	18	N/A	High strength	Very Stiff	89	183
CP102	10.50	Slightly gravelly sandy CLAY	16	13	N/A	Medium strength	Stiff	63	130
CP102	13.50	Slightly gravelly sandy CLAY	30	21	N/A	High strength	Very Stiff	105.7314399	217
CP102	15.00	Slightly gravelly sandy CLAY	50	33	N/A	Very high strength	Very Stiff	167.4107496	344
CP102	16.50	Slightly gravelly sandy CLAY	50	32	N/A	Very high strength	Very Stiff	159.4426577	328



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WS101	1.00	Slightly gravelly sandy CLAY	4	4	N/A	Low strength	Soft	20	41
WS101	2.00	SAND	50	46	Dense	N/A	N/A	N/A	457
WS102	1.00	MADE GROUND: slightly gravelly sandy clay	11	11	N/A	Medium strength	Stiff	55	114
WS102	2.00	Slightly gravelly sandy CLAY	50	46	N/A	Very high strength	Very Stiff	228	470
WS103	1.00	Slightly gravelly sandy CLAY	7	7	N/A	Low strength	Firm	35	73
WS103	2.00	Slightly gravelly sandy CLAY	20	18	N/A	High strength	Very Stiff	91	188
WS103	3.00	Slightly gravelly sandy CLAY	28	24	N/A	High strength	Very Stiff	122	250
WS103	4.00	Slightly gravelly sandy CLAY	29	25	N/A	High strength	Very Stiff	123	252
WS104	1.00	Slightly gravelly sandy CLAY	9	9	N/A	Medium strength	Stiff	45	93
WS104	2.00	Slightly gravelly sandy CLAY	15	14	N/A	Medium strength	Stiff	69	141
WS104	3.00	Slightly gravelly sandy CLAY	24	21	N/A	High strength	Very Stiff	104	215
WS104	3.80	SAND	50	42	Dense	N/A	N/A	N/A	424



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WS105	1.00	Slightly gravelly sandy CLAY	7	7	N/A	Low strength	Firm	35	73
WS105	2.00	Slightly gravelly sandy CLAY	40	37	N/A	Very high strength	Very Stiff	183	376
WS105	3.00	Slightly gravelly sandy CLAY	50	43	N/A	Very high strength	Very Stiff	217	447
WS106	1.00	Slightly gravelly sandy CLAY	9	9	N/A	Medium strength	Stiff	45	93
WS106	2.00	Slightly gravelly sandy CLAY	28	26	N/A	High strength	Very Stiff	128	263
WS106	3.00	Slightly gravelly sandy CLAY	37	32	N/A	Very high strength	Very Stiff	161	331
WS106	4.00	Slightly gravelly sandy CLAY	46	39	N/A	Very high strength	Very Stiff	194	400
WS107	1.00	Slightly gravelly sandy CLAY	8	8	N/A	Medium strength	Stiff	40	83
WS107	2.00	Slightly gravelly sandy CLAY	12	11	N/A	Medium strength	Stiff	55	113
WS107	3.00	Slightly gravelly sandy CLAY	21	18	N/A	High strength	Very Stiff	91	188
WS107	4.00	Slightly gravelly sandy CLAY	50	42	N/A	Very high strength	Very Stiff	211	434
WS108	1.00	Slightly gravelly sandy CLAY	1	1	N/A	Extremely low strength	Very Soft	5	10



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WS108	2.00	Slightly gravelly sandy CLAY	33	30	N/A	Very high strength	Very Stiff	151	310
WS108	2.70	SAND	50	44	Dense	N/A	N/A	N/A	440
WS109	1.00	Slightly gravelly sandy CLAY	9	9	N/A	Medium strength	Stiff	45	93
WS109	2.00	Slightly gravelly sandy CLAY	25	23	N/A	High strength	Very Stiff	114	235
WS109	3.00	Slightly gravelly sandy CLAY	23	20	N/A	High strength	Very Stiff	100	206
WS109	4.00	Slightly gravelly sandy CLAY	50	42	N/A	Very high strength	Very Stiff	211	434
WS110	1.00	Slightly gravelly sandy CLAY	9	9	N/A	Medium strength	Stiff	45	93
WS110	2.00	Slightly gravelly sandy CLAY	17	16	N/A	High strength	Very Stiff	78	160
WS110	3.00	Slightly gravelly sandy CLAY	24	21	N/A	High strength	Very Stiff	104	215
WS110	4.00	Slightly gravelly sandy CLAY	24	20	N/A	High strength	Very Stiff	101	208
WS110	5.00	Slightly gravelly sandy CLAY	37	31	N/A	Very high strength	Very Stiff	153	316
WS111	1.00	Slightly gravelly sandy CLAY	9	9	N/A	Medium strength	Stiff	45	93



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WS111	2.00	Slightly gravelly sandy CLAY	15	14	N/A	Medium strength	Stiff	69	141
WS111	3.00	Slightly gravelly sandy CLAY	23	20	N/A	High strength	Very Stiff	100	206
WS111	4.00	Slightly gravelly sandy CLAY	36	30	N/A	Very high strength	Very Stiff	152	313
WS111	5.00	Slightly gravelly sandy CLAY	26	22	N/A	High strength	Very Stiff	108	222
WS112	1.00	Slightly gravelly sandy CLAY	11	11	N/A	Medium strength	Stiff	55	114
WS112	2.00	Slightly gravelly sandy CLAY	18	16	N/A	High strength	Very Stiff	82	169
WS112	3.00	Slightly gravelly sandy CLAY	27	23	N/A	High strength	Very Stiff	117	241
WS112	4.00	Slightly gravelly sandy CLAY	33	28	N/A	High strength	Very Stiff	139	287
WS112	5.00	Slightly gravelly sandy CLAY	37	31	N/A	Very high strength	Very Stiff	153	316
WS113	1.00	Slightly gravelly sandy CLAY	9	9	N/A	Medium strength	Stiff	45	93
WS113	2.00	Slightly gravelly sandy CLAY	16	15	N/A	Medium strength	Stiff	73	150
WS113	3.00	Slightly gravelly sandy CLAY	25	22	N/A	High strength	Very Stiff	109	224



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WS113	4.00	Slightly gravelly sandy CLAY	19	16	N/A	High strength	Very Stiff	80	165
WS113	5.00	Slightly gravelly sandy CLAY	24	20	N/A	High strength	Very Stiff	100	205
WS114	1.00	MADE GROUND: Slightly gravelly sandy CLAY	4	4	N/A	Low strength	Soft	20	41
WS114	2.00	Slightly gravelly sandy CLAY	5	5	N/A	Low strength	Firm	23	47
WS114	3.00	Slightly gravelly sandy CLAY	9	8	N/A	Low strength	Firm	39	80
WS114	4.00	Slightly gravelly sandy CLAY	17	14	N/A	Medium strength	Stiff	72	148
WS114	5.00	Slightly gravelly sandy CLAY	12	10	N/A	Medium strength	Stiff	50	102
WS115	1.00	Slightly gravelly sandy CLAY	13	13	N/A	Medium strength	Stiff	66	135
WS115	2.00	Slightly gravelly sandy CLAY	15	14	N/A	Medium strength	Stiff	69	141
WS115	3.00	Slightly gravelly sandy CLAY	20	17	N/A	High strength	Very Stiff	87	179
WS115	4.00	Slightly gravelly sandy CLAY	24	20	N/A	High strength	Very Stiff	101	208



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WS116	1.00	Slightly gravelly sandy CLAY	13	13	N/A	Medium strength	Stiff	66	135
WS116	2.00	Slightly gravelly sandy CLAY	18	16	N/A	High strength	Very Stiff	82	169
WS116	3.00	Slightly gravelly sandy CLAY	19	17	N/A	High strength	Very Stiff	83	170
WS116	4.00	Slightly gravelly sandy CLAY	23	19	N/A	High strength	Very Stiff	97	200
WS116	5.00	Slightly gravelly sandy CLAY	37	31	N/A	Very high strength	Very Stiff	153	316
WS117	1.00	Slightly gravelly sandy CLAY	16	16	N/A	High strength	Very Stiff	81	166
WS117	2.00	Slightly gravelly sandy CLAY	14	13	N/A	Medium strength	Stiff	64	131
WS117	3.00	Slightly gravelly sandy CLAY	20	17	N/A	High strength	Very Stiff	87	179
WS117	4.00	Slightly gravelly sandy CLAY	20	17	N/A	High strength	Very Stiff	84	174
WS117	5.00	Slightly gravelly sandy CLAY	24	20	N/A	High strength	Very Stiff	100	205
WS118	1.00	Slightly gravelly sandy CLAY	15	15	N/A	High strength	Very Stiff	76	155
WS118	2.00	Slightly gravelly sandy CLAY	32	29	N/A	High strength	Very Stiff	146	301



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WS118	3.00	Slightly gravelly sandy CLAY	20	17	N/A	High strength	Very Stiff	87	179
WS118	4.00	Slightly gravelly sandy CLAY	17	14	N/A	Medium strength	Stiff	72	148
WS118	5.00	Slightly gravelly sandy CLAY	24	20	N/A	High strength	Very Stiff	100	205
WS119	1.00	Slightly gravelly sandy CLAY	11	11	N/A	Medium strength	Stiff	55	114
WS119	2.00	Slightly gravelly sandy CLAY	19	17	N/A	High strength	Very Stiff	87	178
WS119	3.00	Slightly gravelly sandy CLAY	23	20	N/A	High strength	Very Stiff	100	206
WS119	4.00	Slightly gravelly sandy CLAY	23	19	N/A	High strength	Very Stiff	97	200
WS119	5.00	Slightly gravelly sandy CLAY	24	20	N/A	High strength	Very Stiff	100	205
WS120	1.00	Slightly gravelly sandy CLAY	13	13	N/A	Medium strength	Stiff	66	135
WS120	2.00	Slightly gravelly sandy CLAY	28	26	N/A	High strength	Very Stiff	128	263
WS120	3.00	Slightly gravelly sandy CLAY	21	18	N/A	High strength	Very Stiff	91	188
WS120	4.00	Slightly gravelly sandy CLAY	15	13	N/A	Medium strength	Stiff	63	130



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WS120	5.00	Slightly gravelly sandy CLAY	15	12	N/A	Medium strength	Stiff	62	128
WS121	1.00	Slightly gravelly sandy CLAY	7	7	N/A	Low strength	Firm	35	73
WS121	2.00	Slightly gravelly sandy CLAY	31	28	N/A	High strength	Very Stiff	142	291
WS121	3.00	Slightly gravelly sandy CLAY	22	19	N/A	High strength	Very Stiff	96	197
WS121	4.00	Slightly gravelly sandy CLAY	22	19	N/A	High strength	Very Stiff	93	191
WS121	5.00	Slightly gravelly sandy CLAY	23	19	N/A	High strength	Very Stiff	95	196
WS122	1.00	Slightly gravelly sandy CLAY	13	13	N/A	Medium strength	Stiff	66	135
WS122	2.00	Slightly gravelly sandy CLAY	24	22	N/A	High strength	Very Stiff	110	225
WS122	3.00	Slightly gravelly sandy CLAY	24	21	N/A	High strength	Very Stiff	104	215
WS122	4.00	Slightly gravelly sandy CLAY	27	23	N/A	High strength	Very Stiff	114	234
WS122	5.00	Slightly gravelly sandy CLAY	16	13	N/A	Medium strength	Stiff	66	136
WS123	1.00	Slightly gravelly sandy CLAY	14	14	N/A	Medium strength	Stiff	71	145



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WS123	2.00	Slightly gravelly sandy CLAY	29	26	N/A	High strength	Very Stiff	132	272
WS123	3.00	Slightly gravelly sandy CLAY	23	20	N/A	High strength	Very Stiff	100	206
WS123	4.00	Slightly gravelly sandy CLAY	15	13	N/A	Medium strength	Stiff	63	130
WS123	5.00	Slightly gravelly sandy CLAY	27	22	N/A	High strength	Very Stiff	112	230
WS124	1.00	Slightly gravelly sandy CLAY	9	9	N/A	Medium strength	Stiff	45	93
WS124	2.00	Slightly gravelly sandy CLAY	20	18	N/A	High strength	Very Stiff	91	188
WS124	3.00	Slightly gravelly sandy CLAY	15	13	N/A	Medium strength	Stiff	65	134
WS124	4.00	Slightly gravelly sandy CLAY	19	16	N/A	High strength	Very Stiff	80	165
WS124	5.00	Slightly gravelly sandy CLAY	22	18	N/A	High strength	Very Stiff	91	188
WS125	1.00	Slightly gravelly sandy CLAY	8	8	N/A	Medium strength	Stiff	40	83
WS125	2.00	Slightly gravelly sandy CLAY	16	15	N/A	Medium strength	Stiff	73	150
WS125	3.00	Slightly gravelly sandy CLAY	14	12	N/A	Medium strength	Stiff	61	125



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WS125	4.00	Slightly gravelly sandy CLAY	19	16	N/A	High strength	Very Stiff	80	165
WS125	5.00	Slightly gravelly sandy CLAY	20	17	N/A	High strength	Very Stiff	83	171
WS126	1.00	Slightly gravelly sandy CLAY	11	11	N/A	Medium strength	Stiff	55	114
WS126	2.00	Slightly gravelly sandy CLAY	17	16	N/A	High strength	Very Stiff	78	160
WS126	3.00	Slightly gravelly sandy CLAY	15	13	N/A	Medium strength	Stiff	65	134
WS126	4.00	Slightly gravelly sandy CLAY	15	13	N/A	Medium strength	Stiff	63	130
WS126	5.00	Slightly gravelly sandy CLAY	20	17	N/A	High strength	Very Stiff	83	171
WS127	1.00	Slightly gravelly sandy CLAY	10	10	N/A	Medium strength	Stiff	50	104
WS127	2.00	Slightly gravelly sandy CLAY	11	10	N/A	Medium strength	Stiff	50	103
WS127	3.00	Slightly gravelly sandy CLAY	13	11	N/A	Medium strength	Stiff	57	116
WS127	4.00	Slightly gravelly sandy CLAY	19	16	N/A	High strength	Very Stiff	80	165
WS127	5.00	Slightly gravelly sandy CLAY	16	13	N/A	Medium strength	Stiff	66	136



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WS128	1.00	Slightly gravelly sandy CLAY	6	6	N/A	Low strength	Firm	30	62
WS128	2.00	Slightly gravelly sandy CLAY	13	12	N/A	Medium strength	Stiff	59	122
WS128	3.00	Slightly gravelly sandy CLAY	20	17	N/A	High strength	Very Stiff	87	179
WS128	4.00	Slightly gravelly sandy CLAY	22	19	N/A	High strength	Very Stiff	93	191
WS128	5.00	Slightly gravelly sandy CLAY	17	14	N/A	Medium strength	Stiff	71	145
WS129	1.00	Slightly gravelly sandy CLAY	10	10	N/A	Medium strength	Stiff	50	104
WS129	2.00	Slightly gravelly sandy CLAY	14	13	N/A	Medium strength	Stiff	64	131
WS129	3.00	Slightly gravelly sandy CLAY	19	17	N/A	High strength	Very Stiff	83	170
WS129	4.00	Slightly gravelly sandy CLAY	24	20	N/A	High strength	Very Stiff	101	208
WS129	5.00	Slightly gravelly sandy CLAY	25	21	N/A	High strength	Very Stiff	104	213
WS130	1.00	Slightly gravelly sandy CLAY	12	12	N/A	Medium strength	Stiff	60	124
WS130	2.00	Slightly gravelly sandy CLAY	16	15	N/A	Medium strength	Stiff	73	150



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WS130	3.00	Slightly gravelly sandy CLAY	50	43	N/A	Very high strength	Very Stiff	217	447
WS131	1.00	Slightly gravelly sandy CLAY	12	12	N/A	Medium strength	Stiff	60	124
WS131	2.00	Slightly gravelly sandy CLAY	11	10	N/A	Medium strength	Stiff	50	103
WS131	3.00	Slightly gravelly sandy CLAY	30	26	N/A	High strength	Very Stiff	130	268
WS131	4.00	Slightly gravelly sandy CLAY	17	14	N/A	Medium strength	Stiff	72	148
WS131	5.00	Slightly gravelly sandy CLAY	14	12	N/A	Medium strength	Stiff	58	119
WS132	1.00	Slightly gravelly sandy CLAY	7	7	N/A	Low strength	Firm	35	73
WS132	2.00	Slightly gravelly sandy CLAY	24	22	N/A	High strength	Very Stiff	110	225
WS132	3.00	Slightly gravelly sandy CLAY	24	21	N/A	High strength	Very Stiff	104	215
WS132	4.00	Slightly gravelly sandy CLAY	16	14	N/A	Medium strength	Stiff	68	139
WS132	5.00	Slightly gravelly sandy CLAY	19	16	N/A	High strength	Very Stiff	79	162
WS133	1.00	Slightly gravelly sandy CLAY	10	10	N/A	Medium strength	Stiff	50	104



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WS133	2.00	Slightly gravelly sandy CLAY	20	18	N/A	High strength	Very Stiff	91	188
WS133	3.00	Slightly gravelly sandy CLAY	20	17	N/A	High strength	Very Stiff	87	179
WS133	4.00	Slightly gravelly sandy CLAY	15	13	N/A	Medium strength	Stiff	63	130
WS133	5.00	Slightly gravelly sandy CLAY	19	16	N/A	High strength	Very Stiff	79	162
WS134	1.00	Slightly gravelly sandy CLAY	11	11	N/A	Medium strength	Stiff	55	114
WS134	2.00	Slightly gravelly sandy CLAY	13	12	N/A	Medium strength	Stiff	59	122
WS134	3.00	Slightly gravelly sandy CLAY	20	17	N/A	High strength	Very Stiff	87	179
WS134	4.00	Slightly gravelly sandy CLAY	19	16	N/A	High strength	Very Stiff	80	165
WS134	5.00	Slightly gravelly sandy CLAY	20	17	N/A	High strength	Very Stiff	83	171
WS135	1.00	Slightly gravelly sandy CLAY	9	9	N/A	Medium strength	Stiff	45	93
WS135	2.00	Slightly gravelly sandy CLAY	11	10	N/A	Medium strength	Stiff	50	103
WS135	3.00	Slightly gravelly sandy CLAY	50	43	N/A	Very high strength	Very Stiff	217	447



Chapel Lane, Widnes

Phase II Geoenvironmental Site Assessment

December 2020

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT “N” VALUE	CORRECTED “N” VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS136	1.00	Slightly gravelly sandy CLAY	11	11	Medium Dense	N/A	N/A	N/A	111
WS136	2.00	Very clayey SAND	14	13	Medium Dense	N/A	N/A	N/A	128
WS136	3.00	Very clayey SAND	50	43	Dense	N/A	N/A	N/A	435

Notes

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



3.10. CONSOLIDATION

Four undisturbed samples of Glacial Till were submitted for oedometer analysis. The results are provided in Table 3.6.

TABLE 3.6 OEDOMETER CONSOLIDATION RESULTS

LOCATION	DEPTH (m)	SAMPLE TYPE	MOISTURE CONTENT (%)	OEDOMETER CONSOLIDATION		
				PRESSURE RANGE (kPa)	M _v (m ² /MN)	C _v (m ² /year)
CP102	0.50–1.00	U	19	0–5	Swelling	Swelling
				5–10	1.109	0.394
				10–20	0.668	0.382
				20–5	0.067	0.802
WS125	2.50–3.00	U	14	0–25	0.070	9.054
				25–50	0.228	13.855
				50–100	0.182	12.438
				100–25	0.035	5.853
WS133	2.50–3.00	U	11	0–25	Swelling	Swelling
				25–50	0.130	41.225
				50–100	0.139	35.700
				100–25	0.051	6.691
CP101	2.00–2.50	U	16	0–20	0.423	0.612
				20–40	0.460	0.968
				40–80	0.352	1.024
				80–20	0.073	13.235

When considered at overburden pressure with an additional load of 100 kPa the coefficient of volume compressibility (M_v) ranged from 0.139 m²/MN up to 0.182 m²/MN. The material is considered to be low to medium compressibility.

The rate at which settlement is likely to occur is determined by the coefficient of consolidation (C_v). As shown in Table 3.6, the coefficient ranges from 12.44 m²/yr to 35.70 m²/yr. The rate at which settlement will occur is increased by the presence of sand within the Glacial Till and it is likely that settlement will occur over a period of months to years.

3.11. SOIL INFILTRATION

In-situ BRE 365 Soakaway tests were undertaken over a 48 hour period within trial pits completed as SA101-SA106.

The results are presented in Table 3.7 below and the test certificates are included within Appendix IX.



TABLE 3.7 BRE365 SOAKAWAY TESTING RESULTS

LOCATION	DEPTH (m)	MATERIAL	TEST NO.	SOIL INFILTRATION RATE (m/s)
TP101/SA101	1.80	Slightly sandy gravelly CLAY	Test No.1	N/A
TP104/SA102	1.70	Slightly sandy gravelly CLAY	Test No.1	N/A
TP105/SA103	1.80	Slightly sandy gravelly CLAY	Test No.1	N/A
TP106/SA104	1.70	Slightly sandy gravelly CLAY	Test No.1	N/A
TP107/SA105	1.90	Slightly sandy gravelly CLAY	Test No.1	N/A
TP108/SA106	1.80	Slightly sandy gravelly CLAY	Test No.1	N/A

Soil infiltration was taken over the wetted area from between 75% and 25% of the effective depth. An insufficient fall in water level was recorded in the trial pits over the duration of the tests and as such it has not been possible to calculate a rate for infiltration. The cohesive drift deposits have therefore demonstrated very poor soakage potential.

Therefore, considering the significant volumes of low permeability CLAY on the site, it is considered that soakaway drainage will not be suitable for the proposed development.

3.12. SOIL PLASTICITY

The liquid and plastic limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average plasticity index (PI) for each “type” of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth.

E3P typically only consider a soil to be shrinkable if the proportion finer than 63 µm is > 35%.

PI results are compared against guidance given in the NHBC standards, Chapter 4.2 (revised January 2014), which advocates the use of modified plasticity index (I’p), defined as:

$$I'p = Ip \times (\% < 425 \mu m / 100)$$

In other words, if PI is 30%, but the soil contains 80% < 425 µm, then I’p = 30 × 80/100 = 24%.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425 µm sieve is routinely reported by testing labs.

E3P apply engineering judgement where PI results are spread over a range of classifications. Consideration is given to the average values for each particular soil type (differentiate between residual soil and alluvium), the number of results in each class and the actual values.

The Atterberg limits determinations, summarised in Table 3.8, show the clay to be of predominantly low plasticity with discrete areas of moderate plasticity clay.



TABLE 3.8 SUMMARY OF PLASTICITY INDEX TEST RESULTS

LOCATION	DEPTH (m)	NATURAL MOISTURE CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING 425 µm SIEVE (%)	MODIFIED PLASTICITY INDEX	NHBC VOLUME CHANGE POTENTIAL
TP102	0.80	20	16	33	17	89	15.13	Low
TP107	1.80	17	15	31	16	83	13.28	Low
WS104	1.50	14	13	27	14	87	12.18	Low
WS122	1.00	12	14	29	15	98	14.70	Low
WS127	0.50	14	14	27	13	86	11.18	Low
WS112	2.00	12	12	25	13	98	12.74	Low
WS131	1.00	13	14	30	16	96	15.36	Low
WS133	2.00	12	13	25	12	93	11.16	Low

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

3.13. CALIFORNIA BEARING RATIO

The California bearing ratio (CBR) for the soils were measured using an in-situ TRL probe. The results are summarised in Table 3.9.

The result sheets are included in Appendix VIII and the locations are shown on Drawing 13-759-005 (Appendix III). CBR results have been averaged from the blow counts across the strata tested and any abnormally high blow counts ignored as these are likely to be from larger granular material and so represent anomalies.



TABLE 3.9 SUMMARY OF DCP RESULTS

LOCATION	DEPTH (m)	STRATA	IN-SITU OR LAB TEST	CBR (%)
DCP101	0.74–0.84	Stiff slightly gravelly sandy CLAY	In-Situ	7.42
DCP102	0.17–0.31	Stiff slightly gravelly sandy CLAY	In-Situ	5.32
DCP103	0.33–0.60	Stiff slightly gravelly sandy CLAY	In-Situ	7.44
DCP104	0.58–0.66	Stiff slightly gravelly sandy CLAY	In-Situ	23.21
DCP105	0.39–0.63	Stiff slightly gravelly sandy CLAY	In-Situ	10.64
DCP106	0.39–0.61	Stiff slightly gravelly sandy CLAY	In-Situ	5.56
DCP107	0.26–0.51	Stiff slightly gravelly sandy CLAY	In-Situ	3.72
DCP108	0.71–0.79	Stiff slightly gravelly sandy CLAY	In-Situ	12.56
DCP109	0.38–0.50	Stiff slightly gravelly sandy CLAY	In-Situ	7.94
DCP110	0.38–0.63	Stiff slightly gravelly sandy CLAY	In-Situ	5.96

It should be noted that the reported CBR results were obtained from soils in a highly undisturbed state. If, however, the topsoil and surface cover is removed during periods of wetter climatic condition, the formation will soften, reducing the CBR.

3.14. pH AND SULPHATE

Chemical analyses for pH and soluble sulphate content contained in Appendix V (summarised in Table 3.10), shows that the soils at the site meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE *Special Digest 1* (2005).

TABLE 3.10 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
TP122	0.10	0.0066	7.3	DS-1, AC-1
WS102	0.95	0.0140	7.8	DS-1, AC-1
WS113	0.50	0.0100	7.6	DS-1, AC-1
WS117	0.30	0.0140	7.2	DS-1, AC-1
TP134	0.10	0.0150	7.0	DS-1, AC-1
TP139	0.40	0.0130	6.9	DS-1, AC-1
TP145	0.80	0.0170	7.5	DS-1, AC-1
WS124	0.20	0.0310	7.4	DS-1, AC-1

3.15. GROUND GAS

A ground gas assessment has been completed in accordance with guidance provided within CIRIA 665 – *Assessing risk posed by hazardous ground gases to buildings*.



3.16. INVESTIGATION RATIONALE

The ICSM has identified that the underlying Made Ground/infilled ponds may represent potential sources of ground gas generation. Based on the identification of these sources, E3P has determined that the site represents a moderate ground gas source generation potential.

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

The spacing requirements for monitoring wells are detailed within CIRIA 665 Table 4.2, which indicates that for moderate gas hazard sites (older domestic landfill sites, disused shallow mine workings, hydrocarbon vapour sources) and a high sensitivity development, nominal well spacing should be between 25 m and 50 m.

The spacing requirements for high gas hazard sites (domestic landfill sites) and a high sensitivity development, nominal well spacing should be less than 25 m.

TABLE 3.11 GROUND GAS MONITORING LOCATION RATIONALE

LOCATION	GROUND GAS SOURCE	DEPTH OF MONITORING WELL (m)
WS101	Made Ground	0.50–2.00
WS102	Natural Strata	0.50–1.50
WS103	Natural Strata	1.00–4.00
WS104	Natural Strata	1.00–4.00
WS106	Natural Strata	1.00–4.00
WS108	Natural Strata	0.50–1.50
WS109	Natural Strata	0.50–2.50
WS111	Natural Strata	1.00–4.00
WS112	Natural Strata	1.00–4.00
WS113	Natural Strata	1.00–5.00
WS114	Made Ground/Natural Strata	1.00–4.00
WS115	Natural Strata	1.00–5.00
WS117	Natural Strata	1.00–5.00
WS119	Natural Strata	1.00–4.00
WS123	Natural Strata	1.00–5.00
WS124	Natural Strata	1.00–5.00
WS125	Natural Strata	1.00–5.00
WS126	Natural Strata	1.00–4.00
WS127	Natural Strata	1.00–5.00
WS128	Natural Strata	1.00–5.00
WS129	Natural Strata	1.00–5.00
WS130	Natural Strata	1.00–3.00
WS131	Natural Strata	1.00–5.00



LOCATION	GROUND GAS SOURCE	DEPTH OF MONITORING WELL (m)
WS132	Natural Strata	1.00–5.00

3.17. MONITORING METHODOLOGY

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

Gas measurements were recorded for a minimum of 60 seconds at each location, at which point the maximum concentration of CH₄ and CO₂, together with the lowest concentration of O₂ were recorded. The results of the ground gas monitoring are presented in Table 3.12.



TABLE 3.12 SUMMARY OF GROUND GAS MONITORING RESULTS

WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/ V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)													
WS101	08/09/20	Could not locate																									
	09/10/20																										
	22/10/20																										
	05/11/20																										
	09/11/20																										
	20/11/20																										
WS102	08/09/20	Could not locate																									
	09/10/20	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	1006	steady	0.10	0.50–1.50	1.35	0.75													
	22/10/20	-0.1	-0.1	-0.0001	2.4	2.4	0.0024	16.5	996	rising	0.10		1.44	0.84													
	05/11/20	0.1	0.1	0.0001	4.8	4.8	0.0048	14.7	1035	falling	0.1		1.45	0.67													
	09/11/20	0.1	0.1	0.0001	6.3	6.3	0.0063	11.6	1015	steady	0.1		1.45	0.63													
	20/11/20	0.1	0.1	0.0001	4.8	4.8	0.0048	17.5	1025	falling	0.1		1.45	0.58													
WS103	08/09/20	Could not locate																									
	09/10/20														0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	1006	steady	0.10	1.00–4.00	3.90	0.40
	22/10/20																										
	05/11/20																										
	09/11/20																										
	20/11/20																										
WS104	08/09/20	0.1	0.1	0.00028	0.3	0.3	0.00084	20.3	1020	steady	0.28	1.00–4.00	3.76	dry													
	09/10/20	0.1	0.1	0.0093	0.1	0.1	0.0093	20.1	1006	steady	9.30		3.60	dry													
	22/10/20	0.1	0.1	0.0001	0.3	0.3	0.0003	20.3	996	rising	0.10		3.76	dry													



WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/ V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS104	05/11/20	0.1	0.1	-0.0041	0.1	0.1	-0.0041	20.5	1035	falling	-4.1	1.00–4.00	3.70	dry
	09/11/20	0.1	0.1	0.0001	0.6	0.6	0.0006	19.4	1015	steady	0.1		3.70	dry
	20/11/20	0.1	0.1	0.0001	1.4	1.4	0.0014	18.9	1025	falling	0.1		3.70	dry
WS106	08/09/20	Could not locate												
	09/10/20	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	1006	steady	0.10	1.00–4.00	3.75	2.20
	22/10/20	Could not locate												
	05/11/20													
	9/11/20	0.1	0.1	0.0001	3.8	3.8	0.0038	14.1	1015	steady	0.1	1.00–4.00	3.75	1.60
	20/11/20	0.1	0.1	0.0001	3.5	3.5	0.0035	15.3	1025	falling	0.1		3.75	1.21
WS108	08/09/20	Could not locate												
	09/10/20													
	22/10/20													
	05/11/20	0.1	0.1	0.0001	3.8	3.8	0.0038	10.5	1033	falling	0.1	0.50–1.50	0.50	0.50
	09/11/20	0.1	0.1	0.0001	3.8	3.8	0.0038	10.5	1015	steady	0.1		0.50	0.50
	20/11/20	0.1	0.1	0.0001	1.1	1.1	0.0011	17.6	1024	falling	0.1		0.20	0.42
WS109	08/09/20	0.1	0.1	-0.01136	3.7	3.7	-0.42032	16.1	1020	steady	-11.36	0.50–2.50	3.91	3.43
	09/10/20	0.1	0.1	0.0001	0.1	0.1	0.0001	20.1	1006	steady	0.10		3.90	0.40
	22/10/20	0.1	0.1	0.0001	3.6	3.6	0.0036	16.3	996	rising	0.10		3.90	3.42
	05/11/20	0.1	0.1	0.0001	1.2	1.2	0.0012	18.0	1033	falling	0.1		3.90	0.45
	09/11/20	0.1	0.1	0.0001	1.2	1.2	0.0012	18.2	1015	steady	0.1		3.90	0.49
	20/11/20	0.1	0.1	0.0001	0.7	0.7	0.0007	19.7	1024	falling	0.1		3.90	0.45



WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/ V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS111	08/09/20	Could not locate												
	09/10/20													
	22/10/20	0.1	0.1	0.0001	4.4	4.4	0.0044	15.9	996	rising	0.10	1.00–4.00	Unable to remove bung	
	05/11/20	0.1	0.1	0.0001	4.2	4.2	0.0042	16.2	1033	falling	0.1			
	09/11/20	0.1	0.1	0.0001	4.4	4.4	0.0044	15.8	1015	steady	0.1			
	20/11/20	0.1	0.1	0.0001	4.1	4.1	0.0041	17.0	1025	falling	0.1			
WS112	08/09/20	0.1	0.1	0.00026	4.6	4.6	0.01196	14.7	1020	steady	0.26	1.00–4.00	Unable to remove bung	
	09/10/20	0.1	0.1	0.0001	0.1	0.1	0.0001	20.1	1006	steady	0.10			
	22/10/20	0.1	0.1	0.0001	3.8	3.8	0.0038	18.9	996	rising	0.10			
	5/11/20	0.1	0.1	0.0001	3.8	3.5	0.0038	18.8	1035	falling	0.1			
	9/11/20	0.1	0.1	0.0001	3.9	3.9	0.0039	18.6	1015	steady	0.1			
	20/11/20	Monitoring well destroyed												
WS113	08/09/20	Could not locate												
	09/10/20													
	22/10/20	0.1	0.1	0.0001	4.0	4.0	0.004	12.5	996	rising	0.10	1.00–5.00	4.90	1.90
	5/11/20	0.1	0.1	0.0001	4.6	4.6	0.0046	11.9	1035	falling	0.1		4.90	1.76
	9/11/20	0.1	0.1	0.0001	3.7	3.7	0.0037	13.1	1015	steady	0.1		4.90	1.44
	20/11/20	0.1	0.1	0.0001	5.1	5.1	0.0051	12.4	1025	falling	0.1		4.90	1.51
WS114	08/09/20	0.1	0.1	-0.00088	7.5	7.5	-0.066	9.7	1020	steady	-0.88	1.00–4.00	3.63	1.33
	09/10/20	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	1006	steady	0.10		3.65	0.52
	22/10/20	22.0	21.8	0.0218	3.9	3.9	0.0039	11.2	996	rising	0.10		3.60	1.15



WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/ V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS114	5/11/20	27.1	27	0.0270	4.1	4.1	0.0041	9.8	1035	falling	0.1	1.00–4.00	3.60	0.96
	9/11/20	25.2	25.2	0.0252	4.1	4.0	0.0041	10.1	1015	steady	0.1		3.60	0.92
	20/11/20	41.2	41.2	0.0412	4.3	4.3	0.0043	5.7	1025	falling	0.1		3.60	0.97
WS115	08/09/20	Could not locate												
	09/10/20	Could not locate												
	22/10/20	0.1	0.1	0.0001	2.4	2.4	0.0024	12.8	996	rising	0.1	1.00–5.00	4.70	0.70
	5/11/20	0.1	0.1	0.0001	2.3	2.3	0.0023	14.5	1035	falling	0.1		4.70	0.68
	9/11/20	0.1	0.1	0.0001	2.4	2.4	0.0024	13.8	1015	steady	0.1		4.70	0.64
	20/11/20	0.1	0.1	0.0001	2.4	2.4	0.0024	12.8	1025	falling	0.1		4.70	0.64
WS117	08/09/20	Could not locate												
	09/10/20	Could not locate												
	22/10/20	0.1	0.1	0.0001	6.0	6.0	0.006	12.2	996	rising	0.10	1.00–5.00	4.40	0.75
	5/11/20	0.1	0.1	0.0001	5.9	5.9	0.0059	10.4	1035	falling	0.1		4.40	0.68
	9/11/20	0.1	0.1	0.0001	6.3	6.3	0.0063	11.3	1015	steady	0.1		4.40	0.65
	20/11/20	0.1	0.1	0.0001	5.6	5.3	0.0056	10.7	1025	falling	0.1		4.40	0.66
WS119	08/09/20	0.1	0.1	0.00183	2.5	2.5	0.04575	16.0	1020	steady	1.83	1.00–4.00	3.94	1.05
	09/10/20	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	1006	steady	0.10		3.80	0.20
	22/10/20	0.1	0.1	-0.0352	0.8	0.8	-0.2816	19.8	998	rising	-35.2		3.80	0.55
	5/11/20	0.1	0.1	0.0001	4.1	4.1	0.0041	15.5	1035	falling	0.1		3.80	0.47
	9/11/20	0.1	0.1	-0.0165	2.7	2.7	-0.4455	16.8	1016	steady	-16.5		3.80	0.49
	20/11/20	0.1	0.1	0.0123	4.1	4.1	0.5043	15.1	1025	falling	12.3		3.80	0.35



WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/ V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS121	08/09/20	0.1	0.1	-0.00133	2.1	2.1	-0.02793	16.8	1020	steady	-1.33	1.00–5.00	4.00	0.97
	09/10/20	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	1006	steady	0.10		4.60	0.60
	22/10/20	0.1	0.1	0.0001	0.8	0.8	0.0008	20.2	998	rising	0.10		4.70	0.75
	5/11/20	0.1	0.1	0.0001	2.0	2.0	0.002	18.1	1035	falling	0.1		4.70	0.78
	9/11/20	0.1	0.1	0.0001	1.6	1.6	0.0016	18.7	1016	steady	0.1		4.70	0.77
	20/11/20	0.1	0.1	0.0001	2.1	2.1	0.0021	17.8	1027	falling	0.1		4.70	0.69
WS123	08/09/20	Could not locate												
	09/10/20	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	1006	steady	0.1	1.00–5.00	4.55	0.40
	22/10/20	-0.1	-0.1	0.0321	2.5	2.5	-0.8025	18.6	998	rising	-32.1		4.70	0.66
	5/11/20	0.1	0.1	0.0001	4.9	4.6	0.0049	15.9	1035	falling	0.1		4.70	0.59
	9/11/20	0.1	0.1	-0.0122	4.1	4.1	-0.5002	16.8	1016	steady	-12.2		4.70	0.58
	20/11/20	0.1	0.1	0.0053	5.3	5.3	0.2809	14.9	1027	falling	5.3		4.70	0.62
WS124	08/09/20	0.1	0.1	0.00137	2.4	2.4	0.03288	14.0	1020	steady	1.37	1.00–5.00	4.70	1.34
	09/10/20	0.1	0.1	0.0571	0.1	0.1	0.0571	20.2	1006	steady	57.10		4.50	0.60
	22/10/20	-0.1	-0.1	-0.0001	1.7	1.7	0.0017	18.6	998	rising	0.10		4.70	0.71
	5/11/20	-0.1	0.1	0.0001	1.7	1.7	0.0017	18.0	1033	falling	0.1		4.00	0.63
	9/11/20	0.1	0.1	0.0001	1.5	1.5	0.0015	18.3	1016	steady	0.1		4.00	0.63
	20/11/20	Monitoring Well Destroyed												
WS125	08/09/20	Could not locate												
	09/10/20													
	22/10/20	Waterlogged												



Chapel Lane, Widnes

Phase II Geoenvironmental Site Assessment

December 2020

WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/ V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS125	5/11/20	Waterlogged												
	9/11/20													
	20/11/20													
WS126	08/09/20	Could not locate												
	09/10/20													
	22/10/20													
	5/11/20													
	9/11/20													
	20/11/20													
WS127	08/09/20	Could not locate												
	09/10/20													
	22/10/20													
	5/11/20													
	9/11/20	0.1	0.1	0.0001	3.1	3.1	0.0031	14.5	1015	steady	0.1	1.00–5.00	4.75	0.69
	20/11/20	0.1	0.1	0.0001	2.8	2.8	0.0028	15.0	1025	falling	0.1		4.45	0.71
WS129	08/09/20	Could not locate												
	09/10/20													
	22/10/20													
	5/11/20	0.1	0.1	0.0112	4.3	4.3	0.4816	14.9	1033	falling	11.2	1.00–5.00	4.75	0.88
	9/11/20	0.1	0.1	0.0001	3.4	3.4	0.0034	16.2	1015	steady	0.1		4.75	0.79
	20/11/20	0.1	0.1	0.0001	3.9	3.9	0.0039	14.8	1025	falling	0.1		4.75	0.83



WELL	DATE	CH ₄ INITIAL (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ GSV (l/hr)	CO ₂ INITIAL (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ GSV (l/hr)	O ₂ (%V/ V)	ATMOS (mb)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS130	8/9/20	Could not locate												
	9/10/20													
	22/10/20													
	5/11/20	0.1	0.1	0.0001	1.7	1.7	0.0017	16.1	1033	falling	0.1	1.00–3.00	3.00	0.82
	9/11/20	0.1	0.1	0.0001	1.9	1.9	0.0019	16.0	1015	steady	0.1		3.00	0.81
	20/11/20	0.1	0.1	0.0001	1.9	1.9	0.0019	15.6	1025	falling	0.1		3.00	0.75
WS131	8/9/20	Could not locate												
	9/10/20													
	22/10/20													
	5/11/20	0.1	0.1	0.0001	5.5	5.5	0.0055	18.1	1033	falling	0.1	1.00–5.00	4.50	0.81
	9/11/20	0.1	0.1	0.0001	4.8	4.8	0.0048	18.5	1015	steady	0.1		4.50	0.82
	20/11/20	0.1	0.1	0.0001	5.5	5.5	0.0055	18.6	1025	falling	0.1		4.50	0.76
WS133	8/9/20	Could not locate												
	9/10/20													
	22/10/20													
	5/11/20	0.1	0.1	0.0001	3.5	3.5	0.0035	12.8	1033	falling	0.1	1.00–5.00	4.80	0.75
	9/11/20	0.1	0.1	0.0001	3.5	3.5	0.0035	13.1	1015	steady	0.1		4.80	0.78
	20/11/20	0.1	0.1	0.0001	3.2	3.2	0.0032	14.7	1025	falling	0.1		4.80	0.75



NOTES

NHBC Traffic Light System		Typical Max CH4 Concentration	GSV CH4	Typical Max CO2 Concentration	GSV CO2
	Amber 1	1	0.16-0.63	5	0.78-1.56
	Amber 2	5	0.63-1.56	10	1.56-3.13
	Red	20	1.56+	30	3.13+

Values in **BOLD** exceed Amber 1 Thresholds

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



4. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

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

4.1. HUMAN HEALTH RISK ASSESSMENT

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

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



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

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Arsenic	mg/kg	37	28	26	N/A	1	No Further Action
Cadmium	mg/kg	17	28	0.7	N/A	1	No Further Action
Chromium (VI)	mg/kg	6.1	28	7	TP125 0.10	1	Further Action
Lead	mg/kg	200	28	300	TP138 0.10	1	Further Action
Mercury	mg/kg	1.2	28	0.50	N/A	3	No Further Action
Nickel	mg/kg	180	28	44	N/A	1	No Further Action
Selenium	mg/kg	250	28	< 1.0	N/A	1	No Further Action
Copper	mg/kg	2400	28	120	N/A	1	No Further Action
Zinc	mg/kg	3700	28	140	N/A	1	No Further Action
Cyanide – Total	mg/kg	791	8	< 1.0	N/A	1	No Further Action
Phenols – Total	mg/kg	210	8	< 1.0	N/A	1	No Further Action
Asbestos	Fibres	NFD	28	Chrysotile <0.001	TP145 0.80	4	Further Action
Naphthalene	mg/kg	2.3	28	< 0.05	N/A	3	No Further Action
Acenaphthylene	mg/kg	170	28	< 0.05	N/A	2	No Further Action
Acenaphthene	mg/kg	210	28	< 0.05	N/A	1	No Further Action
Fluorene	mg/kg	170	28	< 0.05	N/A	1	No Further Action
Phenanthrene	mg/kg	95	28	0.29	N/A	2	No Further Action
Anthracene	mg/kg	2400	28	< 0.05	N/A	2	No Further Action
Fluoranthene	mg/kg	280	28	0.64	N/A	2	No Further Action
Pyrene	mg/kg	620	28	0.46	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	28	0.44	N/A	2	No Further Action
Chrysene	mg/kg	15	28	0.43	N/A	2	No Further Action
Benzo(b)Fluoranthene	mg/kg	2.6	28	0.39	N/A	2	No Further Action
Benzo(k)Fluoranthene	mg/kg	77	28	0.31	N/A	2	No Further Action
Benzo(a)Pyrene**	mg/kg	2.2	28	0.44	N/A	2	No Further Action
Indeno(123-cd)Pyrene	mg/kg	27	28	0.22	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.24	28	< 0.05	N/A	2	No Further Action
Benzo(ghi)Perylene	mg/kg	320	28	0.24	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	28	< 1.0	N/A	3	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	28	< 0.1	N/A	3	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	28	< 0.1	N/A	3	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	74	28	< 2.0	N/A	3	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	140	28	< 4.0	N/A	3	No Further Action
TPH C16-C21 (aromatic)*	mg/kg	260	28	< 1.0	N/A	1	No Further Action
TPH C21-C35 (aromatic)*	mg/kg	1100	28	< 1.0	N/A	1	No Further Action



Notes

Main exposure pathways: 1 = soil ingestion, 2 = dermal contact and ingestion, 3 = vapour inhalation (indoor), 4 = dust inhalation.

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

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

-  Chromium (VI) in TP125 at 0.10m bgl;
-  Lead in TP138 at 0.10 m bgl; and,
-  Chrysotile in TP145 at 0.80 m bgl.

Asbestos in the form of loose chrysotile fibres has been identified in the granular Made Ground in TP145 with a quantification <0.001%.

No significant concentrations of SVOCs were identified in the soils submitted for chemical analysis.

The laboratory analysis confirms the assessment within the initial conceptual site model that the main constituents of concern were likely to be asbestos, PAHs, hydrocarbon compounds and heavy metals.

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

-  The main exposure pathways based on the Tier I exceedances are:
 - Soil ingestion;
 - Fibre/dust inhalation.

The exceedances in relation to human health Risk Assessment and Mitigation for contaminants with exposure pathway of soil ingestion are associated with Topsoil (0.10 m). Elevated asbestos has an exposure pathway of inhalation of particulates and has been identified within Made Ground at a depth of 0.80 m.

Elevated concentrations within topsoil samples from TP125 at 0.10 m and TP138 at 0.10 m bgl have primary exposure pathways related to ingestion of soils and inhalation of particulate. Hotspot delineation and segregation of soils in these isolated areas should be undertaken during remediation and enabling works. The materials should then be placed either within public open space (POS), below 600 mm clean cover in private gardens, or beneath plots, hand standing to remove any potential for direct exposure to impacted soils.

Asbestos in the form of chrysotile has also been identified within localised areas in shallow Made Ground deposits within TP145 (0.80 m) at <0.001%. Hotspot delineation should be undertaken within this area to identify the full extent of contamination. Due to materials containing <0.001%, they can be placed below 600 m within private gardens, below 300 m within POS areas, or below highways and plots. No visual signs of ACM were encountered during the ground investigation; it is therefore likely that only trace fibres are present. Impacted soils should be managed according to the asbestos risk mitigation conceptual site model shown in Figure 4.1.



FIGURE 4.1 ASBESTOS RISK MITIGATION CONCEPTUAL SITE MODEL



Notes

ND None Detect

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

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

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

Chemical analysis of the natural clay drift deposits have identified these soils to be acceptable for use as subsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this.

Natural topsoil has been identified as acceptable for reuse within private gardens with the exception of isolated areas TP125 and TP138. Hotspot delineation of these isolated areas should be undertaken during remediation and enabling works. Once delineated the risk to chronic human health associated with the localised marginally elevated concentrations of inorganic heavy metals can be mitigated by placing them within an area of reduced sensitivity.



4.2. CONTROLLED WATERS RISK ASSESSMENT

The site sensitivity with respect to controlled waters is summarised within Table 4.2.

TABLE 4.2 CONTROLLED WATERS SENSITIVITY PROFILE

RISK PROFILE	DISCUSSION	SENSITIVITY RATING
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is located within Groundwater Source Protection Zone 3 – Total Catchment as defined by the Environment Agency.	Moderate
Distance to the Closest Groundwater Abstraction Point	There are no licensed water abstractions within 250 m of site.	Low
Aquifer Classification in Superficial Drift Deposits	The superficial deposits of the Glacial Till are designated as Secondary (Undifferentiated) aquifer.	Low
Aquifer Classification in Bedrock	The bedrock deposits of the Chester Sandstone Formation are designated as Principle aquifer.	High
Viability for Anthropogenic Soil in Direct Contact with Aquifer (Drift or Bedrock)	The site is generally underlain by low permeability clays to depths of between 2.00 m (north east) and >16.95 m bgl (central). Made Ground deposits have been encountered within isolated areas across site. These are not representative of the site as a whole.	Low
Is the Site Located Within 50 m of a Surface Watercourse?	An unnamed brook/ditch is present along the northern boundary along with a ditch present in the centre of site orientated roughly east-west.	High
SUMMARY The ICSM developed within the context of the site setting has only identified two viable pollutant risks, which would be the downward migration of potentially mobile phase-soluble contaminants towards the underlying principal aquifer and lateral migration to the unnamed brook/ditch present along the northern boundary. However, the overall sensitivity of this receptor is reduced given the absence of any groundwater abstraction and thus the potential for the creation of a complete pollutant linkage.		

To further refine the ICSM, E3P has undertaken an initial qualitative assessment of the soil data analysis to assess the potential for a source of separate-phase or dissolved-phase contamination originating from either a defined on-site source or from impacted soils.

This assessment is summarised in Table 4.3.



TABLE 4.3 QUALITATIVE RISK TO CONTROLLED WATERS FROM SOIL ANALYTICAL RESULTS

BTEX > 1 mg/kg	The soil data analysis has not identified any detectable concentrations of TPH C5 to C6 that might otherwise be indicative of VOC impact
Total VOC > 1 mg/kg	
Total SVOC > 1 mg/kg	PAH analysis recorded concentrations below the laboratory LOD. Where detected, PAH concentrations were <1 mg/kg.
C5-C10 > 5 mg/kg	All concentrations are below the laboratory LOD.
C10-C12 > 10 mg/kg	All concentrations are below the laboratory LOD.
C12-C16 > 50 mg/kg	All concentrations are below the laboratory LOD.
Phenols > 2 mg/kg	All concentrations are below the laboratory LOD.
Naphthalene > 2 mg/kg	The most soluble SVOC (naphthalene) has been not identified at concentrations greater than 2 mg/kg
Total PAH > 10 mg/kg	Total combined concentrations of low-solubility PAH compounds greater than 10 mg/kg have not been detected in the soil analysis.
PCB > 1 mg/kg	No potential sources of PCB have been identified.
Heavy metals > 500 mg/kg	Concentrations of heavy metals are all below 500 mg/kg.

In due consideration of the ICSM, which has identified two potential pollutant linkages associated with the migration towards the underlying principal aquifer and drainage ditches, E3P has undertaken a Tier I controlled waters risk assessment.

The Tier I assessment has included a comparison of leachate analysis from samples of the Made Ground in west and groundwater samples to environmental quality standards (EQS) due to the adjacent unnamed brook and drinking water standards (DWS) due to the underlying aquifer.

These are presented in Table 4.4.



TABLE 4.4 COMPARISON OF GROUNDWATER ANALYSIS WITH TIER 1 SCREENING LEVELS

DETERMINAND	UNIT	EQS ^{1, 2, 3}	DWS ^{3, 4, 5}	NO. OF GW SAMPLES	MAX CONC. IN GROUND-WATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Arsenic	µg/l	50	10	4	109	WS114 (DWS & EQS)	2	3.7	N/A	No Further Action
Cadmium	µg/l	0.08-0.25	5	4	0.03	N/A	2	<0.08	N/A	No Further Action
Chromium (VI)	µg/l	3.4	—	4	<5.0	N/A	2	<5.0	N/A	No Further Action
Chromium (III)	µg/l	4.7	50	4	1.2	N/A	2	4	N/A	No Further Action
Copper	µg/l	1	2000	4	0.9 4.5 5.6 7.4	WS114 (EQS) WS127 (EQS) WS131 (EQS) WS103 (EQS)	2	8.2 35	WS120 (DWS) TP140 (DWS)	Further Action
Total Cyanide	µg/l	1	50	4	13	WS114 (EQS)	2	<1.0	N/A	No Further Action
Lead	µg/l	1.2	10	4	15	WS103 (DWS & EQS)	2	2 6.2	WS120 (EQS) TP140 (EQS)	Further Action
Mercury	µg/l	—	1.0	4	<0.05	N/A	2	<5.0	N/A	No Further Action
Nickel	µg/l	4	20	4	5	WS114 (EQS)	2	3	N/A	No Further Action
Selenium	µg/l	—	10	4	2.5	N/A	2	<4.0	N/A	No Further Action
Zinc	µg/l	10.9	—	4	13 14	WS103 (EQS) WS131 (EQS)	2	23	TP140 (EQS)	Further Action
pH	6–9			4	6.7–7.5	N/A	2	6.5–7.2	N/A	No Further Action
Naphthalene	µg/l	2	10*	4	<0.01	N/A	2	< 0.01	N/A	No Further Action
Anthracene	µg/l	0.1	10*	4	<0.01	N/A	2	< 0.01	N/A	No Further Action
Benzo[b]fluoranthene	µg/l	0.00017*	10*	4	<0.01	N/A	2	< 0.01	N/A	No Further Action
Benzo[k]fluoranthene	µg/l	0.00017*	10*	4	<0.01	N/A	2	< 0.01	N/A	No Further Action



DETERMINAND	UNIT	EQS ^{1, 2, 3}	DWS ^{3, 4, 5}	NO. OF GW SAMPLES	MAX CONC. IN GROUND- WATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Benzo(a)pyrene	µg/l	0.00017*	10*	4	<0.01	N/A	2	< 0.01	N/A	No Further Action
Indeno(123-cd)pyrene	µg/l	0.00017*	10*	4	<0.01	N/A	2	< 0.01	N/A	No Further Action
Fluoranthene	µg/l	0.0063	10*	4	<0.01	N/A	2	< 0.01	N/A	No Further Action
Benzo(ghi)perylene	µg/l	1.7–4	10*	4	<0.01	N/A	2	< 0.01	N/A	No Further Action
TPH C5-C6 (benzene)	µg/l	10	1	4	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C6-C8 (toluene)	µg/l	74	700	4	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C8-C10 (ethyl benzene)	µg/l	20	300	4	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C10-C12 (xylene)	µg/l	30	500	4	< 10	N/A	2	< 10	N/A	No Further Action
TPH C12-C16	µg/l	2	905	4	< 10	N/A	2	< 10	N/A	No Further Action
TPH C16-C35	µg/l	50#	905	4	< 10	N/A	2	< 10	N/A	No Further Action
TPH C5-C6	µg/l	–	15000	4	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C6-C8	µg/l	–	15000	4	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C8-C10	µg/l	–	300	4	< 1.0	N/A	2	< 1.0	N/A	No Further Action
TPH C10-C12	µg/l	–	300	4	< 10	N/A	2	< 10	N/A	No Further Action
TPH C12-C16	µg/l	–	300	4	< 10	N/A	2	< 10	N/A	No Further Action
TPH C16-C21	µg/l	–	300**	4	< 10	N/A	2	< 10	N/A	No Further Action
TPH C21-C35	µg/l	–	300**	4	< 10	N/A	2	< 10	N/A	No Further Action
Tetrachloroethylene	µg/l	0.4	10	0	N/A	N/A	0	N/A	N/A	No Further Action
Trichloroethylene	µg/l	10	10	0	N/A	N/A	0	N/A	N/A	No Further Action



DETERMINAND	UNIT	EQS 1, 2, 3	DWS 3,4,5	NO. OF GW SAMPLES	MAX CONC. IN GROUND-WATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Trichlorobenzene	µg/l	0.4	—	4	<1.0	N/A	0	N/A	N/A	No Further Action
Trichloromethane	µg/l	2.5	—	4	<1.0	N/A	0	N/A	N/A	No Further Action
Dichloromethane	µg/l	20	200	0	N/A	N/A	0	N/A	N/A	No Further Action
Carbon Tetrachloride	µg/l	12	3	0	N/A	N/A	0	N/A	N/A	No Further Action
Vinyl Chloride	µg/l	—	0.3	4	<1.0	N/A	0	N/A	N/A	No Further Action

Notes

Solubility <0.01µg/l

AA – Annual Average

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

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

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



CONTROLLED WATER RISK ASSESSMENT AND MITIGATION

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

- ✳ Arsenic (EQS and DWS);
- ✳ Copper (EQS and DWS);
- ✳ Total Cyanide (EQS and DWS);
- ✳ Lead (EQS and DWS);
- ✳ Nickel (EQS); and,
- ✳ Zinc (EQS).

4.2.1. M-BAT ASSESSMENT

Due to EQS exceedances in both soils and leachate samples for copper, nickel and zinc, an m-BAT assessment has been completed to assess the bioavailability of the metals with respect to surface water receptors (adjacent brook/drainage ditches). The chemical values from the groundwater analysis have been input into the assessment and the following Risk Characterisation Ratios (RCR) have been calculated.

1. W114
 - Copper (0.01)
 - Nickel (0.15)
2. WS127
 - Copper (0.54)
3. WS131
 - Copper (0.37)
 - Zinc (0.59)
4. WS103
 - Copper (0.27)
 - Zinc (0.35)

The Risk Characterisation Ratio (RCR) for all elevated compounds has been found to be less than 1, which indicates the bioavailable concentrations are below the EQS and the receptor is therefore not at risk from copper, nickel or zinc. In this instance, groundwater chemical data for DOC was input into the m-BAT for the onsite locations.

4.2.2. FINAL PB SCREENING TOOL

Lead is not included in the M-BAT tool as it is not a full bioavailable EQS, however, a separate assessment using the Pb screening tool has been completed for lead for elevated levels noted in WS103. The assessment confirms that there is not a risk within WS103 (RCR- 0.09), as the concentrations do not exceed the site specific PNEC and the risk characterisation ratio is less than 1.0.

In light of the above assessment, E3P do not consider the site to pose an unacceptable level of risk to surface waters for lead.



With regards to the elevated arsenic and total cyanide within WS114, they are general low solubility and therefore mobility, suggesting that these will not migrate to controlled water receptors. Furthermore, soakaway testing undertaken at the site has confirmed that the infiltration rate is very low, and the low permeability of the material will therefore significantly reduce the potential for downward or lateral migration.

Based on the above, there is considered to be no unacceptable level of risk to the controlled water receptors.

4.3. GROUND GAS

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

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

$$GSV = \frac{\text{concentration (by vol)}}{100} \times \text{flowrate (1 / hr)}$$

The GSVs within CIRIA C665 are based upon all buildings other than standard residential houses. The NHBC GSVs are based upon standard residential houses with precast concrete floors (block and beam). The CIRIA 665 report author (Steve Wilson) since provided further clarification regarding which guidance should be adopted for residential houses that have suspended cast in-situ concrete floor slab: for the avoidance of doubt, it was confirmed that the GSVs within the CIRIA 665 guidance should be adopted. The thresholds for GSVs based upon NHBC and CIRIA guidance are provided within Table 4.5.

TABLE 4.5 RESIDENTIAL THRESHOLDS FOR GAS SCREENING VALUES (GSV) IN ACCORDANCE WITH CIRIA C665 AND NHBS REPORT NO 10627-R01 – RESIDENTIAL END USE

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

4.3.1. SOURCES OF GROUND GAS

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

- ✚ Made Ground deposits; and,
- ✚ Infilled ponds.



4.3.2. GROUNDWATER

Monitoring wells WS103, WS114, WS115, WS117, WS121, WS123, WS127, WS129, WS130, WS131 and WS133 were flooded on a number of occasions and cannot therefore be included within the gas assessment.

Within the remaining wells, groundwater levels were observed to fluctuate over the monitoring period. The greatest groundwater change occurred within WS109 where levels increased by 3.03 m over the monitoring period. WS109 was set within a low-permeability clay stratum and groundwater may be a result of surface water collecting in the well rather than a measure of true groundwater.

4.3.3. GAS FLOW

During the monitoring, a positive flow was noted in all wells. The highest flow was recorded within WS124 at 57.10l/hr, this well was noted to be flooded at the time of this recording and is therefore not considered to be representative of true active flow.

The measure of positive flow is considered to be the result of groundwater fluctuations and flooding of the well causing compression – as opposed to gas generation – as the highest flows are generally recorded during periods of high groundwater levels.

Negative flows are indicative of back pressure from wind being greater than the active flow from the wells. Negative flows were recorded in WS104, WS109, WS114, WS119, WS121 and WS123.

4.3.4. GAS CONCENTRATIONS

Methane has been recorded in within non-flooded monitoring all wells at maximum concentrations of 0.1%.

However, methane has been recorded at concentrations of between 21.8 and 41.2% v/v within monitoring well WS114 during the last four monitoring visits. This monitoring well is located in the vicinity of a historical (potentially infilled) pond; however, no obvious organic material was encountered. This location was also noted to be flooded on three of these occasions, so the elevated concentrations may be the result of gases being compressed within the well headspace and therefore the results should be treated with caution/discounted from the overall assessment.

Carbon dioxide concentrations were recorded within non-flooded monitoring wells at concentrations ranging from 0.1% v/v to 7.5% v/v (WS114 – not flooded on this occasion). Concentrations above 5% were also recorded in WS102, WS113 (flooded), WS117 (flooded) and WS131.

4.3.5. GAS ASSESSMENT

In accordance with the methodology outlined with the CIRIA publication C665, E3P have utilised the results of the ground gas monitoring surveys to calculate a tentative gas screening value (GSV). The GSVs for the monitoring positions are summarised in Table 4.6.



TABLE 4.6 GAS RISK PROFILE AND LOCATION

LOCATION	MAX CH ₄ (% v/v)	GSV (l/hr)	MAX CO ₂ (% v/v)	GSV (l/hr)	CLASSIFICATION
WS102	0.1	0.00010	6.3	0.00630	CS2/Amber 1
WS104	0.1	0.00930	1.4	0.00140	CS1/Green
WS106	0.1	0.00010	3.8	0.00380	CS1/Green
WS109	0.1	0.00010	3.7	-0.42032	CS1/Green
WS111	0.1	0.00010	4.4	0.00440	CS1/Green
WS112	0.1	0.00026	4.6	0.01196	CS1/Green
WS113	0.1	0.00010	4.0	0.00400	CS1/Green
WS114*	22.0	0.02180	7.5	-0.06600	CS4/Red
WS119	0.1	0.00183	2.5	0.04575	CS1/Green
WS124	0.1	0.05710	2.4	0.03288	CS1/Green

Notes

*Max concentrations from visits where the monitoring well was not flooded have been included in the assessment

Monitoring is incomplete, but based on the preliminary results to date, the GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area.

The results indicate the majority of the site to be classified as CS1/Green

Although the calculated GSVs all fall into the Green/CS1 classification, guidance suggests that where carbon dioxide is >5% or methane is >1%, consideration for increasing the classification should be made. Preliminary ground gas monitoring suggests that the site can be predominantly classified as CS1, and in these areas it is considered that gas protection measures will not be required.

However, concentrations recorded in WS102 indicate a classification of CS2/Amber 1 and are associated with Made Ground deposits. Concentrations recorded in WS114 indicate a classification of CS4/Red, therefore allowance for specialist protection measures within plots in the vicinity of these locations should be made.

With respect to WS114, it was noted that on recent monitoring visits, the water level was recorded above the top of the response zone i.e. flooded. Therefore, for subsequent monitoring visits, it is recommended that water be bailed/removed from the well, prior to monitoring, to determine whether high gas concentrations are genuine, or the result of compression within the reduced headspace.

If high gas concentrations persist after bailing, it may be possible to remove the source of the ground gas (Made Ground) in the vicinity of WS114 where a CS4/Red classification has been noted to eliminate the risk and reduce the classification but would require further assessment post-removal to ensure no further risk remains.

Further assessment and recommendations will be required on completion of the monitoring programme.

4.4. RESIDENTIAL BUILDING GAS RISK MITIGATION

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

-  **Type A Building** – Private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Some small rooms are present. Probably conventional building construction (rather than civil engineering). Examples include private housing and some retail premises.



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

Based on the ground gas risk assessment and the proposed Type A Building, it is envisaged that a point score of 3.5 will be required for CS2/Amber 1 affected properties, as summarised in Table 4.7.

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

TABLE 4.7 BS 8485 (2015) POINTS REQUIRED FOR TYPE A AND TYPE B BUILDINGS

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

The requisite 3.5 points for CS2/Amber 1 plots must be achieved by installation of a suitable combination of measures detailed in Table 4.8.

TABLE 4.8 SUMMARY OF GROUND GAS MITIGATION MEASURES – BS8485 (2015)+A1(2019)

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

^A) The scores are conditional on breaches of floor slabs, etc. being effectively sealed.

^B) To achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast in (see A.2.2.2).

^C) The score is conditional on the waterproofing not being based on the use of a geosynthetic clay liner waterproofing product (see C.3, Note 4).



Gas protection scores for ventilation protection measures			
(a) Pressure Relief Pathway – Usually formed of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building.		0.5	Whenever possible a pressure relief pathway (as a minimum) should be installed in all gas protection measures systems. If the layer has a low permeability and/or is not terminated in a venting trench (or similar), then the score is 0.
(b) Passive Subfloor Dispersal Layer – Media used to provide the dispersal layer are: ☛ Clear void; ☛ Polystyrene void former blanket; ☛ Geocomposite void former blanket; ☛ No-fines gravel layer with gas drains; and ☛ No-fines gravel layer.	Very good performance	2.5	The ventilation effectiveness of different media depends on a number of different factors including the transmissivity of the medium, the width of the building, the side ventilation spacing and type and the thickness of the layer. The selected score should be assigned taking into account the recommendations in Annex B of BS 8485 (2015). Passive ventilation should be designed to meet at least “good performance”.
	Good performance	1.5	
(c) Active Dispersal Layer – Usually comprising fans with active abstraction (suction) from a subfloor dilution layer with roof-level vents. The dilution layer may comprise a clear void or be formed of geocomposite or polystyrene void formers.		1.5 to 2.5	This system relies on continued serviceability of the pumps, therefore alarm and response systems should be in place. There should be robust management systems in place to ensure the continued maintenance of the system, including pumps and vents. Active ventilation should always be designed to meet at least “good performance”.
(d) Active Positive Pressurisation – Provided by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket.		1.5 to 2.5	This system relies on continued operation of the pumps, therefore alarm and response systems should be in place. The score assigned should be based on the efficient “coverage” of the building footprint and the redundancy of the system. Active ventilation should always be designed to meet at least “good performance”.
(e) Ventilated Car Park – Floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park.		4	Assumes that the car park is vented to deal with car exhaust fumes, designed to Buildings Regulations 2000, Approved Document F [9].



Gas Protection Score for the Gas-Resistant Membrane		
Gas-resistant membrane meeting all of the following criteria: ✳ Sufficiently impervious to the gases with a methane gas transmission rate < 40.0 ml/day/m²/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method); ✳ Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; ✳ Sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab); ✳ Sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre-reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools); ✳ Capable, after installation, of providing a complete barrier to the entry of the relevant gas; and ✳ Verified in accordance with CIRIA C735.	2	The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and integrity of joints. For example, a minimum 0.4 mm thickness (equivalent to 370 g/m² for polyethylene) reinforced membrane (virgin polymer) meets the performance criteria opposite. If a membrane is installed that does not meet all the criteria opposite, then the score is 0.
This table should be read in conjunction with the notes presented in BS 8485 (2015)+A1 (2019)		



4.5. POTABLE WATER SUPPLY

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

TABLE 4.9 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

Contaminant Group	PE-threshold (mg/kg)	Concentrations at <u>Current</u> pipeline depth (mg/kg)
Total VOC	0.5	<1.0
Total BTEX And MTBE	0.1	N/A
Total SVOCs (Excluding PAH and those substances marked with an *)	2	N/A
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2	<1.0
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	<4.0
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	<10
Phenols (From SVOC Analysis)*	2	N/A
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	NA
Ethers*	0.5	NA
Nitrobenzene*	0.5	NA
Ketones*	0.5	NA
Aldehydes*	0.5	NA
Amines	Fail	NA
Other Consideration		
Are there any exceedances of the PE threshold outside of the pipeline depth?	No exceedances have been noted within or outside of pipeline depth.	
Is free product present in soil and groundwater?	No	
Could hydrocarbon impact at greater depth than current pipeline depth be mobilised by rising groundwater levels?	No hydrocarbon impact has been noted across the site.	
Will soils impacted with above determinants likely be utilised elsewhere on site?	No	
Will soils be imported to site as part of any future earth works	Currently unknown, however it is unlikely soils will be required to be imported to site. If materials are to be imported a WIR Risk Assessment will be required after completion.	

Notes

Pipe line depth normally between 0.75m–1.35m

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



4.6. CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 4.10 has been prepared for the site.

TABLE 4.10 CONCEPTUAL MODEL

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL1 PL2	Heavy metals (Topsoil)	Dermal contact. Dermal contact and ingestion.	Future site users. Off-site receptors.	Likely	High	LOW
Discussion: Heavy metals (chromium VI and Lead) identified in Made Ground between depths of 0.10 m bgl within two isolated locations (TP125 and TP138) Recommendation: At the time of site stripping, a hotspot delineation exercise should be undertaken to ensure impacted materials are segregated and stockpiled separately for placement below a 600 mm cover system or an area of reduced sensitivity e.g. POS/beneath hardstanding. Construction works completed with PPE and provision of welfare.						
PL3	Volatile Contaminants	Inhalation of vapours.	Future site users. Off-site receptors.	Low likelihood	Low	LOW
Assessment: No volatile contamination has been identified. Recommendation: N/A						
PL4	ACM in shallow Made Ground	Inhalation of dust.	Future site users. Buildings. Off-site land users.	Likely	High	LOW
Assessment:						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
Chrysotile has been identified at a quantity of <0.001% within Made Ground deposits within TP145 at 0.80 m bgl. Recommendation: A hotspot delineation exercise should be undertaken to ensure impacted materials are segregated and stockpiled separately for placement below a 600 mm cover system or an area of reduced sensitivity e.g. POS/beneath hardstanding. Construction works completed with PPE and provision of welfare.						
PL5	Methane, carbon dioxide (Made Ground)	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Low likelihood	High	LOW
Assessment: Current assessment based on initial monitoring visit confirms one area of the site (WS102) identifies levels of CO2 that would require CS2/Amber 1 classification. The monitoring well is located within Made Ground strata; therefore, delineation of the Made Ground would remove the source of CO2 decreasing the classification to CS1/Green. WS114 has encountered levels of methane that have been assessed as CS4/Red classification. This area was historically a pond; therefore, the infill material is thought to be the source of high methane levels, although the monitoring well was noted to be flooded on recent occasions and thus results may not be reflective of the true gassing regime. Recommendation: Completion of ground gas monitoring ensuring water is removed from wells beforehand. If high concentrations persist, delineation and removal of the source of elevated carbon dioxide and methane (made ground/pond) within the vicinity of these locations may be required to mitigate the risk to end users.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL5	Mobile contaminants such as metals	Migration through permeable strata and preferential pathways.	Groundwater (secondary A aquifer). Adjacent unnamed Brook	Likely	Low	LOW
Assessment: Exceedances have been detected within leachate and water samples analysed including arsenic, copper, total cyanide, lead, nickel and zinc. An m-BAT assessment has been completed to assess the bioavailability of the metals with respect to surface water receptors (adjacent unnamed brook/drainage ditches) which indicates the determinands to be of low bioavailability and thus do not pose a risk to surface water courses. A separate assessment using the Pb screening tool has been completed for lead for elevated levels noted in WS103. The assessment confirms that there is not a risk within WS103, as the concentrations do not exceed the site specific PNEC and the risk characterisation ratio is less than 1.0. With regards to the elevated arsenic and total cyanide within WS114, they are general low solubility and therefore mobility, suggesting that these will not migrate to controlled water receptors. Furthermore, soakaway testing undertaken at the site has confirmed that the infiltration rate is very low, and the low permeability of the material will therefore significantly reduce the potential for downward or lateral migration. Based on the above, there is considered to be no unacceptable level of risk to the controlled water receptors. Recommendation: N/A						
PL6	Sulphate (potential ash within Made Ground)	Sulphate attack on concrete.	Building structure.	Low	Low	LOW
Assessment: Chemical analyses for pH and soluble sulphate shows that the soils at the site meet Class DS-1, AC-1. Recommendation: Concrete design meeting Class DS-1, AC-1 classification.						



PL7	Organic contaminants such as hydrocarbons, solvents	Ingestion of tainted water supply.	Future site users. Water pipes.	Low likelihood	Low	LOW
Assessment: No elevated contaminants of concern have been noted at pipeline depth. Recommendation: A WIR Risk Assessment will be required after completion of enabling works.						
PL8	Phytotoxic contaminants (Made Ground)	Direct Contact (plant uptake).	Flora.	Low likelihood	Low	LOW
Assessment Significant contamination is unlikely to be present at the site that might inhibit healthy plant growth.						

Main exposure pathways:

PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = vapour inhalation (indoor), PL4 = dust inhalation; PL5 = Vertical/lateral migration;

PL6 = Corrosion of concrete; PL7=Tainting of water supply; PL8 = Uptake by plants



5. GEOTECHNICAL ASSESSMENT

5.1. PROPOSED DEVELOPMENT

Taylor Wimpey NW intends to construct a low-rise residential development comprising residential dwellings with associated gardens, estate roads and infrastructure.

Drawing 13-759-002 (Appendix III) identifies the proposed development layout.

5.2. SUMMARY OF GROUND CONDITIONS

MADE GROUND

Made Ground deposits were encountered within thirteen exploratory hole locations to depths of between 0.30 m and 1.80 m bgl although, generally less than 0.80 m bgl.

Made Ground deposits comprise a reworked topsoil of dark brown sandy clay with gravel of mudstone and sandstone with selected areas containing fragments of occasional brick and concrete. The majority of locations were underlain by a black sandy mudstone gravel (land drain bedding).

DRIFT DEPOSITS

Drift generally comprises firm brown mottled grey slightly gravelly sandy CLAY with gravel of mudstone, underlain by a stiff brown slightly gravelly sandy CLAY where gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Some locations encountered occasional cobbles of subrounded to rounded mudstone and sandstone.

Low strength clays were encountered within 8 locations across the whole site. Seven locations were between a depth of 1.00 m and 1.65 m bgl (CP101, CP102, WS101, WS105, WS121, WS128 and WS132) with WS114 experiencing soft clays between 2.00 m and 3.45 m bgl.

Medium dense SAND was encountered within two locations WS104 (0.30 m–0.40 m bgl) and WS136 (1.00 m–3.40 m bgl)

Gravel with sand bands was encountered between 12.00 m and 13.10 m bgl within CP102.

SOLID GEOLOGY

Weathered bedrock comprising reddish brown SANDSTONE was encountered within the east of the site between 2.00 m (WS101) and 5.30 m bgl (CP101).

Bedrock was not encountered in the central or western areas of site, with one location (CP102) advancing to 16.95 m bgl in Clay drift deposits, indicating the bedrock is significantly deeper within these areas.

GROUNDWATER

Groundwater was encountered between 0.40 m bgl and 12.00 m bgl during the site investigation with monitoring recording groundwater levels between ground level and 3.43 m bgl.



5.3. SITE PREPARATION

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

- ✿ Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void infilled with suitable compacted engineered fill.
- ✿ Demolition of all existing buildings and removal of all concrete hardstanding.
- ✿ Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill.
- ✿ Buried structures and old foundations have not been encountered on site; however, relic structures and foundations are likely to be present beneath the existing farm buildings to the east. If present, these should be excavated from below the proposed development footprint with the resulting void backfilled.

5.4. FOUNDATION CONDITIONS AND ASSESSMENT OF POTENTIAL BEARING CAPACITIES

In due consideration of the identified ground conditions, in-situ and laboratory geotechnical testing, E3P has undertaken an assessment of the net safe allowable bearing pressure (ABP) within the underlying natural stratum to assist in the detailed design of foundations and infrastructure and determine the target founding stratum. The results of this assessment are summarised in Table 5.1.

TABLE 5.1 SUMMARY OF ABPS

GRANULAR SOILS			
Description	Depth (Range m bgl)	Relative Density	Allowable Bearing Pressure (kN/m ²)
Weathered SANDSTONE (East of site - WS101, WS104, WS108, CP101)	2.00–3.80	Dense/Hard	413–440
Clayey SAND	1.00–3.00	Medium Dense–Dense	110–434
COHESIVE SOILS			
Description	Depth (range m bgl)	Undrained Shear Strength (Cu) (kN/m ²)	Allowable Bearing Pressure (kN/m ²)
Very low strength to low strength CLAY (CP101)	1.00–1.65	20	40
Low strength CLAY (WS101, WS105, WS121, WS128, WS132)	1.00–1.45	20–35	41–73
Low strength CLAY (WS114)	1.00–3.45	20–39	41–80
Medium Strength/Firm to Very Stiff, CLAY	1.00–2.00	45–228	100–470
High Strength Very stiff CLAY	2.00–4.00	80–211	150–434



Based on the assessment of the relative undrained shear strength, relative in-situ densities and corresponding safe net allowable bearing pressure, the suitable target founding stratum has been identified as follows:

- ✿ Firm to very stiff glacial CLAY;
- ✿ Localised areas of medium-dense SAND; and/or,
- ✿ Weathered SANDSTONE in the east of the site.

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

- ✿ Standard strip/trench foundations (suitably deepened in areas of tree influence and locally softer clays);
- ✿ Plots within close proximity of trees or areas of soft clays/loose sands will require piled foundations.

Foundation options based on existing levels are summarised in Table 5.2.

TABLE 5.2 ANTICIPATED FOUNDATIONS

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	TARGET STRATUM	TREES	FOUNDATION TYPE	TYPE OF CONCRETE
TP101	0.90	N/A	CLAY	Yes	Shallow Strip	DS-1 AC-1s
TP102	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP103	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP104	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP105	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP106	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP107	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP108	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP109	1.05	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP110	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP111	0.90	N/A	CLAY	Yes	Shallow Strip	DS-1 AC-1s
TP112	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP113	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP114	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP115	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP116	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP117	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s



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LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	TARGET STRATUM	TREES	FOUNDATION TYPE	TYPE OF CONCRETE
TP118	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP119	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP120	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP121	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP122	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP123	1.25	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP124	1.15	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP125	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP126	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP127	1.05	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP128	1.15	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP129	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP130	0.95	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP131	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP132	1.05	0.40	CLAY	No	Shallow Strip	DS-1 AC-1s
TP133	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP134	1.15	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP135	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP136	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP137	1.15	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP138	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP139	1.35*	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP140	0.95	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP141	1.35*	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP142	1.05	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP143	1.35*	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP144	0.95	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
TP145	1.35*	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS101	2.35	N/A	CLAY	No	Pile	DS-1 AC-1s
WS102	2.25	N/A	CLAY	No	Pile	DS-1 AC-1s
WS103	1.15	2.00	CLAY	No	Shallow Strip	DS-1 AC-1s
WS104	0.90	N/A	CLAY	Yes	Shallow Strip	DS-1 AC-1s
WS105	1.45	2.20	CLAY	No	Mass Trench	DS-1 AC-1s



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LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	TARGET STRATUM	TREES	FOUNDATION TYPE	TYPE OF CONCRETE
WS106	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS107	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS108	>2.50	1.00	CLAY	Yes	Pile	DS-1 AC-1s
WS109	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS110	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS111	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS112	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS113	1.45	N/A	CLAY	No	Mass Trench	DS-1 AC-1s
WS114	1.95	N/A	CLAY	No	Mass Trench	DS-1 AC-1s
WS115	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS116	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS117	1.45	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS118	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS119	1.15	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS120	1.15	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS121	1.65	N/A	CLAY	No	Mass Trench	DS-1 AC-1s
WS122	0.95	3.80	CLAY	No	Shallow Strip	DS-1 AC-1s
WS123	0.95	N/A	CLAY	Yes	Shallow Strip	DS-1 AC-1s
WS124	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS125	0.95	N/A	CLAY	Yes	Shallow Strip	DS-1 AC-1s
WS126	1.15	4.00	CLAY	No	Shallow Strip	DS-1 AC-1s
WS127	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS128	2.45	N/A	CLAY	Yes	Pile	DS-1 AC-1s
WS129	0.90	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS130	1.05	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS131	1.25	3.50	CLAY	No	Shallow Strip	DS-1 AC-1s
WS132	2.45	N/A	CLAY	No	Pile	DS-1 AC-1s
WS133	1.25	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS134	0.95	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS135	1.05	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
WS136	0.95	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
CP101	2.45	N/A	CLAY	No	Shallow Strip	DS-1 AC-1s
CP102	1.05	11.80	CLAY	No	Shallow Strip	DS-1 AC-1s



The above foundation depths are indicative and make no consideration for proposed changes in levels or the influence of trees.

It is recommended that at working drawing stage a foundation schedule is prepared for the development, taking account of the physical change of natural clay soils and the current/proposed locations of trees, with foundations deepened locally to mitigate the potential for volumetric instability attributed to fluctuations in moisture content, in accordance with the requirements of NHBC standards.

A programme of remediation and enabling works may be required to provide suitable development platform levels. Therefore, upon completion of these enabling works, it is possible that a deeper/abnormal foundation solution may be required in areas of the site where levels have been raised.

5.5. GROUND FLOOR SLABS

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

In this instance, it is considered that for the majority of substructures, the underlying stratum would have in excess of 600 mm of Clay deposits and, as such, a suspended floor slab will be required.

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

5.6. HEAVE PRECAUTIONS

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

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

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

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

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

A summary of heave precautions is presented in Table 5.3.



TABLE 5.3 SUMMARY OF HEAVE PRECAUTIONS

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

5.7. HIGHWAYS CONSTRUCTION

In-situ CBR testing from existing ground level suggest an indicative CBR in the range of 3.72% to 23.21%.

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

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

5.8. DRAINAGE

The presence of isolated areas of Made Ground across some areas of the site may result in settlement. It is therefore recommended that drain runs are designed using steeper gradients and flexible joints to allow for some differential settlement.

Furthermore, the site is predominantly underlain by circa 2.00 m to >16.95 m of low-permeability gravelly CLAY. Soakaway tests have confirmed the soils to have very poor soakage potential, therefore it is not recommended that soakaways are utilised for disposal of surface water runoff.



5.9. CONCRETE DURABILITY

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

5.10. EXCAVATIONS

Trial pits were generally stable in both Made Ground and natural strata; as such, it is considered that near-surface excavations will be feasible. One location was observed to be unstable to water ingress.

Site observations indicated that excavations should be feasible in the near surface with normal plant; however, obstructions under current farm buildings are thought to be present, however, these areas could not be . It is anticipated that any obstructions will be grubbed out during the reduced-level dig for the substructure works.

If trench collapse is likely it is considered that all excavations are supported or battered back in accordance with guidance contained in CIRIA R97.

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

TABLE 5.4 CIVIL ENGINEERING EXCAVATION RISK MATRIX

RISK ITEM	PRESENT	COMMENT
Running Sands	No	No running sand has been identified.
Minor Water Ingress	No	Mine water ingress will require localised dewatering/sump pumping during the construction of site drainage infrastructure. Ingress of water into foundation excavation will potentially flood foundation excavations, limiting the viability of spread foundations to be constructed.
Shallow Bedrock	No	Shallow bedrock has been identified within the east at a minimum depth of 2.0 m bgl, which may impede foundations/service excavations if levels are to be reduced or deep installations are proposed.

5.11. CONSTRUCTION ACTIVITY AND INSPECTION

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

- ✳ Excavations where access is required should be subject to a risk assessment from a competent person and, where appropriate, mitigation measures such as benching back the sides or use of support systems in accordance with CIRIA R97 should be utilised.
- ✳ It is considered that dewatering may be required, especially following periods of heavy rainfall. Removal of surface water and water within trenches should be possible with conventional sump pumping. Discharge of any water should be agreed with the relevant regulatory body and be undertaken under a trade effluent discharge, where required. Measures to remove silt and suspended solids may be required and consideration should be given to provision of space for settling tanks or an attenuation pond.



-  Where access to confined spaces is required, appropriate mitigation measures should be addressed within the construction stage health and safety plan. Particular account should be taken of the gas results.
-  The presence of potential contamination and mitigation measures should be addressed as part of the construction stage health and safety plan and should include measures to design out the risks, reduce their impact and, finally, to include the use of personnel protective equipment (PPE).



5.12. GEOTECHNICAL RISK REGISTER

POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Remediation of contaminated soils		On site	5	Inorganic heavy metals have been encountered in TP125 (0.10 m) and TP138 (0.10 m). Trace Asbestos has also been identified in Made Ground in TP145 at 0.80 m. Delineation and segregation of this impacted topsoil material will be required to ensure it is placed in an area of reduced sensitivity e.g. Beneath 600 mm cover system in private gardens, POS, beneath hardstanding/plots/roads. Further post-demolition investigation in the farmyard area will be required to confirm the ground conditions and potential for contamination.
Bedrock		East	10	Shallow weathered bedrock has been identified at depths of between 2.0 m (WS101) and 5.3 m bgl (CP101); this represents a risk in terms of the viability for excavations to install infrastructure using standard construction equipment and should be considered when finalising development levels.
Obstructions		N/A	N/A	No obstructions were encountered during site investigations; however, there is potential for obstructions to be present below current farm buildings and hard standing areas in the west of the site that could not be investigated at the time.
Artificially levelled and filled platforms		N/A	N/A	N/A
Retaining walls		N/A	N/A	N/A
Trench collapse		On site	N/A	Trial pits were generally stable; however, saturated ground increases the likelihood of trench collapse. Pumping may be required during wetter months.
Mature trees		Periphery	35	Arboriculture survey required to determine areas of potential tree influence.
Volume change potential clay		On site	100	The site is underlain by Clay deposits that have low volume change potential.
Running sands		N/A	N/A	Running sands were not identified.



POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Ground dissolution		N/A	N/A	Data searches indicate no hazard.
Concrete design		On site	100	DS-1, AC-1.
Low-permeability ground		On site	100	The site is underlain by low-permeability gravelly CLAY. Therefore, the use of soakaway drainage will not be feasible.
Services/sensitive structures		On site	5	Online plans show a sewer present in the western sector of site with a trunk main present though Chapel lane to the west of site . On site within the east private water pipes are present supplying all farm buildings with one orientated roughly north-south between the cattle shed and the northern boundary. Electricity is also present within this area creating a loop from the cattle shed, south, then back north towards the farm buildings. This could not be located during site investigations A foul drainage pipe is present orientated north-south originating from a septic tank near the access track in the east flowing out towards the northern boundary. All services are associated with Rose Farm. A surface water drain roughly orientated east-west is present within the central and eastern field. This was located during site investigation by a hand excavated pit. The drain was uncovered at 0.40 m bgl and found to be in good condition.
Abnormal foundation solutions		TBC	5	At this time it is not possible to accurately define the foundation types due to the absence of a detailed tree survey and final development levels; however, we would anticipate that the final foundation solution would be a combination of the following: - Strip/trench foundations bearing on firm to very stiff gravelly CLAY or medium dense SAND/SANDSTONE (east) - Piled foundations within areas of localised soft/loose soils or deep Made Ground/upfill.



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POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Areas not investigated		East	5	Further post-demolition investigation in the farmyard area in the west of the site will be required to confirm the ground conditions and potential for contamination.
Surface water features		South	2	A pond is located to the central south of site within an area utilised for cattle grazing.
Historically infilled pond		On site	10	Infilled ponds are inferred on site from historical mapping, however ground conditions in these areas have been found to be similar to the general wider site. Further assessment at the time of enabling works may be required.



6. CONCLUSIONS AND RECOMMENDATIONS

CONTAMINATED LAND ASSESSMENT

Human Health	The Tier 1 human health risk assessment identified the concentrations of the following in exceedance of screening criteria relevant to a residential end use with plant uptake: - Chromium VI – TP125 Made Ground at 0.1 m bgl; - Lead – TP138 Made Ground at 0.1 m bgl; and, - Asbestos (<0.001%) – TP145 Made Ground at 0.80 m bgl Which present unacceptable degrees of theoretical risk to the identified receptors associated with ingestion of soils and inhalation of particulate, respectively. Delineation and segregation of this impacted material will be required to ensure it is placed in an area of reduced sensitivity such as: - Beneath 600 mm clean cover within private gardens; - Within POS – Material from TP125 and TP138 will be suitable for use as topsoil within areas of POS. However, asbestos impacted material would need to be placed below 300 mm clean cover); or, - Beneath plots/hardstanding/roads. With the exception of the locations noted above, topsoil and subsoil deposits on site are considered suitable for re-use, subject to further chemical validation testing. Further post-demolition investigations are required in the farmyard area in the west of the site to confirm the findings of this initial assessment as and when full and unrestricted access is available.
Controlled Waters	Exceedances of EQS and DWS values have been detected within leachate and water samples analysed including arsenic, copper, total cyanide, lead, nickel and zinc. M-BAT and Pb assessment has confirmed the determinands to be of low bioavailability and thus do not pose a risk to surface water courses. Soakaway testing undertaken at the site has confirmed that the infiltration rate is very low, and the low permeability of the material will therefore significantly reduce the potential for downward or lateral migration. Based on the above, there is considered to be no unacceptable level of risk to the controlled waters receptors.
Ground Gas	Current assessment based on initial monitoring visit confirms one area of the site (WS102) identifies levels of CO₂ that would require CS2/Amber 1 classification. The monitoring well is located within Made Ground strata; therefore, delineation of the Made Ground would remove the source of CO₂ decreasing the classification to CS1/Green.



	WS114 has encountered levels of methane that have been assessed as CS4/Red classification. This area was historically a pond; therefore, the infill material is thought to be the source of high methane levels, although the monitoring well was noted to be flooded on recent occasions and thus results be not be reflective of the true gassing regime. Completion of ground gas monitoring is required, ensuring water is removed from wells beforehand. If high concentrations persist, delineation and removal of the source of elevated carbon dioxide and methane (made ground/pond) within the vicinity of these locations may be required to mitigate the risk to end users.
Potable Water	Based on the assessment of current site conditions it is likely that PE pipe can be used at the proposed development. This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.

GEOTECHNICAL ASSESSMENT

Ground conditions predominantly comprise topsoil (with limited thicknesses of Made Ground/reworked soil) overlying Glacial Till (Clay). Sandstone was encountered in select locations the east and centre of the site at depths of between 2.0 m (WS101) and 5.3 m bgl (CP101).

The underlying cohesive deposits generally comprise firm to very stiff brown slightly gravelly CLAY circa 0.5 m bgl – 4.0 m bgl which has a net ABP in the order of >100 kN/m².

Localised areas of soft/firm (low strength) clays were encountered in CP101, CP102, WS101, WS105, WS115, WS121, WS128 and WS132 with an ABP of 10–40 kN/m². These soils are located across the entire site within isolated areas.

The weathered SANDSTONE if encountered at foundation depth is anticipated to provide an ABP >400 kN/m².

It is considered that the optimum foundation solution for the proposed residential development would therefore be as follows:

- Standard strip/trench foundations bearing onto firm/stiff CLAY or weathered SANDSTONE (suitably deepened in areas of tree influence and locally softer clays);
- Plots within close proximity of trees or areas of soft clays/loose sands will require piled foundations.

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

Soakaway tests indicate the clays will not be suitable for soakaway drainage and alternative means of suitable surface water disposal will be required.

Investigation in the farmyard in the west of the site was limited due to the presence of buildings and sensitive livestock. Further geoenvironmental and geotechnical investigation in this part of the site should be undertaken to confirm the ground conditions when possible. Deeper Made Ground deposits are anticipated in this part of the site.

Further works to locate / delineate infilled ponds in the south east of the site is also recommended at enabling works stage.



FURTHER WORKS

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

- ✿ Further post-demolition investigation in the farmyard area in the west of the site, together with additional investigations to delineate infilled ponds at enabling works stage;
- ✿ Plot-specific foundation schedule (upon receipt of the final development levels and layout);
- ✿ Arboricultural survey;
- ✿ Materials management plan;
- ✿ Geotechnical earthworks strategy (infrastructure);
- ✿ Remediation and enabling works strategy; and,
- ✿ Full three-dimensional earthworks cut/fill model.

END OF REPORT



APPENDIX I

LIMITATIONS

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



APPENDIX II

GLOSSARY

TERMS

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



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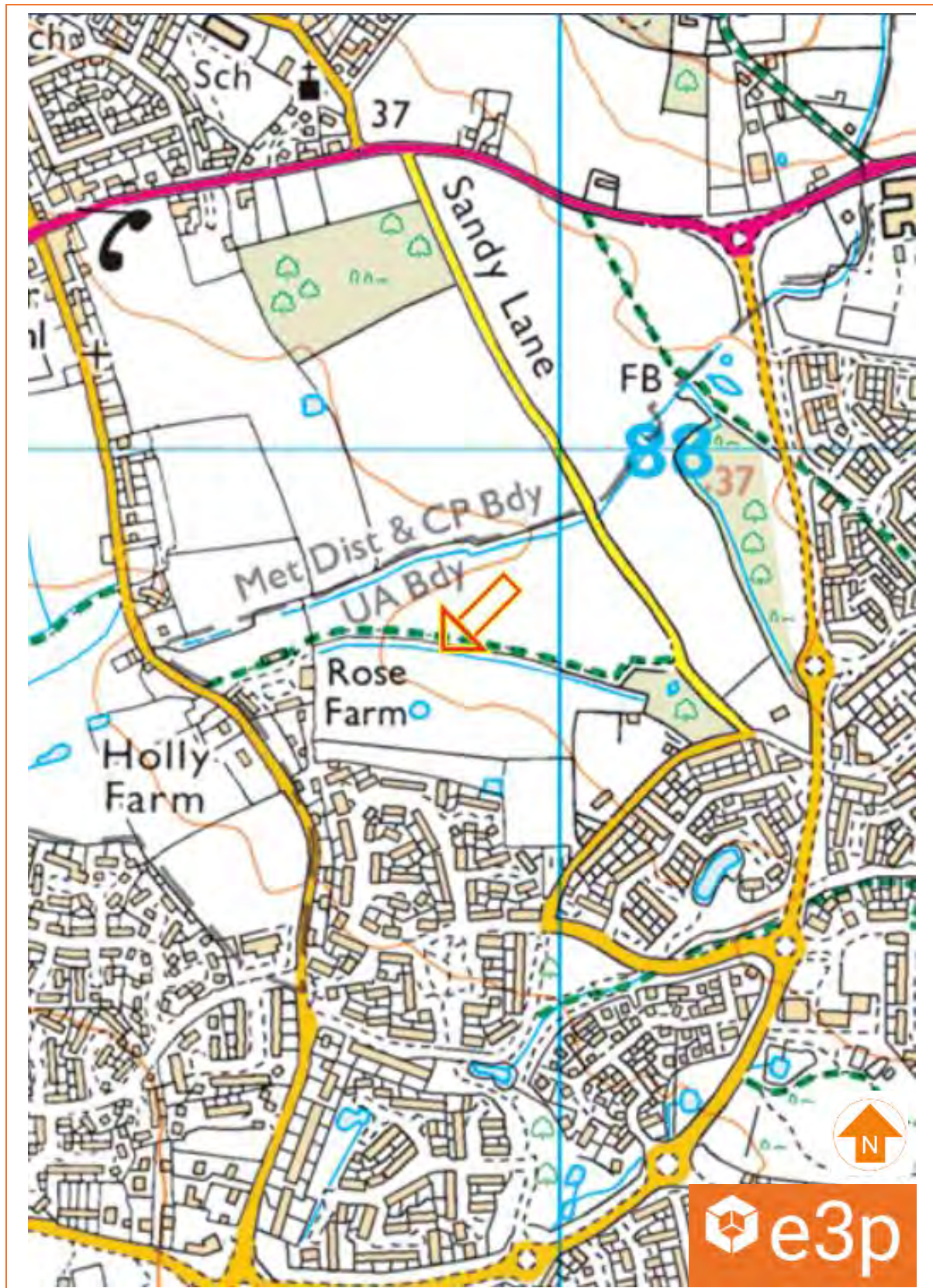
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts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



APPENDIX III

DRAWINGS

DRAWING 13-759-001 – SITE LOCATION PLAN





Hatched area denotes land currently in third party ownership.



Notes:				
P1	REVA	25.09.2020	HM	VW
Phase	Issue	Date	Drawn	Checked

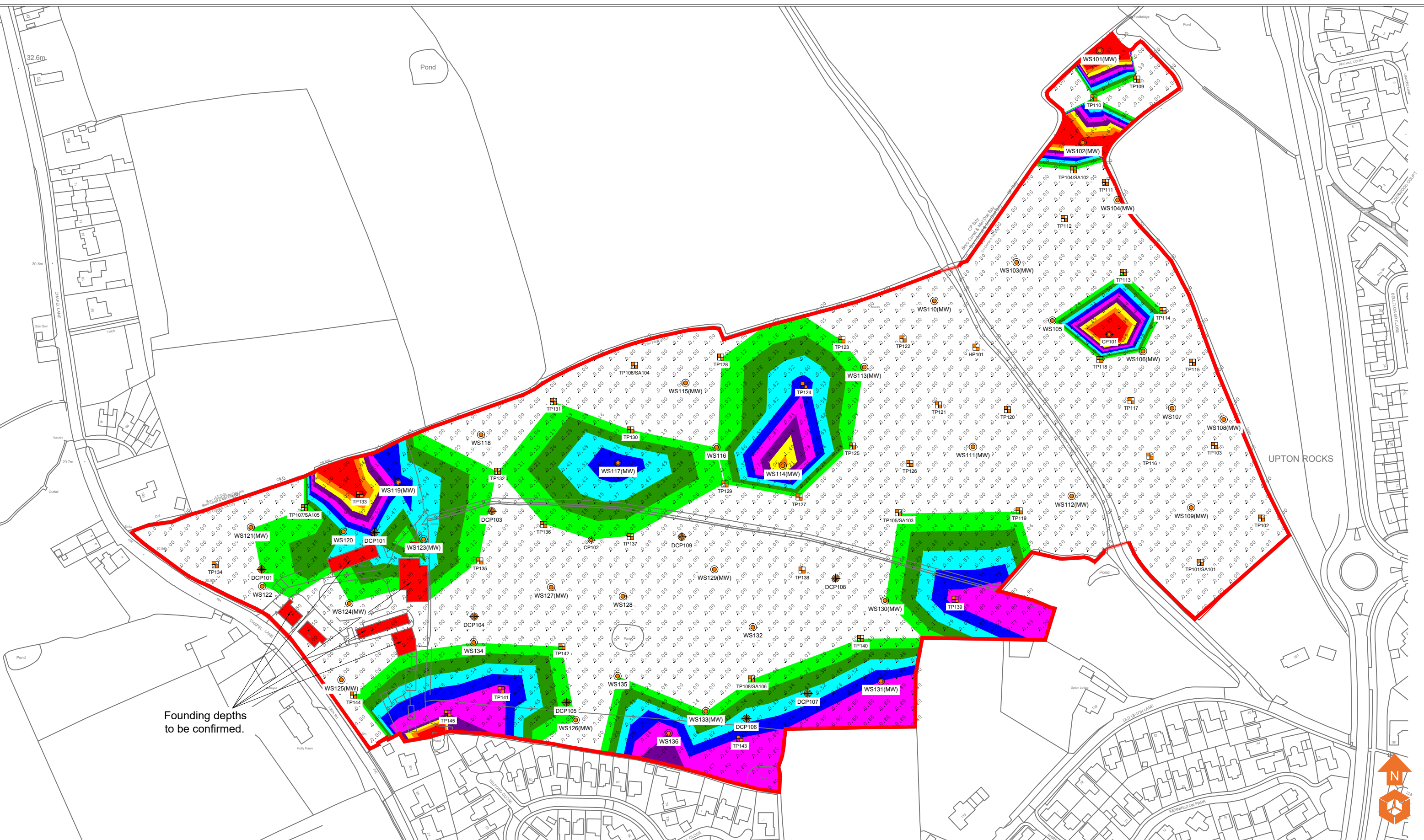
Client:	TWNW
Job Title:	Chapel Lane

Job No:	13-759	Date:	25.09.2020
Drawing No:	002	Scale:	NTS
Drawing Title:		Proposed Development Plan	



Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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Location Symbols

Approximate Window Sample Probehole Location

Approximate Window Sample Probehole Location with Install

Approximate Trial Pit Location

Approximate Soakaway Test Location

Approximate Cable Percussive Borehole Location

Approximate Hand Dug Pit Location

Made Ground Depth (m)

Depth of Made Ground 0.00 - 0.19m

Depth of Made Ground 0.20 - 0.39m

Depth of Made Ground 0.40 - 0.59m

Depth of Made Ground 0.60 - 0.79m

Depth of Made Ground 0.80 - 0.99m

Depth of Made Ground 1.00 - 1.19m

Depth of Made Ground 1.20 - 1.39m

Depth of Made Ground 1.40 - 1.59m

Depth of Made Ground >1.60m

Notes:

P1

REVA

15.12.2020

LM

VW

Phase

Issue

Date

Drawn

Checked

Client:

TWNW

Job Title:

Chapel Lane

Job No:

13-759

Drawing No:

006

Date:

15.12.2020

Scale:

NTS

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Taylor Road, Trafford Park
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Job No:

13-759

Drawing No:

006

Date:

15.12.2020

Scale:

NTS

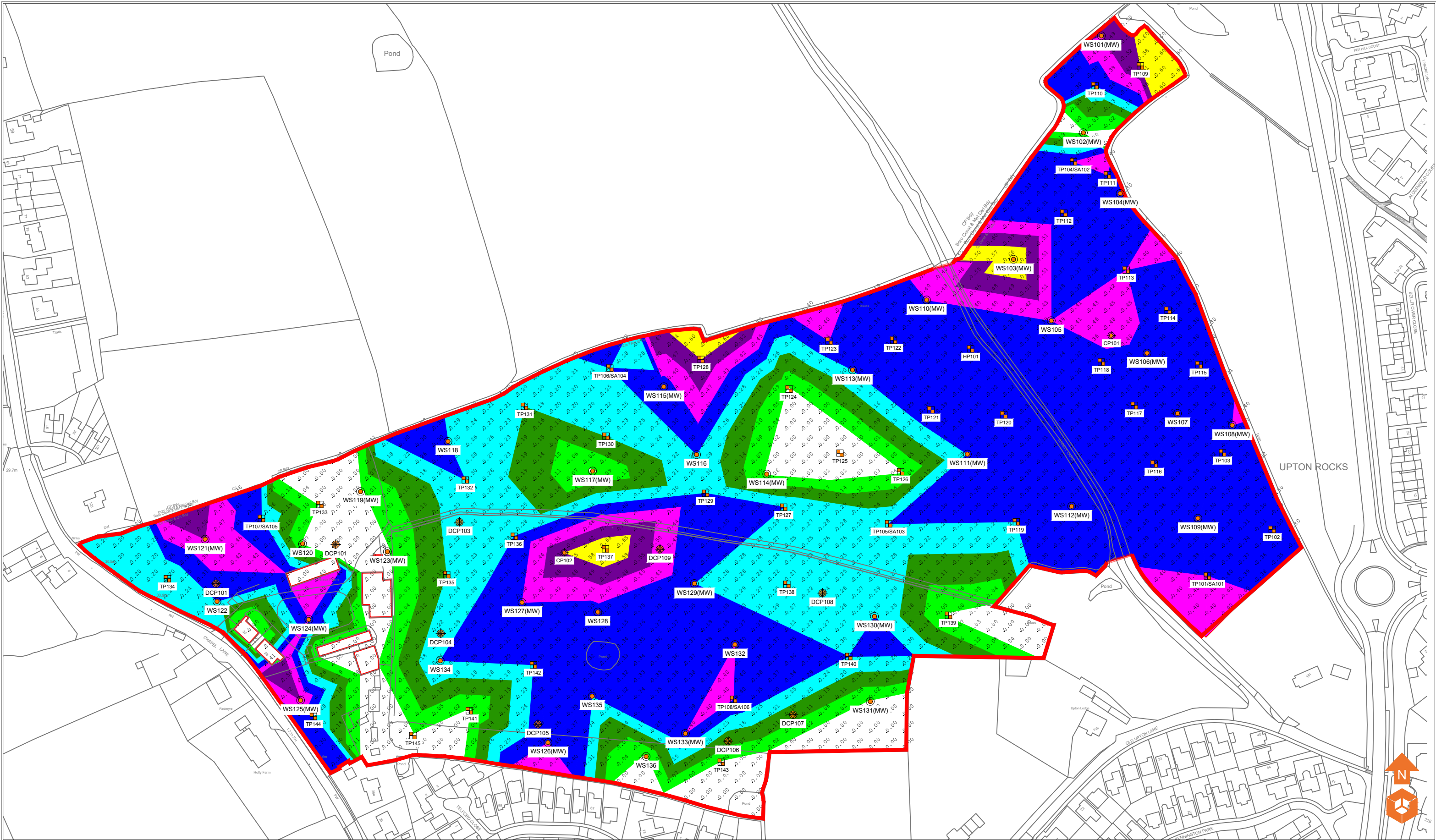
Job Title:

Chapel Lane

Drawing Title:

Depth of Made Ground Plan

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- Location Symbols**
- Approximate Window Sample Probehole Location
 - Approximate Window Sample Probehole Location with Install
 - Approximate Trial Pit Location
 - Approximate Soakaway Test Location
 - Approximate Cable Percussive Borehole Location
 - Approximate Hand Dug Pit Location
 - Topsoil Not Identified

- Topsoil Depth (m)**
- Depth of Topsoil 0.00
 - Depth of Topsoil 0.01 - 0.09m
 - Depth of Topsoil 0.10 - 0.19m
 - Depth of Topsoil 0.20 - 0.29m
 - Depth of Topsoil 0.30 - 0.39m
 - Depth of Topsoil 0.40 - 0.49m
 - Depth of Topsoil 0.50 - 0.59m
 - Depth of Topsoil 0.60 - 0.69m
 - Depth of Topsoil 0.70 - 0.79m
 - Depth of Topsoil >0.80m

Notes:

P1	REVB	15.12.2020	LM	VW
P1	REVA	25.09.2020	HM	VW
Phase	Issue	Date	Drawn	Checked

Client:

TWNW

Job Title:

Chapel Lane

Job No:

13-759

Drawing No:

007

Date:

15.12.2020

Scale:

NTS

Drawing Title:

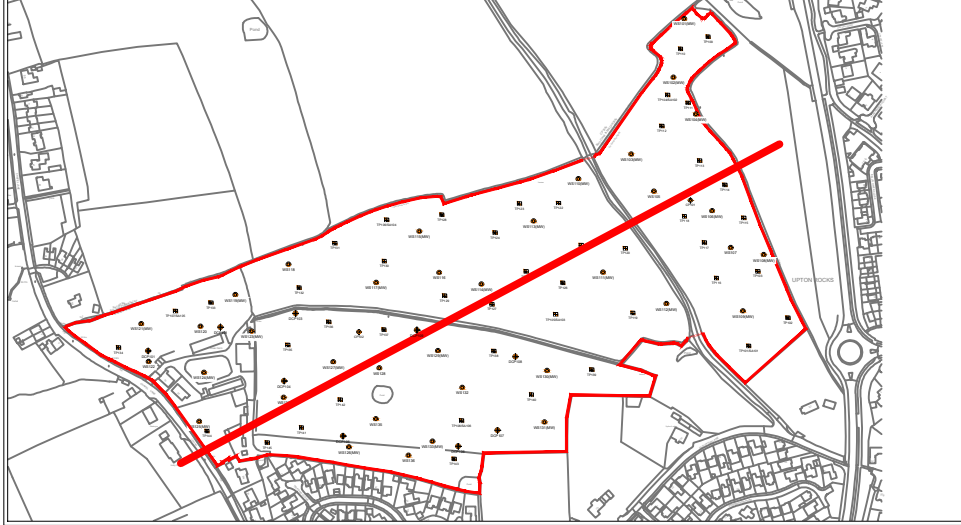
Depth of
Topsoil Plan



Environmental Engineering
Partnership Ltd
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Website: www.e3p.co.uk

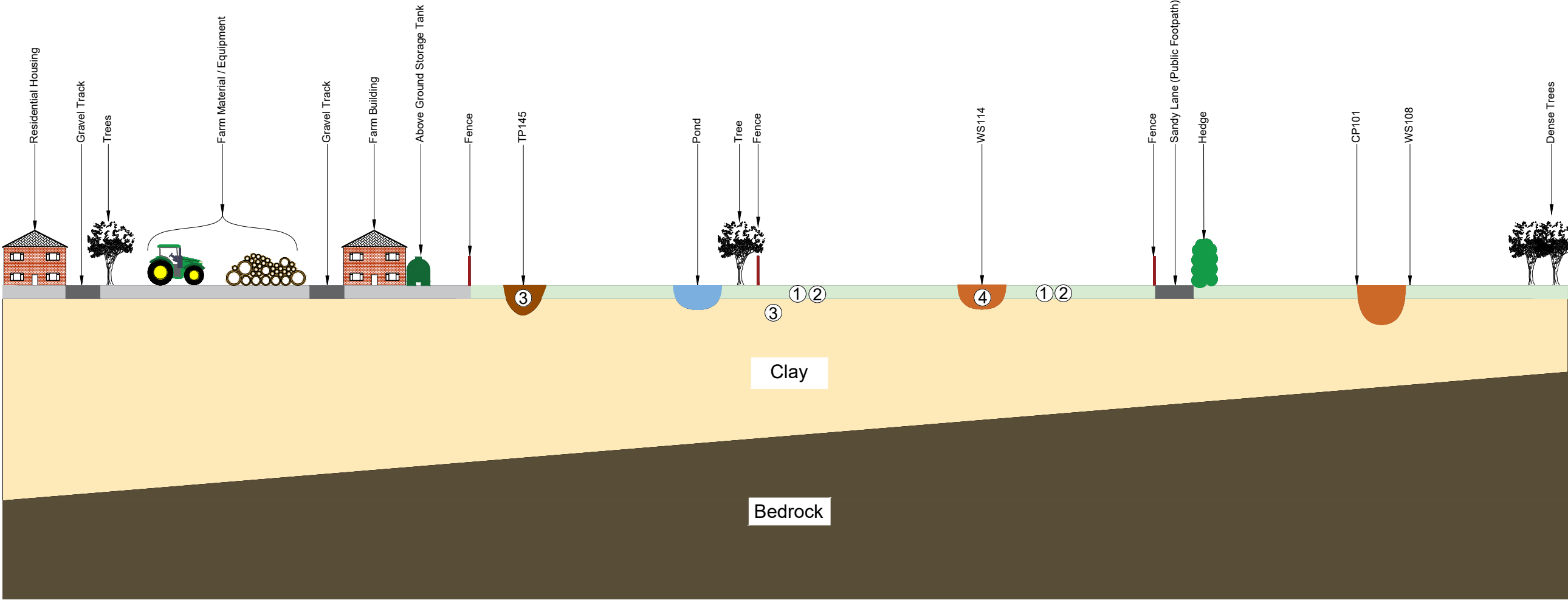
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No.	Potentially Contaminative Activity	Contaminant(s)	Migration/Exposure Pathway(s)	Receptor(s)
PL1 PL2	Topsoil, farming activity	Heavy Metals (chromium VI and Lead)	Dermal Contact Dermal Contact and Ingestion	Future Site Users and Off-site Receptors
PL3	Made Ground and infilled clay pits	Asbestos and/or ACM	Inhalation of Dust	Flora and Future Site Users
PL4	Made Ground, infilled pond, natural clay deposits	Methane and Carbon dioxide	Inhalation of gas, Migration through permeable strata and preferential pathways and explosion in confined spaces	Future site users, buildings and off-site receptors

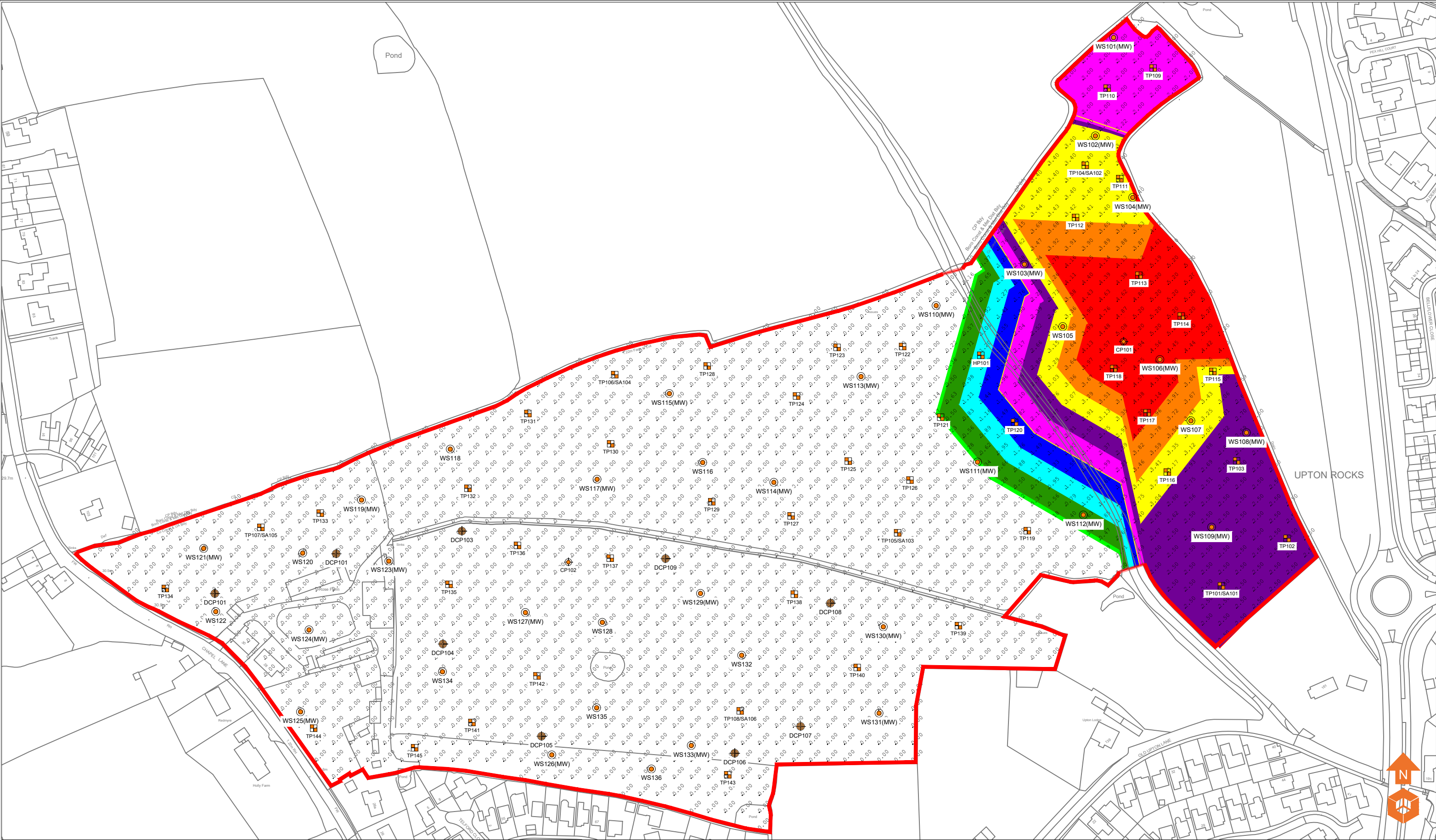


SW

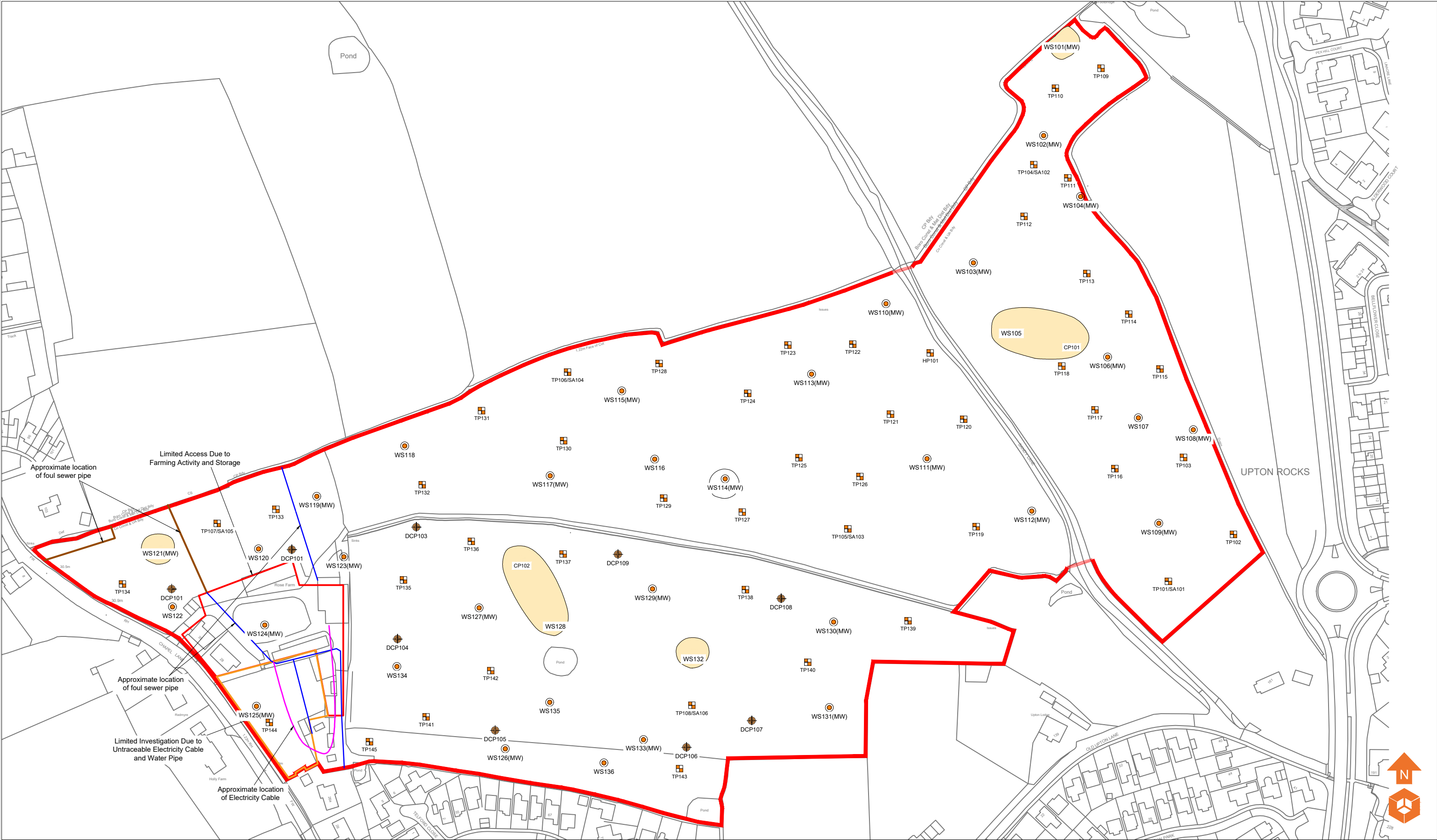
NE



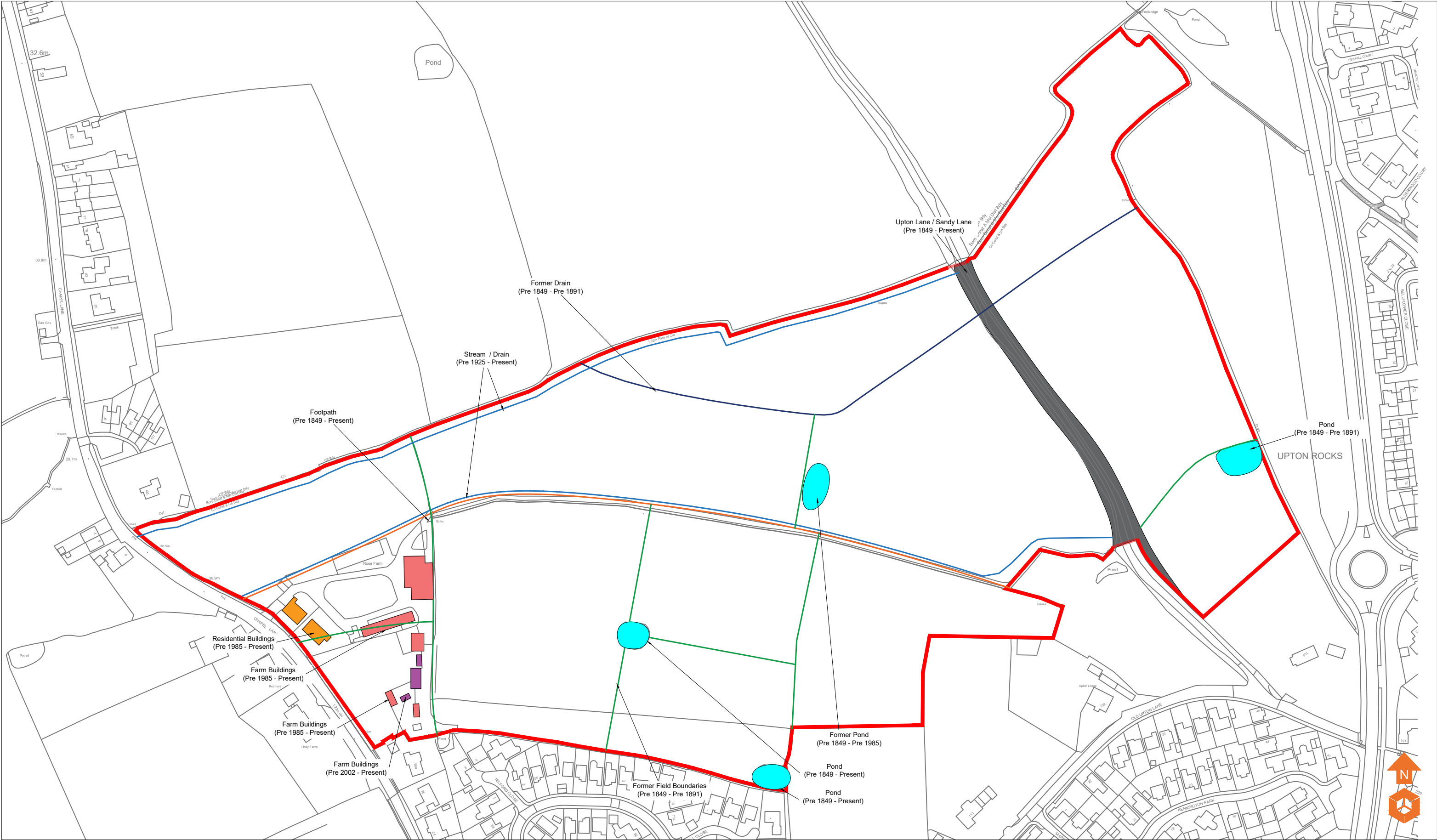
Geological Features Bedrock Clay Topsoil Made Ground Gravel Track / Roads Pond Soft Clay	Notes:					Client: TWNW		Job No: 13-759	Date: 03.11.2020	e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk	
								Drawing No: 010	Scale: NTS		
						Job Title: Chapel Lane		Drawing Title: Conceptual Site Model			The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.
	P1	REVB	03.11.2020	LM	VW						
	P1	REVA	29.09.2020	HM	VW						
					Phase	Issue	Date	Drawn	Checked		



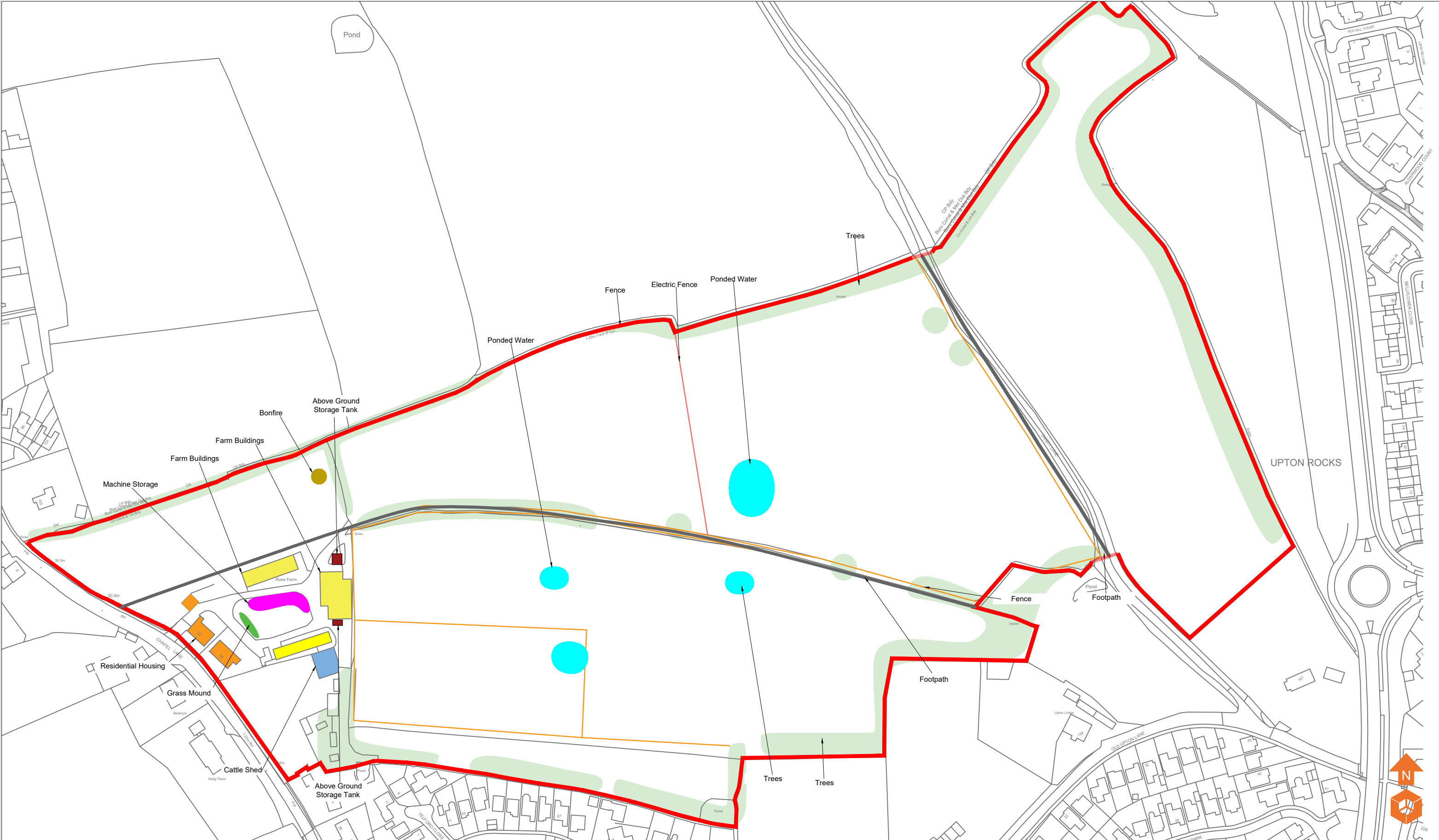
Location Symbols  Approximate Window Sample Probehole Location  Approximate Window Sample Probehole Location with Install  Approximate Trial Pit Location  Approximate Soakaway Test Location  Approximate Cable Percussive Borehole Location  Approximate Hand Dug Pit Location	Bedrock Depth (m)  Depth to Bedrock 0.00 - 0.49m  Depth to Bedrock 0.50 - 0.99m  Depth to Bedrock 1.00 - 1.49m  Depth to Bedrock 1.50 - 1.99m  Depth to Bedrock 2.00 - 2.49m  Depth to Bedrock 2.50 - 2.99m  Depth to Bedrock 3.00 - 3.49m  Depth to Bedrock 3.50 - 3.99m  Depth to Bedrock > 4.00m	Notes:	Client:	Job No:	Date:	 Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk	
				TWNW	13-759		03.11.2020
					Drawing No:		Scale:
					012		NTS
			Job Title:	Drawing Title:	The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.		
			Chapel Lane	Depth to Bedrock Plan			
P1	REVB	03.11.2020	LM	VW			
P1	REVA	29.09.2020	HM	VW			
Phase	Issue	Date	Drawn	Checked			



Location Symbols WS001 WS101(MW) TP001 SA001 DCP001 HP001 Approximate Window Sample Probehole Location Approximate Window Sample Probehole Location with Install Approximate Trial Pit Location Approximate Soakaway Test Location Approximate Cable Percussive Borehole Location Approximate Hand Dug Pit Location		Development Constraints Limited Investigation Due to Untraceable Electricity Cable and Water Pipe Limited Access Due to Farming Activity and Storage Very low to low strength Clays Approximate location private surface water pipe. Approximate location of foul sewer pipe Approximate location of electricity cable
--	--	---



Historical Features Farm Buildings (Pre 1985 - Present) Farm Buildings (Pre 2002 - Present) Residential Buildings (Pre 1985 - Present) Field Boundaries (Pre 1849 - 1891) Former Ponds (Pre 1849 - Present) Upton Lane / Sandy Lane (Pre 1985 - Present) Stream / Drain (Pre 1925 - Present) Footpath (Pre 1849 - Present) Former Field Boundaries (Pre 1849 - 1891) Former Drain (Pre 1849 - 1891)	Notes:					Client: TWNW	Job No: 13-759	Date: 25.09.2020	e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk		
	P1 REVA 25.09.2020 HM VW					Job Title: Chapel Lane	Drawing No: 003		Scale: NTS	The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.	
	Phase Issue Date Drawn Checked					Job Title: Chapel Lane	Drawing Title: Historical Features Plan				



Site Features

	Farm Buildings		Electric Fence
	Residential Housing		Fence
	Machine Storage		Footpath
	Cattle Shed		
	Above Ground Storage Tank		
	Bonfire		
	Trees		
	Ponded Water		
	Grass Mound		

Notes:				
P1	REVB	03.11.2020	LM	VW
P1	REVA	25.09.2020	HM	VW
Phase	Issue	Date	Drawn	Checked

Client:

TWNW

Job Title:

Chapel Lane

Job No:
13-759

Drawing No:
004

Date:
03.11.2020

Scale:
NTS

Drawing Title:

Site Features Plan

Environmental Engineering Partnership Ltd
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Website: www.e3p.co.uk

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APPENDIX IV

PHOTOGRAPHS

PLATE 1 UNNAMED BROOK ADJACENT TO NORTHERN BOUNDARY



PLATE 2 FARM BUILDINGS AND EQUIPMENT



PLATE 3 ABOVE GROUND SOTRAGE TANK ADJACENT TO FARM BUILDING



PLATE 4 WATERLOGGED FIELD



PLATE 5 POOR DRAINAGE WITHIN CATTLE GRAZING FIELD (WEST)



PLATE 6 ACCESS TRACK WITH MACHINERY STORAGE IN THE BACKGROUND



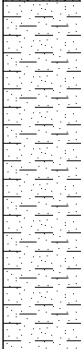
PLATE 7 HP101 LOCATING SURFACE WATER PIPE WITHIN CENTRAL FIELD



APPENDIX V

E3P EXPLORATORY HOLE LOGS

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350199.00 - 387739.00 Level:	Date 24/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 1.80		Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.00	ES		1.80			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
							End of Pit at 1.80m	2
								3
								4

Trial Pit Photographs



Trial Pit 101/ Soakaway 101



Trial Pit 101/ Soakaway 101 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350236.00 - 387771.00 Level:	Date 24/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 2.10	Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	0.80	B					Firm medium strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
	1.50	HVP	74					
				2.10				2
							End of Pit at 2.10m	3
								4

Trial Pit Photographs



Trial Pit 102

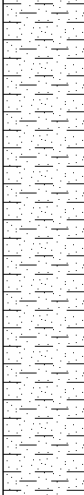


Trial Pit 102 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350212.00 - 387810.00 Level:	Date 24/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 2.30	Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.50	ES		2.30			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1 2 3 4
							End of Pit at 2.30m	

Trial Pit Photographs



Trial Pit 103

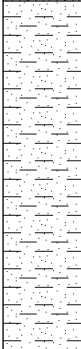


Trial Pit 103 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350121.00 - 387985.00 Level:	Date 24/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 1.80		Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES					Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	0.50	ES		0.40			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
				1.80			End of Pit at 1.80m	2
								3
								4

Trial Pit Photographs



Trial Pit 104/ Soakaway 102



Trial Pit 104/ Soakaway 102 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350006.00 - 387775.00 Level:	Date 24/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 1.80		Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	0.60	ES		1.80			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
							End of Pit at 1.80m	2
								3
								4

Trial Pit Photographs



Trial Pit 105/ Soakaway 103



Trial Pit 105/ Soakaway 103 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349842.00 - 387867.00 Level:	Date 24/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 1.70	Scale 1:30 Logged V. Wilkinson
Client: Taylor Wimpey North West			

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.00	ES					Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
	1.50	B		1.70			End of Pit at 1.70m	2
								3
								4

Trial Pit Photographs



Trial Pit 106/ Soakaway 104

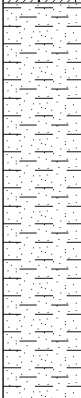


Trial Pit 106/ Soakaway 104 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349632.00 - 387784.00 Level:	Date 24/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 1.90		Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.80	B		1.90			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
							End of Pit at 1.90m	2
								3
								4

Trial Pit Photographs



Trial Pit 107/ Soakaway 105



Trial Pit 107/ Soakaway 105 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349915.00 - 387664.00
Level:

Date
24/08/2020

Location: Widnes

Dimensions (m): 2.50

Scale
1:30

Client: Taylor Wimpey North West

Depth
1.80

Logged
V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	1
	0.60	ES (L)					Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	
	1.20	B						
				1.80			End of Pit at 1.80m	2
								3
								4

Trial Pit Photographs



Trial Pit 108/ Soakaway 106

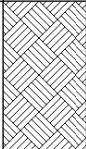
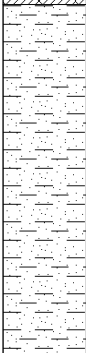


Trial Pit 108/ Soakaway 106 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350169.00 - 388046.00 Level:	Date 24/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 2.00	Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES					Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	0.80	ES		0.60			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
				2.00			End of Pit at 2.00m	2
								3
								4

Trial Pit Photographs



Trial Pit 109

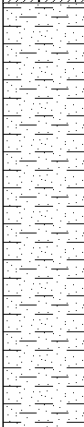


Trial Pit 109 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350133.00 - 388035.00 Level:	Date 24/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.00		Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.00	HVP	140				Stiff high strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone. Becoming firm medium strength at 1.50 m bgl.	1
	1.50	HVP	64					
				2.00			End of Pit at 2.00m	2
								3
								4

Trial Pit Photographs



Trial Pit 110

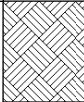


Trial Pit 110 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350145.00 - 387975.00 Level:	Date 24/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.10		Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				2.10			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
							End of Pit at 2.10m	2
								3
								4

Trial Pit Photographs



Trial Pit 111

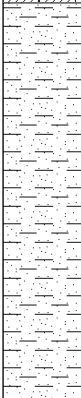


Trial Pit 111 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350110.00 - 387955.00 Level:	Date 24/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 1.90	Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.20	HVP	83	1.90			Stiff high strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
							End of Pit at 1.90m	2
								3
								4

Trial Pit Photographs



Trial Pit 112

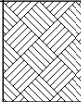
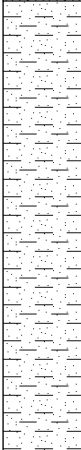


Trial Pit 112 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350148.00 - 387926.00 Level:	Date 24/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.20		Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.00	ES		2.20			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1 2 3 4
							End of Pit at 2.20m	

Trial Pit Photographs



Trial Pit 113

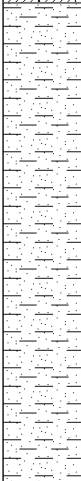


Trial Pit 113 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350178.00 - 387896.00 Level:	Date 24/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 2.20	Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
							Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1 2 3 4
				2.20			End of Pit at 2.20m	

Trial Pit Photographs



Trial Pit 114

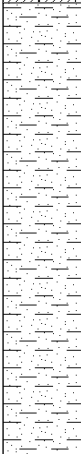


Trial Pit 114 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350193.00 - 387868.00 Level:	Date 24/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.10		Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.00	HVP	64				Firm medium strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
	1.50	HVP	70					2
				2.10			End of Pit at 2.10m	3
								4

Trial Pit Photographs



Trial Pit 115



Trial Pit 115 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane

Project No.
13759

Co-ords: 350164.00 - 387802.00
Level:

Date
24/08/2020

Location: Widnes

Dimensions (m): 2.50

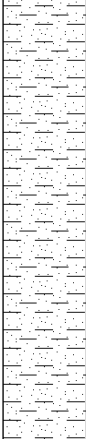
Scale
1:30

Client: Taylor Wimpey North West

Depth
2.20

0.60

Logged
J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.00	HVP	45	2.20			Firm medium strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1 2 3 4
							End of Pit at 2.20m	

Trial Pit Photographs



Trial Pit 116

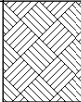
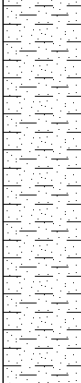


Trial Pit 116 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350146.00 - 387841.00 Level:	Date 24/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.00		Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.20	HVP	64				Firm medium strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
				2.00			End of Pit at 2.00m	2
								3
								4

Trial Pit Photographs



Trial Pit 117



Trial Pit 117 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane

Project No.
13759

Co-ords: 350132.00 - 387869.00
Level:

Date
24/08/2020

Location: Widnes

Dimensions (m): 2.50

Scale
1:30

Client: Taylor Wimpey North West

Depth
2.10

0.60

Logged
J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				2.10			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
							End of Pit at 2.10m	2
								3
								4

Trial Pit Photographs



Trial pit 118

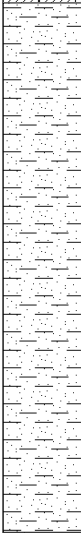


Trial Pit 118 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350080.00 - 387773.00 Level:	Date 24/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.40		Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	0.50	ES					Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
				2.40			End of Pit at 2.40m	2
								3
								4

Trial Pit Photographs



Trial Pit 119



Trial Pit 119 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane

Project No.
13759

Co-ords: 350081.00 - 387831.00
Level:

Date
25/08/2020

Location: Widnes

Dimensions (m): 2.50

Scale
1:30

Client: Taylor Wimpey North West

Depth
2.00

0.60

Logged
J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				2.00			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
							End of Pit at 2.00m	2
								3
								4

Trial Pit Photographs



Trial Pit 120

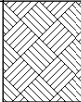


Trial Pit 120 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350030.00 - 387844.00 Level:	Date 25/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.40		Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.60	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				2.40			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1 2 3 4
							End of Pit at 2.40m	

Trial Pit Photographs



Trial Pit 121

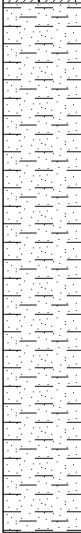


Trial Pit 121 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349999.00 - 387888.00 Level:	Date 25/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 2.40	Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.20	HVP	83	2.40			Stiff high strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1 2 3 4
							End of Pit at 2.40m	

Trial Pit Photographs



Trial Pit 122



Trial Pit 122 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349957.00 - 387884.00 Level:	Date 25/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 2.20	Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES					Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	0.50	B		0.40			Firm light brown slightly gravelly very sandy CLAY. Gravel is fine to medium sub-angular of mudstone and sandstone.	
				0.80			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
				2.20			End of Pit at 2.20m	2
								3
								4

Trial Pit Photographs



Trial Pit 123



Trial Pit 123 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349941.00 - 387847.00 Level:	Date 25/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.30		Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES					MADE GROUND: Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	0.50	ES		0.50			MADE GROUND: Black sandy gravel. Gravel is fine sub-angular of mudstone, asphalt and concrete. (Red ceramic land drain pipe encountered at 0.55 m bgl)	
	1.00	ES		0.70			Firm medium strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
	1.50	HVP	64					
	2.00	HVP	70					2
				2.30			End of Pit at 2.30m	3
								4

Trial Pit Photographs



Trial Pit 124

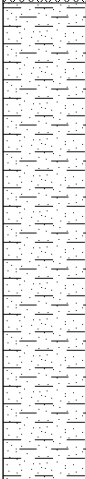


Trial Pit 124 Spoil

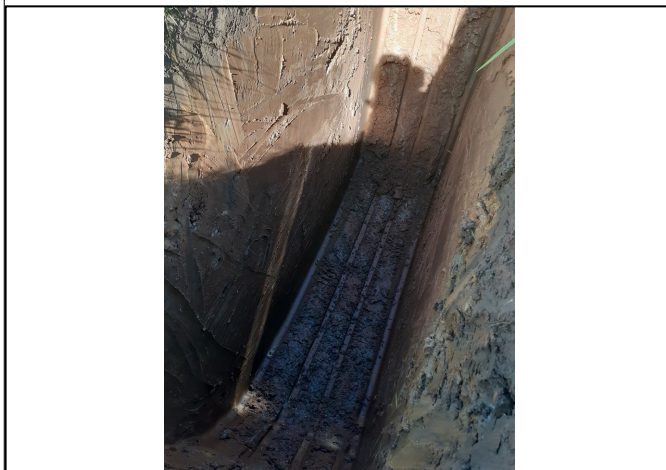
Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349976.00 - 387819.00 Level:	Date 25/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.20		Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.20	HVP	108				Stiff medium strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
	1.60	HVP	83					2
				2.20			End of Pit at 2.20m	3
								4

Trial Pit Photographs



Trial Pit 125

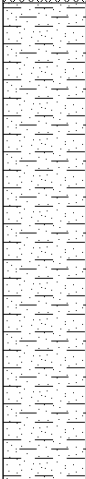


Trial Pit 125 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350017.00 - 387800.00 Level:	Date 25/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.20		Scale 1:30
Client: Taylor Wimpey North West			Logged J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	1.00	HVP	95				Stiff high strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
	1.50	HVP	83					
	1.80	HVP	76					2
				2.20			End of Pit at 2.20m	3
								4

Trial Pit Photographs



Trial Pit 126



Trial Pit 126 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349952.00 - 387780.00
Level:

Date
25/08/2020

Location: Widnes

Dimensions (m): 2.50

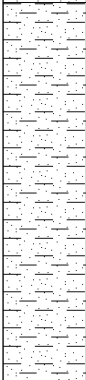
Scale
1:30

Client: Taylor Wimpey North West

Depth
2.10

0.60

Logged
J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				0.60			Firm brown slightly gravelly very sandy CLAY. Gravel is fine to medium sub-angular of mudstone and sandstone.	
	0.80	ES					Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
				2.10			End of Pit at 2.10m	2
								3
								4

Trial Pit Photographs



Trial Pit 127



Trial Pit 127 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349886.00 - 387885.00
Level:

Date
25/08/2020

Location: Widnes

Dimensions (m): 2.50

Scale
1:30

Client: Taylor Wimpey North West

Depth
2.20

0.60

Logged
J. Oliver

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES					Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				0.60 0.70			Light brown slightly gravelly very sandy CLAY. Gravel is fine to medium sub-angular of mudstone and sandstone.	
	0.90	ES					Firm medium strength brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone. Becoming stiff high strength 1.50 m bgl.	1
	1.20	HVP	70					
	1.50	HVP	76					
				2.20			End of Pit at 2.20m	2
								3
								4

Trial Pit Photographs



Trial Pit 128



Trial Pit 128 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349900.00 - 387792.00 Level:	Date 26/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.30		Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	0.40 0.40	ES HVP	105	0.50			Stiff high strength light brown slightly gravelly very sandy CLAY. Gravel is fine to medium sub-angular of mudstone and sandstone. Stiff high strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
	2.00	HVP	101	2.30			End of Pit at 2.30m	2
								3
								4

Trial Pit Photographs



Trial Pit 129



Trial Pit 129 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349835.00 - 387823.00 Level:	Date 26/08/2020
Location: Widnes		Dimensions (m): 2.50	Scale 1:30
Client: Taylor Wimpey North West		Depth 2.20	Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.20			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	0.40	ES		0.50			Light brown slightly gravelly very sandy CLAY. Gravel is fine to medium sub-angular of mudstone and sandstone.	
				2.20			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1 2 3 4
							End of Pit at 2.20m	

Trial Pit Photographs



Trial Pit 130

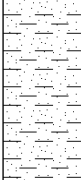
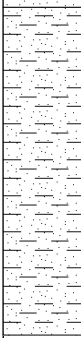


Trial Pit 130 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349788.00 - 387839.00 Level:	Date 26/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 2.30	Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.20			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				1.00			Firm grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
	2.00	ES		2.30			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	2
							End of Pit at 2.30m	3
								4

Trial Pit Photographs



Trial Pit 131

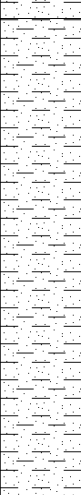


Trial Pit 131 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

				Trial Pit Log			TrialPit No TP132 Sheet 1 of 1	
Project Name: Chapel Lane				Project No. 13759		Co-ords: 349751.00 - 387799.00 Level:		Date 26/08/2020
Location: Widnes						Dimensions (m): 0.60		Scale 1:30
Client: Taylor Wimpey North West						Depth 2.50		Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 0.40	0.50	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				0.60			Firm grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
							Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
				2.50			End of Pit at 2.50m	2
								3
								4

Trial Pit Photographs



Trial Pit 132



Trial Pit 132 Spoil

Remarks: 1. Complete. 2. Hand shear vane could not be obtained due to brittle CLAY. 3. Steady water seepage at 0.40 m bgl.

Stability: Unstable side walls from ground level to 2.50m bgl.



Project Name: Chapel Lane

Project No.
13759

Co-ords: 349663.00 - 387795.00
Level:

Date
26/08/2020

Location: Widnes

Dimensions (m): 2.50

Scale
1:30

Client: Taylor Wimpey North West

Depth
2.40

Logged
V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.05	ES		0.10			MADE GROUND: Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of brick, mudstone and sandstone.	
				0.40			MADE GROUND: Soft grey mottled brown slightly gravelly sandy clay. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
	1.00	ES					MADE GROUND: Grey mottled brown slightly gravelly slightly silty sandy clay. Gravel is fine to coarse sub-angular to sub-rounded of timber, mudstone, coal and sandstone.	1
	2.00	HVP	64	1.80			Firm medium strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	2
				2.40			End of Pit at 2.40m	3
								4

Trial Pit Photographs



Trial Pit 133

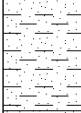


Trial Pit 133 Spoil

Remarks: 1. Complete .

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349586.00 - 387749.00 Level:	Date 26/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.40		Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.20			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				0.70			Firm grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
	1.00	ES					Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
				2.40			End of Pit at 2.40m	2
								3
								4

Trial Pit Photographs



Trial Pit 134



Trial Pit 134 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349744.00 - 387749.00 Level:	Date 26/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 1.70	Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.20			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
	0.30	ES		0.40			Firm grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
				1.70			Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
							End of Pit at 1.70m	2
								3
								4

Trial Pit Photographs



Trial Pit 135



Trial Pit 135 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349770.00 - 387770.00 Level:	Date 26/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 2.00	Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				0.50			Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
							Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
				2.00			End of Pit at 2.00m	2
								3
								4

Trial Pit Photographs



Trial Pit 136



Trial Pit 136 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349835.00 - 387764.00 Level:	Date 26/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.80		Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES					Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				0.70				
	1.10 1.10	B ES		1.20			Firm grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
							Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	2
				2.80			End of Pit at 2.80m	3
								4

Trial Pit Photographs



Trial Pit 137



Trial Pit 137 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349951.00 - 387741.00 Level:	Date 26/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 2.00	Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.20			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				0.40			Firm grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
							Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
				2.00			End of Pit at 2.00m	2
								3
								4

Trial Pit Photographs



Trial Pit 138



Trial Pit 138 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 350040.00 - 387722.00 Level:	Date 26/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 0.90	Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
 0.90	0.40	ES		0.30			MADE GROUND: Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of brick, mudstone and sandstone.
				0.75			MADE GROUND: Grey mottled brown slightly gravelly sandy clay. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.
				0.90			MADE GROUND: Black slightly clayey sandy gravel. Gravel is fine to medium angular to sub-angular of mudstone. (Orange ceramic land drain encountered at 0.90m bgl)
							End of Pit at 0.90m

Trial Pit Photographs



Trial Pit 139



Trial Pit 139 Spoil

Remarks: 1. Incomplete. 2. Terminated due to land drain water inflow at 0.90 m bgl.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349970.00 - 387699.00 Level:	Date 26/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 2.00		Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30 0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
							Firm grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Stiff grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
				2.00			End of Pit at 2.00m	2
								3
								4

Trial Pit Photographs



Trial Pit 140



Trial Pit 140 Spoil

Remarks: 1. Complete 2. Hand shear vane could not be obtained due to brittle CLAY.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349764.00 - 387669.00 Level:	Date 26/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 0.90	Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
 0.90	0.10	ES		0.30			MADE GROUND: Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of brick, mudstone and sandstone.
	0.50	ES		0.80			MADE GROUND: Grey mottled brown slightly gravelly sandy clay. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.
				0.90			MADE GROUND: Black slightly clayey sandy gravel. Gravel is fine to medium angular to sub-angular of mudstone. (Orange ceramic land drain encountered at 0.90m bgl)
							End of Pit at 0.90m

Trial Pit Photographs



Trial Pit 141



Trial Pit 141 Spoil

Remarks: 1. Incomplete. 2. Terminated due to land drain water inflow at 0.90 m bgl.

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349797.00 - 387694.00 Level:	Date 26/08/2020
Location: Widnes		Dimensions (m): 2.50 Depth 2.00	Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
				0.60			Firm grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
	1.00	ES					Stiff high strength grey mottled brown slightly gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Cobbles are sub-rounded to rounded of mudstone and sandstone.	1
	1.20	HVP	103					
				2.00			End of Pit at 2.00m	2
								3
								4

Trial Pit Photographs



Trial Pit 142



Trial Pit 142 Spoil

Remarks: 1. Complete

Stability: Stable

Project Name: Chapel Lane	Project No. 13759	Co-ords: 349913.00 - 387631.00 Level:	Date 26/08/2020
Location: Widnes	Dimensions (m): 2.50 Depth 0.80		Scale 1:30
Client: Taylor Wimpey North West			Logged V. Wilkinson

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
 0.80	0.20	ES		0.30			MADE GROUND: Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of brick, mudstone and sandstone.
				0.70			MADE GROUND: Grey mottled brown slightly gravelly sandy clay. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.
				0.80			MADE GROUND: Black slightly clayey sandy gravel. Gravel is fine to medium angular to sub-angular of mudstone. (Orange ceramic land drain encountered at 0.90m bgl)
							End of Pit at 0.80m

Trial Pit Photographs



Trial Pit 143



Trial Pit 143 Spoil

Remarks: 1. Incomplete. 2. Terminated due to land drain water inflow at 0.80 m bgl.

Stability: Stable

Date
26/08/2020

Scale
1:30

Logged
V. Wilkinson

Trial Pit Photographs



Trial Pit 144 Spoil

Stability:	Stable
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Project Name: Chapel Lane

Project No.
13759

Co-ords: 349733.00 - 387656.00
Level:

Date
26/08/2020

Location: Widnes

Dimensions (m): 2.50

Scale
1:30

Client: Taylor Wimpey North West

Depth
1.00

Logged
V. Wilkinson

[illegible]

Trial Pit Photographs



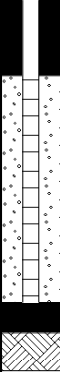
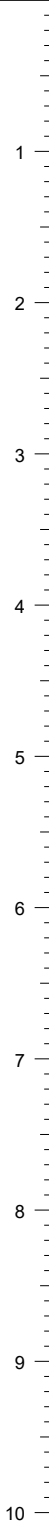
Trial Pit 145



Trial Pit 145 Spoil

Remarks: 1. Incomplete. 2.Terminated at 1.00 m bgl due to gravel indicative of service below.

Stability:	Stable
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				Borehole Log				Borehole No. WS101 Sheet 1 of 1	
Project Name: Chapel Lane				Project No. 13759		Co-ords: 350151E - 388063N		Hole Type WS	
Location: Widnes				Level:		Scale 1:50			
Client: Taylor Wimpey North West				Dates: 25/08/2020		Logged By J. Sheridan			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.50		 Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.		
	0.60	ES					 Soft low strength grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.		
	1.00 1.00	D SPT	N=4 (2,2/1,1,1,1)						
	2.00 2.00	D SPT	N=50 (3,2/4,4,12,30)						
					2.00		 Dense reddish brown gravelly fine to medium SAND. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. (Weathered bedrock).	2	
					2.45		End of Borehole at 2.45m	3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	
Remarks 1. Complete. 2. Refused at 2.45 on weathered bedrock. 3. Monitoring well installed (Response zone between 0.50 m and 2.00 m bgl)									



Project Name: Chapel Lane

Project No.
13759

Co-ords: 350086E - 387943N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

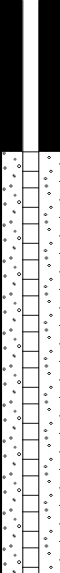
Dates: 25/08/2020

Logged By
V. Wilkinson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES					Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00	D		0.70				
		1.00	SPT	N=7 (1,1/2,1,2,2)				Firm low strength grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 2.00m bgl.	1
		2.00	D						
		2.00	SPT	N=20 (3,3/4,5,5,6)					2
		2.20	ES						
		3.00	D						
		3.00	SPT	N=28 (3,4/6,7,7,8)					3
		4.00	SPT	N=29 (4,6/7,6,8,8)					4
		4.60	SPT	50 (25 for 10mm/50 for 0mm)	4.61			End of Borehole at 4.61m	5
									6
									7
									8
									9
									10

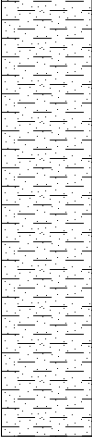
Remarks

1. Complete. 2. Refused at 4.61 m bgl on very stiff CLAY. 3. Water strike at 2.00 m bgl. 4. Monitoring well installed (response zone between 1.00 m and 4.00 m bgl).

				Borehole Log			Borehole No. WS104 Sheet 1 of 1		
Project Name: Chapel Lane				Project No. 13759		Co-ords: 350153E - 387965N		Hole Type WS	
Location: Widnes				Level:		Scale 1:50			
Client: Taylor Wimpey North West				Dates: 25/08/2020		Logged By V. Wilkinson			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.30 0.40		  Stiff medium strength grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff very high strength at 3.00 m bgl.	1	
		1.00	SPT	N=9 (2,2/2,2,2,3)					
		1.20	D						
		1.50	U						
		2.00	SPT	N=15 (3,2/4,3,4,4)					2
		3.00	SPT	N=24 (25 for 115mm/9,2,3,10)	3.40				3
	3.80	SPT	50 (25 for 10mm/50 for 0mm)	3.80		 End of Borehole at 3.80m	4		
								5	
								6	
								7	
								8	
								9	
								10	

Remarks
 1. Complete. 2. Refused at 3.80 m bgl on weathered SANDSTONE bedrock. 3. Monitoring well installed (response zone between 1.00m and 3.80m bgl).



				Borehole Log				Borehole No. WS105 Sheet 1 of 1	
Project Name: Chapel Lane				Project No. 13759		Co-ords: 350099E - 387903N		Hole Type WS	
Location: Widnes						Level:		Scale 1:50	
Client: Taylor Wimpey North West						Dates: 25/08/2020		Logged By J. Sheridan	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
	 2.20	0.20	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	1
		0.50	ES						
		1.00 1.00	D SPT	N=7 (1,2/2,1,2,2)				Firm low strength grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. No recovery between 2.20 m and 2.40 m bgl. Becoming very stiff very high strength at 2.00 m bgl.	2
		2.00 2.00	D SPT	N=40 (3,5/7,6,14,13)					
		3.00 3.00	D SPT	50 (14,11/50 for 170mm)					
				3.30			End of Borehole at 3.30m	3	
									4
									5
									6
									7
									8
									9
									10
Remarks 1. Complete. 2. Refused at 3.30 m bgl on very stiff CLAY. 3. Water strike at 2.20 m bgl.									

Borehole Log

Borehole No.

WS106

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 350164E - 387868N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
V. Wilkinson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00	D		1.00			Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
		1.00	SPT	N=9 (1,2/2,2,2,3)					
		2.00	D					Stiff medium strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 2.00 m bgl. Becoming very stiff very high strength at 3.00 m bgl.	2
		2.00	SPT	N=28 (2,4/5,5,9,9)					
		3.00	D						3
		3.00	SPT	N=37 (5,6/7,8,10,12)					
		4.00	ES		4.40				4
		4.00	SPT	50 (7,9/50 for 283mm)					
								End of Borehole at 4.40m	5
									6
									7
									8
									9
									10

Remarks

1. Complete. 2. Refused at 4.00 m bgl on very stiff CLAY. 3. Monitoring well installed (response zone between 1.00 m and 4.00 m bgl).

				Borehole Log				Borehole No. WS107 Sheet 1 of 1	
Project Name: Chapel Lane				Project No. 13759		Co-ords: 350179E - 387825N		Hole Type WS	
Location: Widnes						Level:		Scale 1:50	
Client: Taylor Wimpey North West						Dates: 25/08/2020		Logged By V. Wilkinson	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00 1.00	D SPT	N=8 (1,2/2,1,2,3)	1.00			Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
		2.00 2.00	D SPT	N=12 (2,2/2,2,4,4)				Stiff medium strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 3.00 m bgl. Becoming very stiff very high strength at 4.00 m bgl.	2
		3.00 3.00	D SPT	N=21 (4,4/4,5,5,7)					3
		4.00	SPT	N=50 (6,6/12,12,13,13)					4
					4.45			End of Borehole at 4.45m	5
									6
									7
									8
									9
									10

Remarks
 1. Complete. 2. Refused at 4.45 m bgl on very stiff CLAY.



Project Name: Chapel Lane

Project No.
13759

Co-ords: 350222E - 387824N

Hole Type
WS

Location: Widnes

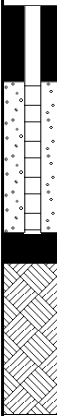
Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
V. Wilkinson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	1
		0.50	U					Soft brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
		1.00	SPT	N=0 (1,0/0,0,0,0)	1.10			Very soft extremely low strength brown very sandy CLAY with organic matter.	2
		2.00	D		1.50			Very stiff high strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
		2.00	SPT	N=33 (4,5/5,10,9,9)	2.50			Dense reddish brown gravelly fine to medium SAND. Gravel is fine to coarse sub-angular to sub-rounded of sandstone. (Weathered bedrock)	3
		2.70	SPT	50 (25 for 20mm/50 for 10mm)	2.70			End of Borehole at 2.70m	
									4
									5
									6
									7
									8
									9
									10

Remarks

1. Complete. 2. Refused at 2.70 m bgl on weathered bedrock. 3. Water strike at 1.00 m bgl. 4. Monitoring well installed (Response zone between 0.50 m and 1.50 m bgl).

Borehole Log

Borehole No.

WS109

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 350193E - 387774N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00	D					Stiff medium strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 2.00 m bgl. Becoming very stiff very high strength at 4.00 m bgl.	1
		1.00	SPT	N=9 (1,1/2,2,2,3)					
		2.00	D						2
		2.00	SPT	N=25 (2,4/5,6,7,7)					
		2.50	ES						
		3.00	D						3
		3.00	SPT	N=23 (3,3/5,5,6,7)					
		4.00	SPT	50 (7,9/50 for 285mm)	4.40				4
								End of Borehole at 4.40m	5
									6
									7
									8
									9
									10

Remarks

1.Complete. 2. Refused at 4.40 m bgl on very stiff CLAY. 3. Monitoring well installed (response zone between 0.50 m and 2.50 m bgl).

Borehole Log

Borehole No.

WS110

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 350028E - 387907N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	1
		1.00 1.00	D SPT	N=9 (1,1/2,2,2,3)				Stiff medium strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 2.00 m bgl. Becoming very stiff very high strength at 5.00 m bgl.	
		2.00 2.00	D SPT	N=17 (3,4/3,4,5,5)					
		3.00 3.00	D SPT	N=24 (4,4/5,6,6,7)					
		4.00 4.00	D SPT	N=24 (5,5/6,5,6,7)					
		5.00 5.00	D SPT	N=37 (6,6/8,10,8,11)	5.45			End of Borehole at 5.45m	5
									6
									7
									8
									9
									10

Remarks

1. Complete.



Borehole Log

Borehole No.

WS111

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 350054E - 387809N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
V. Wilkinson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		0.60	ES					Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
		1.00	D		1.00				1
		1.00	SPT	N=9 (1,2/2,2,2,3)					
		2.00	D					Stiff medium strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 3.00 m bgl. Becoming very stiff very high strength at 4.00 m bgl. Becoming very stiff high strength at 5.00 m bgl.	2
		2.00	SPT	N=15 (2,2/3,3,4,5)					
		2.50	U						
		3.00	D						3
		3.00	SPT	N=23 (5,4/5,5,6,7)					
		4.00	SPT	N=36 (4,5/7,9,10,10)					4
		5.00	SPT	N=26 (4,5/5,6,7,8)					5
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 4.00 m bgl).



Borehole Log

Borehole No.

WS112

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 350119E - 387773N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
V. Wilkinson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00	D		1.00			Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
		1.00	SPT	N=11 (1,2/2,3,3,3)					
		2.00	D						2
		2.00	SPT	N=18 (2,2/4,4,5,5)					
		3.00	D						3
		3.00	SPT	N=27 (5,5/5,6,7,9)					
		4.00	D						4
		4.00	SPT	N=33 (6,6/7,8,9,9)					
		5.00	D		5.45				5
		5.00	SPT	N=37 (6,6/8,9,10,10)					
								End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 4.00 m bgl).

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349973E - 387863N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
V. Wilkinson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30 0.40 0.60	ES					Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00 1.00	D SPT	N=9 (1,2/2,2,3,2)	1.00			Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
		2.00 2.00	D SPT	N=16 (2,3/3,4,4,5)				Soft dark brown slightly gravelly sandy CLAY (Relict topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		3.00 3.00	D SPT	N=25 (3,3/5,6,6,8)				Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	2
		4.00 4.00	D SPT	N=19 (3,3/4,4,5,6)				Stiff medium strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 3.00 m bgl.	3
		5.00	SPT	N=24 (3,4/5,5,7,7)					4
					5.45			End of Borehole at 5.45m	5
									6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).

Borehole Log

Borehole No.

WS114

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349942E - 387798N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
V. Wilkinson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.30			MADE GROUND: Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		0.30	ES					MADE GROUND: Grey mottled brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
		1.00	SPT	N=4 (1,1/2,1,0,1)	1.20			MADE GROUND: Black slightly gravelly very clayey fine to medium SAND. Gravel is fine to coarse angular to sub-angular of brick.	
					1.50			Firm low strength black slightly silty sandy CLAY. Becoming stiff medium strength at 4.00 m bgl.	2
		2.00	SPT	N=5 (1,4/2,1,1,1)					
		3.00	SPT	N=9 (2,1/2,2,2,3)					3
		4.00	SPT	N=17 (2,3/4,4,4,5)					4
					4.50			Stiff medium strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	5
		5.00	SPT	N=12 (2,3/2,3,3,4)					
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 4.00 m bgl).

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349876E - 387852N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
J. Oliver

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.35			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00	ES					Stiff medium strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 3.00 m bgl.	1
		1.00	SPT	N=13 (3,3/3,4,3,3)					
		1.50	U						
		2.00	D						2
		2.00	SPT	N=15 (3,3/3,4,4,4)					
		3.00	D						3
		3.00	SPT	N=20 (2,3/5,4,5,6)					
		4.00	D						4
		4.00	SPT	N=24 (4,3/5,5,7,7)					
					5.45			End of Borehole at 5.45m	5
									6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).



Borehole Log

Borehole No.

WS116

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349894E - 387816N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
V. Wilkinson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00	D					Stiff medium strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 2.00 m bgl. Becoming very stiff very high strength at 5.00 m bgl.	1
		1.00	SPT	N=13 (2,3/3,4,3,3)					
		2.00	D						2
		2.00	SPT	N=18 (3,3/4,3,5,6)					
		3.00	D						3
		3.00	SPT	N=19 (4,3/4,5,5,5)					
		4.00	SPT	N=23 (4,3/6,5,6,6)					4
		5.00	SPT	N=37 (6,8/8,9,9,11)					5
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete.



Borehole Log

Borehole No.

WS117

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349826E - 387802N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
V. Wilkinson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES					MADE GROUND: Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00	SPT	N=16 (3,2/3,4,4,5)	0.70 0.80 1.00			MADE GROUND: Black slightly clayey sandy gravel. Gravel is fine sub-angular of mudstone. (orange ceramic land drain encountered at 0.75 m bgl) Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Very stiff high strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming stiff medium strength at 2.00 m bgl. Becoming very stiff high strength at 3.00 m bgl.	1
		2.00	SPT	N=14 (3,3/4,4,3,3)					2
		3.00	SPT	N=20 (3,4/4,5,4,7)					3
		4.00	SPT	N=20 (3,4/5,5,4,6)					4
		5.00	SPT	N=24 (3,4/5,6,6,7)					5
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).

Borehole Log

Borehole No.

WS118

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349747E - 387828N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 26/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		0.70	ES					Firm brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
		1.00	D		1.00				1
		1.00	SPT	N=15 (2,2/3,4,4,4)					
		2.00	D					Stiff Very stiff high strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	2
		2.00	SPT	N=32 (6,6/8,8,8,8)					
		3.00	D						3
		3.00	SPT	N=20 (3,3/5,5,5,5)	3.50				
		4.00	D					Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 5.00 m bgl.	4
		4.00	SPT	N=17 (2,3/3,4,5,5)					
		5.00	D						5
		5.00	SPT	N=24 (5,5/6,6,6,6)	5.45				
								End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete.

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349696E - 387795N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 26/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.40	ES		0.70			MADE GROUND: Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of brick, concrete, mudstone and sandstone.	
		1.00 1.00	ES SPT	N=11 (1,1/2,2,3,4)				Stiff medium strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
		2.00 2.00	ES SPT	N=19 (3,4/3,4,6,6)	2.00			Very stiff high strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	2
		3.00 3.00	ES SPT	N=23 (2,3/4,5,7,7)					3
		4.00	SPT	N=23 (3,3/5,5,6,7)					4
		5.00	SPT	N=24 (6,6/6,6,6,6)					5
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 4.00 m bgl).

Borehole Log

Borehole No.

WS120

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349664E - 387769N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 26/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.30	ES	N=13 (2,2/2,4,3,4)	0.40			MADE GROUND: Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of charcoal, mudstone and sandstone.	1 —	
		0.50	ES							
		1.00	D		N=28 (3,5/5,7,7,9)		0.70			Firm brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.
		1.00	SPT							
		2.00	D		N=21 (4,4/4,5,6,6)			Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff very high strength at 2.00 m bgl. Becoming stiff medium strength at 4.00 m bgl.		
		2.00	SPT							
		3.00	D	N=15 (3,3/3,4,4,4)						
		3.00	SPT							
		4.00	D	N=15 (3,3/3,3,4,5)						
		4.00	SPT							
		5.00	D	5.45						
		5.00	SPT							
End of Borehole at 5.45m								2 —		
	6 —									
	7 —									
	8 —									
	9 —									
	10 —									

Remarks

1. Complete.

Borehole Log

Borehole No.

WS121

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349591E - 387769N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 26/08/2020

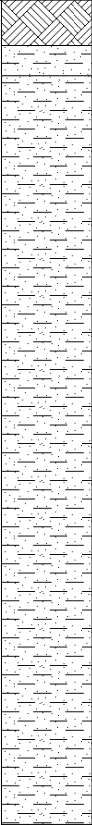
Logged By
V. Wilkinson

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.50			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00	D		1.20			Firm low strength brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
		1.00	SPT	N=7 (1,1/1,1,2,3)					
		1.50	U					Very stiff high strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. SAND band encountered between 3.00 m and 3.20 m bgl.	2
		2.00	D						
		2.00	SPT	N=31 (5,6/7,7,7,10)					
		3.00	D						3
		3.00	SPT	N=22 (3,3/4,5,6,7)					
		4.00	ES						4
		4.00	SPT	N=22 (3,3/4,5,6,7)					
		5.00	SPT	N=23 (4,4/4,6,6,7)	5.45				5
								End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).

				Borehole Log				Borehole No. WS122 Sheet 1 of 1	
Project Name: Chapel Lane				Project No. 13759		Co-ords: 349613E - 387737N		Hole Type WS	
Location: Widnes						Level:		Scale 1:50	
Client: Taylor Wimpey North West						Dates: 26/08/2020		Logged By V. Wilkinson	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
	 3.80	0.20	ES		0.30		 Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone. Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Stiff medium strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. SAND band encountered between 3.80 m and 4.20 m bgl. Becoming very stiff high strength at 2.00 m bgl. Becoming stiff medium strength at 5.00 m bgl.	1 2 3 4 5 6 7 8 9 10	
		1.00	D						
		1.00	SPT	N=13 (3,4/3,3,3,4)					
		2.00	D						
		2.00	SPT	N=24 (5,4/5,5,7,7)					
		3.00	D						
		3.00	SPT	N=24 (5,4/5,5,7,7)					
		3.90	ES						
		4.00	D						
		4.00	SPT	N=27 (5,5/5,7,7,8)					
		5.00	SPT	N=16 (4,4/4,4,4,4)					
					5.45		End of Borehole at 5.45m		

Remarks
 1. Complete. 2. Water strike at 3.80 m bgl.



Project Name: Chapel Lane

Project No.
13759

Co-ords: 349704E - 387762N

Hole Type
WS

Location: Widnes

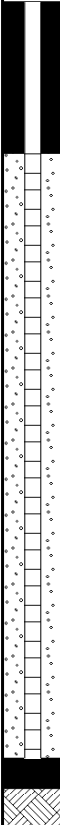
Level:

Scale
1:50

Client: Taylor Wimpey North West

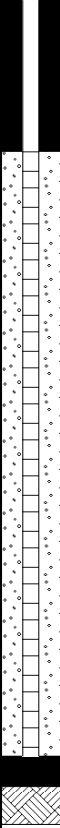
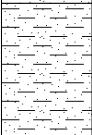
Dates: 26/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.50			MADE GROUND: Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of brick, concrete, mudstone and sandstone.	
		1.00	D		1.20			Stiff grey brown mottled slightly gravelly sandy CLAY with occasional layers of grey medium sand. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
		1.00	SPT	N=14 (2,1/2,3,4,5)					
		2.00	D					Stiff medium strength reddish brown mottled slightly gravelly sandy CLAY with occasional layers of grey medium sand. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 2.00 m bgl.	2
		2.00	SPT	N=29 (4,5/7,7,7,8)					
		3.00	D						3
		3.00	SPT	N=23 (3,4/5,5,6,7)					
		4.00	D		4.00				4
		4.00	SPT	N=15 (3,3/3,4,4,4)				Stiff medium strength reddish brown mottled slightly gravelly sandy CLAY with occasional layers of grey medium sand. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 5.00 m bgl.	
		5.00	D		5.45				5
		5.00	SPT	N=27 (5,6/5,6,6,10)					
End of Borehole at 5.45m									
									6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).

				Borehole Log				Borehole No. WS124 Sheet 1 of 1	
Project Name: Chapel Lane				Project No. 13759		Co-ords: 349662E - 387727N		Hole Type WS	
Location: Widnes				Level:		Scale 1:50			
Client: Taylor Wimpey North West				Dates: 26/08/2020		Logged By J. Sheridan			
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00	D		1.00			Stiff brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
		1.00	SPT	N=9 (1,1/1,2,3,3)				Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 2.00 m bgl. Becoming stiff medium strength at 3.00 m bgl. Becoming very stiff very high strength at 4.00 m bgl.	2
		2.00	D						3
		2.00	SPT	N=20 (2,3/5,5,5,5)					
		3.00	D						4
		3.00	SPT	N=15 (3,3/4,3,4,4)					
		4.00	D						5
		4.00	SPT	N=19 (4,3/4,5,4,6)					
		4.50	U						6
	5.00	D			5.45				7
	5.00	SPT	N=22 (3,5/5,4,6,7)						8
								End of Borehole at 5.45m	9
									10

Remarks
1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).



Project Name: Chapel Lane

Project No.
13759

Co-ords: 349660E - 387680N

Hole Type
WS

Location: Widnes

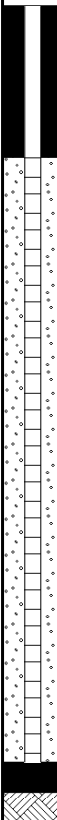
Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 26/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.50			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00	D		1.00			Firm brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
		1.00	SPT	N=8 (2,1/2,2,2,2)				Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 4.00 m bgl.	
		2.00	D						2
		2.00	SPT	N=16 (3,3/3,4,4,5)					
		2.50	U						
		3.00	D						3
		3.00	SPT	N=14 (2,3/3,4,4,3)					
		4.00	D						4
		4.00	SPT	N=19 (3,3/4,3,6,6)					
		5.00	D						5
		5.00	SPT	N=20 (3,4/4,4,5,7)					
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349801E - 387649N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 26/08/2020

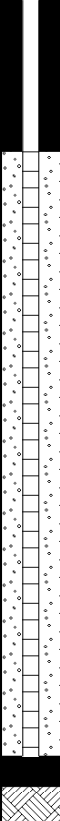
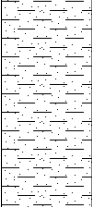
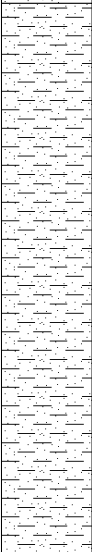
Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES					Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
					0.40			Firm brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
					0.70			Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 2.00 m bgl. Becoming stiff medium strength at 3.00 m bgl. Becoming Very stiff high strength at 5.00 m bgl.	1
		1.00	D						
		1.00	SPT	N=11 (2,3/3,3,2,3)					
		1.50	U						
		2.00	D						2
		2.00	SPT	N=17 (3,3/4,4,4,5)					
		3.00	D						3
		3.00	SPT	N=15 (2,3/3,4,4,4)					
		4.00	D						4
		4.00	SPT	N=15 (3,4/4,3,3,5)					
		5.00	D						5
		5.00	SPT	N=20 (3,4/5,4,5,6)					
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Water strike at 4.00 m bgl. 3. Monitoring well installed (response zone between 1.00 m and 4.00 m bgl).

				Borehole Log				Borehole No. WS127 Sheet 1 of 1	
Project Name: Chapel Lane				Project No. 13759		Co-ords: 349772E - 387735N		Hole Type WS	
Location: Widnes				Level:		Scale 1:50			
Client: Taylor Wimpey North West				Dates: 26/08/2020		Logged By J. Sheridan			

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.40		Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	1	
		0.50	U						
		1.00	D		1.80		Firm low strength brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	2	
		1.00	SPT	N=10 (3,2/2,2,3,3)					
		2.00	D		5.45		Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 3.00 m bgl. Becoming stiff medium strength at 5.00 m bgl.	3	
		2.00	SPT	N=11 (3,4/3,2,3,3)					
		3.00	D		End of Borehole at 5.45m			4	
		3.00	SPT	N=13 (3,4/3,3,3,4)					
		4.00	D					5	
		4.00	SPT	N=19 (5,4/5,5,4,5)					
	5.00	D					6		
	5.00	SPT	N=16 (5,4/3,5,4,4)						
								7	
								8	
								9	
								10	

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).



Project Name: Chapel Lane

Project No.
13759

Co-ords: 349822E - 387731N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 26/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.35			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
					0.60			Firm brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
		1.00	D					Stiff low strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Brown fine to medium SAND pockets encountered at 1.00 m and 2.60 m bgl. Becoming stiff medium strength at 2.00 m bgl. Becoming very stiff very high strength at 3.00 m bgl. Becoming stiff medium strength at 5.00 m bgl.	1
		1.00	SPT	N=6 (2,1/1,2,1,2)					
		2.00	D						2
		2.00	SPT	N=13 (3,4/4,3,3,3)					
		3.00	D						3
		3.00	SPT	N=20 (4,4/5,5,5,5)					
		4.00	D						4
		4.00	SPT	N=22 (3,3/5,6,5,6)					
		5.00	D						5
		5.00	SPT	N=17 (4,5/4,4,5,4)					
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349882E - 387748N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 26/08/2020

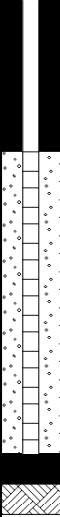
Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.30 0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone. Greyish brown fine to medium SAND.	
		1.00 1.00	D SPT	N=10 (3,3/3,2,3,2)				Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 3.00 m bgl.	1
		2.00 2.00	D SPT	N=14 (3,4/3,3,4,4)					2
		3.00 3.00	D SPT	N=19 (4,5/5,4,5,5)					3
		3.50	U						
		4.00 4.00	D SPT	N=24 (6,7/6,6,6,6)					4
		5.00 5.00	D SPT	N=25 (7,6/7,6,6,6)					5
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).

				Borehole Log				Borehole No. WS130 Sheet 1 of 1	
Project Name: Chapel Lane				Project No. 13759		Co-ords: 350002E - 387723N		Hole Type WS	
Location: Widnes				Level:		Scale 1:50			
Client: Taylor Wimpey North West				Dates: 26/08/2020		Logged By J. Sheridan			

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.30		Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone. Stiff brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff very high strength at 3.00 m bgl.		
					0.60				
	1.00	ES						1	
	1.00	SPT	N=12 (4,3/3,3,3,3)						
	2.00	ES						2	
	2.00	SPT	N=16 (3,4/4,4,4,4)						
	3.00	ES						3	
	3.00	SPT	50 (8,10/50 for 275mm)						
					3.40				
									4
End of Borehole at 3.40m								5	
								6	
								7	
								8	
								9	
								10	

Remarks

1. Complete. 2. Refused at 3.40 m bgl on very stiff CLAY. 3. Monitoring well installed (response zone between 1.00 m and 3.00 m bgl).



Project Name: Chapel Lane

Project No.
13759

Co-ords: 349993E - 387664N

Hole Type
WS

Location: Widnes

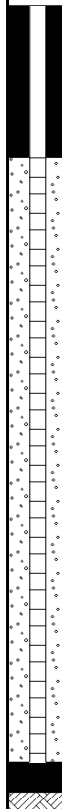
Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 26/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30			0.30			MADE GROUND: Dark brown slightly gravelly sandy clay (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		0.60	ES		0.70			MADE GROUND: Brown mottled grey slightly gravelly sandy clay. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
		1.00	D		0.80			MADE GROUND: Black slightly clayey sandy gravel. Gravel is fine sub-angular of mudstone. (Orange ceramic land drain encountered at 0.75 m bgl)	1
		1.00	SPT	N=12 (2,3/3,2,3,4)				Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 3.00 m bgl. Becoming stiff medium strength at 4.00 m bgl.	
		2.00	D						2
		2.00	SPT	N=11 (4,3/3,3,2,3)					
		3.00	D						3
		3.00	ES						
		3.00	SPT	N=30 (6,7/7,7,8,8)					
		4.00	D						4
		4.00	SPT	N=17 (4,5/5,4,4,4)					
		5.00	D						5
		5.00	SPT	N=14 (3,4/4,3,4,3)					
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Water strike at 3.50 m bgl. 3. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349903E - 387707N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 26/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.00	D SPT	N=7 (2,1/1,1,2,3)	1.00			Stiff brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	1
		2.00	D SPT	N=24 (3,4/5,5,7,7)				Firm low strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 2.00 m bgl. Becoming stiff medium strength at 4.00 m bgl. Becoming very stiff very high strength at 5.00 m bgl.	2
		3.00	D SPT	N=24 (7,6/6,6,6,6)					3
		4.00	SPT	N=16 (4,3/4,4,4,4)					4
		5.00	SPT	N=19 (4,5/5,4,5,5)					5
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed (response zone between 1.00 m and 5.00 m bgl).

Borehole Log

Borehole No.

WS133

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349882E - 387656N

Hole Type
WS

Location: Widnes

Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 26/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.40			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
					0.80			Stiff brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone.	
		1.00	D					Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 2.00 m bgl. Becoming stiff medium strength at 4.00 m bgl. Becoming very stiff high strength at 5.00 m bgl.	1
		1.00	SPT	N=10 (2,1/2,2,3,3)					
		2.00	D						2
		2.00	SPT	N=20 (5,6/5,4,6,5)					
		2.50	ES						
		3.00	D						3
		3.00	SPT	N=20 (4,5/5,5,5,5)					
		4.00	D						4
		4.00	SPT	N=15 (3,4/3,4,4,4)					
		5.00	D						5
		5.00	SPT	N=19 (5,4/5,5,5,4)					
					5.45			End of Borehole at 5.45m	6
									7
									8
									9
									10

Remarks

1. Complete.

Borehole Log

Borehole No.

WS134

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349737E - 387703N

Hole Type
WS

Location: Widnes

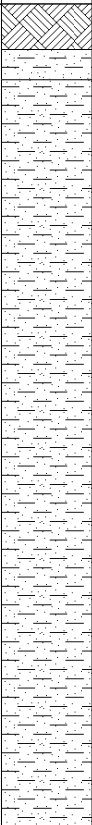
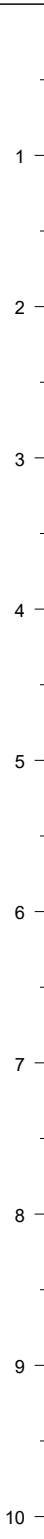
Level:

Scale
1:50

Client: Taylor Wimpey North West

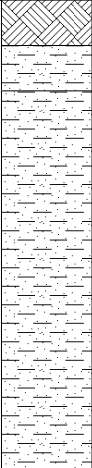
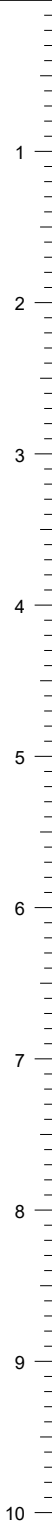
Dates: 26/08/2020

Logged By
J. Sheridan

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone. Stiff brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff high strength at 3.00 m bgl.	
		0.50	U		0.50				
		1.00	D						
		1.00	SPT	N=11 (2,1/3,2,2,4)					
		2.00	D						
		2.00	SPT	N=13 (2,3/3,4,3,3)					
		3.00	D						
		3.00	SPT	N=20 (3,4/4,5,5,6)					
		4.00	D						
		4.00	SPT	N=19 (3,4/4,5,5,5)					
		5.00	D						
		5.00	SPT	N=20 (3,4/4,5,5,6)					
					5.45			End of Borehole at 5.45m	

Remarks

1. Complete.

					Borehole Log			Borehole No. WS135 Sheet 1 of 1		
Project Name: Chapel Lane				Project No. 13759		Co-ords: 349835E - 387680N		Hole Type WS		
Location: Widnes						Level:		Scale 1:50		
Client: Taylor Wimpey North West						Dates: 26/08/2020		Logged By J. Sheridan		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.30			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone. Stiff brown mottled grey slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Stiff medium strength reddish brown slightly gravelly sandy CLAY. Gravel is fine to coarse sub-angular to sub-rounded of mudstone, coal and sandstone. Becoming very stiff very high strength at 3.00 m bgl.		
					0.60					
		1.00	D	N=9 (1,2/2,2,2,3)						
		1.00	ES							
		1.00	SPT							
		1.50	U							
		2.00	D	N=11 (2,2/3,2,3,3)						
		2.00	SPT							
		3.00	D	50 (25 for 10mm/50 for 5mm)	3.10					
		3.00	SPT							
End of Borehole at 3.10m										
Remarks										
1. Complete. 2. Refused at 3.10 m bgl on dense SAND.										



Borehole Log

Borehole No.

CP101

Sheet 1 of 1

Project Name: Chapel Lane

Project No.
13759

Co-ords: 350156E - 387897N

Hole Type
CP

Location: Widnes

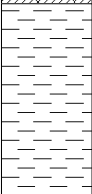
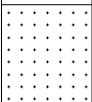
Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 24/08/2020

Logged By
PM Sampling

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.50			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
								Soft low strength brown mottled grey CLAY.	1
		1.20 1.20 1.20	B D SPT	N=4 (1,0/1,1,0,2)					
		1.80 2.00	B U		1.80			Very stiff very high strength brown boulder CLAY.	2
					2.50			Very stiff very high strength brown boulder CLAY.	
		3.00 3.00	D SPT	N=35 (2,4/6,9,10,10)					3
		4.00	U						4
		5.00 5.00	D SPT	50 (8 for 0mm/50 for 10mm)					5
		5.30 5.50 5.50	D D SPT	50 (25 for 0mm/50 for 10mm)	5.30			Dense SANDSTONE.	
					5.95			End of Borehole at 5.95m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Refused at 5.95 m bgl on SANDSTONE bedrock.

					Borehole Log			Borehole No. CP102 Sheet 1 of 2	
Project Name: Chapel Lane					Project No. 13759		Co-ords: 349802E - 387765N		Hole Type CP
Location: Widnes					Level:		Scale 1:50		Logged By PM Sampling
Client: Taylor Wimpey North West					Dates: 25/08/2020				

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.60			Dark brown slightly gravelly sandy CLAY (Topsoil) with frequent rootlets. Gravel is fine to medium angular to sub-rounded of mudstone and sandstone.	
		1.20	B	N=6 (1,1/1,2,1,2)	2.00			Firm low strength brown mottled grey CLAY.	1
		1.20	D						
		1.20	SPT						
		2.00	U				Very stiff very high strength brown boulder CLAY.	2	
		3.00	D	N=38 (1,5/7,10,10,11)	4.00			Stiff medium strength CLAY. Becoming very stiff high strength at 7.50 m bgl. Becoming stiff medium strength at 10.50 m bgl. Becoming very stiff high strength at 13.50 m bgl. Becoming very stiff very high strength at 15.00 m bgl.	3
		3.00	SPT						
		4.00	U						
		5.00	D	N=17 (2,2/4,4,4,5)					4
		5.00	SPT						
6.00	U								
6.50	B							5	
7.50	D	N=22 (2,4/5,5,6,6)						6	
7.50	SPT								
9.00	U								
								7	
								8	
								9	
								10	

Remarks
 1. Complete. 2. Refused at 16.95 m bgl on very stiff CLAY. 3. Water strikes encountered at 11.80 m bgl and 12.00 m bgl.



Borehole Log

Borehole No.

CP102

Sheet 2 of 2

Project Name: Chapel Lane

Project No.
13759

Co-ords: 349802E - 387765N

Hole Type
CP

Location: Widnes

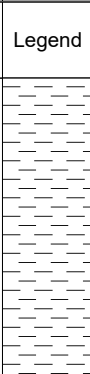
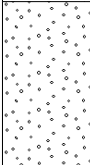
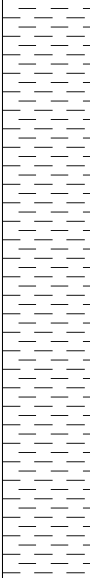
Level:

Scale
1:50

Client: Taylor Wimpey North West

Dates: 25/08/2020

Logged By
PM Sampling

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
	 12.00	10.50 10.50	D SPT	N=16 (1,3/3,4,4,5)	12.00			Stiff medium strength CLAY. Becoming very stiff high strength at 7.50 m bgl. Becoming stiff medium strength at 10.50 m bgl. Becoming very stiff high strength at 13.50 m bgl. Becoming very stiff very high strength at 15.00 m bgl.	11
		12.00	U					Sparce GRAVEL with SAND bands.	12
		13.50 13.50	D SPT	N=30 (3,4/5,7,8,10)	13.10			Very stiff high strength brown boulder CLAY. Becoming very stiff very high strength at 15.00 m bgl.	13
		15.00 15.00	D SPT	50 (4,4/50 for 255mm)			14		
		16.50 16.50	D SPT	50 (3,6/50 for 150mm)	16.95				15
							16		
							End of Borehole at 16.95m	17	
								18	
								19	
								20	