HyNet North West Hydrogen Pipeline

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Your Gas Network

Appendix 14A

Minerals Resource Assessment

October 2024

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Glossary

Term	Description
Aggregate minerals	The most commonly used minerals in the construction industry, typically crushed rock or sand and gravels.
Block Valves	A small scale HAGI, required on sections of pipeline which are over 16km in length to allow shutdown of the pipeline if needed.
DCO	Development Consent Order
Draft Order Limits	The Draft Order Limits (the boundary of the Project) published for the Statutory Consultation exercise in Autmn 2024.
HAGI(s)	Hydrogen Above Ground Installation(s). Above ground infrastructure utilised along the pipeline to control; the flow and pressure of the hydrogen
Host Authorities	The Local Authorities through which the pipeline runs: Cheshire East, Cheshire West and Chester, Halton, St Helens, Trafford and Warrington.
Incidental re-use	Where minerals are being incidentally extracted as part of a non-minerals development (such as in the excavation of pipeline trenches), the use of that mineral elsewhere (rather than simply re-using as a fill material in the reinstatement of the excavation).
Landbank	A means of calculating minerals availability by dividing the permitted reserves of that mineral by annual sales to give identify how many years' worth of mineral remains. Typically used for aggregates minerals, where it is recommended that each MPA with sand and gravel resources maintains a seven year landbank.
Minerals Buffer Zones	An area of land around the pipeline where the Project's easement agreements could mean that minerals extraction cannot take place. Measured as 50m either side of the pipeline.
Minerals resource	A natural minerals deposit which is identified by geological data but for which there is no current means of commercial extraction available. They differ from a minerals reserve, which is a minerals deposit where there is a commercial means of extraction available (usually confirmed by a valid planning permission being in place for their extraction).

Term	Description
MPA	Minerals Planning Authority. The Local Authority with responsibility for minerals planning. In this case the Host Authorities are all the relevant MPAs.
MSA	Minerals Safeguarding Areas, planning policy designations which cover known deposits of minerals which may form a minerals resource and which could be of interest for future extraction. The safeguarding designation provides protection to these minerals to avoid sterilisation from other development proposals.
Overburden	Ground material overlying the mineral resource, which has to be excavated to reach the mineral. Overburden is usually of no economic or commercial value.
Overlap Areas	Areas of land where the Project runs through a MSA.
PEIR	Preliminary Environmental Impact Report, and early stage report identifying potential environmental impacts used during the Statutory Consultation Exercise in Autumn 2022.
Permitted Reserves	The amount of minerals which are currently available in mines/quarries with valid planning permissions.
POL	Preliminary Order Limits, the extent of the order limits used for the Statutory Consultation exercise in Autmn 2023, and the accompanying PEIR documents.
Prior Extraction	Where a non-minerals development occurs in an area of minerals resource, prior extraction would see the extraction of the minerals from the ground prior to the non-minerals development being built.
The Project	The HyNet North West Hydrogen Pipeline Project
Severance	Where the pipeline divides an area of mineral resource, leaving parcels of land which are no longer of sufficient size for minerals extraction to be viable.
Sterilisation	Sterilisation occurs when a minerals resource can no longer be extracted due to non-mineral development. This is usually from direct sterilisation (development occurring on the land under which the minerals lie). However, it can also be from indirect sterilisation, whereby development in proximity to a minerals resource introduces sensitive land uses which may be affected by issues such as noise or dust which occur during minerals extraction.

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Executive Summary

The purpose of this report is to present the outputs of a Minerals Resource Assessment which has been undertaken for the Hynet North West Hydrogen Project to support the application for a Development Consent Order. The assessment will consider the areas where the Draft Order Limits overlaps with Minerals Safeguarding Areas and determines whether any minerals resources will be sterilised by the Project.

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1. Introduction

1.1. Project Overview

1.1.1. The HyNet North West Hydrogen Pipeline Project (hereafter 'the Project') is a proposal by Cadent Gas Ltd to construct and operate the UK's first 100 percent hydrogen pipeline network at scale. It will deliver hydrogen – meeting the low carbon standard - to multiple industrial customers and power generators, it will also transport hydrogen to potential gas blending points for introduction into the existing natural gas network.

1.1.2. The Project is part of the wider HyNet North West programme that will produce, store and distribute hydrogen as well as capture and store carbon from industry in the North West of England and North Wales. By achieving this, the HyNet North West programme will create and maintain thousands of local jobs, enabling long-term sustainability for businesses and supporting financial security for communities across the region. It is possible that further hydrogen pipelines will be built across the North West region to support the wider supply of hydrogen to homes and industrial customers.

1.1.3. The Project includes the design, construction, operation and maintenance of over 100km of new pipeline to distribute hydrogen to industry and to support the potential blending of hydrogen into the existing natural gas network. Hydrogen Above Ground Installations (HAGIs) are also required to control the flow and pressure of hydrogen at key points along the proposed pipeline.

1.1.4. Cadent has obtained a Section 35 Direction dated 05 July 2022 from the Secretary of State for Business, Energy and Industrial Strategy. This confirms that the Project (save for the pipeline spurs) is of national significance and is to be treated as development for which a Development Consent Order is required. Cadent therefore intends to submit an application for such an order for the Project pursuant to the Planning Act 2008; this application will include the pipeline spurs as associated development.

1.2. Consultation

1.2.1. The Project will run through six local authorities (the Host Authorities). In response to the statutory consultation exercise held in September to November 2022, the host authorities made the following comments in their responses in relation to how the Project interacts with minerals policies within their areas.

Cheshire East (CE)

1.2.2. The existing planning policies of CE include the Cheshire Replacement Minerals Local Plan[1], although there are relevant policies within that document which relate to the Project. CE consulted on a replacement Local Plan between April and July 2024[2], having previously consulted on a potential separate Minerals and Waste Plan in late 2022. The current intention would be to continue with a single Local Plan which includes minerals policy. The 2024 consultation was an early stage consultation exercise and did not contain any proposed safeguarding. Within the 2022 consultation draft plan[3], land near Agden Bridge had been identified as a Minerals Safeguarding Areas (MSA) for salt and sand and gravel. The Draft Order Limits would run across very small corners of the draft salt MSA near Agden Bridge and the draft sand and gravel MSA, neither of which is expected to be of a size which would create any minerals sterilisation issues. For the salt MSA, the commentary in **Section 6.12** regarding the salt resources at Boston Green is also relevant and describes why no sterilisation could occur.

Cheshire West and Chester Council (CWAC)

1.2.3. In response to the Statutory Consultation event in Autumn 2022, CWAC provided a response which highlighted the fact the pipeline route would run through MSAs for salt and for sand gravel[4], and that a detailed Mineral Resource Assessment (MRA) should be prepared.

1.2.4. CWAC also highlighted the approved northern extension to Forest Hill Quarry and that the Project must not prevent that development from going ahead. It was recommended that Cemex, the operators of Forest Hill Quarry, are consulted to understand their extraction plans in the area and ensure the working operations here are not sterilised. Further information on this is provided within **Section 6.10** on the Sandiway MSA.

1.2.5. CWAC requests that Compass Minerals and Inovyn (as salt / brine extractors) are consulted, that all MSAs, preferred areas, areas of search and quarries are considered, that prior extraction or re-use is considered within the MRA and that the combined effect of all sterilisation is accounted for. These matters are included within this MRA.

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1 Cheshire County Council (1999) The Cheshire Replacement Minerals Local Plan. (online) Available at: https://www.cheshireeast.gov.uk/pdf/planning/spatial-planning/strategic-planning/en-ldf-crepmlp-99.pdf (Accessed July 2024)

2 Cheshire East Council (2024) New Local Plan for Cheshire East, Issues Paper and Background Topic Papers. Available at: New local plan (cheshireeast.gov.uk) (Accessed July 2024)

3 Cheshire East Council (2022) Draft Minerals and Waste Plan. Available at: Draft Minerals and Waste Plan - Keystone (objective.co.uk) (Accessed July 2024)

4 Cheshire West and Chester Council (2015, 2019). Interactive Local Plan Map (of both Local Plan Parts 1 and 2). Available at: Local Plan (cheshirewestandchester.gov.uk) (accessed July 2024).

1.2.6. A query was made on the volume of aggregates that would be required for the Project. That is not a question that can be answered at this point in time. Aggregate requirements will not be available until the detailed design stage which will be post-DCO consent. In addition, some aggregate requirements will be dependent on weather conditions during construction or may be reused from other construction projects.

1.2.7. The consideration of prior extraction is provided at **Section 7.3** of this MRA as far as it can be considered at this stage of the Project.

1.2.8. The query with regard to the POL and a MSA near the Hover Force site on the West Corridor is no longer relevant due to changes made to produce the Draft Order Limits since the Statutory Consultation exercise in 2022.

Trafford

1.2.9. In response to the Statutory Consultation event in Autumn 2022, Trafford identified the area around Partington as being within a MSA for sand and gravel[5]. This is considered in **Section 6.8** on Partington.

Halton, St Helens and Warrington

1.2.10. No minerals related comments were received from Halton or Warrington Councils. No response was received from St Helens Council.

[5] Greater Manchester Authorities 2013. Greater Manchester Joint Minerals Development Plan. (online) Available at: https://www.trafford.gov.uk/planning/strategic-planning/docs/Greater-Manchester-Joint-Minerals-Plan-2013.pdf (Accessed July 2024)

2. Minerals Planning Policy

2.1. National Policy

Overarching National Policy Statement for Energy (EN-1)[6]

2.1.1. EN-1 states that mineral resources should be safeguarded as a far as possible, taking into account the long-term potential of the land after future decommissioning has taken place, and that where a development has an impact on a MSA the Secretary of State should ensure that appropriate mitigation is in place to safeguard minerals resources.

National Planning Policy Framework[7]

2.1.2. The National Planning Policy Framework (December 2023) (NPPF) (Paragraph 216) requires that planning policies should adopt planning policies that mean that "*specific minerals resources of local and national importance are not sterilised by non-mineral development where this should be avoided (whilst not creating a presumption that the resources defined will be worked)"*. These policies should include the use of Minerals Safeguarding Areas (MSAs). In addition, Paragraph 218 states that "*local planning authorities should not normally permit other development proposals in Mineral Safeguarding Areas if it might constrain potential future use for mineral working.*" The NPPF also states that planning policies should encourage prior extraction, where this is practical and environmentally feasible.

2.2. Local Policy

2.2.1. MSAs and associated minerals safeguarding policies are therefore set out by Mineral Planning Authorities (MPA), which in the case of Project are the six host authorities:

- Cheshire East;
- Cheshire West and Chester;
- Halton;
- St Helens;
- Trafford; and

[6] Department of Energy & Climate Change (2023). Overarching National Policy Statement for Energy (EN-1). (online) Available at: EN-1 Overarching National Policy Statement for Energy (publishing.service.gov.uk) (Accessed July 2024).

[7] Ministry of Housing, Communities and Local Government (2023). National Planning Policy Framework National Planning Policy Framework (publishing.service.gov.uk) (Accessed July 2024)

- Warrington.

2.2.2. The relevant local policies to the Project are summarised here:

Cheshire East

2.2.3. Minerals related policies in the Cheshire East area are covered by the Cheshire Replacement Minerals Local Plan[1]. The Plan does not have a specific minerals safeguarding policy which identifies minerals resources for safeguarding. Policy 6 of this document does however state that: "*An application for the extraction of minerals in advance of development which would otherwise cause the permanent sterilisation of proven mineral resources will be permitted if the mineral extraction and restoration is capable of being completed within an acceptable timescale and without compromising the subsequent development.*"

2.2.4. CE consulted on a replacement Local Plan between April and July 2024[8], having previously consulted on a potential separate Minerals and Waste Plan in late 2022. The current intention would be continued with a single Local Plan which includes minerals policy. The 2024 consultation was an early stage consultation exercise and did not contain any proposed minerals safeguarding. Within the 2022 consultation draft plan[9], land near Agden Bridge had been identified as a Minerals Safeguarding Areas (MSA) for salt and sand and gravel.

Cheshire West and Chester Local Plan

2.2.5. The Cheshire West and Chester Local Plan is provided within two documents: Part 1[10] provides strategic policies and Part 2[11] identifies land allocations and more detailed development management policies.

2.2.6. Within Part 1 Policy ENV9 states that the Council will "make provision for the adequate, steady and sustainable supply of sand, gravel, salt and brine, contributing to the sub-national guidelines for aggregate land-won sand and gravel, whilst ensuring the prudent use of our important natural finite resources." It goes on to state that this will be achieved by a number of actions, including the safeguarding of "*finite natural resources and associated infrastructure from incompatible development by delineating Mineral Safeguarding Areas for sand and gravel, salt and shallow coal, as shown on the Policies Map, together with existing and potential sites for minerals infrastructure*".

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[8] Cheshire East Council (2024) New Local Plan for Cheshire East, Issues Paper and Background Topic Papers. Available at: New local plan (cheshireeast.gov.uk) (Accessed July 2024)

[9] Cheshire East Council (2022) Draft Minerals and Waste Plan. Available at: Draft Minerals and Waste Plan - Keystone (objective.co.uk) (Accessed July 2024)

[10] Cheshire West and Chester Council (2015). Cheshire West and Chester Local Plan (Part One) Strategic Policies Available at: Local Plan - Part One | Cheshire West and Chester Council (accessed July 2024).

[11] Cheshire West and Chester Council (2019). Cheshire West and Chester Local Plan (Part Two) Land Allocations and Detailed Policies Available at: Local Plan - Part Two | Cheshire West and Chester Council (accessed July 2024).

2.2.7. The Project overlaps the MSA in nine locations in relation to sand and gravel resources and one location in regard to salt.

Sand and Gravel

2.2.8. Within Part 2, Policy M1 identifies four allocations for future minerals extraction. These allocations are:

- Existing extraction sites at Cheshire Sands, Oakmere; Forest Hill, Sandiway; Cobden Farm, Oakmere; and Town Farm, Kingsley;
- An allocation of land to extend Forest Hill, Sandiway;
- Preferred Areas for future minerals extraction at Moss Farm and on land north of the railway near to Forest Hill, Sandiway (which would present an extension to Forest Hill); and
- An Area of Search within which new minerals extraction may be acceptable.

2.2.9. The policy states that "The four existing sites and the allocated site…will be safeguarded against non-mineral development that prejudices their ability to supply sand and gravel."

2.2.10. The Project runs through the area around the Forest Hill Quarry and has the potential to affect the existing site, the allocation for its extension, the Preferred Area and an Area of Search in this location.

2.2.11. Also, within Part 2, Policy M2 identifies MSAs. It states that where non-minerals development are proposed within an MSA, they will be supported where:

- *"1: Mineral sterilisation will not occur; or*
- *2: The quantity or quality of the mineral it is no longer of any existing or potential value; or*
- *3: The mineral can be extracted satisfactorily prior to the incompatible development taking place; or*
- *4: The incompatible development is of a temporary nature and can be completed and the site restored to a condition that does not inhibit extraction within the timescale that the mineral is likely to be needed and does not permanently sterilise the mineral; or*
- *5. There is an overriding need for the incompatible development and the material planning benefits of the non-mineral or hydrocarbon development would outweigh the material planning benefits of the underlying or adjacent material.*

Salt

2.2.12. The Project overlaps the MSA for salt from where the south corridor runs past Moulton and then head east to the Hydrogen Storage Facility, off King Street. Within this MSA a preferred area for working rock salt is identified from the south of Moulton to the Northwich to Middlewich rail line.

2.2.13. Policy ENV9 of the Local Plan Part 1 states that the salt resources from this area and from the existing Winsford Rock Salt Mine will be safeguarded from incompatible development. Policy M6 of the Local Plan Part 2 explains that the preferred area relates to the workings of the existing Winsford Rock Salt Mine. Policy M2 (as noted above) provides the criteria for where non-minerals development (such as the Project) will be supported within the MSA.

Halton

2.2.14. The Halton Delivery and Allocations Local Plan[12] includes Policy CS(R)25 which states that Policy HE10 will identify MSAs. Policy HE10 identifies MSA and Areas of Search for new minerals extraction. It states that "Planning permission for other development that would result in the direct or indirect sterilisation of the identified mineral resources in a defined MSA will not be permitted unless:

a. it is demonstrated by way of a minerals assessment (MA) that the resource is not of economic value; or

b. the mineral can be extracted without unacceptable community or environmental impacts prior to the development taking place; or

c. the development is of a temporary nature and can be completed and the site left in a condition that does not inhibit later mineral extraction or mineral extraction elsewhere within the MSA; or

d. there is an overriding need for the development that outweighs the need for the mineral.

2.2.15. Two MSAs and two Areas of Search are identified by the policy, however three of these areas are outside of the Draft Order Limits and therefore not relevant to the Project. The only one relevant to the Project is an MSA at Cholmondeley Road, Runcorn, where the Runcorn Spur overlaps with the MSA.

St Helens

2.2.16. Policy LPC14 of the St Helens Borough Local Plan[13] identifies a MSA around deposits of coal, clay and sandstone which are considered to be of current or future economic importance. Policy LPC14 states that proposals for non-minerals development within the MSA will be permitted where prior extraction can acceptably take place, minerals have already extracted or are no longer of economic value, the need of the proposed development outweighs the benefit of the minerals, the proposed development is compatible with minerals safeguarding

[12] Halton Borough Council (2022). Halton Delivery and Allocations Local Plan. (online) Available at: https://www3.halton.gov.uk/Documents/planning/planning%20policy/newdalp/DALP%20Adopted.pdf (Accessed July 2024)

[13] St Helens Borough Council (2022). St Helens Borough Local Plan up to 2037. (online) Available at: https://www.sthelens.gov.uk/media/4410/St-Helens-Borough-Local-Plan-up-to-2037/pdf/Local_Plan_Written_Statement_-_FINAL_adoption_version_16.06.2022_with_appendices.pdf?m=637934026451200000 (Accessed July 2024)

or is temporary and its reversal would allow minerals extraction to take place in the future.

2.2.17. Policy LCP14 also states the non-minerals development close to existing minerals extraction sites will only be permitted where they do not have unacceptable impacts on the continued working of those sites.

2.2.18. Along the pipeline route the relevant parts of the MSA are:

- Adjacent to Bold Heath Quarry (existing minerals extraction site for sandstone);
- North and South of the M62 crossing (shallow coal and clay); and
- From where the pipeline meets Elton Head Road to the pipeline's northern extent (shallow coal and clay).

Trafford

2.2.19. Minerals policy for Trafford Council is provided within the Greater Manchester Joint Minerals Development Plan[5]. Policy 8 identifies minerals safeguarding areas and states that: "*All non-mineral development proposals within the Mineral Safeguarding Area (see maps 4, 5, 6 & 7) should extract any viable mineral resources present in advance of construction. Proposals for prior extraction of minerals will be permitted provided the proposal is in accordance with Policy 2 Key Planning and Environmental Criteria. Proposals for non-mineral development within the Mineral Safeguarding Areas that do not allow for the prior extraction of minerals will only be permitted where:*

1. *The need for the development outweighs the need to extract the mineral; or*
2. *It can be clearly demonstrated that it is not environmentally acceptable or economically viable to extract the mineral prior to non-mineral development taking place; or;*
3. *It can be clearly demonstrated that the mineral is either not present or of no economic value or too deep to extract in relation to the proposed development; or;*
4. *The development is limited or temporary and would not prevent minerals extraction taking place in the future."*

2.2.20. The Project overlaps with the identified MSA for sand and gravel on the East Corridor in the Warburton and Partington areas.

Warrington

2.2.21. Policy ENV3 of the Warrington Local Plan 2021/22 – to 2038/39[14] identifies MSAs on the Policies map, and the Project overlaps with the sand and gravel MSA in two locations: on the North Corridor near Bold Heath and Higher Walton. The policy states that non-minerals development will be approved in the MSAs where:

a. the mineral is not of economic value or potential value, or does not exist; or

b. that extraction of the mineral would not be physically viable or practicable; or

c. the mineral can be extracted satisfactorily prior to the non-minerals development taking place without adversely affecting the viability or deliverability of the non-minerals development; or

d. the development is of a temporary nature that can be completed and the site returned to a condition that would not prevent future mineral extraction; or

e. material considerations indicate that the need for the development overrides the presumption for mineral safeguarding such that sterilisation of the mineral can be permitted following the exploration of opportunities for prior extraction; or

f. it constitutes development that is exempt from mineral safeguarding policy.

2.2.22. The Local Plan provides details on exemptions but the Project does not fall within any of the exempt categories of development.

[14] Warrington Borough Council (2023) Warrington Local Plan 2021/22-2038/39. Available at: Adopted Local Plan 2021/22 – 2038/39 | warrington.gov.uk (Accessed: July 2024)

3. Proposed Development

3.1. DCO Proposed Development Works

3.1.1. The pipeline elements of the Project will be underground for its entire length (except where the connect to HAGIs and Block Valves). For most of the pipeline route, open cut trench excavations will be used to lay the pipeline. This is where soils are stripped from the surface, a trench is excavated and the pipeline is laid within the trench. Sands are used to line the trench to protect the pipeline from damage. The trench is then backfilled and the soils are replaced. Where trenches have been dug in areas of vegetation, appropriate planting or seeding is then undertaken to reinstate the land. Where the pipeline is required to cross features that are unsuitable for open cut trenches (e.g. major watercourses or transport network routes), a trenchless crossing technique will be used. A number of different techniques are available but all will involve the excavation of pits or chambers either side of the feature to be crossed and then the pipeline being 'tunnelled' from/to these pits therefore passing underneath the feature.

3.1.2. Where HAGIs or Block Valves are required, these works will involve standard building techniques for industrial/utility type facilities, with land stripped/levelled and a hard standing area created. Pipeline connections will lead from the underground pipeline into this area where it will be connected to the relevant equipment. The type and amount of equipment will depend on the type of site, and the number and type of connections needed from each HAGI.

3.1.3. Additional works will be required to enable the construction of the Project. These will include works such as the creation of access tracks, construction compounds and equipment laydown areas. For these, soils will be stripped, stored and the land surfaced in unbound aggregate. Land used for such purposes will be reinstated once construction is complete and other than during its temporary use, land will not be sterilised.

3.2. Operational Infrastructure

3.2.1. Following construction of the pipeline and the reinstatement of ground, any previous land uses that would not impact on the pipeline structure can resume. The pipeline route will however be subject to an easement along its length. This easement will cover an area of land around the pipeline where there are restrictions on the types of land use that can take place. These restrictions will prevent any development which could involve ground disturbance to the depth of the pipeline from occurring within the easement, and therefore preventing accidental damage to the pipeline. The extraction of minerals within the easements would be prevented.

3.3. Decommissioning

3.3.1. The pipeline and above ground infrastructure is being not being proposed as a time-limited (or temporary) development; however, the condition of the pipeline will deteriorate over time and at some point maintenance will no longer be viable and the pipeline will cease to be fit for purpose. At this point, the pipeline can be decommissioned, and whilst it would be left in the ground from these decommissioning works the presence of a disused pipeline is unlikely to be a barrier to the extraction of minerals in the area. A minerals developer would be able to lift the pipeline out of the ground as they strip the soils and overburden ready for minerals extraction. As such any sterilisation identified would expire once operational use of the pipeline ceases.

4. The Project and the MSAs

4.1.1. Within the Draft Order Limits, there are a number of MSAs identified in the local policy. These MSAs cover sand and gravel aggregate, salt, coal and clay resources. The Project overlaps with sand and gravel MSAs in several locations along all four main corridors, with the North Corridor overlapping with MSAs for coal and clay and for sandstone. The South Corridor also overlaps with a salt MSA. These overlap areas are described in **Table 14A 4.1**.

4.1.2. Not all of the overlap areas will create sterilisation, with temporary Project activities or use of existing access routes not creating any permanent problems for potential minerals extraction. In addition, land within the overlap areas may already have development or land designations in place which would be a constraint to minerals extraction. **Table 14A 4.1** provides an initial review of the overlap areas, with reasoning provided for any which can immediately be scoped out. These issues are then discussed further, as required for each overlap area, in Chapter 6.

Table 14A 4.1 Project and MSA Overlap details

Location	Mineral Safeguarding Area	Relevant Geology	Extraction constraints	Potential for minerals extraction
West Corridor: Runcorn Spur	Halton Delivery and Allocations Local Plan: Policy HE10	Sand and gravel Superficial: Glaciofluvial Deposits, Devensian	Within a Local Wildlife Site (LWS). The eastern part of the MSA area contains the A557 and junction 12 with the M56. In addition, land within the centre of the MSA contains an existing industrial business and is allocated for employment use.	No. The existing highway infrastructure and industrial land uses mean that there is insufficient land available to extract sand and gravel viably.
West Corridor: Sutton Weaver and Aston	Chester West and Chester Local Plan Part 2: Policy M2	Sand and gravel Superficial: Glaciofluvial Deposits, Devensian	Within a LWS, Tree Preservation Order (TPO), flood zone and Grade 2 agricultural land class (ALC). Overlap area contains Listed Buildings. A56 and properties near Sutton Weaver, Aston Lane and properties at Aston and Aston Grange	Yes. The constraints identified would not rule out the possibility of some extraction.

Location	Mineral Safeguarding Area	Relevant Geology	Extraction constraints	Potential for minerals extraction
North Corridor: Higher Walton	Warrington Local Plan: Policy ENV3	Sand and gravel Superficial: Glaciofluvial Deposits, Devensian Tidal Flats Deposits	Flood zone. Existing industrial development, West Coast Mainline, Manchester Ship Canal.	No. The MSA here consists of a 250m buffer around the Devensian sand deposits. The actual sand deposits cover a thin, liner area of around 8ha adjacent to the Manchester Ship Canal. The size and shape of the deposits, plus the proximity to the canal mean that the deposit would not be viable for extraction.
North Corridor: Bold Heath	St Helens Borough Local Plan: Policy LPC14 Warrington Local Plan: Policy ENV3	Sandstone / Sand Bedrock: Chester Pebble Beds Formation Sandstone Sand and gravel Superficial: Glaciofluvial Deposits, Devensian Tidal Flats Deposits	Flood zone, scheduled monument, ALC Grade 2. Properties along A0580, rail line.	Yes, within St Helens Sandstone MSA. There is an existing sandstone quarry within this area indicating minerals are viable and the constraints identified would not rule out the possibility of some extraction. No, within Warrington Sand and gravel MSA. The two MSAs are split, roughly by the Liverpool to Glazebrook rail line. The sand MSA (to the south) is constrained by the size of the potential sand deposit, the rail line and nearby properties, meaning it would not be viable for extraction.

Location	Mineral Safeguarding Area	Relevant Geology	Extraction constraints	Potential for minerals extraction
North Corridor: M62 crossing	St Helens Borough Local Plan: Policy LPC14	Coal and clay Bedrock: Pennine Middle Coal, Etruria formation	Flood zone, TPO, Proximity to M62, A570, properties on School Lane / Chapel Lane.	No. Coal is now considered an unlikely mineral for viable extraction, and clay resources have historically been viable only with coal extraction. In addition, South of the M62 there is insufficient area for viable extraction. North of M62 land suitable for extraction is restricted by the proximity to M62 and A570, plus properties.
North Corridor: Elton Head Road and north	St Helens Borough Local Plan: Policy LPC14	Coal and clay Bedrock: Pennine Middle Coal, Etruria formation	Built up, urban area.	No. Existing urban area would rule out viable extraction.
East Corridor: Tarporley Road	Chester West and Chester Local Plan Part 2: Policy M2	Sand and gravel Superficial: Alluvium: Clay, Silt, Sand and Gravel	MSA not large enough for viable extraction.	No. MSA not large enough for viable extraction.
East Corridor: Lower Whitley	Chester West and Chester Local Plan Part 2: Policy M2	Sand and gravel Superficial: Glaciofluvial Sheet Deposits, Devensian	Listed Buildings, scheduled monument, TPO. Properties at Lower Whitley and Higher Whitley.	Yes. The constraints identified would not rule out the possibility of some extraction.

Location	Mineral Safeguarding Area	Relevant Geology	Extraction constraints	Potential for minerals extraction
East Corridor: Antrobus	Chester West and Chester Local Plan Part 2: Policy M2	Sand and gravel Superficial: Glaciofluvial Sheet Deposits, Devensian	ALC Grade 2. A559 and scattered properties.	Yes. The constraints identified would not rule out the possibility of some extraction.
East Corridor: Dunham Massey	Greater Manchester Joint Minerals Development plan: Policy 8 Warrington Local Plan: Policy ENV3	Sand and gravel Superficial: Glaciofluvial Deposits, Devensian, Shirdley Hill Sand Formation, Alluvium: Clay, Silt, Sand And Gravel	Flood zone, ALC Grade 2. Bridgewater Canal, properties at Dunham Woodhouses.	Yes. The constraints identified would not rule out the possibility of some extraction.
East Corridor: Partington	Greater Manchester Joint Minerals Development plan: Policy 8	Sand and gravel Superficial: Glaciofluvial Deposits, Devensian, Shirdley Hill Sand Formation	ALC Grade 2, Flood risk area, peat soils. Scattered properties.	Yes. The constraints identified would not rule out the possibility of some extraction.
Central Hub / South Corridor: Acton Bridge	Chester West and Chester Local Plan Part 2: Policy M2	Sand and gravel Superficial: Glaciofluvial Deposits, Devensian Alluvium: Clay, Silt, Sand and Gravel	Flood zone, Listed Buildings, ALC Grade 2. River Weaver / Weaver Navigation, A49, properties / businesses at Barrington and Acton Bridge.	Yes. The constraints identified would not rule out the possibility of some extraction.

Location	Mineral Safeguarding Area	Relevant Geology	Extraction constraints	Potential for minerals extraction
South Corridor: Gorstage North	Chester West and Chester Local Plan Part 2: Policy M2	Sand and gravel Superficial: Glaciofluvial Deposits, Devensian Alluvium: Clay, Silt, Sand and Gravel	None.	No. MSA not large enough for viable extraction.
South Corridor: Gorstage South	Chester West and Chester Local Plan Part 2: Policy M2	Sand and gravel Superficial: Glaciofluvial Deposits, Devensian	Properties at Gorstage, A49.	No. MSA not large enough for viable extraction.
South Corridor: Sandiway	Chester West and Chester Local Plan Part 2: Policy M2	Sand and gravel Superficial: Glaciofluvial Deposits, Devensian Alluvium: Clay, Silt, Sand and Gravel	TPO, LWS, Peat Soils. Rail line, A556, A559, Sandiway Golf Club, Vale Royal Golf Club, properties at Hartford and around Gorstage Hall Farm.	Yes. There is an existing sand and gravel quarry within this area indicating minerals are viable and the constraints identified would not rule out the possibility of some extraction.
South Corridor: Moulton	Chester West and Chester Local Plan Part 2: Policy M2	Sand and gravel Superficial: Glaciofluvial Deposits, Devensian Alluvium: Clay, Silt, Sand and Gravel	Flood zone, Listed Buildings, scheduled monument, TPO. River Weaver / Weaver Navigation, West Coast rail line, properties in Moulton.	Yes. The constraints identified would not rule out the possibility of some extraction.

Location	Mineral Safeguarding Area	Relevant Geology	Extraction constraints	Potential for minerals extraction
South Corridor: Bostock Green	Chester West and Chester Local Plan Part 1: Policy ENV9. Chester West and Chester Local Plan Part 2: Policies M2 and M6	Salt Bedrock: Northwich Halite	Landfill, properties at Bostock / Bostock Green	Yes. The constraints identified would not rule out the possibility of some extraction.

4.1.3. Ten areas of overlap between the Draft Order Limits and the MSAs have therefore been identified which need to be taken forward for further consideration in this MRA.

5. Methodology

5.1.1. This Minerals Resource Assessment has been produced in response to the necessity for the pipeline to pass through identified MSAs, the consultation responses received on the Project to date and the relevant policy requirements identified. However, due to the nature of the Project, its current stage and the information that is available at this point in time a number of factors have influenced the methodology. Where assumptions have had to be made, a worst case scenario has been considered. These factors include:

- Buffer zone: a buffer zone of 50m either side of the pipeline has been considered as the area to be directly sterilised by the Project. This 50m buffer is based on the 40 yard distance referenced in the mining code, pursuant to the Acquisition of Land Act 1981. Within this 40 yard distance from a pipeline, any proposals for minerals extraction would need to be notified to Cadent and agreed with them before they occur. The EIA has extended the distance to 50m, and also considered that any minerals in this area would be sterilised, to provide a worst case assessment. In practice, minerals extraction could be agreed subject to negotiation with Cadent.
- Volume of minerals: within the buffer a ‘straight line down’ consideration has been given to the minerals below ground. Taking a cross section of the buffer zone, this means that the volume calculation considers a rectangle – running straight down from the outer boundary on each side, and straight across at the top and bottom of the mineral resource. The calculation therefore does not take into account any stability issues which may be relevant and could effect the volume (by introducing sloping walls).
- It is not possible for the pipeline to avoid MSAs (or other minerals related policy designations) completely. This is due to the extensive coverage of MSAs in local policy documents and the long, linear nature of the Project. The project design has accounted for the MSAs wherever possible, looking to minimise routes through the areas and in discussion with the minerals operators at Forest Hill Quarry to agree routes. The route therefore avoids all operational minerals sites and any potential/planned extension works that the Project has been made aware of.
- Ground investigation data is not available along all of the pipeline route. This, plus the points above, mean that the volume calculations are only suitable for consideration as part of the EIA. They are not intended for use in mineral rights owner discussions around values or any related compulsory acquisition compensations.

5.2. Identification of Relevant MSA Area

5.2.1. Across the six host authorities, the approach to identifying MSAs differs. For the purposes of the minerals identified as being relevant to this study the approaches used are:

- Cheshire East: identifies MSAs around a small number of areas of search for new minerals extraction;
- Cheshire West and Chester: includes all Salt and Sand (Devensian and Alluvial) geology identified from BGS records;
- Halton: identifies MSAs around a small number of areas which are potentially unconstrained by existing development;
- St Helens: focussed on Bold Heath Quarry and a surrounding buffer zone;
- Trafford: includes all Sand (Devensian only) geology from BGS records; and
- Warrington: includes all Sand (Devensian and Alluvial) geology identified from BGS records, plus a buffer zone around them.

5.2.2. These different approaches mean that a consistent approach cannot be taken as to how the Project affects the MSA across each host authority. Cheshire East, Halton and St Helens only safeguard small areas of land or specific minerals sites and if the Project overlaps with one of these areas then it is simple to determine the impact on that area. Cheshire West and Chester, Trafford and Warrington however safeguard all minerals within the identified geological layers, which cover substantial areas of land across the local authority area. In order to provide a sensible consideration of the potential sterilisation against these wider MSA areas, a 1km buffer has been used around the Project to identify a relevant part of the MSA to consider in the assessment.

5.3. Considerations for Viability Assessment

5.3.1. Within the overlap areas identified within **Table 14A 4.1**, the Project will require a buffer zone around the pipeline or other permanent infrastructure where minerals extraction from surface mining will be prevented in order to avoid land stability issues which may damage the pipeline. The exact buffer zones needed will be detailed within the easement agreements made with the relevant landowners, however they will all be 50m or less from the pipeline route. A 50m buffer either side of the pipeline or other permanent features (100m wide in total) has therefore been used within the sand and gravel MSAs to identify the area of land which would actually be affected by the Project. This in referred to as the “minerals buffer zone”.

5.3.2. The Bostock Green MSA considers deep lying salt resources where surface mining would not be applicable. Details of how this overlap area has been considered are provided in **Section 6.12**.

5.3.3. The MRA will examine available geological data to determine, where possible, the quality and quantity of the minerals resource within the overlap areas and whether it could be economically viable to extract. The general methodology follows that identified in Mee et al (2019)[15], where deposits falling under categories A or B are considered potentially viable.

Table 14A 5.1 Category A and B deposits

Category A	Category B
The deposit should average at least 2m thickness.	The deposit should average at least 2m thickness.
Ratio of overburden to mineral should not exceed 1:1.	Ratio of overburden to mineral should exceed 2:1.
The proportion of fines (particles passing 0.063mm British Standards sieve) should not exceed 20%.	The proportion of fines (particles passing 0.063mm British Standards sieve) should not exceed 40%.
The deposit should lie within 5m of the surface.	The deposit should lie within 10m of the surface.

5.3.4. Exploratory hole records are analysed, where available, to determine this information. As particle size data is not available, the depositional environment is analysed to deduce the likely quality of the mineral resource and its homogeneity.

5.3.5. The mineral resource will also be assessed in terms of any constraints to minerals extraction. Constraints could include matters such as:

- Existing built development which can create either direct or indirect sterilisation;
- Environmental / land use constraints, such as designated areas (e.g. SSSIs, National Landscape areas), listed buildings / heritage assets, footpath networks etc.; and
- Workability of the mineral resource, in terms of mineral volume, site size, access/transport arrangements etc.

5.3.6. If necessary, the assessment will also consider the matter of severance (where a development 'splits' an MSA and mineral in the 'cut off' area becomes too small a resource to be viable).

[15] Mee, K., Marchant, B.P., Mankelow, J.M. and Bide, T.P. (2019). Modelling the distribution and quality of sand and gravel resources in 3D: a case study in the Thames Basin, UK. Environmental Modelling & Assessment, 24(5), pp.585-603.

5.3.7. The assessment assumes that standard construction practices will be followed throughout the construction phase of the works, where all materials (including minerals) that are extracted from the ground for the pipeline trench or trenchless crossing excavations, will be stored close to their extraction location in a manner so as avoid contamination between different materials (e.g. minerals materials would be stored separately from soils or other materials). These stored materials will then be used to backfill the excavations once construction work is complete and as far as possible, the different materials will be placed back at the depths/thicknesses they were originally found. This will be the same for both pipeline construction and any trenchless crossing pits required within the overlap areas. In this way, the majority of any minerals materials that may be excavated will be replaced and remain available for future extraction after the operational phase of the Project.

5.3.8. For any HAGI construction, the process will be different as there will less need for the backfilling of materials as land will be built upon, rather than excavated for below ground works and then reinstated.

5.3.9. As the assessment does not have available ground investigation data from all locations, and the information available does not provide details on particle sizes, the methodology is considered suitable only for calculating volumes for the purposes of the Environmental Impact Assessment.

6. Mineral Resource Assessment

6.1. Potential Mineral Resources

6.1.1. For the ten overlap areas that have been identified between the Project and the MSAs, an assessment is made of the mineral viability following the methodology set out on Chapter 5. These assessments are provided in the remainder of this chapter.

6.1.2. An initial calculation of potentially viable minerals resource is taken using geological data from publicly available sources, principally the BGS, plus any ground investigation data which is available from the Project. However, ground investigation work to date on the Project has not been undertaken for the purposes of the MRA (it has been focussed on ground conditions for construction purposes). Publicly available data is also limited in some of the overlap areas and therefore assumptions have had to be made in certain areas to allow relevant data to be identified. Where assumptions have been made, these have taken a precautionary view to avoid underplaying the assessment conclusions. Additional information may become available during the Project as further ground investigation is undertaken however this is likely to be undertaken post consent and prior to construction and due to the precautionary nature of the assessment, it is considered unlikely that they would materially alter the outcome of this assessment.

6.1.3. The initial calculations are then reviewed to consider any existing constraints to extraction, whether the proposals would create any issues of severance or whether there would be any other matters which require consideration.

6.2. Sand and Gravel Resources

6.2.1. Where the MSAs host sand and gravel resources, these are hosted within three Quaternary sedimentary units across the Project area (BGS Geo Index Onshore web viewer[16]):

- Devensian Glaciofluvial deposits (Pleistocene), deposited by meltwater streams. Includes mostly coarse-grained sediments (i.e. sand and gravel) with some finer-grained layers (i.e. clay and silt), locally with lenses of silt, clay or organic material.
- Shirdley Hill Sand Formation (Holocene). The sediments are interpreted as coastal blown sands. Moderately to well-sorted, fine-grained sand with peat layers in the lower part. Sand grains are dominated by rounded to sub-rounded quartz grains. The formation is divisible into an upper "white" sand and a lower "brown" sand that is olive grey and brown.
- Alluvium (Quaternary) - clay, silt, sand and gravel, unconsolidated detrital material deposited by watercourses.

[16] GeoIndex - British Geological Survey (bgs.ac.uk), accessed March 2024

6.3. West Corridor: Aston

Geological Mapping and Resource Description

6.3.1. Sand and gravel mineral resources, identified in the Aston MSA are hosted in the Devensian Glaciofluvial deposits (Pleistocene), deposited by meltwater streams. Includes mostly coarse-grained sediments (i.e. sand and gravel) with some finer-grained layers (i.e. clay and silt).

6.3.2. An extract from BGS 1:50,000 scale geological mapping, displaying superficial deposits and thickness of sand layers intersected in boreholes, is presented in **Figure 6.1**.

6.3.3. The Aston MSA does not include any resources in bedrock geological formations.

Data Analysed

6.3.4. There are multiple BGS boreholes located within the western part of the MSA, and also a few boreholes across the central and eastern parts, and these are considered to provide a reasonable evaluation of sand and gravel resource potential in this area.

6.3.5. Information from the boreholes used for analysis is summarized in **Table 14A** 6.1. Boreholes logs can be found in **Annex 14A 1** and their locations are shown in **Graphic 14A 6.1**.

Table 14A 6.1 Aston: Boreholes near pipeline easement

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ57NE10	0.3	7.0	6.7	Medium dense fine to coarse sand with some gravel	scans.bgs.ac.uk/sobi_scans/boreholes/166819
SJ57NE11	0	8	8	Medium dense slightly silty sand	scans.bgs.ac.uk/sobi_scans/boreholes/166820
SJ57NW185	3	5.7	2.7	Medium/coarse grained sand and gravel	scans.bgs.ac.uk/sobi_scans/boreholes/16115752
SJ57NW187			-	Clay	scans.bgs.ac.uk/sobi_scans/boreholes/16115754

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ57NW189			-	Clay and marl	scans.bgs.ac.uk/sobi_scans/boreholes/16115765
SJ57NW190	2.4	4.7	2.3	Medium grained sand	scans.bgs.ac.uk/sobi_scans/boreholes/16115767
SJ57NW201	0.3	1.5	1.2	Coarse grained sand	scans.bgs.ac.uk/sobi_scans/boreholes/16116986
SJ57NW202			-	Clay	https://scans.bgs.ac.uk/sobi_scans/boreholes/16117021/images/15299441.html
SJ57NW203	0.6	3.9	3.3	Fine grained, medium dense sand, with some clay and silt	scans.bgs.ac.uk/sobi_scans/boreholes/16117027
SJ57NW204	0.6	2.7	2.1	Fine grained loose sand	scans.bgs.ac.uk/sobi_scans/boreholes/16117034
SJ57NW270			-	Marl	scans.bgs.ac.uk/sobi_scans/boreholes/17088191
SJ57NW294	0.5	6.7	6.2	Fine sand	scans.bgs.ac.uk/sobi_scans/boreholes/17100378
SJ57NW296	3.6	6.7	3.1	Fine sand	https://scans.bgs.ac.uk/sobi_scans/boreholes/17100380/images/15172509.html
SJ57NW302	1.9	3.6	1.7	Medium grained sand	scans.bgs.ac.uk/sobi_scans/boreholes/17116417

Minerals

6.3.6. The sand deposits in several boreholes close to the overlap area can be classified as potentially viable deposits (in accordance with **Table 14A 5.1**). The thickness of sand/gravel intersections typically varies significantly in glacial deposits, but based on the information presented across the boreholes, plus data from similar deposits in the wider area, the thickness of sand and gravel deposits at the Aston MSA can be estimated to be 3m on average.

Sterilisation considerations

6.3.7. The sterilisation considerations identified below are shown on **Figure 6.2** and their impact on the available MSA area summarised in **Table 14A 6.2.**

Constraints

6.3.8. Within the minerals buffer zone, land within the western extent of the MSA will be constrained by the A56, the rail line and nearby properties. Moving eastwards, land will be constrained between the properties near the former Sutton Weaver Golf Club (which include Listed structures) and Aston Lane. A small area of land will also be sterilised by Aston Lane as it turns north towards Aston Heath. These areas total around 10.5ha.

6.3.9. Within the wider MSA, the above constraints will also sterilise land outside of the overlap area. Aston Lane, buildings and properties within Aston and the River Weaver will also sterilise land. In addition, in the southern part of the MSA there are ancient woodlands and LWS between the River Weaver and Aston. There is also a finger of land within the MSA on its northeastern extent which is too small to be viable for extraction. These areas outside of the overlap area cover around 141ha.

Severance

6.3.10. There is an area of approximately 4ha which could be subject to severance from the pipeline route to the north of the pipeline route as it passes north of Aston. There is also an area of approximately 9ha which would be sterilised as the pipeline passes to the southeast of the A56.

Table 14A 6.2 Aston sterilisation considerations

	Mineral resource	Area (ha)
A	MSA total area	315
B	MSA total constrained land	151
C	MSA total unconstrained	164
D	Minerals buffer zone	37.6
E	Constrained land within minerals buffer zone	10.5

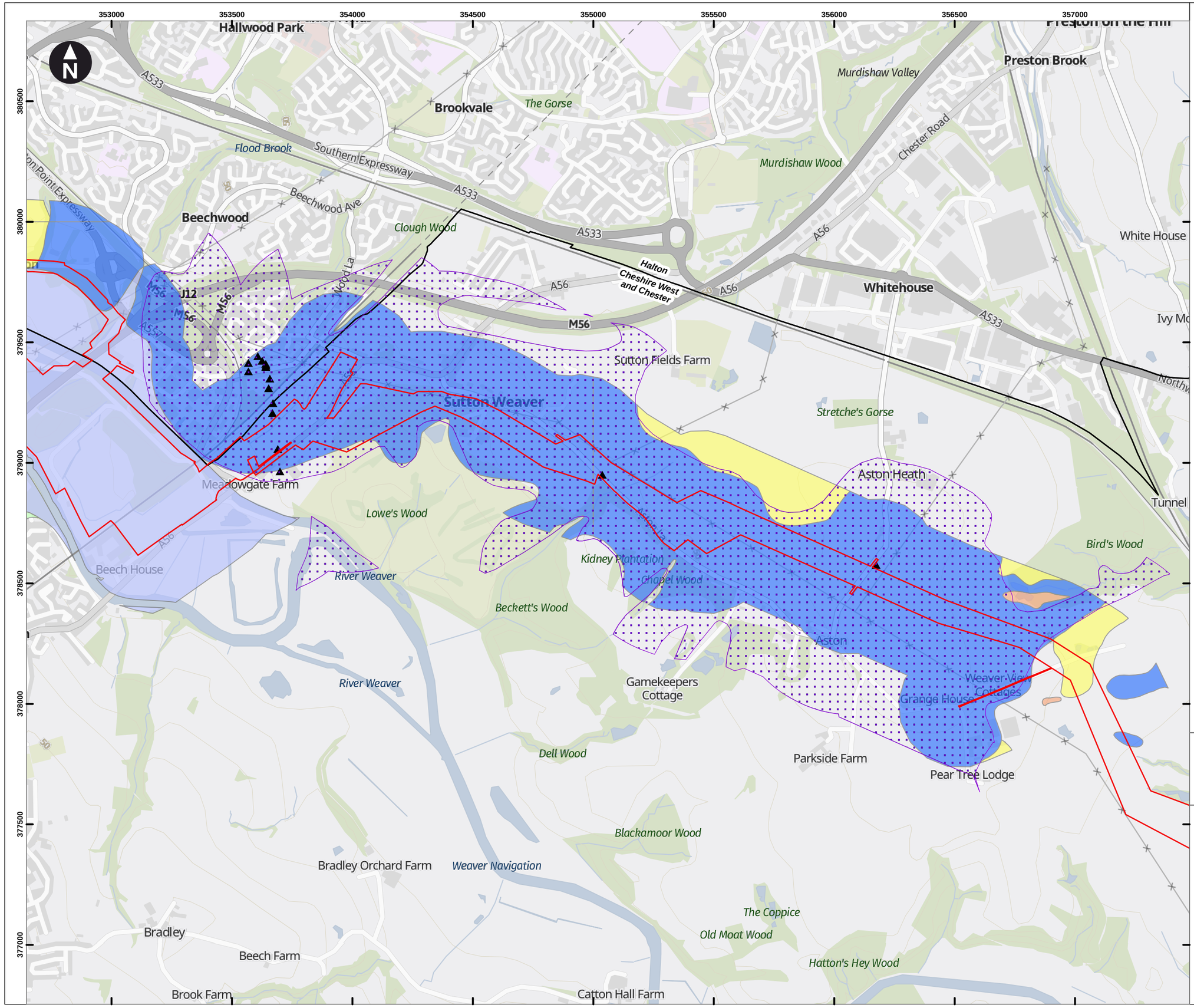
	Mineral resource	Area (ha)
F	Unconstrained land within minerals buffer zone	27.1
G	Severance land	13
H	Sterilised	40.1
I	Remaining unconstrained and unsterilised land	123.9

H: Sterilised land includes the unconstrained land within the minerals buffer zone, plus the severance land
I: The total land that would remain available within the MSA that is unconstrained and unsterilised by the Project and therefore theoretically available for minerals extraction.
All figures are rounded values

Conclusion

6.3.11. The minerals buffer zone would cover approximately 38ha of land and would create severance for another 13ha. However, around 10.5ha of the minerals buffer zone is already sterilised by existing developments so only around 40ha of land is sterilised by the Project. At an assumed average sand and gravel thickness of 3m, 1,203,000m^3 of sand and gravel has been identified as being at risk of sterilisation.

6.3.12. However, this would only be around 24% of the total unconstrained land in the MSA, and there would remain around 124ha of unsterilised / unconstrained land, which could provide around 3,717,000m^3 of sand and gravel.



Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- BGS Boreholes

Superficial Geology

- Alluvial Fan Deposits
- Alluvium
- Glaciofluvial Deposits, Devensian
- Glaciofluvial Ice Contact Deposits, Devensian
- Glaciofluvial Sheet Deposits, Devensian
- Peat
- River Terrace Deposits, 1
- Shirdley Hill Sand Formation
- Superficial Theme Not Mapped [For Digital Map Use Only]
- Tidal Flat Deposits
- Till, Devensian

0 200 400 600 Metres

Scale at A3: 1:15,000

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Draft Environmental Statement
Chapter 14: Land Use
Appendix 14B: Minerals Resource Assessment

Figure 6.1
Aston MSA: Superficial Geology and Sand/ Gravel thickness.

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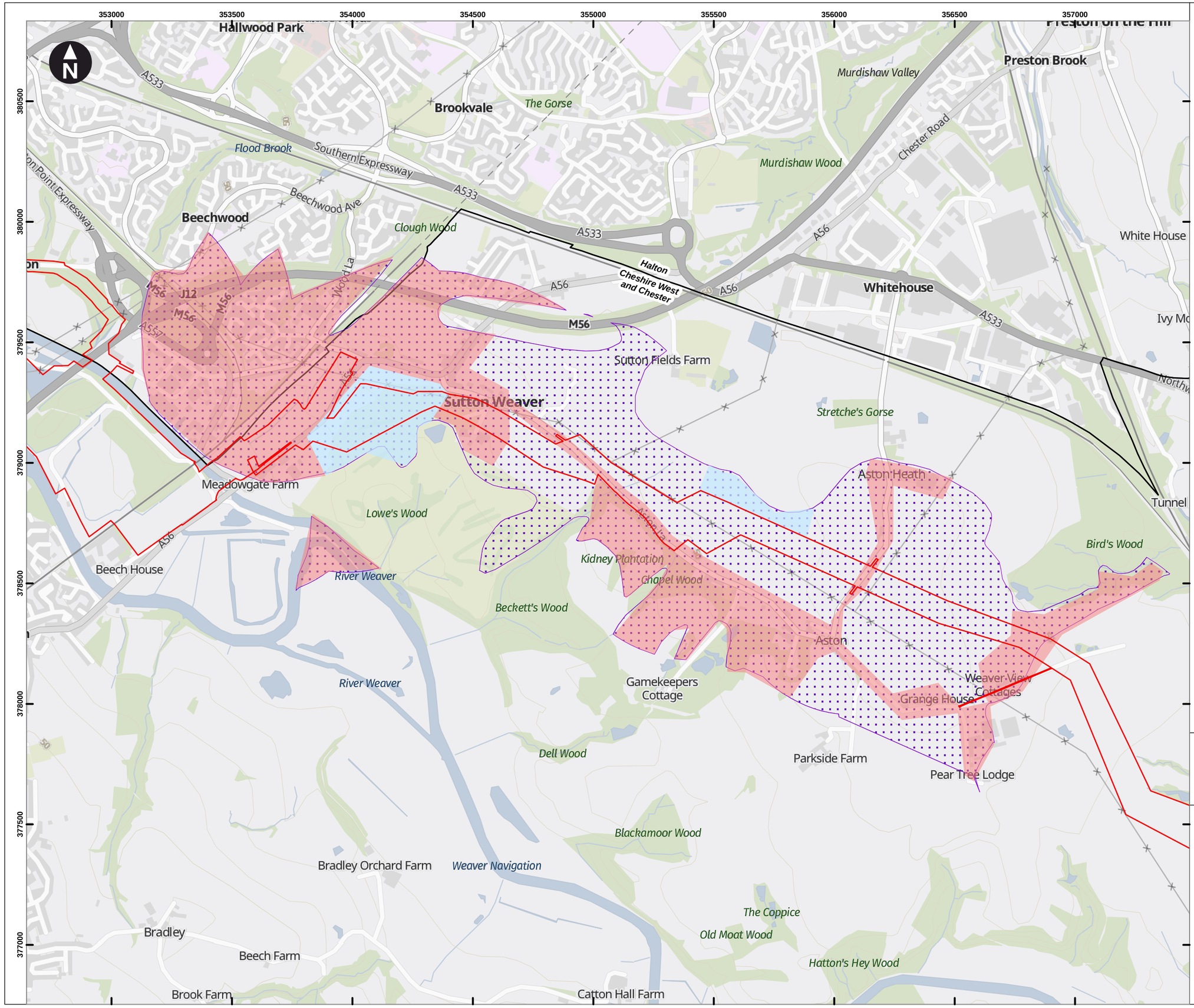
October 2024



Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- Constrained
- Severance

0 200 400 600 Metres

Scale at A3: 1:15,000

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Figure 6.2
Aston: Other Considerations

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6.4. North Corridor: Bold Heath

Geological Mapping and Resource Description

6.4.1. The Bold Heath MSA identified consists of two separate minerals resources. South of the rail line, the MSA covers a small area of alluvial deposits, plus a buffer zone around this feature added by the Minerals Planning Authority (Warrington). However, the area of alluvial deposit is too small to be viable for extraction and therefore the whole MSA south of the rail line is excluded from further assessment.

6.4.2. North of the rail line, the relevant geological layer is the Triassic, Chester Pebble Beds Formation.

6.4.3. The Chester Pebble Beds comprise a distinctive facies of cyclic sedimentation. They typically consist of red or yellow, cross laminated, pebbly sandstones with interbedded mudstone and micaceous horizons. The unit is comparatively hard, with siliceous, ferruginous and calcareous cements. The pebbles are well rounded and consist predominantly of white vein quartz and purple quartzite. Soft red-brown marl clasts can also be found within the sandstone. Part of the eastern edge of the MSA is mapped as Wilmslow Sandstone Formation, however description of continuous sandstone beds in boreholes can be interpreted as continuation of the same Chester Pebble Beds formation.

6.4.4. Bedrock geology map and thickness of prospective sandstone bed is shown in **Figure 6.3**.

6.4.5. No mineral resource in this northern part of the Bold Heath MSA belongs to superficial Quaternary deposits.

Data Analysed

6.4.6. Multiple boreholes contain information relevant to the evaluation of potential resource within and around the pipeline easement. Information from the boreholes used for analysis is summarized in **Table 14A 6.3**. Boreholes logs can be found in **Annex 14A 2** and their locations are shown on **Figure 6.3**.

Table 14A 6.3 Bold Heath: Boreholes near pipeline easement

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ58NW20	0.76	>25	>25	Red and grey sandstone	scans.bgs.ac.uk/sobi_scans/boreholes/168304
SJ58NW21	7.92	>25	>25	Red and grey sandstone with pebbles	scans.bgs.ac.uk/sobi_scans/boreholes/168305

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ58NW23	3.9	>25	>25	Soft red and grey sandstone with quartzite pebbles	scans.bgs.ac.uk/sobi_scans/boreholes/168307
SJ58NW24	2.0	>25	>25	Soft and grey red sandstone with quartzite pebbles	scans.bgs.ac.uk/sobi_scans/boreholes/168308
SJ58NW28	0.3	>25	>25	Red sandstone with pebbles	scans.bgs.ac.uk/sobi_scans/boreholes/168312
SJ58NW35	10.3	>25	>25	Red and grey sandstone with quartz pebbles	scans.bgs.ac.uk/sobi_scans/boreholes/168319
SJ58NW39	3.96	>25	>25	Red and yellow variegated sandstone with a few rounded pebbles	scans.bgs.ac.uk/sobi_scans/boreholes/168323

6.4.7. In addition to the borehole data, there is an active quarry within the MSA (**see Figure 6.4**). Bold Heath Quarry is operated by D Morgan plc and it is understood from historic planning permission information that the quarry provides material for the company's construction projects. Planning documents show that the quarry has permission to extract sandstone down to a level of 15m AOD (above ordnance datum). This is due to groundwater levels in the area causing concerns over extraction at lower depths.

6.4.8. Pre-quarrying ground levels appear to be in the region of 25m AOD to the east of the quarry, rising to around 35m AOD to the west. From borehole records, overburden appears to be around 3m thick to the east, increasing to around 5m in the west. This would indicate a working depth of sandstone of between 7m in the east, up to around 15m in the west.

Sterilisation considerations

Minerals

6.4.9. From the information contained within the planning documents for Bold Heath Quarry, and the BGS borehole data, an assumed working depth of sandstone of 11m has been taken forward for the calculations.

Sterilisation considerations

6.4.10. The sterilisation considerations identified below are shown on **Figure 6.5** and their impact on the available MSA area summarised in **Table 14A 6.4.**

Constraints

6.4.11. Within the sandstone area of the MSA, the land to the west of Mill Lane is unlikely to be viable for extraction due to the size of the land available and constraints from Mill Lane, properties at Bold Heath and buildings around Twyford Lane. This would include around 3ha in the buffer zone.

6.4.12. Within the rest of the sandstone MSA, Bold Heath Quarry is coming to the end of its planning permission and is subject to progressive restoration. This will sterilise this area from any further extraction once the existing permission expires. Land around the A5080 and the rail line, including Bridge House, White Moss Garden Centre and properties along the A5080 would also sterilise land in this area. This would all be outside of the minerals buffer zone and would sterilise an area of around 44ha.

Severance

6.4.13. No land is considered to be subject to severance due to the pipeline route.

Table 14A 6.4 Bold Heath sterilisation considerations

	Mineral resource	Area (ha)
A	MSA total area	165
B	MSA total constrained land	47
C	MSA total unconstrained	118
D	Minerals buffer zone	20
E	Constrained land within minerals buffer zone	3
F	Unconstrained land within minerals buffer zone	17
G	Severance land	0
H	Sterilised	17
I	Remaining unconstrained and unsterilised land	101

H: Sterilised land includes the unconstrained land within the minerals buffer zone, plus the severance land
I: The total land that would remain available within the MSA that is unconstrained and unsterilised by the Project and therefore theoretically available for minerals extraction.
All figures are rounded values

Conclusion

6.4.14. The minerals buffer zone would cover approximately 20ha of land. However, around 3ha of the minerals buffer zone is already sterilised by existing developments so only around 17ha of land is sterilised by the Project. At an assumed average sandstone thickness of 11m, 1,870,000m^3 of sandstone has been identified as being at risk of sterilisation.

6.4.15. However, this would only be around 14% of the total unconstrained land in the MSA, and there would remain around 101ha of unsterilised / unconstrained land, which could provide around 11,110,000m^3 of sand and gravel.

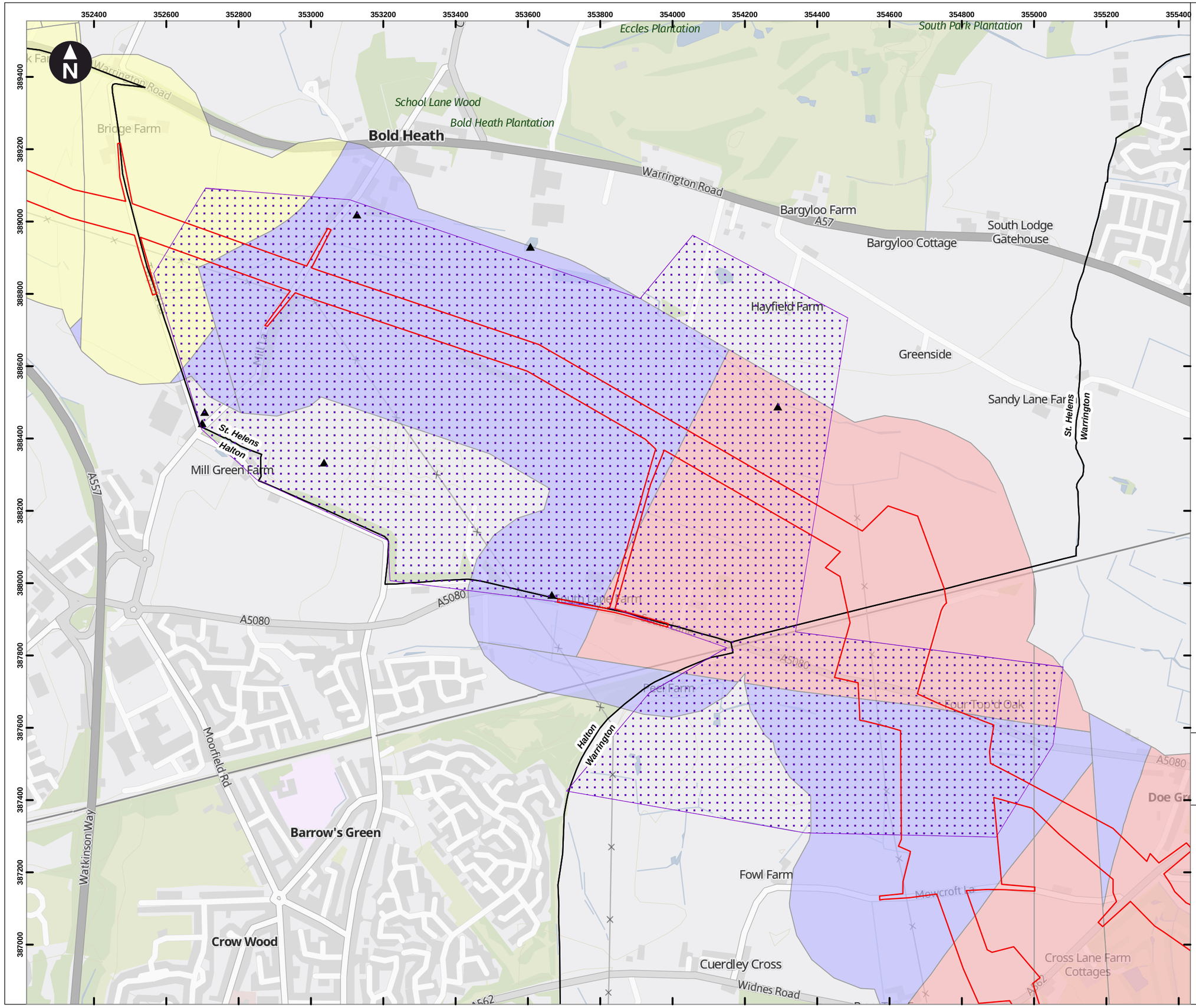

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Figure 6.3
Bold Heath MSA: Bedrock Geology and thickness of Chester Pebble Beds

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352400 352600 352800 353000 353200 353400 353600 353800 354000 354200 354400 354600 354800 355000 355200 355400

389400 389200 389000 388800 388600 388400 388200 388000 387800 387600 387400 387200 387000

N

St. Helens
Halton

Halton
Warrington

St. Helens
Warrington

Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- Existing Quarry

0 200 400 Metres

Scale at A3: 1:10,000

Maxar, Microsoft

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Figure 6.4
Bold Heath sandstone quarry within the MSA and pipeline easement area

wsp

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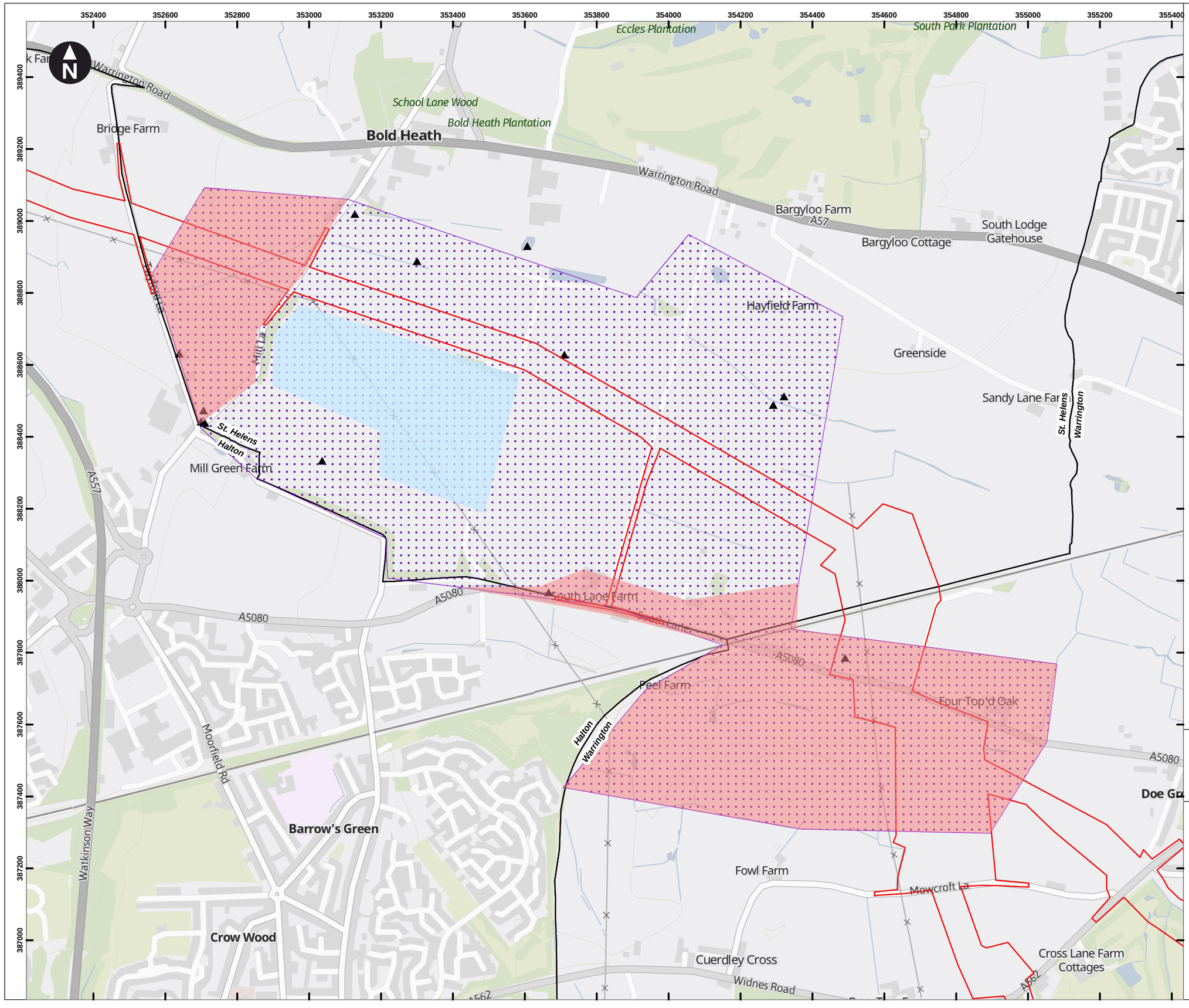

Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- BGS Boreholes
- Constrained
- Existing quarry

0 200 400 Metres

Scale at A3: 1:10,000

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Figure 6.5
Bold Heath: Other Considerations

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6.5. East Corridor: Lower Whitley

Geological Mapping and Resource Description

6.5.1. Similar to the Antrobus MSA, the sand and gravel resources identified in the Lower Whitley MSA are hosted in Devensian Glaciofluvial deposits (Pleistocene).

6.5.2. An extract from BGS 1:50,000 scale geological mapping, displaying superficial deposits and thickness of sand layers intersected in relevant borehole, is presented in **Figure 6.6**.

Sterilisation considerations

6.5.3. The sterilisation considerations identified below are shown on **Figure 6.8** and their impact on the available MSA area summarised in **Table 14A 6.6**.

6.5.4. The Lower Whitley MSA does not include any resources in bedrock geological formations.

Data Analysed

6.5.5. Only one BGS borehole contains information that could be considered relevant for the evaluation of sand and gravel resources in the area. Borehole SJ67NE196 is located in the area geologically similar to the Lower Whitley MSA (covered by Devensian sand and gravel deposits). However, it is 6km south-east of the Antrobus MSA (see **Figure 6.7**).

6.5.6. Information for this borehole is summarised in **Table 14A 6.5**. The borehole log can be found in **Annex 14A 5**.

Table 14A 6.5 Lower Whitley, Borehole near pipeline easement

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ67NE196	2.5	6.0	3.5	Sand and Gravel	https://api.bgs.ac.uk/sobi-scans/v1/borehole/scans/items/763680

Minerals

6.5.7. Although Borehole SJ67NE166 is located 6km from the Lower Whitley MSA, the sand and gravel resources within this borehole have similar characteristics to the sand and gravel resources found in Devensian deposits elsewhere in this report. It could therefore be considered an appropriate proxy borehole for the MSA. The northern half of the Lower Whitley MSA is underlain by Devensian glaciofluvial deposits, similar to those intersected in borehole SJ67NE196. The sand deposits intersected in borehole SJ67NE166 can be classified as Category A, being less than 5 m from the surface, over 2m thick and with an overburden ratio of less than 1:1.

6.5.8. In reality, the Lower Whitley MSA is a relatively small area and therefore the thicknesses of sand and gravel would not be expected to be 3m thick. However, taking a worst case scenario into this assessment, 3m is used as the relevant thickness of the deposit.

Sterilisation considerations

6.5.9. The sterilisation considerations identified below are shown on **Figure 6.8** and their impact on the available MSA area summarised in **Table 14A 6.6**.

Constraints

6.5.10. Within the minerals buffer zone, there are no constraints to extraction.

6.5.11. Within the northern extent of the wider MSA, there are constraints from Higher Whitley, from both the existing properties, water bodies and the fact it is a Conservation Area, plus the properties of Lower Whitley which are just outside of the MSA. There is also record of historic minerals extraction in this northern area (Raddell Lane sand quarry), plus historic landfill related to a similar area. This suggests all sands in this area have previously been extracted. In addition, there are a number of Tree Preservation Orders (TPOs) and a scheduled monument in this northern area. The constraints would be expected to sterilise any sand and gravel extraction from a 40ha area from the proposed pipeline route to the north west.

6.5.12. To the south east of the pipeline route, there will be small constrained areas around the properties of Little Merryfall and properties on Back Lane. The total constrained area across the north and south of the MSA is estimated to be around 45ha.

Severance

6.5.13. Given the constraints identified in the wider MSA, it is not considered the pipeline route would create any severance issues.

Table 14A 6.6 Lower Whitley sterilisation considerations

	Mineral Resource	Area (ha)
A	MSA total area	69
B	MSA total constrained land	45
C	MSA total unconstrained	24
D	Minerals buffer zone	5
E	Constrained land within minerals buffer zone	0
F	Unconstrained land within minerals buffer zone	5

	Mineral Resource	Area (ha)
G	Severance land	0
H	Sterilised	5
I	Remaining unconstrained and unsterilised land	19

H: Sterilised land includes the unconstrained land within the minerals buffer zone, plus the severance land
I: The total land that would remain available within the MSA that is unconstrained and unsterilised by the Project and therefore theoretically available for minerals extraction.
All figures are rounded values

Conclusion

6.5.14. The minerals buffer zone would sterilise approximately 5ha of land. At an assumed average sand and gravel thickness of 3m, around 150,000m^3 of sand and gravel has been identified as being at risk of sterilisation.

6.5.15. However, this would only be around 21% of the total unconstrained land in the MSA, and there would remain around 19ha of unsterilised / unconstrained land, which could provide around 570,000m^3 of sand and gravel.

361000 361200 361400 361600 361800 362000 362200 362400 362600

380000 379800 379600 379400 379200 379000 378800 378600

N

A49

Higher Whitley

Ivy Dene Cottage

Whitley Village School/School House

Rouge Farm

Tarporley Road

Village La

South View

Back La

Crimwellpool Farm

Poachers Lodge

Oldmill Farm

Factor's House

Bowling Green

Lower Whitley

Lester House Farm

Brookhouse La

Little Merryfall

Key

Natural Resources Study Area

Mineral Safeguarding Areas scoped into Assessment

BGS Boreholes

Superficial Geology

Glaciofluvial Deposits, Devensian

Till, Devensian

0 100 200 Metres

Scale at A3: 1:6,000

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Figure 6.6
Higher Whitley MSA: Surperficial Geology map

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Key

Natural Resources Study Area

Mineral Safeguarding Areas scoped into Assessment

Lower Whitley Borehole

Superficial Geology

ALLUVIUM

GLACIOFLUVIAL DEPOSITS, DEVENSIAN

PEAT

TILL, DEVENSIAN

0 300 600 900 Metres

Scale at A3: 1:23,000

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Figure 6.7
Higher Whitley MSA: Regional Superficial Geology map

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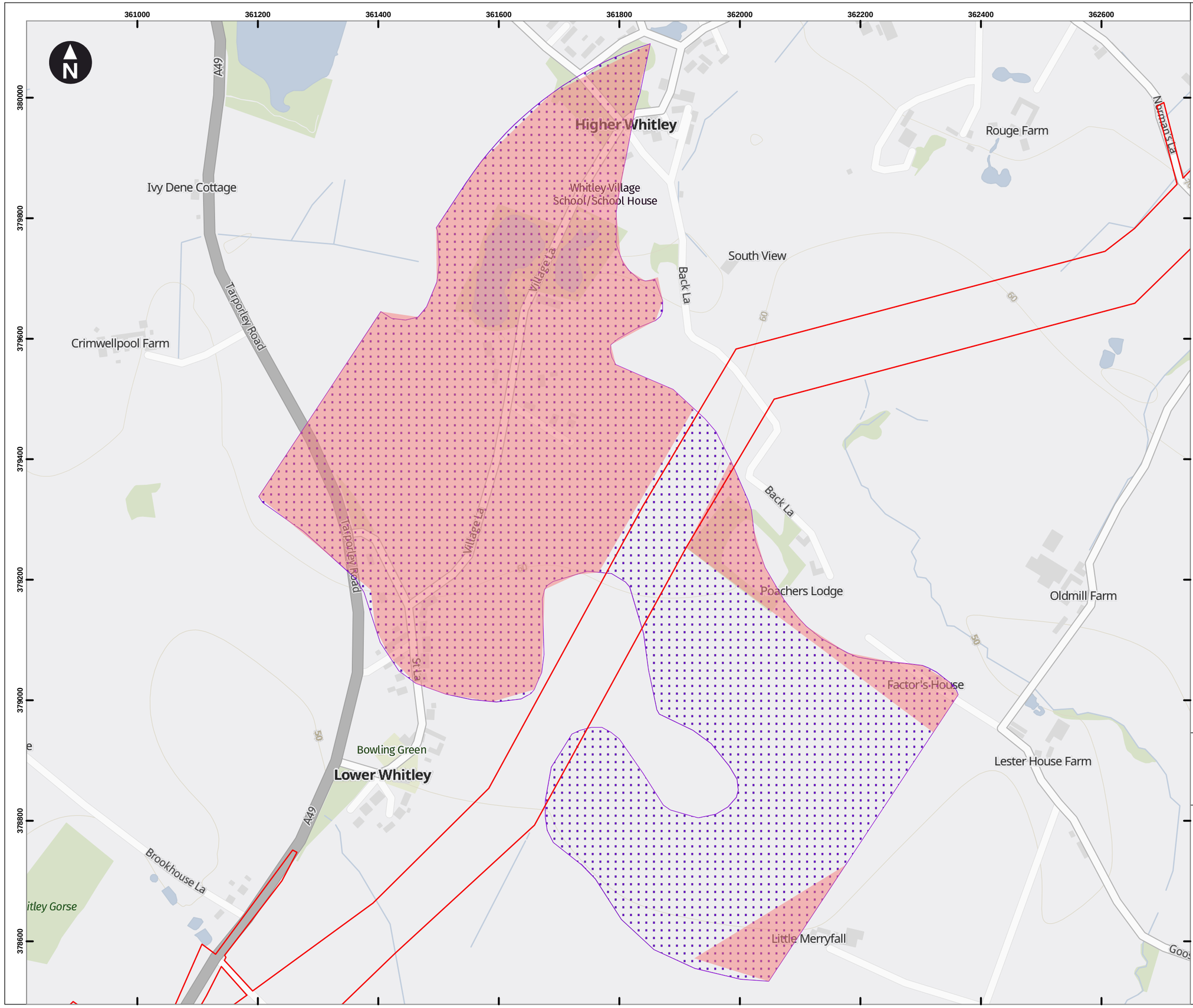

Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- Constrained land

0 100 200 Metres

Scale at A3: 1:6,000

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Figure 6.8
Higher Whitley: Other considerations

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6.6. East Corridor: Antrobus

Geological Mapping and Resource Description

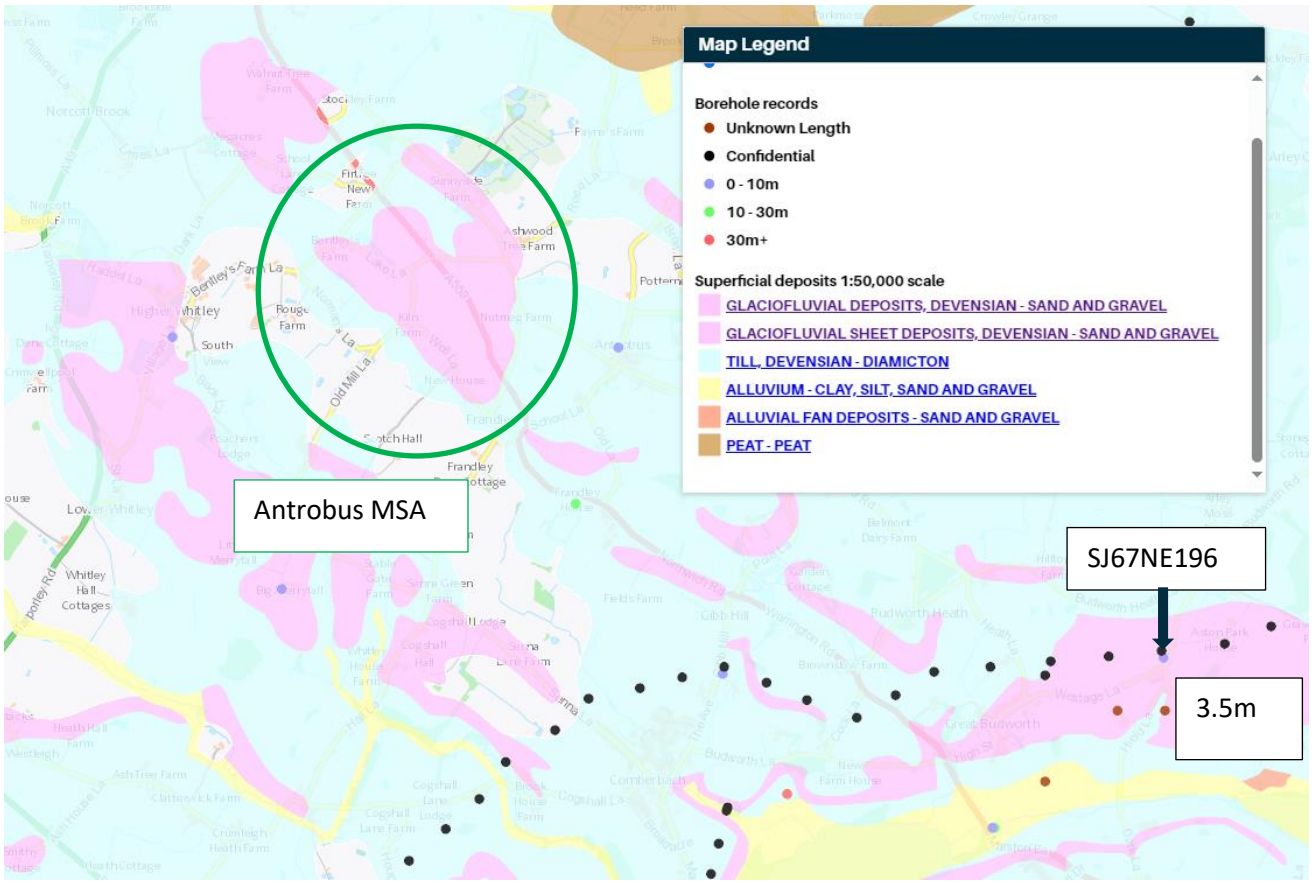
6.6.1. Sand and gravel mineral resources, identified in the Antrobus MSA, are hosted in Devensian Glaciofluvial deposits. An extract from BGS 1:50,000 scale geological mapping, displaying superficial deposits is presented in **Figure 6.9**.

6.6.2. Antrobus MSA does not include any resources in bedrock geological formations.

Data Analysed

6.6.3. Only one BGS borehole contains information that could be considered relevant for the evaluation of sand and gravel resources in the area. Borehole SJ67NE196 is located in the area geologically similar to Antrobus MSA (covered by Devensian sand and gravel deposits). However, it is 4.5km south-east of the Antrobus MSA (see **Figure 6.10**).

Graphic 14A 6.1 Antrobus and wider area: Superficial Geology and Sand/Gravel Thickness



6.6.4. Information for this borehole is summarised in **Table 14A 6.7**. The boreholes log can be found in **Annex 14A 5**.

Table 14A 6.7 Antrobus: borehole near pipeline easement

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ67NE196	2.5	6.0	3.5	Sand and Gravel	https://api.bgs.ac.uk/sobi-scans/v1/borehole/scans/items/763680

Minerals

6.6.5. Although Borehole SJ67NE166 is located over 4.5km from the Antrobus MSA, the sand and gravel resources within this borehole have similar characteristics to the sand and gravel resources found in Devensian deposits elsewhere in this report. It could therefore be considered an appropriate proxy borehole for the MSA. The sand deposits intersected in borehole SJ67NE166 can be classified as Category A, being less than 5 m from the surface, over 2m thick and with an overburden ratio of less than 1:1.

6.6.6. However, given that the Antrobus MSA is a relatively small area the sand and gravel would not normally be expected to be 3m thick.

Sterilisation considerations

6.6.7. The sterilisation considerations identified below are shown on **Figure 6.11**.

Constraints

6.6.8. Within the minerals buffer zone, there will be constraints covering small areas of land around the A559 as well as Old Mill Lane and Knutsford Road. Elsewhere in the MSA, there is a finger of land to the north west which is too small to be viable for extraction, and properties around Lake Lane and Old Mill Lane would constrain extraction within the west of the MSA. A large extent of the MSA is also classed as Grade 2 agricultural land. Whilst this is not a hard barrier to extraction, it could be a factor in minerals operators looking elsewhere in the MSA for lower grade land.

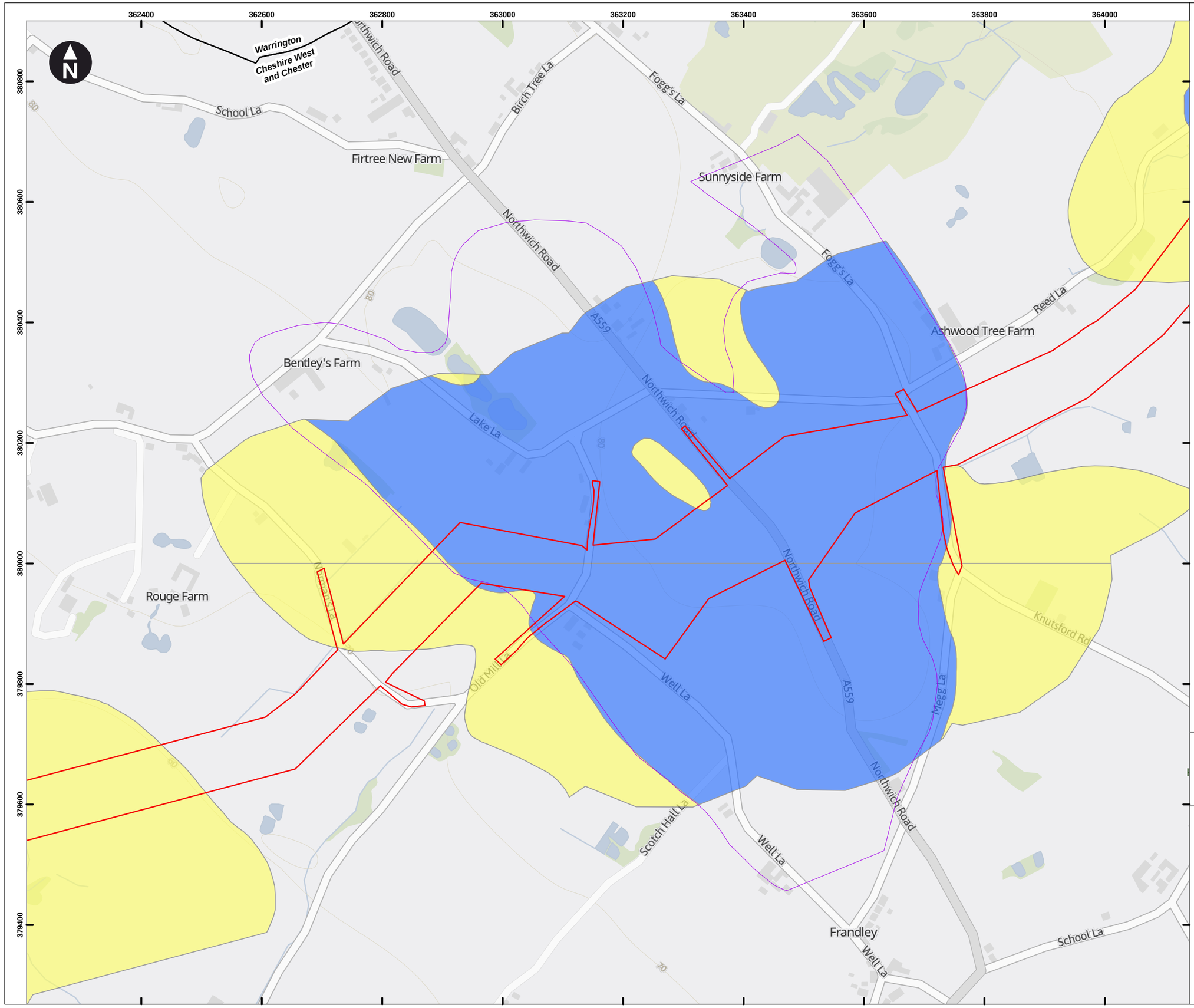
Severance

6.6.9. Given the accumulation of constraints identified within the wider MSA, it is considered the pipeline route would not create any severance issues.

Conclusion

6.6.10. Taking the identified constraints into consideration, an area of land of around 27ha would remain as unconstrained land. This land is however split by the A559, with around 15ha (west) and 12ha (east) of the road. Neither of these plots of land are likely to be attractive for minerals extraction due to their size and the uncertainty of whether the thickness of sand and gravels would actually be 2m or greater. The cost of providing a crossing point over the A559 is likely to prohibit a scheme where both sides of the road could be worked as one site.

6.6.11. It is therefore considered that the Antrobus MSA is not likely to be viable for minerals extraction and therefore no sterilisation would occur.



Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment

Superficial Geology

- Glaciofluvial Deposits, Devensian
- Till, Devensian

0 100 200 Metres

Scale at A3: 1:6,000

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Figure 6.9
Antrobus: MSA area

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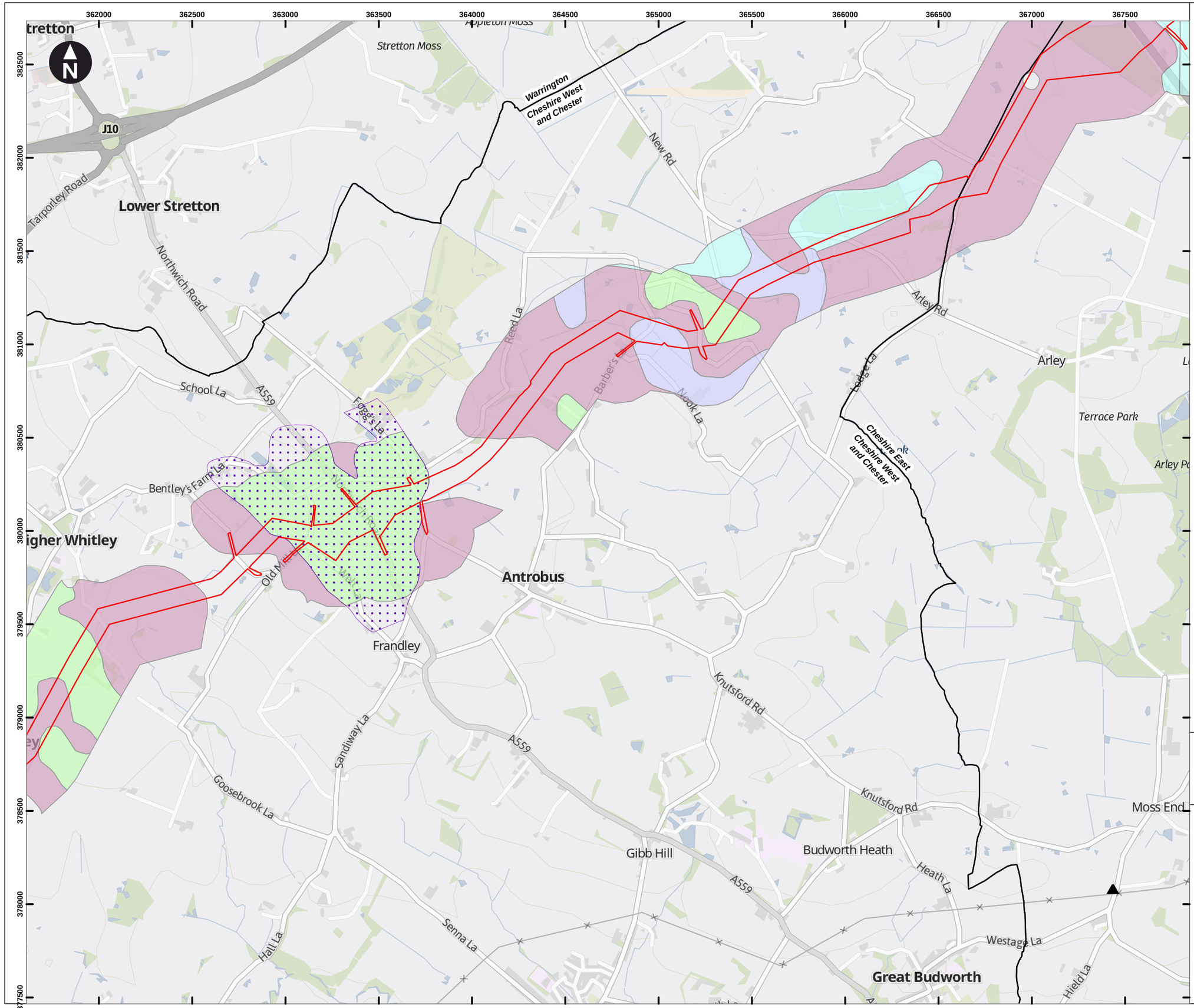

Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- Antrobus Borehole

Superficial Geology

- ALLUVIUM
- GLACIOFLUVIAL DEPOSITS, DEVENSIAN
- PEAT
- TILL, DEVENSIAN

0 350 700 Metres

Scale at A3: 1:19,364

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Figure 6.10
Antrobus and wider area: Superficial Geology and Sand/Gravel Thickness

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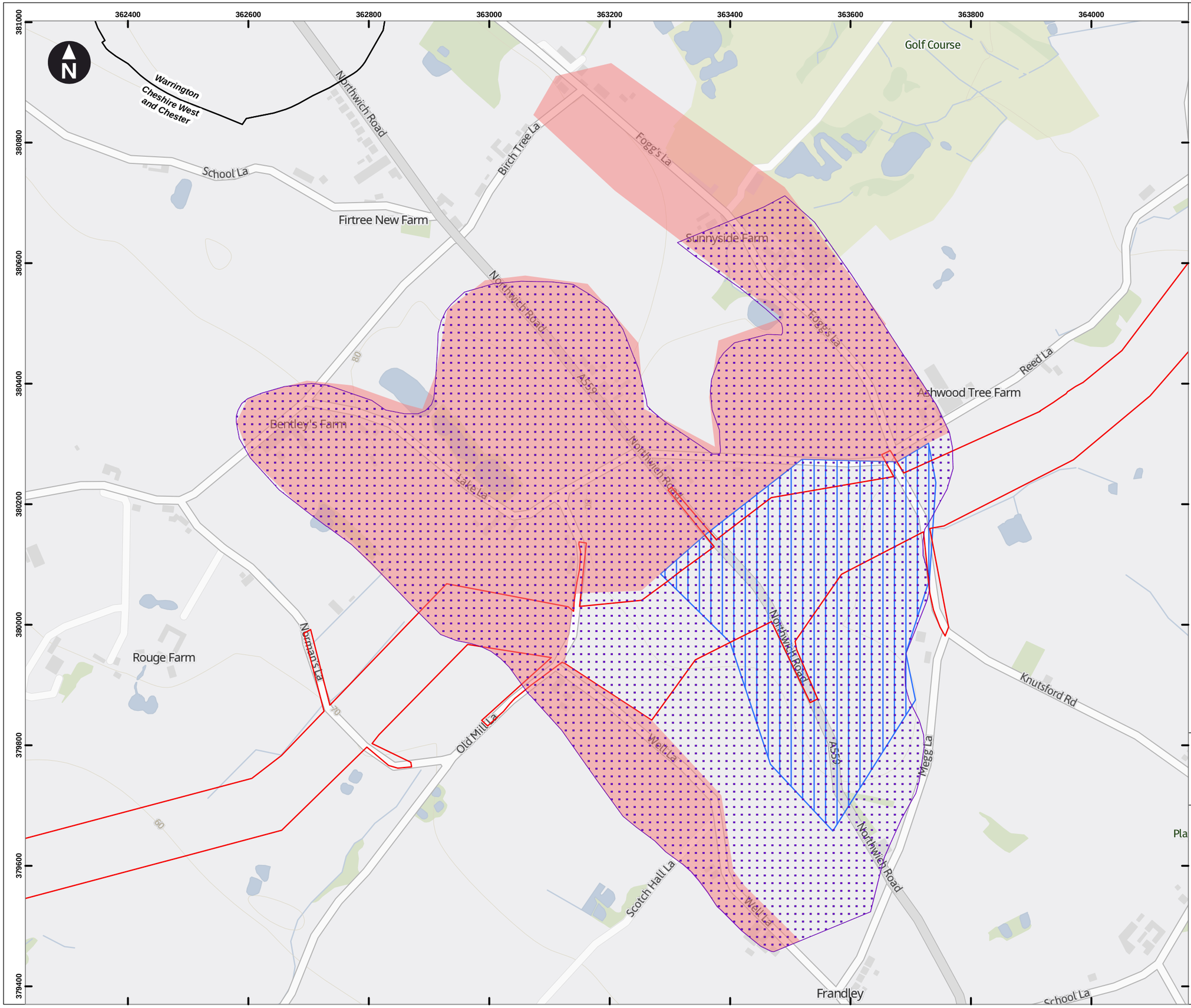

Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- Constrained
- Agric grade 2

0 100 200 Metres

Scale at A3: 1:6,000

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Figure 6.11
Antrobus: Other Considerations

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6.7. East Corridor: Dunham Massey

Geological Mapping and Resource Description

6.7.1. Sand and gravel mineral resources, identified in Dunham Massey MSA, are hosted in all three Quaternary sedimentary units.

6.7.2. The overlap between the Project and the MSA contains elements of all three units. An extract from BGS 1:50,000 scale geological mapping, displaying these superficial deposits and the thickness of sand layers intersected in boreholes, is presented in **Figure 6.12**.

6.7.3. Dunham Massey MSA does not include any resources in bedrock geological formations.

Data Analysed

6.7.4. Twelve BGS (British Geological Survey) boreholes and 2 boreholes from Ian Farmer Associates[17] report contain relevant information for evaluation of sand and gravel resources in the area. Sand intersections are contained in Shirdley Sand Formation, Devensian Fluvioglacial and Alluvial deposits.

6.7.5. Information from the boreholes used for analysis is summarized in **Table 14A 6.8.** Boreholes logs for Dunham Massey MSA can be found in **Annex 14A 4** and are shown in **Figure 6.12**.

Table 14A 6.8 Dunham Massey: boreholes near overlap area

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ78NW57	0.25	7.6	7.4	Sand, medium dense, pale brown	https://scans.bgs.ac.uk/sobi_scans/boreholes/765653/images/12271732.html
SJ78NW64	1.5	4	2.5	Sand, loose brown	https://scans.bgs.ac.uk/sobi_scans/boreholes/765660/images/12271744.html
SJ78NW65	0.8	3.3	2.5	Sand, medium dense	https://scans.bgs.ac.uk/sobi_scans/boreholes/765661/images/12271745.html

[17] Ian Farmer Associates (2023). Hynet, North West Hydrogen Pipeline Factual Report On Ground Investigation.

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ78NW62	3	6.9	3.9	Sand with occasional gravel	https://scans.bgs.ac.uk/sobi_scans/boreholes/765658/images/12271740.html
SJ78NW66	0.3	3.4	3.1	Sand, medium, medium dense	https://scans.bgs.ac.uk/sobi_scans/boreholes/765662/images/12271746.html
SJ78NW67	0.25	3.55	3.3	Sand, medium, medium dense	https://scans.bgs.ac.uk/sobi_scans/boreholes/765663/images/12271747.html
SJ78NW60	0	3.3	3.3	Sand, medium, dense	https://scans.bgs.ac.uk/sobi_scans/boreholes/765656/images/12271737.html
SJ78NW82	-	-	-	Silty. clayey sand and clay (no sand relevant for assessment)	https://scans.bgs.ac.uk/sobi_scans/boreholes/765678/images/12271762.html
SJ78NW63	-	-	-	Mainly silty clay with thin sand layer <1m thick (no sand relevant for assessment)	https://scans.bgs.ac.uk/sobi_scans/boreholes/765659/images/12271742.html
SJ78NW59	-	-	-	Sand with gravel to 1.75m, then clay to EOH (no sand relevant for assessment)	https://scans.bgs.ac.uk/sobi_scans/boreholes/765655/images/12271735.html
SJ78NW58	1.7	7.5	5.8	Sand, medium dense, brown	https://scans.bgs.ac.uk/sobi_scans/boreholes/765654/im

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
					ages/12271733.html
SJ78NW61	-	-	-	Clay (no sand relevant for assessment)	https://scans.bgs.ac.uk/sobi_scans/boreholes/765657/images/12271739.html
BH106	0.4	1	0.6	Shirdley Hill sand formation sand, silty, fine to coarse sand	Ian Farmer Associates report
BH114	0.4	3.0	2.6	Shirdley Hill sand formation sand, silty, fine to coarse sand	Ian Farmer Associates report

Minerals

6.7.6. Most of overlap area in the Dunham Massey MSA is underlain by Devensian fluvioglacial deposits, but sand intersections over 2m thick are mostly confined to small area covered by alluvial deposits or areas covered by the Shirdley Sands Formation.

6.7.7. The information from boreholes within the Alluvial and Shirdley Hill Sand Formation deposits have therefore been used to estimate the mineral resource across the whole overlap area, with an average deposit thickness of 3m identified.

6.7.8. Sand/gravel deposits can be classified as Category A, being less than 5 m from the surface, over 2m thick and with an overburden ratio of less than 1:1.

Sterilisation considerations

6.7.9. The sterilisation considerations identified below are shown on **Figure 6.13** and their impact on the available MSA area summarised in **Table 14A 6.9**.

Constraints

6.7.10. North of the Bridgewater Canal, up to Spring Lane, the minerals buffer zone is close to properties on Spring Lane which would sterilise land to the east. The land is also categorised as Grade 2 Agricultural land which, although it is not a hard barrier to extraction, could be a factor in minerals operators looking elsewhere in the MSA for lower grade land.

6.7.11. From Spring Lane to the north of the MSA the only constraint within the overlap area is the River Bollin, which would require a buffer zone either side of the river.

6.7.12. These constraints would sterilise around 3ha of land within the minerals buffer zone.

6.7.13. Within the wider MSA, sterilisation occurs from the Bridgewater Canal, Agden Lane and Warrington Lane and properties on these roads. There are also constraints to extraction in the northeast, with the properties along Barns Lane and the adjacent Dunham Woodhouses, the northwest with cargreen lane and the Trans Pennine Trail and to the west by Wet Gate Lane/Heatly Farm. These areas would measure around 53ha.

Severance

6.7.14. The pipeline corridor would split off a small area of land to the north of Spring Lane measuring around 1ha.

Table 14A 6.9 Dunham Massey sterilisation considerations

	Mineral Resource	Area (ha)
A	MSA total area	146
B	MSA total constrained land	53
C	MSA total unconstrained	93
D	Minerals buffer zone	15
E	Constrained land within minerals buffer zone	3.15
F	Unconstrained land within minerals buffer zone	11.85
G	Severance land	1
H	Sterilised	12.85
I	Remaining unconstrained and unsterilised land	80.15

H: Sterilised land includes the unconstrained land within the minerals buffer zone, plus the severance land
I: The total land that would remain available within the MSA that is unconstrained and unsterilised by the Project and therefore theoretically available for minerals extraction.
All figures are rounded values

Conclusion

6.7.15. The minerals buffer zone would sterilise around 12ha of land and 1 ha of land would be sterilised by the Project. At an assumed average sand and gravel thickness of 3m, around 385,000m^3 of sand and gravel has been identified as being at risk of sterilisation.

6.7.16. However, this would only be around 14% of the total unconstrained land in the MSA, and there would remain around 80ha of unsterilised / unconstrained land, which would provide around 2,404,500m^3 of sand and gravel.

Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- BGS Boreholes

Superficial Geology

- Alluvium
- Glaciofluvial Sheet Deposits, Devensian
- River Terrace Deposits, 1
- Shirdley Hill Sand Formation
- Till, Devensian

0 100 200 300 400 Metres

Scale at A3: 1:9,000

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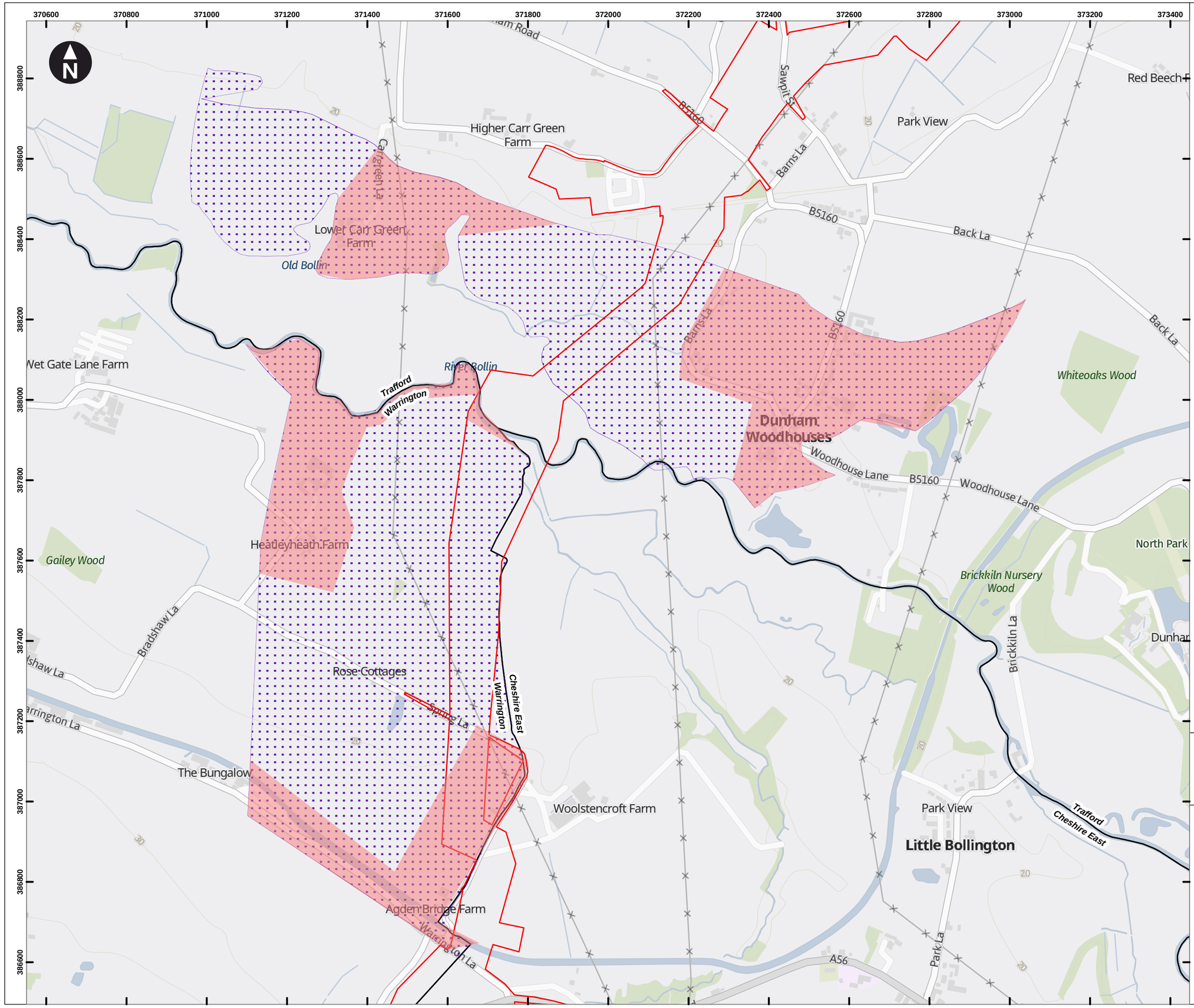
Appendix 14B: Minerals Resource Assessment

Figure 6.12
Dunham Massey: Superficial Geology and Sand/Gravel thickness

wsp

October 2024



Key

- Natural Resources Study Area
- Mineral safeguarding areas
- Constrained

0 100 200 300 400 Metres

Scale at A3: 1:9,000

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Figure 6.13
Dunham Massey: Other Considerations

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6.8. East Corridor: Partington

Geological Mapping and Resource Description

6.8.1. The sand and gravel mineral resources, identified in the Partington MSA, are hosted across all three Quaternary sedimentary units.

6.8.2. The overlap between the Project and the MSA contains elements of all three units. An extract from BGS 1:50,000 scale geological mapping, displaying these superficial deposits and the thickness of sand layers intersected in boreholes, is presented in **Annex 14A 5**.

6.8.3. Partington MSA does not include any resources in bedrock geological formations.

Data Analysed

6.8.4. No available boreholes exist within the overlap area identified within the MSA, so boreholes with sand intersections closest to the pipeline were analysed. Eleven BGS boreholes contain information that can be considered relevant for the evaluation of sand and gravel resources in the area. A cluster of ten boreholes is located on the south western side of the MSA in the area underlain by the Shirdley Sand Formation. Borehole SJ79SW1 is located west of the northern edge of the MSA, also in the area covered by the Shirdley Sand Formation. Thicknesses of over 2m of potentially viable sand resources are intersected in the cluster of ten boreholes and in borehole SJ79SW1, however the thickness of the sand intersections varies greatly and a significant proportion of sand is described as fine-grained, clayey and with peat admixtures.

6.8.5. No boreholes exist in the area mapped as Devensian Glaciofluvial deposits, however around half of the overlap area falls within these deposits. Glaciofluvial deposits typically vary greatly in thickness and composition.

6.8.6. Information from the boreholes used for analysis is summarised in **Table 14A 6.10**. Boreholes logs for Partington MSA can be found in **Annex 14A 1** and their locations are shown on **Figure 6.14**.

Table 14A 6.10 Partington: boreholes near overlap area

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ79SW1	0.3	3.35	3	Sand and pebbles	https://api.bgs.ac.uk/sobi-scans/v1/borehole/scans/items/802667
SJ78NW27	0.15	5.94	5.8	Brown sand with some silt	scans.bgs.ac.uk/sobi_scans/boreholes/765623

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ28NW28	1.00	8.9	7.9	Fine- to medium grade sand	https://scans.bgs.ac.uk/sobi_scans/boreholes/765624/images/12271675.html
SJ78NW29	0.2	5.3	5.1	Fine- to medium sand	scans.bgs.ac.uk/sobi_scans/boreholes/765625
SJ78NW30	0.2	10.2	10	Fine sand with some peat and silt	https://scans.bgs.ac.uk/sobi_scans/boreholes/765626/images/12271676.html
SJ78NW31	0.4	1.98	1.5	Fine-medium grade sand with little silt	scans.bgs.ac.uk/sobi_scans/boreholes/765627
SJ78NW33			-	Clay and clayey sand (no sand relevant for assessment)	scans.bgs.ac.uk/sobi_scans/boreholes/765629
SJ78NW34			-	Silty sandy clay (no sand relevant for assessment)	scans.bgs.ac.uk/sobi_scans/boreholes/765630
SJ78NW35	1.7	6.7	5	Fine to medium grained sand	https://scans.bgs.ac.uk/sobi_scans/boreholes/765626
SJ78NW36			-	Clay and clayey sand (no sand relevant for assessment)	scans.bgs.ac.uk/sobi_scans/boreholes/765632
SJ78NW37			-	Very silty sand (no sand relevant for assessment)	scans.bgs.ac.uk/sobi_scans/boreholes/765633OI

Minerals

6.8.7. The most prevalent sand and gravel deposits, mapped within the Partington MSA, belong to the Devensian Glaciofluvial deposits, but no boreholes with publicly available information exist in the areas covered by these geological units.

6.8.8. Sand deposits, intersected by boreholes, are mostly located in the areas covered by the Shirdley Hill Sand Formation. Alluvial deposits of Sinderland Brook, located in the north part of the MSA, are too small to be considered for viable resource extraction.

6.8.9. The information from boreholes within the Shirdley Hill Sand Formation have therefore been used to estimate the mineral resource across the whole overlap area, with an average deposit thickness of 3m identified.

6.8.10. The sand and gravel deposits can be classified as Category A deposits, being less than 5m from the surface, over 2m thick and with an overburden ratio of less than 1:1. All figures are rounded values.

Sterilisation considerations

6.8.11. The sterilisation considerations identified below are shown on **Figure 6.15** and their impact on the available MSA area summarised in **Table 14A 6.11.**

Constraints

6.8.12. It is not considered that there are any existing constraints within the minerals buffer zone that would prohibit extraction.

6.8.13. Within the wider MSA there are constraints to extraction including Henshaw Lane and orchard plantations in the south and Red House Lane, Sinderland Lane and associated properties and church in the east. These constraints could sterilise around 45.5ha of land.

6.8.14. Most of the land within the MSA is Grade 2 agricultural land. This is not a hard constraint to extraction but it may encourage minerals operators to look elsewhere for lower grade agricultural land.

Severance

6.8.15. The pipeline corridor would split off an area of the MSA on its western side. This land contains Goresy Lane and Moss Lane which already sterilise some of the land, but there is around 4 ha that could be subject to severance.

6.8.16. The details of the sterilisation considerations are provided in **Table 14A 6.11.**

Table 14A 6.11 Partington sterilisation considerations

	Mineral Resource	Area (ha)
A	MSA total area	145
B	MSA total constrained land	46
C	MSA total unconstrained	99
D	Minerals buffer zone	17

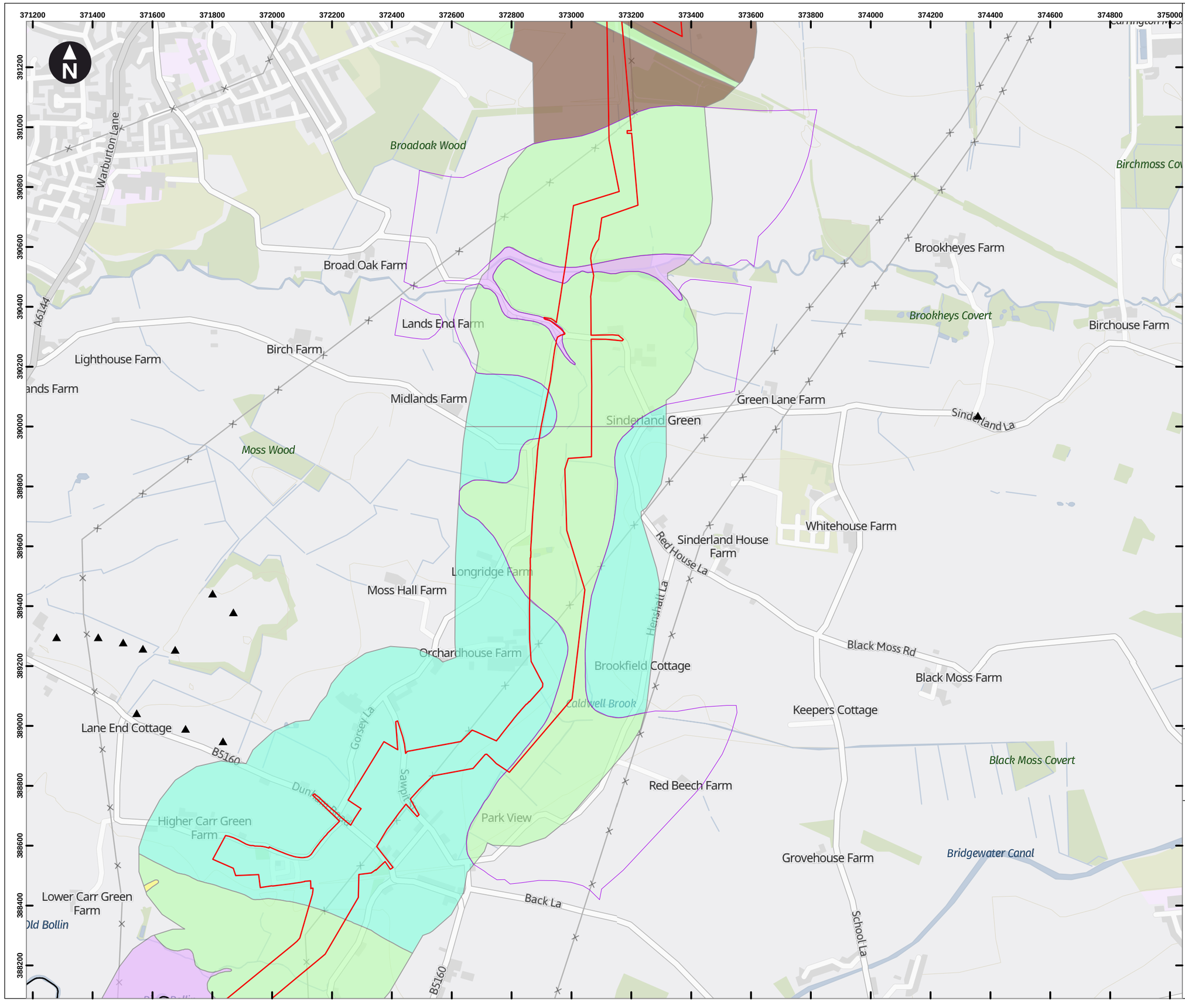
	Mineral Resource	Area (ha)
E	Constrained land within minerals buffer zone	0
F	Unconstrained land within minerals buffer zone	17
G	Severance land	4
H	Sterilised	21
I	Remaining unconstrained and unsterilised land	78

H: Sterilised land includes the unconstrained land within the minerals buffer zone, plus the severance land
I: The total land that would remain available within the MSA that is unconstrained and unsterilised by the Project and therefore theoretically available for minerals extraction.
All figures are rounded values

Conclusion

6.8.17. The overlap area would sterilise approximately 17ha of land and could also sever around 4ha of land from potential extraction. Around 21ha of land could therefore be sterilised. At an assumed average sand and gravel thickness of 3m, 630,000m^3 of sand and gravel has been identified as being at risk of sterilisation.

6.8.18. However, this would only be around 21% of the total unconstrained land in the MSA, and there would remain around 78ha of unsterilised / unconstrained land within the Partington MSA which could provide around 2,340,000m^3 of sand and gravel.



Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- BGS Boreholes

Superficial Geology

- Alluvium
- Glaciofluvial Sheet Deposits, Devensian
- Peat
- Shirdley Hill Sand Formation
- Till, Devensian

0 100 200 300 400 500 Metres

Scale at A3: 1:12,000

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Figure 6.14
Partington: Superficial Geology

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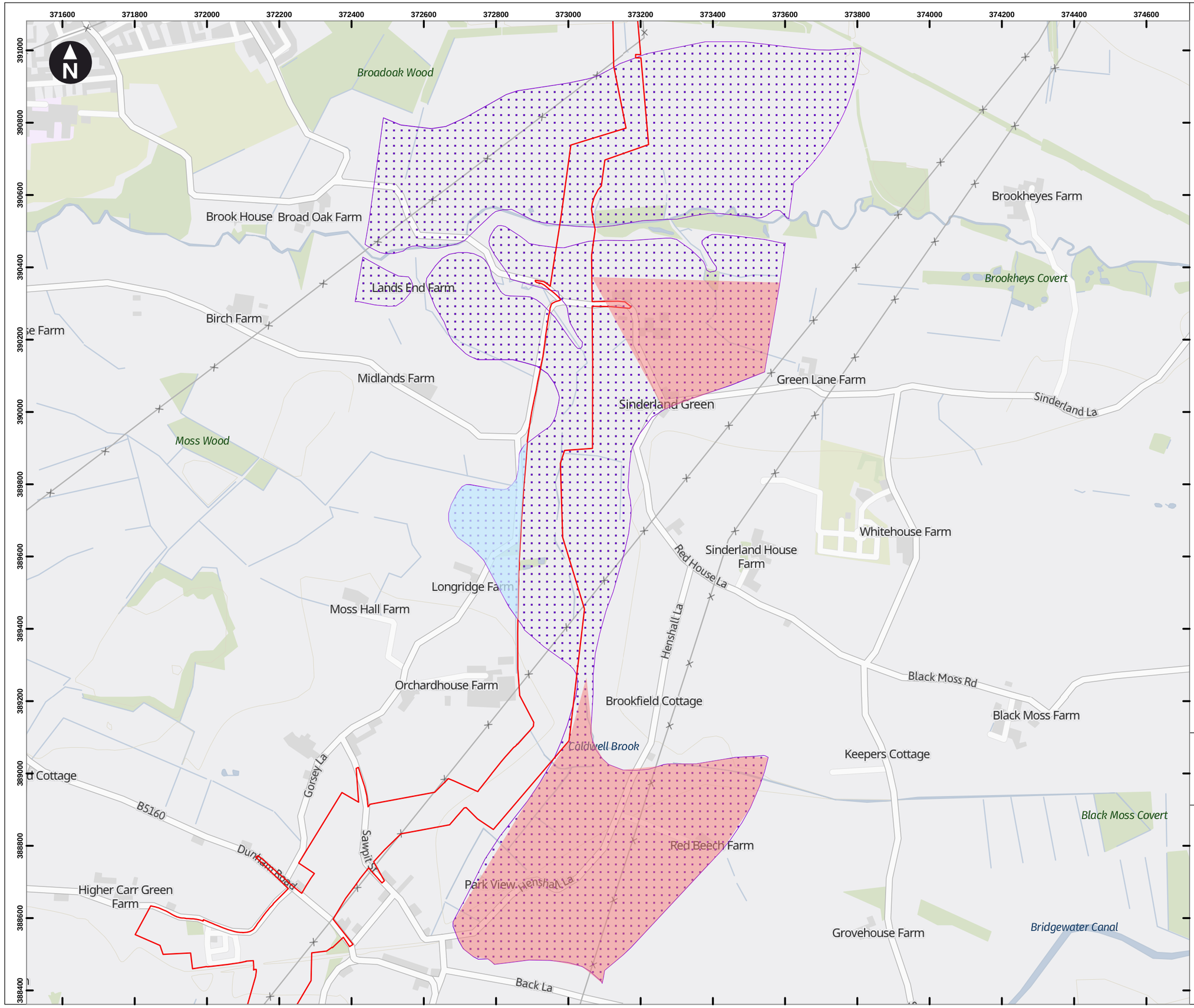

Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- Constrained Land
- Severance Land

0 100 200 300 400 Metres

Scale at A3: 1:10,000

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Figure 6.15
Partington: Other considerations

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6.9. Central Hub / South Corridor: Acton Bridge

Geological Mapping and Resource Description

6.9.1. Sand and gravel mineral resources, identified in the Acton Bridge MSA, are hosted in two Quaternary sedimentary units, the Devensian Glaciofluvial and Alluvium deposits.

6.9.2. The overlap between the Project and the MSA contains elements of both units. An extract from BGS 1:50,000 scale geological mapping, displaying these superficial deposits and the thickness of sand layers intersected in boreholes, is presented in **Annex 14A 6.**

6.9.3. Acton Bridge MSA does not include any resources in bedrock geological formations.

Data Analysed

6.9.4. The only boreholes which exist within the MSA are located within the southern part of the MSA (from where Warrington Road crosses the River Weaver and to the south of here). A cluster of nine boreholes is located close to the Warrington Road crossing, with a further three being located close to the Sandy Lane and Warrington Road junction. A single borehole is also located to the west of that junction. Other than within that single borehole, thicknesses of over 2m of potentially viable sand resources are intersected in all of the boreholes identified. Due to the location of these boreholes around the river, it appears that the thicker sand and gravels are located close to the River.

6.9.5. Information from the boreholes used for analysis is summarized in. Boreholes logs for the Acton Bridge MSA can be found in **Annex 14A 6.** and their location is shown on **Figure 6.16**.

Table 14A 6.12 Acton Bridge: boreholes near pipeline easement

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ57NE16	1.7	4.9	3.2	Fine to coarse sand and gravel (Alluvial)	scans.bgs.ac.uk/sobi_scans/boreholes/166825
SJ57NE17	3.3	3.8	0.5	Coarse sand	scans.bgs.ac.uk/sobi_scans/boreholes/166826
SJ57NE18			-	Mosty clay (no sand relevant for assessment)	scans.bgs.ac.uk/sobi_scans/boreholes/166827

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ57NE2			-	Sandy clay (Alluvial) (no sand relevant for assessment)	scans.bgs.ac.uk/sobi_scans/boreholes/166803
SJ67NW10			-	Silty fine sand (Alluvial) deposits (no sand relevant for assessment)	scans.bgs.ac.uk/sobi_scans/boreholes/704013
SJ67NW11	2.1	10.4	8.3	Silty coarse sand (Fluvioglacial)	scans.bgs.ac.uk/sobi_scans/boreholes/704014
SJ67NW12	0	7.8	7.8	Sand (Alluvial) and gravel (Fluvioglacial)	scans.bgs.ac.uk/sobi_scans/boreholes/704015
SJ67NW13	1.0	11.9	10.9	Granite and quartzite gravel and sand (Fluvioglacial)	scans.bgs.ac.uk/sobi_scans/boreholes/704016
SJ67NW14			-	Made ground to the depth of 5m (no sand relevant for assessment)	scans.bgs.ac.uk/sobi_scans/boreholes/704017
SJ67NW114			-	Sand and clay, drift (no sand relevant for assessment)	scans.bgs.ac.uk/sobi_scans/boreholes/704117
SJ67NW129			-	Clay (no sand relevant for assessment)	scans.bgs.ac.uk/sobi_scans/boreholes/15627288
SJ67NW130	2.3	8.1	5.8	Sand and gravel	scans.bgs.ac.uk/sobi_scans/boreholes/15627289

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ67NW131			-	Silty, clayey sand (no sand relevant for assessment)	scans.bgs.ac.uk/sobi_scans/boreholes/15627290

Minerals

6.9.6. The most prevalent sand and gravel deposits, mapped within the Acton Bridge MSA, belong to Devensian Glaciofluvial deposits. These deposits cover large extents of the northern parts of the overlap areas; however, no boreholes exist in these areas.

6.9.7. Considering the boreholes in the southern part of the site, there are some clear distinctions between 'clean' deposits and those with greater silt/peat content. However, these different deposits are found within a limited area close to Acton Swing Bridge. Considering the clean deposits are identified both within this area plus elsewhere in overlap area, an average depth of sand of around 3m has been identified from these records and this has been assumed across all of the overlap area within this MSA.

6.9.8. The sand and gravel deposits can be classified as Category A deposits, being less than 5m from the surface, over 2m thick and with an overburden ratio of less than 1:1. The initial calculation of the volume of sand and gravel contained within the overlap area (shown in **Table 14A 6.13**).

6.9.9. Within the overlap area, two options exist to allow a consideration of the pipeline routeing around properties to the west of Barrington (Options SP5 and SP6). Both options run through similar extents of the MSA.

Sterilisation considerations

6.9.10. The sterilisation considerations identified below are shown on **Figure 6.17** and their impact on the available MSA area summarised in **Table 14A 6.13.**

Constraints

6.9.11. Within the minerals buffer zone, there are small areas of land in the west which areas sterilised by the Trent and Mersey Canal, in the north by the A533 and in the south by Acton Lane. A larger extent of land around the Trent and Mersey Canal and the Weaver Navigation, to the west of Barrington, would also be sterilised by the canals and properties in this area. Some of these constraints are within Option SP5, with SP6 being free from constraints. This constrained land within the minerals buffer zone measures around 19ha.

6.9.12. Within the wider MSA there are constraints to extraction around Dutton Locks from the river and canal, around the Trent and Mersey Canal and A533 in the north, around the Weaver Navigation and the villages of Acton Bridge and Barrington. There would also be small areas of the MSA throughout the area which are too small to be of interest for minerals extraction. These areas total around 210ha.

Severance

6.9.13. The pipeline corridor would split off an area north of the River Weaver, in the vicinity of Dutton Sluice. This area would measure around 6ha.

Table 14A 6.13 Acton Bridge sterilisation considerations

	Mineral Resource	Area (including SP5) (ha)	Area (including SP6) (ha)
A	MSA total area	400	400
B	MSA total constrained land	229	229
C	MSA total unconstrained	171	171
D	Minerals buffer zone	60	60.5
E	Constrained land within minerals buffer zone	17	11.5
F	Unconstrained land within minerals buffer zone	43	49
G	Severance land	6	6
H	Sterilised	49	55
I	Remaining unconstrained and unsterilised land	122	116

H: Sterilised land includes the unconstrained land within the minerals buffer zone, plus the severance land
I: The total land that would remain available within the MSA that is unconstrained and unsterilised by the Project and therefore theoretically available for minerals extraction.
All figures are rounded values

Conclusion

6.9.14. The minerals buffer zone area would sterilise approximately 60ha of land and could also severe around 6ha of land from potential extraction (these figures are the same whether option SP5 or option SP6 is chosen). However, is SP5 is chosen around 17ha of this land is already considered to be sterilised by existing constraints. If SP6 is chosen around 11.5ha of this land is already considered to be sterilised. Taking SP6 as the worst case scenario, around 55ha of land could therefore be sterilised. At an assumed average sand and gravel thickness of 3m, 1,650,000m3 of sand and gravel has been identified as being at risk of sterilisation.

6.9.15. However, this would only be around 32% of the total unconstrained land in the MSA, and there would remain around 116ha of unsterilised / unconstrained land within the Acton Bridge MSA, which could provide around 3,480,000m^3 of sand and gravel.

Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- ▲ BGS Boreholes

Superficial Geology

- Alluvial Fan Deposits
- Alluvium
- Glaciofluvial Deposits, Devensian
- Glaciofluvial Sheet Deposits, Devensian
- Till, Devensian

0 100 200 300 400 500 600 Metres

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Figure 6.16
Acton Bridge: Superficial Geology and Sand/Gravel Thickness in boreholes

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Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- Constrained

0 100 200 300 400 500 600 Metres

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Figure 6.17
Acton Bridge: Other Considerations

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6.10. South Corridor: Sandiway

Geological Mapping and Resource Description

6.10.1. Sand and gravel mineral resources, identified in the Sandiway MSA, are hosted in two Quaternary sedimentary units:

- Devensian Glaciofluvial deposits (Pleistocene), deposited by meltwater streams. Includes mostly coarse-grained sediments (i.e. sand and gravel) with some finer-grained layers (i.e. clay and silt), locally with lenses of silt, clay or organic material.
- Alluvium (Quaternary) - clay, silt, sand and gravel, unconsolidated detrital material deposited by Sinderland Brook.

6.10.2. The overlap between the Project and the MSA contains elements of all both units. An extract from BGS 1:50,000 scale geological mapping, displaying these superficial deposits and the thickness of sand layers intersected in boreholes, is presented in **Annex 14A 7.**

6.10.3. Sandiway MSA does not include any resources in bedrock geological formations.

Data Analysed

6.10.4. No available boreholes exist within the overlap area identified within the MSA, however there is an ongoing minerals extraction site contained within the MSA (Forest Hill Quarry, operated by Tarmac). There are boreholes located within the wider operation, some associated with Tarmac's past and potential future extraction plans. A small number of boreholes also exist to the south west of the MSA, on the western side of Sandiway Golf Club although these are less than 2m deep (in total) and do not provide sufficient information to draw any conclusions. Analysis of local planning policy and discussions with Cemex have also provided information on deposits in this MSA. Of the boreholes around the Forest Hill Quarry site, thicknesses of between 7.7m and 9.7m have been recorded.

6.10.5. No boreholes exist in the area mapped as Alluvial deposits; however these deposits only account for small areas of the MSA.

6.10.6. Information from the boreholes used for analysis is summarized in **Table 14A 6.14**. Boreholes logs for the Sandiway MSA can be found in **Annex 14A 7** and their locations are shown in **Figure 6.18**.

Table 14A 6.14 Sandiway, Boreholes near pipeline easement

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ67SW108*	0.5	10	9.5	Silty fine to medium sand	scans.bgs.ac.uk/sobi_scans/boreholes/717106
SJ67SW117*	0.3	8	7.7	Silty fine to medium sand	scans.bgs.ac.uk/sobi_scans/boreholes/717115
SJ67SW111*	0.3	10	9.7	Silty fine to medium sand	https://scans.bgs.ac.uk/sobi_scans/boreholes/717109/images/12252085.html
*a number of other borehole records are available from the same location as SJ67SW108/17/11. They have not been noted here as they all show similar data. They are available via the BGS (**GeoIndex - British Geological Survey (bgs.ac.uk)**)					
SJ67SW134	0.6	10	9.4	Fine to medium sand, slightly silty	https://scans.bgs.ac.uk/sobi_scans/boreholes/717132/images/12252134.html
SJ67SW135	0.9	10	9.1	Fine to medium sand, slightly silty	https://scans.bgs.ac.uk/sobi_scans/boreholes/717133/images/12252137.html

Minerals

6.10.7. North of the A556, the current overlap area runs through land between the A556 and the rail line where minerals extraction has now ceased. North of the rail line, the overlap area partly runs through land which has permission for minerals extraction. Cemex has confirmed that extraction operations will commence here now that extraction has been completed in the existing quarry south of the rail line. Discussions are ongoing with Cemex regarding their proposed programme of future development, with these discussions intending to confirm a route for the pipeline which will run through land where all viable minerals have been extracted by the time the pipeline is constructed, thereby avoiding any sterilisation. The pipeline route therefore also contains land to the east of this permission area in case extraction is still ongoing at the of construction.

6.10.8. Until an agreement with Cemex is reached however, a worst case calculation has been taken forward where sterilisation would occur on land north of the rail line.

6.10.9. Boreholes close to Forest Hill Quarry have been used to estimate the mineral resource across the whole overlap area, with an average deposit thickness of 8m identified.

6.10.10. The sand and gravel deposits can be classified as Category A deposits, being less than 5m from the surface, over 2m thick and with an overburden ratio of less than 1:1. The initial calculation of the volume of sand and gravel contained within the overlap area (shown in **Table 14A 6.15**).

Sterilisation considerations

6.10.11. The sterilisation considerations identified below are shown on **Figure 6.19** and their impact on the available MSA area summarised in **Table 14A 6.15**.

Constraints

6.10.12. Within the minerals buffer zone, there is one small area of constrained land (from Whitegate Lane), but this is too small to take into consideration in the calculations. North of the A556, there is around 12ha of land within the overlap area which will have been subject to extraction by the time the pipeline is developed and therefore no sterilisation can occur there.

6.10.13. More widely within the MSA there are direct constraints from the rail line itself, a TPO and Local Wildlife Site at Littledale Gorse and properties around Weaverham Road. These cover land of around 48ha. There is also around 24ha of land which has been subject to previous extraction.

6.10.14. South of the A556, there are wide areas of the MSA sterilised by the Sandiway and Vale Royal Golf Clubs, as well as by some properties in this area. These areas cover around 101ha.

Severance

6.10.15. It is not considered that the pipeline route would create any issues with severance in this area.

Table 14A 6.15 Sandiway sterilisation considerations

	Mineral Resource	Area (ha)
A	MSA total area	299
B	MSA total constrained land	188
C	MSA total unconstrained	111
D	Minerals buffer zone	15
E	Constrained land within minerals buffer zone	9
F	Unconstrained land within minerals buffer zone	6
G	Severance land	0
H	Sterilised	6

	Mineral Resource	Area (ha)
I	Remaining unconstrained and unsterilised land	105

H: Sterilised land includes the unconstrained land within the minerals buffer zone, plus the severance land
I: The total land that would remain available within the MSA that is unconstrained and unsterilised by the Project and therefore theoretically available for minerals extraction.
All figures are rounded values

Conclusion

6.10.16. The buffer zone area would sterilise approximately 6ha of land, at an assumed average sand and gravel thickness of 8m, 480,000m^3 of sand and gravel has been identified as being at risk of sterilisation.

6.10.17. However, there would remain around 105ha of unsterilised / unconstrained land within the Sandiway MSA which could provide around 8,400,000m^3 of sand and gravel.

Key

Natural Resources Study Area

Mineral Safeguarding Areas scoped into Assessment

BGS Boreholes

Superficial Geology

Glaciofluvial Deposits, Devensian

Peat

Till, Devensian

0 100 200 300 400 500 Metres

Scale at A3: 1:12,000

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Figure 6.18
Sandiway: Superficial Geology and Sand/ Gravel Thickness in boreholes

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Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- Constrained
- Previously extracted in overlap
- Previously extracted outside overlap

0 100 200 300 400 500 Metres

Scale at A3: 1:12,000

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Figure 6.19
Sandiway: Other Considerations

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6.11. South Corridor: Moulton

Geological Mapping and Resource Description

6.11.1. Sand and gravel mineral resources, identified in Moulton MSA, are hosted in two Quaternary sedimentary units:

- Devensian Glaciofluvial deposits (Pleistocene), deposited by meltwater streams. Includes mostly coarse-grained sediments (i.e. sand and gravel) with some finer-grained layers (i.e. clay and silt). Sand and gravel, locally with lenses of silt, clay or organic material.
- Alluvium (Quaternary) - clay, silt, sand and gravel, unconsolidated detrital material deposited by River Weaver and tributaries.

6.11.2. The overlap between the Project and the MSA contains elements of both units. An extract from BGS 1:50,000 scale geological mapping, displaying superficial deposits and thickness of sand layers intersected in boreholes, is presented in **Annex 14A 8**.

6.11.3. Moulton MSA does not include any resources in bedrock geological formations.

Moulton Data Analysed

6.11.4. Four BGS boreholes with information relevant for the evaluation of sand and gravel resources are located close to the overlap area in the Moulton MSA. Three within the east-central area and one on the southern-most end of the MSA.

6.11.5. Boreholes located within alluvial formations along the River Weaver within Moulton MSA did not intersect sand/gravel deposits that meet requirements to be considered viable mineral resources. All of this area is therefore ruled out of the MSA.

6.11.6. Information from the boreholes used for analysis is summarised in **Table 14A 6.16**. Boreholes logs can be found in **Annex 14A 8** and their location is shown in **Figure 6.20**.

Table 14A 6.16 Moulton, boreholes near pipeline easement

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ66NE130	0.4	2.1	1.7	Medium dense medium grained sand	scans.bgs.ac.uk/sobi_scans/boreholes/732592
SJ66NE131	0.15	1.9	1.75	Slightly clayey fine- to medium-grained sand	scans.bgs.ac.uk/sobi_scans/boreholes/732593

Borehole ID	Depth, from (m)	Depth, to (m)	Thickness (m)	Resource	Link to borehole log
SJ66NE132	0.35	0.75	0.4	Clayey fine- to medium-grained sand	scans.bgs.ac.uk/sobi_scans/boreholes/732594
SJ66NE8	0	6.1	6.1	Wet sand and gravel	scans.bgs.ac.uk/sobi_scans/boreholes/732469
SJ67SW46			-	Clay to 5.4m (no sand relevant for assessment)	https://api.bgs.ac.uk/sobi-scans/v1/borehole/scans/items/717044
SJ67SW45			-	Clay to 6.2m (no sand relevant for assessment)	https://api.bgs.ac.uk/sobi-scans/v1/borehole/scans/items/717043

Minerals

6.11.7. The sand deposits, intersected in borehole SJ66NE8, are within area underlain by Devensian Glaciofluvial deposits and can be classified as Category A deposits, being less than 5m from the surface, over 2m thick and with an overburden ratio of less than 1:1.

6.11.8. The three boreholes located on the central-eastern edge of the MSA are also within Devensian Glaciofluvial deposits, have intersected sand layers that are below 2m thickness. Therefore, they do not meet the criteria to be considered as Mineral Resource.

6.11.9. Thickness of sand/gravel intersections typically varies significantly in glacial deposits, but for Moulton MSA can be estimated to be 3m on average.

Sterilisation considerations

6.11.10. The sterilisation considerations identified below are shown on **Figure 6.21** and their impact on the available MSA area summarised in **Table 14A 6.17**.

Constraints

6.11.11. Within the overlap area, where the pipeline route crosses the West Coast Mainline and Weaver Navigation, this area of around 4ha is already sterilised by the River, the rail line and surrounding ancient woodland and Local Wildlife Sites.

6.11.12. To the east of the West Coast Mainline, the town of Moulton sterilises a large area within the wider MSA in this area. Between Moulton and the West Coast Main Line, this land (around 10ha in the overlap) is then considered to be constrained by the proximity of Moulton and the rail line, along with a scheduled monument near Niddries Lane.

6.11.13. To the north west of Moulton, a large proportion of this area is Grade 2 agricultural land, which although is not a hard barrier to extraction may encourage minerals developers to look elsewhere, especially as the land is relatively close large residential areas and access would be difficult. However, none of this land to the north west of Moulton has access available. There is no direct access onto the A556 to the north, and access via Eaton Lane would run through residential streets, plus is a National Cycle Route and a public bridleway. It is therefore considered that all of this area is also sterilised (14ha within overlap area).

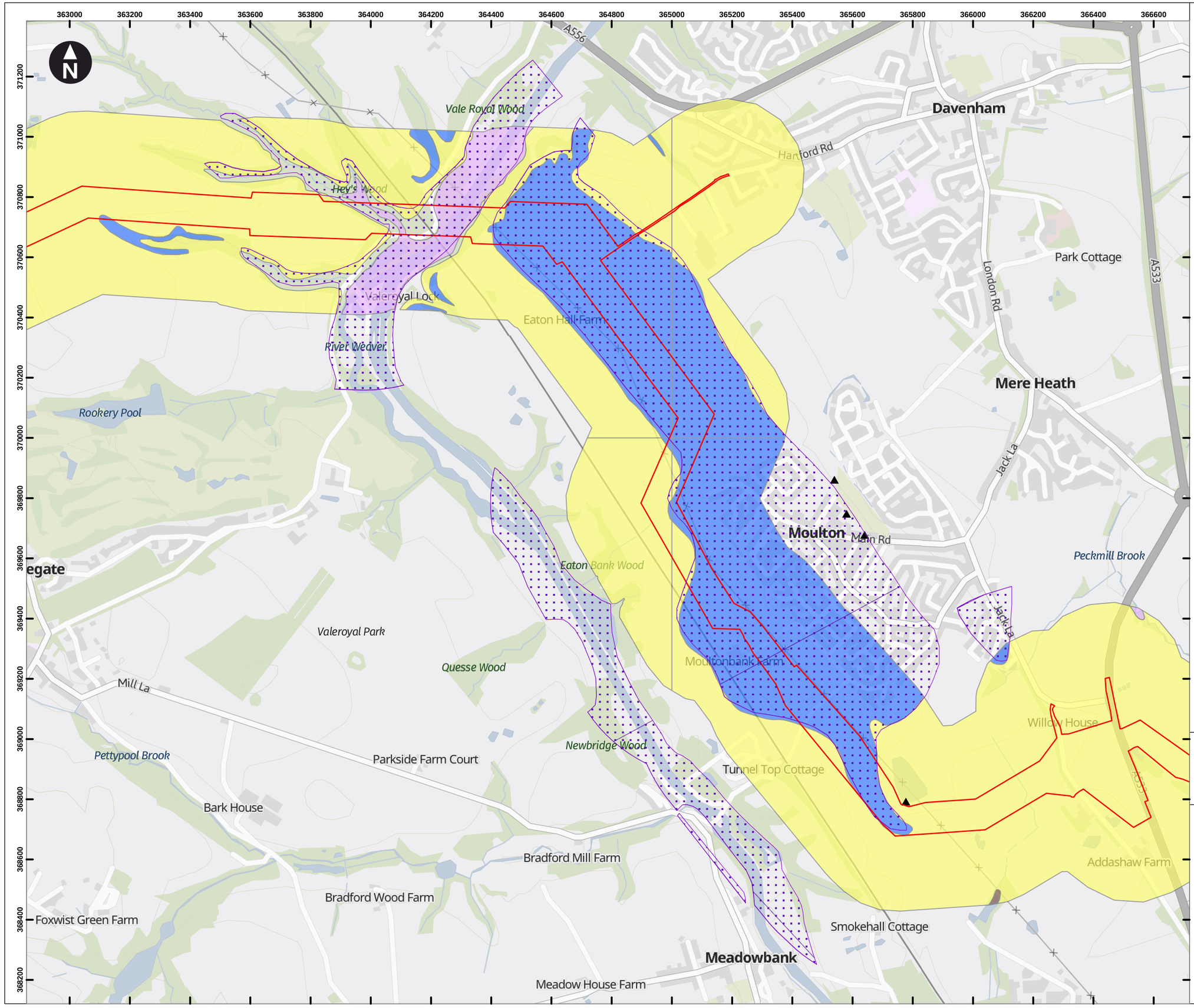
Table 14A 6.17 Moulton sterilisation considerations

	Mineral Resource	Area (ha)
A	MSA total area	159
B	MSA total constrained land	159
C	MSA total unconstrained	0
D	Minerals buffer zone	26
E	Constrained land within minerals buffer zone	26
F	Unconstrained land within minerals buffer zone	0
G	Severance land	0
H	Sterilised	26
I	Remaining unconstrained and unsterilised land	0

H: Sterilised land includes the unconstrained land within the minerals buffer zone, plus the severance land
I: The total land that would remain available within the MSA that is unconstrained and unsterilised by the Project and therefore theoretically available for minerals extraction.
All figures are rounded values

Conclusion

6.11.14. Taking the areas of constraints that have been identified into consideration, it is not considered that there are any viable minerals resources in the Moulton MSA area. The Proposed Development would therefore not create any minerals sterilisation.



Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- ▲ BGS Boreholes

Superficial Geology

- Alluvium
- Glaciofluvial Deposits, Devensian
- Peat
- Till, Devensian

Scale at A3: 1:12,000

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Contains data from OS Zoomstack

Client

Cadent

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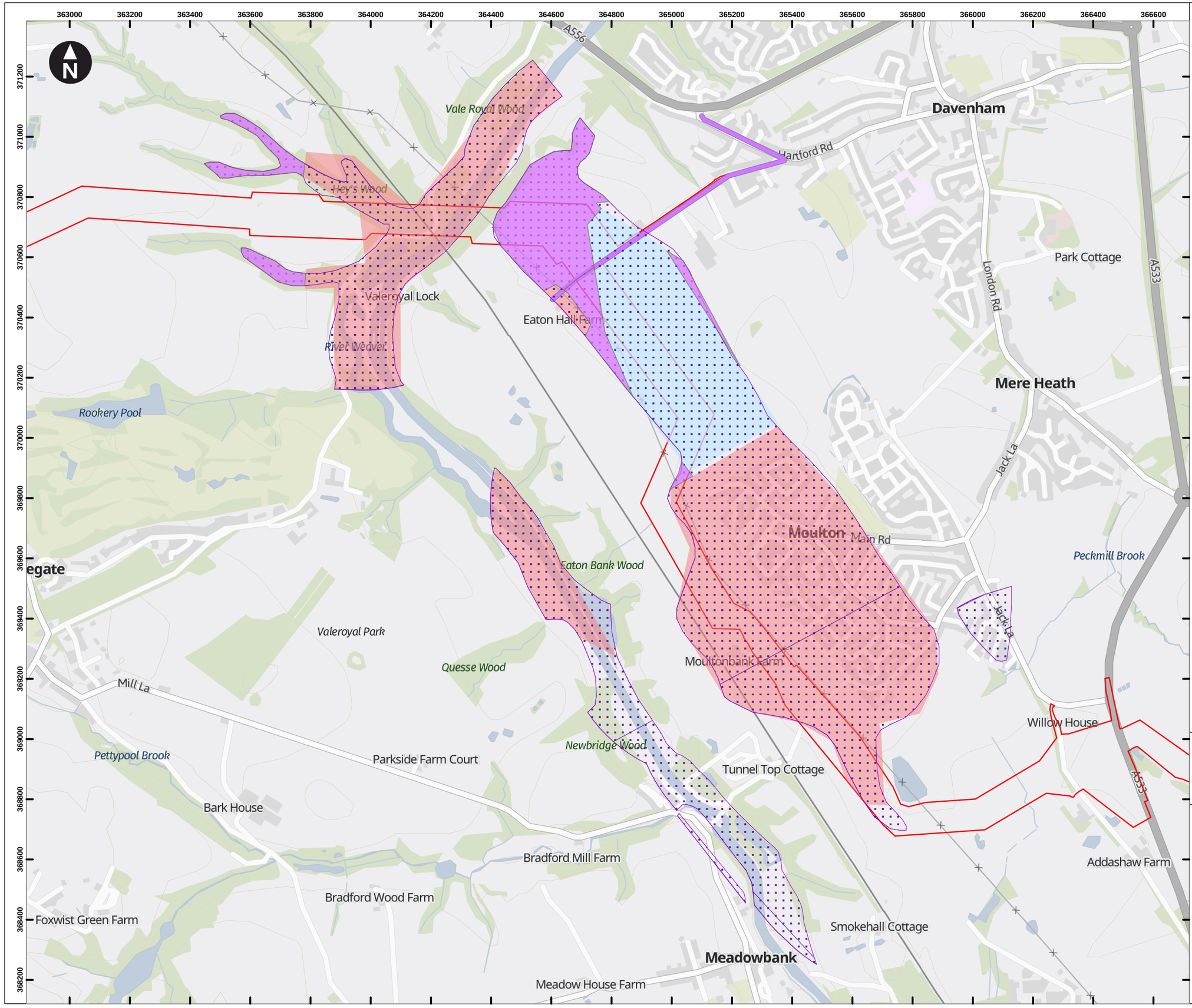
Draft Environmental Statement
Chapter 14: Land Use
Appendix 14B: Minerals Resource Assessment

Figure 6.20
Moulton MSA: Superficial Geology and Sand/Gravel thickness

October 2024



Key

- Natural Resources Study Area
- Mineral Safeguarding Areas scoped into Assessment
- Constrained
- Grade 2 ALC
- Eaton Lane access

0 100 200 300 400 500 Metres

Scale at A3: 1:12,000

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Appendix 14B: Minerals Resource Assessment

Figure 6.21
Moulton: Other Considerations

October 2024

6.12. South Corridor: Bostock Green

Geological Mapping and Resource Description

6.12.1. The MSA in the Bostock Green area relates to salt and BGS geological mapping shows that the bedrock geology in the area consists of the Northwich Halite Member.

Data Analysed

6.12.2. There are multiple BGS boreholes located across the MSA in this area, although most are confidential and not available for reference. Of the records that are available, in formation varies between records of over 90m deep not encountering any salt deposits (to the south of Moulton), to recording salt at depths of between ~75m and ~270m below ground level (further east in the MSA area).

6.12.3. Information from the boreholes used for analysis is summarized in **Table 14A 6.18**. Boreholes logs can be found in **Annex 14A 9**.

Table 14A 6.18 Bostock Green, boreholes near pipeline easement

Borehole ID	Depth of salt deposit (M) below ground level	Link to borehole log
SJ66NE8	Not encountered at 92m deep	BGS ID: 732469 : BGS Reference: SJ66NE8
SJ66NE125	~270	BGS ID: 732590 : BGS Reference: SJ66NE128
SJ66NE126	~210	BGS ID: 732590 : BGS Reference: SJ66NE128
SJ66NE127	-100	BGS ID: 732590 : BGS Reference: SJ66NE128
SJ66NE128	~90	BGS ID: 732590 : BGS Reference: SJ66NE128
SJ67SE191	~75	BGS ID: 828594 : BGS Reference: SJ67SE191

6.12.4. The Halite Risk Assessment Report[18] references a report by Peter Wharmby for Cheshire County Council in 1987[19] which describes there being no record of rock salt having been found at depths shallower than 40mbgl in Cheshire.

6.12.5. The Halite Risk Assessment includes commentary on potential risks to the Project which could arise from the Project construction activities interacting with the salt deposit and creating subsidence activities. If subsidence was to occur as a result of the pipeline, this could also sterilise the salt deposits by making the ground too instable to work. This commentary states that the most prevalent risk of subsidence would be if the construction works were to alter hydrogeological conditions. This is particularly crucial in the Bostock Green area where the salt deposits exist as 'wet rockhead', i.e. they lie directly below the superficial geology with no other bedrock between them. Changes to the hydrogeological conditions could therefore introduce water to the salt deposits or amend the existing hydrogeological regime, which could result in salt dissolution and subsequent subsidence.

6.12.6. The Halite Risk Assessment therefore advises that groundworks should not fully penetrate through the superficial deposits and that soakaways or infiltration methods should be avoided in the management of surface water. If historic brine wells of shafts were discovered during the construction works, these should also be plugged / grouted to avoid water ingress.

6.12.7. Detailed ground investigation works would be needed prior to construction to ascertain the exact ground conditions and guide the design of the construction works, but it is considered that the mitigation recommended in the Halite Risk Assessment can be realised and would be sufficient to avoid subsidence occurring and therefore avoid any sterilisation of salt deposits in the MSA.

6.12.8. In addition, Compass Minerals who operate the existing Meadowbank Mine in the salt MSA here have been contacted and have raised no objection to the Proposed Development.

6.12.9. From the information that is available, and the Project being able to adhere to the recommended mitigation to avoid subsidence issues arising, it is considered that there would be no sterilisation of the salt deposits within the MSA in this area.

[18] Halite Risk Assessment 'Draft for Comment', Wardell Armstrong, August 2024. Provided at Appendix 12C of the Hynet North West Hydrogen Pipeline Project Draft Environmental Statement.

[19] A Report on the Rocksalt Mines and Brine Shafts in the Cheshire Saltfield for the County planner, Cheshire County Council, prepared by peter Wharmby, July 1987.

7. Minerals Resource Requirement

7.1. Sand and Gravel

7.1.1. For sand and gravel used for aggregates purposes, the requirement for minerals across local and regional areas is managed by the North West Region Aggregates Working Party. This group is made up of representatives from the relevant minerals planning authorities plus the minerals industry and sets apportionment targets for each MPA area in the region. It also tracks aggregate sales, permitted reserves and landbanks across these areas. In addition, each minerals planning authority is required to undertake a Local Aggregates Assessment, which provides similar details for their specific area. For sand and gravel, it is recommended that a seven year landbank is maintained.

7.1.2. Landbanks are calculated from the amount of permitted reserves available in an area, divided by the annual rate of sales from that area. So, a one million tonne permitted reserve figure and a 100,000 tonne annual sales figures would give a 10 year landbank. However, the annual sales figures can vary year or year for range of reasons and may therefore be different from the apportionment target figure set at a regional level. Some minerals planning authorities therefore provide information on different scenarios for their landbank.

7.1.3. In general terms, a landbank figure below seven years suggest that additional reserves need to be identified within that area, whilst a figure above seven years indicates that sufficient reserves are available. However, all landbank figures are subject to some degree of interpretation depending on the data used in their calculation.

North West Region

7.1.4. The most recent Annual Monitoring Report from the North West Region Aggregate Working Party (2022)[20] stated that the existing regional land bank contained a 7.68 year supply of sand and gravel.

Cheshire East

7.1.5. The Cheshire East LAA (Local Aggregate Assessment) 2023[21] shows four different scenarios. It reports that Cheshire East has a 2.67 year landbank based on the apportionment figures set for them at the regional level, a 5.09 year landbank when a 10 year average sales figures is used or a 10.98 year landbank for a 3 year average sales figures. The LAA however suggest a 10 year average, plus a 2% uplift, is the most appropriate figure to use which would provide a 4.11 year landbank. *Cheshire East Local Aggregates Assessment 2023, September 2023, v2*.

[20] North West Aggregates Working Party (2023). North West Aggregates Working Party Annual Monitoring Report 2022 (2021 Data).
[21] Cheshire East Council (2023). Local Plan Strategy Local Aggregate Assessment 2023

Cheshire West and Chester Council

7.1.6. The Cheshire West and Chester LAA 2023[22] provides three different scenarios and shows a landbank of 4.5 years (using apportionment figures), 5.64 years (using a ten year sales average) and 5.47 (using a three year sales average).

St Helens

7.1.7. St Helens does not have any sand and gravel resources so there is no landbank relevant. Bold Heath Quarry can produce sand from crushed sandstone; however, it is considered to be low quality sand and more suitable for use as fill material rather than aggregate.

Halton, Trafford and Warrington

7.1.8. These three authorities manage their aggregate supply responsibilities as part of a joint working group across all of the Merseyside, Greater Manchester (of which Trafford is part), Halton and Warrington authorities. The most recent LAA which is available for this joint group of authorities dates from 2019[23] and shows a four year landbank (based on apportionment figures) and a 4.4 year landbank (based on 10 year sales average).

7.1.9. However, it should be noted that this landbank is based around only one quarry holding permitted reserves and contributing to sales across the entire joint area. This is Astley Moss Quarry, which is not located within the Halton, Trafford and Warrington areas.

Other supply

7.1.10. Alongside land-won resources, sand and gravel aggregate can also be sourced from marine dredged resources or from secondary and recycled aggregates. These secondary or recycled resources are typically construction and demolition waste materials.

Summary

7.1.11. Although the landbank figures available do vary, the overall picture is one where permitted reserves are lower than they need to be to provide a secure, seven year landbank, especially over the six host authorities within the Project area.

[22] Cheshire West and Chester Council (2023). Cheshire West and Chester Council Local Plan Local Aggregate Assessment 2023.

[23] Greater Manchester, Merseyside and Halton, and Warrington Minerals Planning Authorities. Joint Annual Local Aggregate Assessment 2019.

7.2. Salt and Sandstone

7.2.1. There is no process in place for apportioning salt requirements over any area of the UK or for tracking supply against a landbank calculation (or similar). The consideration of salt requirements requires information to be submitted by the salt industry, and considered by the minerals planning authority, during planning policy preparation and planning application determinations.

7.2.2. For sandstone, Bold Heath Quarry does provide crushed sandstone for construction purposes and therefore this could be considered under the regional and local apportionment process for crushed rock as an aggregate (similar to sand and gravel aggregate). However, St Helens does not produce a LAA and it is assumed this is because the material from Bold Heath Quarry is considered low quality and mainly suitable for fill purposes, and that it primarily supplies its operator (D Morgan plc) with material which is used in the construction projects they operate.

7.3. Opportunity for Prior Extraction or Incidental Extraction

7.3.1. Where minerals sterilisation occurs from non-minerals developments, sterilisation can be avoided through prior extraction, or reduced through the use of incidentally extracted minerals within the project.

7.3.2. Prior extraction takes advantage of land being cleared and stripped of soils in preparation for development, to access all of the minerals lying beneath. These minerals can then be extracted prior to the built elements of the non-minerals development commencing and either used within the Project or sold into the minerals market for use elsewhere. This would mean that minerals would not be required to be procured from other minerals extraction sites, saving that mineral to be used elsewhere. The local plan policies across the six host authorities support prior extraction as a means of avoiding sterilisation.

7.3.3. Incidental extraction differs from prior extraction in that only those minerals which would be extracted as part of the non-minerals development works (in this case from pipeline trenches or from excavations for trenchless crossings) are then sold on or used for minerals purposes.

7.3.4. Both of these mitigation measures are however better suited to typical built development projects (e.g. residential, commercial etc) where you would normally see development occur on a single, discreet site. For a pipeline project (or other underground, linear development) prior extraction is not usually a practical option, as the extraction of all of the mineral available below the construction works would substantially change the landform levels through which the pipeline will run. This would then either leave a void in the landscape which would be seen as a trench like feature along the pipeline route or would necessitate the import of substantial amounts of fill materials to bring the ground back up to its original levels. Notwithstanding the above point, for a single site development it is also more viable to undertake ground investigation works in advance of planning which would allow an understanding of what mineral may be present, and whether that mineral would be suitable to use elsewhere (either within or outside of the project). For a

linear development of around 100km, this amount of ground investigation work is not practical and therefore it cannot be confirmed whether the mineral in question would even be a feasible option for prior extraction at this early stage of the project.

7.3.5. It is therefore proposed that the Project will seek to make use of any minerals which are incidentally extracted during construction, within the Project's construction works. In some areas, where soils or other overburden lies above the mineral resource, this may be to a depth greater than the pipeline trench so no minerals would be extracted during the construction works.

7.3.6. For example, where the Project overlaps with sand and gravel resources, these resources will be excavated. The Project will require sands for the lining of the open cut trenches created for laying the pipeline and, subject to the quality of the sand minerals encountered the sand resources encountered can be considered this use. If the quality of minerals extracted are not suitable for re-use in a specified manner, they will be re-used as general fill materials to help reinstate trenches and voids.

7.3.7. At this stage of the Project, it is not possible to know what volume of mineral resources will be needed for different activities, nor exactly how much mineral will be available along the Project route that is suitable for these activities. Mineral resources that may therefore be extracted along the Project route (either from within the MSAs identified or from incidental extraction if suitable minerals are encountered elsewhere) will be managed by a Soils Management Plan (SMP) to ensure the sustainable use of all excavated materials (soils, sub-soils, minerals etc). It is expected that a SMP would form part of a Construction Environmental Management Plan (or similar) which would be delivered via a requirement of the DCO.

8. Conclusions

8.1.1. The Project is proposed to overlap with MSAs in seven areas where sterilisation of the minerals being safeguarded would occur. These areas include Bold Heath, where the relevant mineral is sandstone and six areas containing sand.

8.1.2. The overlap with the Bold Heath MSA occurs close to a quarry where extraction of sandstone to be used for construction fill purposes take place. Around 1.9 million m3 of sandstone would be sterilised in this area (approximately 2.8 million tonnes (mt)), however the pipeline would not affect the operation of the existing quarry and the MSA also includes another 11.1 million m3 of sandstone should the quarry operators be interested in extending the quarry in the future. The sandstone from the existing quarry is used primarily as fill material for construction operations. If sandstone is encountered by the pipeline trench in this area, the majority would be utilised as backfill for the reinstatement of the trench once the pipeline is laid and any residual amounts are likely to be able to use as fill elsewhere on the project. So, the sandstone would be utilised for its usual purpose as a fill material. As fill material is not a particularly rare resource (it can be sourced from any inert material including construction and demolition wastes) and the existing quarry can continue its permitted activities, it is not considered that the sterilisation of 1.9mt of sandstone here would be a concern.

8.1.3. The six overlap areas between the Project and the sand MSAs would sterilise around 4.5 million m^3 of sand (around 6.75mt), until the pipeline ceases operation. 4.5mt of sand is a substantial amount of sand, given that the North West Region as a whole has around 18.7mt of permitted sand reserves and annual sales of around 2mt. The six host authorities have 5.4-6.5mt of permitted reserves and annual sales of around 0.8mt. However, these figures should be viewed in the context of:

- Due to the geological extent of the sand resources considered under the different MSA areas, it would not be possible for the Project to avoid the MSAs;
- No permitted mineral extracted sites would be affected;
- Where policy allocations supporting potential minerals extraction exist (in the Sandiway MSA), the pipeline route has been located in discussion with the Cemex (minerals operator of Forest Hill Quarry in this MSA) to avoid the land in which they have plans for future extraction;
- The sterilisation would cease at the point in the future where the pipeline is no longer operationally viable;
- Where sand is encountered during extractions, it will be returned to the ground as back fill meaning the mineral will be available again once sterilisation ceases;
- Any residual minerals which become available will be considered either for re-use or for the minerals right owner to use, meaning they will be re-used for beneficial purposes; and

- Within the MSA study areas identified, there is around 19mt of sand which is potentially still available for extraction (equivalent to the entire permitted reserves within the North West Region), and the MSAs identified cover land which is substantially larger than the study area utilised.

8.1.4. Further borehole analysis is to be undertaken in the Autumn of 2024. The results of this exercise will be reported in the Final ES accompanying the DCO submission.

9. References

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- Halton: Halton Delivery and Allocations Local Plan, 2022 https://www3.halton.gov.uk/Documents/planning/planning%20policy/newdalp/DALP%20Adopted.pdf
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- Ministry of Housing, Communities and Local Government: National Planning Policy Framework, 2023 National Planning Policy Framework (publishing.service.gov.uk)
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- Wardell Armstrong, North West Hydrogen Pipeline Project Halite Risk Assessment, August 2024. (Appendix 12C of the Project Draft ES).
- Warrington Borough Council (2023) Warrington Local Plan 2021/22-2038/39, 2023. Adopted Local Plan 2021/22 – 2038/39 | warrington.gov.uk

HyNet North West Hydrogen Pipeline

Delivering clean growth

Annex 14A 1
Aston Borehole Logs

British Geological Survey

BGS ID: 166819 : BGS Reference: SJ57NE10
EPSG: 27700 : 355037,378953

SJ 57 NE 10

FUGRO - McCLELLAND LIMITED

BOREHOLE LOG

Borehole B194/01R

Sheet 1 of 2

Method: Shell & Auger.	Date: 18/06/90 - 19/06/90	Site: NWEP	
Dia mm: 200	Coord: 355037mE, 378953mN	Ground Level m.OD: 46.25	Client: SCUK/BECHTEL

Soil Samples/Tests		Water & Progress	OD Level m.	Depth m.	Description of Strata	Legend
Type/Test	Depth m.					
B1	0.00 - 1.00	18/06/90	45.95	0.30	Brown sandy TOPSOIL (0.30)	
					Loose to medium dense light grey-brown silty fine to coarse SAND with fine to medium gravel (0.70)	
B2	1.00		45.25	1.00		
C3 (12)	1.00 - 1.45				Medium dense grey-brown silty fine to coarse SAND and fine to medium GRAVEL (2.60)	
C4 (19)	2.00 - 2.45					
C5 (19)	3.00 - 3.45					
D6	3.60		42.65	3.60		
C7 (21)	4.00 - 4.45		42.25	4.00	Medium dense brown to light brown fine to coarse SAND (0.40)	
		18/06/90			Medium dense grey-brown clayey silty fine to coarse SAND with fine to coarse gravel (0.60)	
B8	4.50 - 4.60	19/06/90				
S9 (31)	4.60 - 5.05		41.65	4.60	Medium dense grey-brown fine to coarse SAND and fine to coarse GRAVEL with some cobbles (2.40)	
C10 (21)	5.50 - 5.95					
C11 (21)	6.50 - 6.95					
		19/06/90	39.25	7.00		

Remarks

Ground-water was not encountered

Logged by	Scale	End Casing Depth	Job No.
SPM	1:50	m. 7.00	901235

Sample/Test key:
- U () U100 sample (blows)
- D Disturbed sample
- B Bulk sample
- W Water sample
- ~ Progress & Day

Penetration Tests
- S () Standard (N value)
- C () Cone (N value)
- * Blows and penetration when 300mm not achieved

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166819 : BGS Reference: SJ57NE10
EPSG: 27700 : 355037,378953

SJ 57 NE 10

FUGRO - McCLELLAND LIMITED

BOREHOLE LOG

Borehole B194/01R

Sheet 2 of 2

Method: Shell & Auger.	Date: 18/06/90 - 19/06/90	Site: NWEP	
Dia mm: 200	Coord: 355037mE, 378953mN	Ground Level m.OD: 46.25	Client: SCUK/BECHTEL

Soil Samples/Tests		Water & Progress	OD Level m.	Depth m.	Description of Strata	Legend
Type/Test	Depth m.					
					i. Install standpipe to 3.00. ii. Water added from 0.00 to 7.00.	

GROUNDWATER OBSERVATIONS

Date	Time	Borehole Depth	Casing Depth	Water Level
18/06/90	1800	4.50	4.50	DRY
19/06/90	0800	4.50	4.50	DRY
19/06/90	1200	7.00	7.00	DRY

Remarks

Ground-water was not encountered

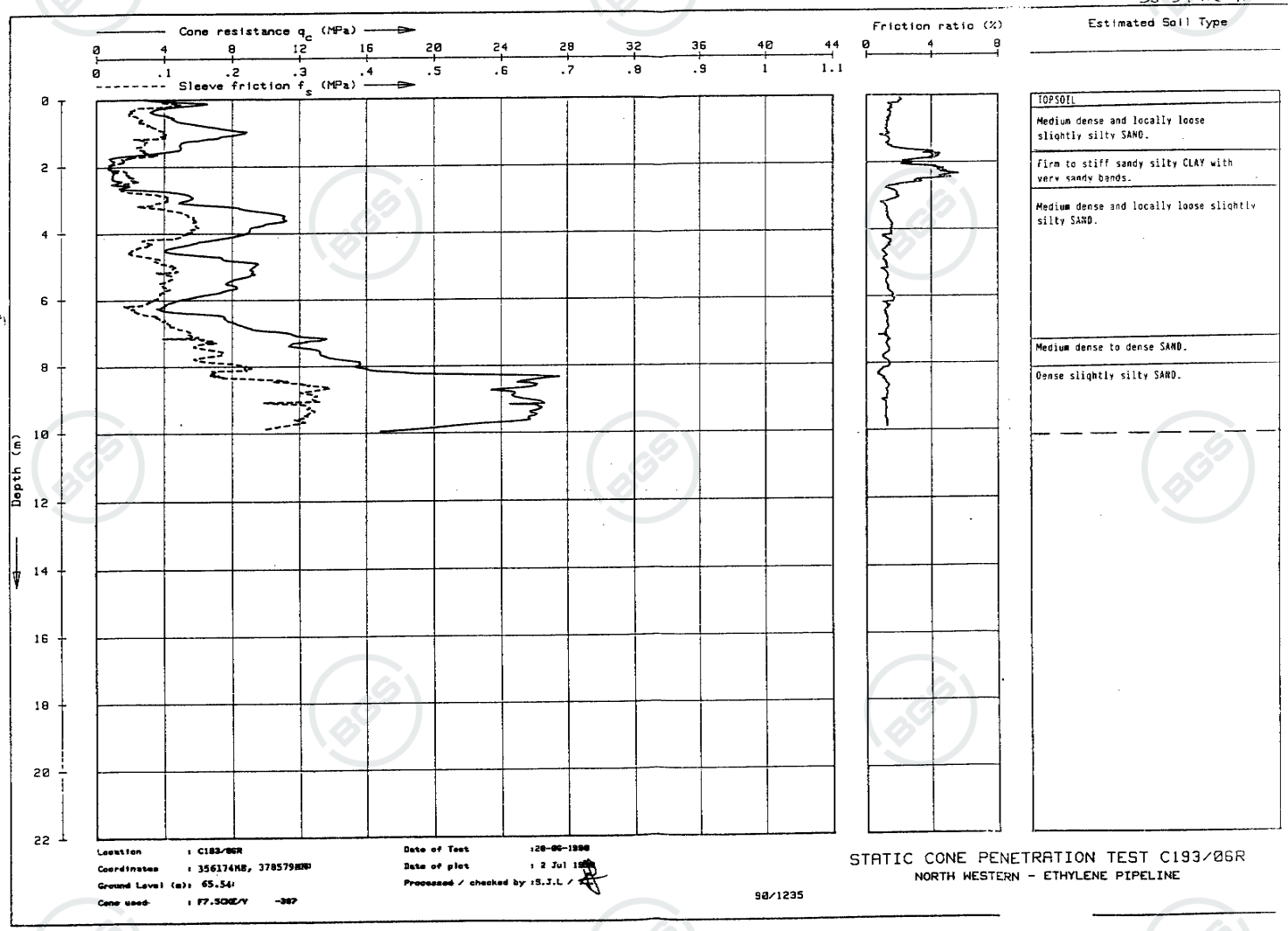
Logged by	Scale	End Casing Depth m.	Job No.
SPM	1:50	7.00	901235

Sample/Test key:
U () U100 sample (blows)
D Disturbed sample
B Bulk sample
W Water sample
→ Progress & Day

Penetration Tests
S () Standard (N value)
C () Cone (N value)
* Blows and penetration when 300mm not achieved

Contact BGS: ngdc@bgs.ac.uk

SJ 57 NE 11



STATIC CONE PENETRATION TEST C193/06R
NORTH WESTERN - ETHYLENE PIPELINE

British Geological Survey

BGS ID: 16115752 : BGS Reference: SJ57NW185
British National Grid (27700) : 353657,379352

PROJECT: [illegible]

LOCATION: Flood Brook II

GROUND LEVEL: 71.5 ft.

DIA. OF CASING: 154 mm. to metres

INCLINATION: Vertical

mm. to metres

SCALE OF LOG: 1" = 4'

DATE DRILLED: 28/29.8.70.

TYPE OF BORING: Shell and Auger

Reduced Level	Depth	Legend	Sampling Type	Sampling Depth	Soil Description	Key to Laboratory Tests
69.5	2.0		D S(4.5)*	2.0	FILL - sand, dry	
					clay, sandy, stoney, hard	
			D S(5)*	5.0		
			D	8.0		
61.5	10.0		D S(16)	10.0	▼ GWL 10.0' SAND - red, medium/coarse grained, wet	
			D	13.0		
			D S(26)	15.0		
54.5	17.0				GRAVEL - sandy, fine grained	
			D	18.0		
52.5	19.0		S(0.5)*	19.0	SANDSTONE- unweathered, medium hard	
51.0	20.5		D	20.0	BOTTOM OF BOREHOLE	

Moisture Content and plot of Atterberg Limits

Percent

10 20 30 40

Ground water encountered at

Quantity

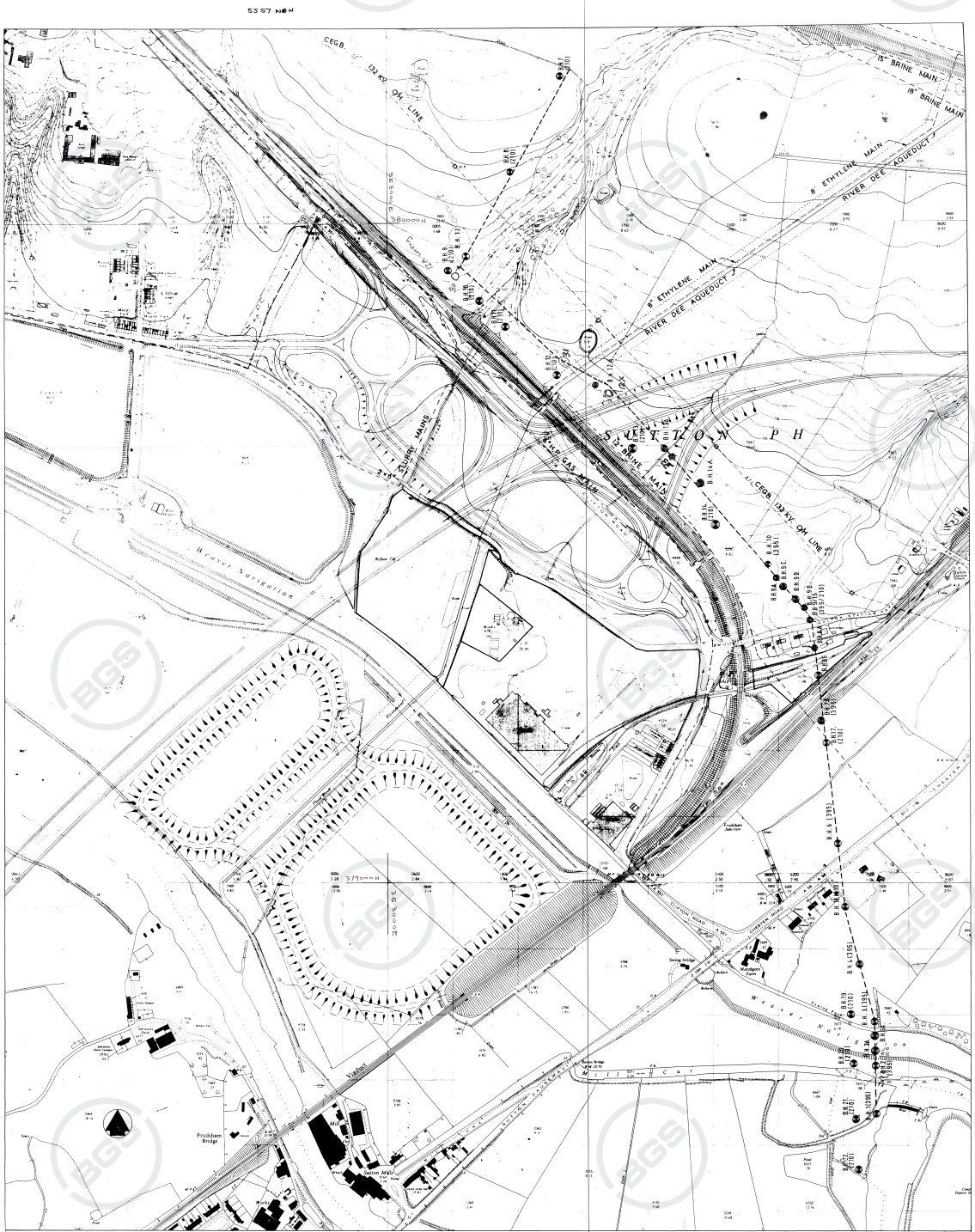
SHEET 1 OF 1

Borehole No. 8A

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 16115752 : BGS Reference: SJ57NW185
British National Grid (27700) : 353657,379352



BOREHOLE LOCATION PLAN — FLOOD BROOK TRUNK STORM WATER SEWER PHASE II

SCALE 1:2500

RS164XX1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 16115754 : BGS Reference: SJ57NW187
British National Grid (27700) : 353596,379458

PROJECT: RUNCORN NEW TOWN
LOCATION: Flood Brook II

GROUND LEVEL: 65.8 ft.
INCLINATION: Vertical
SCALE OF LOG: 1" = 4'

DIA. OF CASING: 154 mm. to metres
mm. to metres
DATE DRILLED: 14.7.70.

TYPE OF BORING: Shell and auger

Reduced Level	Depth ft.	Legend	Sampling Type	Sampling Depth	Soil Description	Key to Laboratory Tests
			D	2.0	CLAY - soft, grey, very sandy	
60.8	5.0		D U4	5.0	▼GWL 5.0' MARL - red/brown, weathered	TX
59.3	6.5		D	6.5	red, soft, unweathered	
52.8	13.0		D	13.0	Bottom of borehole	

Moisture Content and plot of Atterberg Limits
Percent
10 20 30 40

Ground water encountered at 5.0'
Quantity

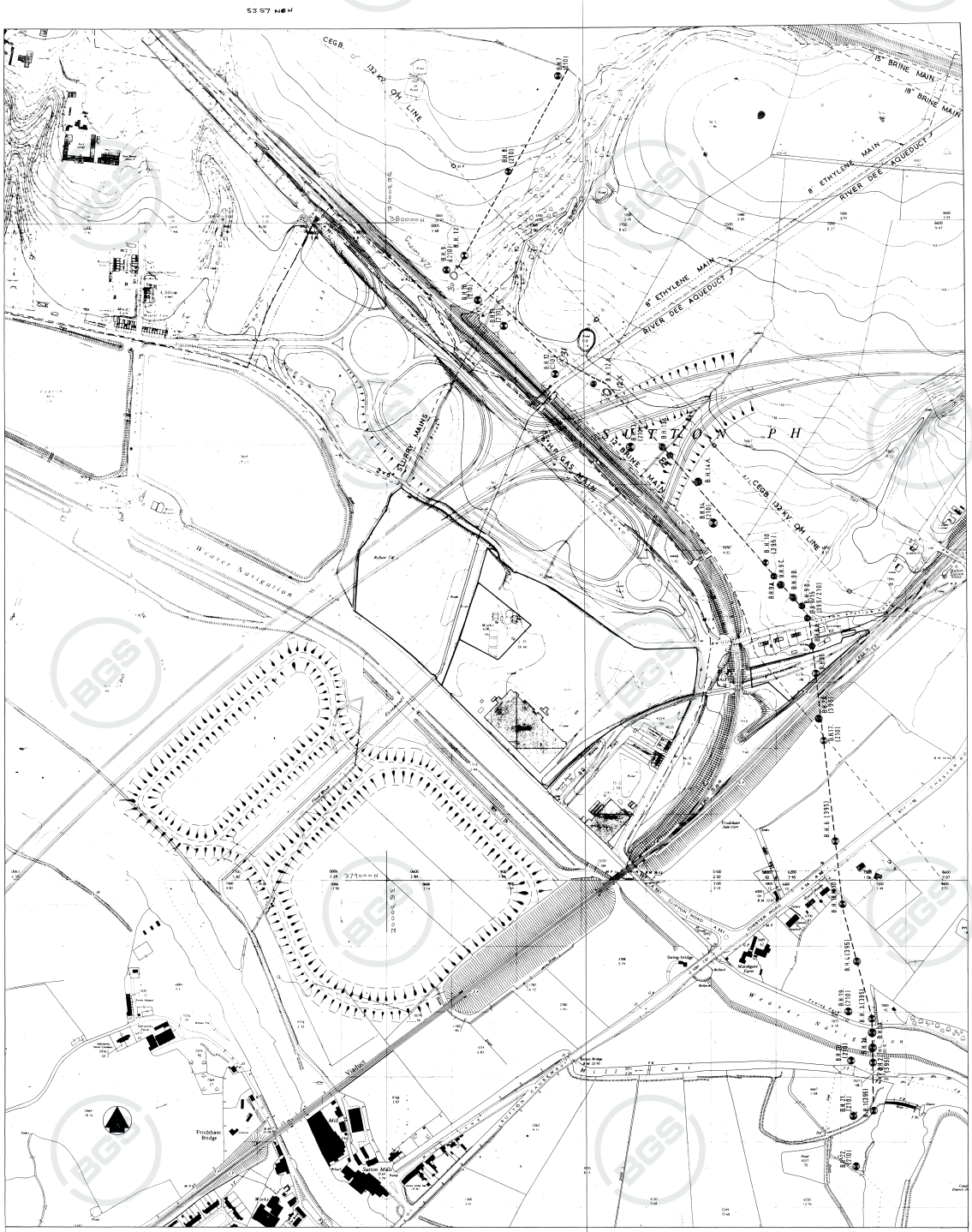
SHEET 1 OF 1

Borehole No.9A

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 16115754 : BGS Reference: SJ57NW187
British National Grid (27700) : 353596,379458



BOREHOLE LOCATION PLAN — FLOOD BROOK TRUNK STORM WATER SEWER PHASE II

SCALE 1:2500

RS164XX1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 16115765 : BGS Reference: SJ57NW189
British National Grid (27700) : 353607,379445

PROJECT: RUNCORN NEW TOWN
LOCATION: Flood Brook II

GROUND LEVEL: 68.0 ft.
INCLINATION: Vertical
SCALE OF LOG: 1" = 4'

DIA. OF CASING: 154 mm. to metres
mm. to metres
DATE DRILLED: 16.7.70.

TYPE OF BORING: Shell and auger

Reduced Level	Depth ft.	Legend	Sampling Type	Sampling Depth	Soil Description	Key to Laboratory Tests
			D	2.0	CLAY - soft, grey/brown, sandy	
			D	4.0		
63.0	5.0		U4	5.0		TX
			D	6.5	MARL - red/brown, weathered	
			D	8.0		
			D U4	10.0		TX
			D	11.5		
			D	13.0		
			D U4	15.0		TX
51.5	16.5		D	16.5	firm, unweathered	
50.0	18.0		D	18.0		
					hard, unweathered	
47.0	21.0				Bottom of borehole	

Moisture Content and plot of Atterberg Limits

Percent

10 20 30 40

Ground water encountered at
Quantity

SHEET 1 OF 1

Borehole No.9C

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 16115765 : BGS Reference: SJ57NW189
British National Grid (27700) : 353607,379445

BOREHOLE LOCATION PLAN — FLOOD BROOK TRUNK STORM WATER SEWER PHASE II

SCALE 1:2500

RS164XX1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 16115767 : BGS Reference: SJ57NW190
British National Grid (27700) : 353640,379413

PROJECT : RUNCORN NEW TOWN
LOCATION : Flood Brook II
GROUND LEVEL : 75.4 ft.
INCLINATION : Vertical
SCALE OF LOG : 1" = 4'
DIA. OF CASING : 154 mm. to metres
mm. to metres
DATE DRILLED : 18/19.7.70.
TYPE OF BORING : Shell and Auger

Reduced Level	Depth ft	Legend	Sampling Type	Sampling Depth	Soil Description	Key to Laboratory Tests
					TOPSOIL - black, sandy	
73.4	2.0		D	2.0	CLAY - firm, brown, sandy	
			D	4.0		
70.4	5.0		U4	5.0	CLAY - grey, very sandy	TX
			D	6.5		
67.4	8.0		D	8.0	SAND red, brown, medium grained	
			D	10.0		
			D	12.0		
			D	14.0		
59.9	15.5		S(7")*	15.5	CLAY - firm, brown, sandy, stoney	
			D	18.0		
			S(3)*	20.0		
			D	21.0		
			D	22.0		
			D	24.0		
50.4	25.0		D U4	25.0	MARL - red/brown, weathered	TX
			D	26.5		
			D	28.0		
			S(3)*	30.0		
43.4	32.0		D	32.0		

Moisture Content and plot of Atterberg Limits
Percent
10 20 30 40

Ground water encountered at
Quantity

SHEET 1 OF 2

Borehole No. 9D

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 16115767 : BGS Reference: SJ57NW190
British National Grid (27700) : 353640,379413

PROJECT: RUNCORN NEW TOWN
LOCATION: Flood Brook II
GROUND LEVEL: 75.4 ft.
INCLINATION: Vertical
SCALE OF LOG: 1" = 4'

DIA. OF CASING: 154 mm. to metres
mm. to metres
DATE DRILLED: 18/19.7.70.

TYPE OF BORING: Shell and Auger

Reduced Level	Depth ft	Legend	Sampling Type	Sampling Depth	Soil Description	Key to Laboratory Tests	Moisture Content and plot of Atterberg Limits (Percent: 10, 20, 30, 40)
40.4	35.0				MARL - red/brown, unweathered		
					BOTTOM OF BOREHOLE		

Ground water encountered at
Quantity

SHEET 2 OF 2

Borehole No. 9D

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 16115767 : BGS Reference: SJ57NW190
British National Grid (27700) : 353640,379413

BOREHOLE LOCATION PLAN — FLOOD BROOK TRUNK STORM WATER SEWER PHASE II

SCALE 1:2500

RS164XX1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 16116986 : BGS Reference: SJ57NW201
British National Grid (27700) : 353720,378880

LOCATION : Flood Brook Sewer, Phase II

GROUND LEVEL: 38.4 DIA. OF CASING : 6 INS. TO FT.

INCLINATION : Vertical INS. TO FT.

SCALE OF LOG : 1" = 4' SHEET 1 OF 1

TYPE OF BORING: Shell and auger

Daily Progress	Reduced Level	Depth ft.	Legend	Sampling Type	Sampling Depth	Nat. m %	Description and Remarks, including Water Observations.	Key to Laboratory Tests
	37.4	1.0					TOPSOIL - black/brown	
				D S(5)	2.0	16	SAND - grey/brown, coarse grained	
18.2.70.	33.4	5.0		D U4	5.0	15		
				D	6.5	14	CLAY - red/brown, soft, sandy, stoney	
				D	8.0	18		
	28.4	10.0		D U4	10.0	11		
				D	11.6	10	hard, sandy, stoney	
				D	13.0	9		
19.2.70.				D U4	15.0	9		
	21.9	16.5		D	16.5	9		
				D	18.0	12	MARL - grey/brown, weathered	
	18.4	20.0		D	20.0	6		
							rock, brown, hard	
	15.4	23.0					Bottom of borehole	

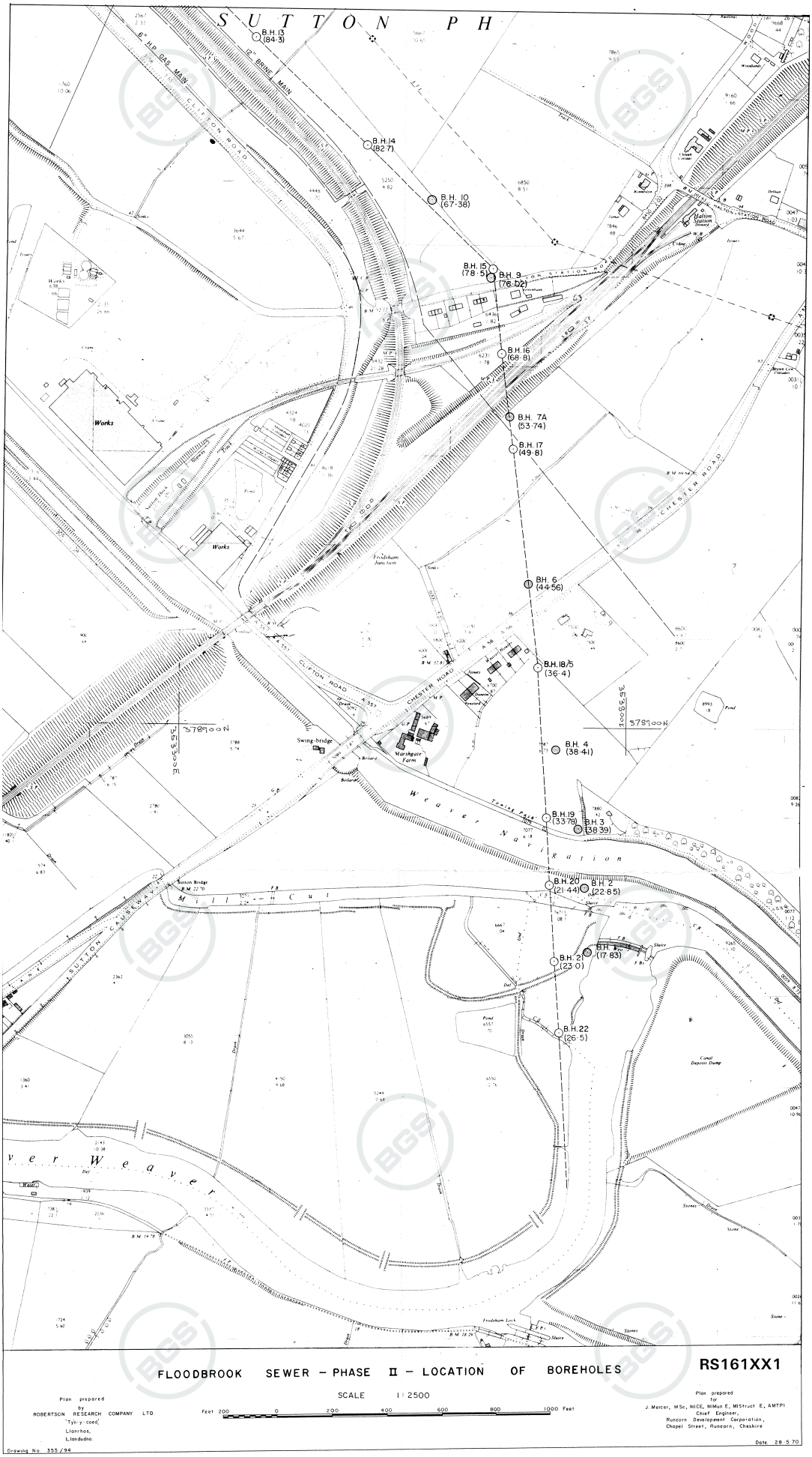
~~CONTINUED~~

U(4) = 4" Dia. Undisturbed Sample
D = Disturbed Sample
Δ = Water Sample
S( ) = Standard Penetration Test
C( ) = Cone Penetration Test
Figures in Brackets Indicate No. of Blows
* Indicates Penetration in ins. for 50 Blows
V = Vane Test

TX = Triaxial Test
CV = Consolidation Test
I = Index Test
O = Compaction Test
Ch = Chemical Test

Borehole No. 4

Contact BGS: ngdc@bgs.ac.uk


S U T T O N P H
B.H.13 (84·3)
6" H.P. GAS MAIN
12" BOWLE MAIN
B.H.14 (82·7)
B.H. 10 (67·38)
B.H. 15 (78·5)
B.H. 9 (76·02)
B.H. 16 (68·8)
B.H. 7A (53·74)
B.H. 17 (49·8)
B.H. 6 (44·56)
B.H.18/5 (36·4)
B.H. 4 (38·41)
B.H.19 (33·79)
B.H. 3 (38·39)
B.H.20 (21·44)
B.H. 2 (22·65)
B.H. 1 (17·83)
B.H. 21 (23·0)
B.H.22 (26·5)
Works
Works
Swing-bridge
Marshgate Farm
Weaver Navigation
Mill Cut
Sutton Bridge
Sutton Causeway
Clifton Road
Chester Road
Halton Station
Halton Station Road
Frodsham Junction
Frodsham Lock
Canal Deposit Dump
Stores
Pond
378000N
353000E
FLOODBROOK SEWER – PHASE II – LOCATION OF BOREHOLES
RS161XX1
SCALE 1:2500
Feet 200 0 200 400 600 800 1000 Feet
Plan prepared by ROBERTSON RESEARCH COMPANY LTD. Tyn-y-coed, Llanrhos, Llandudno.
Plan prepared for J. Mercer, M.Sc., M.I.C.E., M.I.Mun.E., M.I.Struct.E., A.M.T.P.I. Chief Engineer, Runcorn Development Corporation, Chapel Street, Runcorn, Cheshire
Drawing No. 355/94
Date. 28.5.70

British Geological Survey

BGS ID: 16117021 : BGS Reference: SJ57NW202
EPSG: 27700 : 353690,379060

LOCATION : Flood Brook Sewer Phase II

GROUND LEVEL: 44.6 DIA. OF CASING: 6 INS. TO FT.

INCLINATION : Vertical INS. TO FT.

SCALE OF LOG: 1" = 4' SHEET 1 OF 1

TYPE OF BORING: Shell and auger

Daily Progress	Reduced Level	Depth ft.	Legend	Sampling Type	Sampling Depth	Nat. m %	Description and Remarks, including Water Observations.	Key to Laboratory Tests
	43.6	1.0					TOPSOIL - brown/black	
				D S(6)	2.0	18	CLAY - brown, soft, sandy	
	41.1	3.5					grey, soft, sandy	
19.2.70.				D	5.0	20		
				D	8.0	21		
	35.6	9.0		D U4	10.0	20	brown, soft, silty	
	33.1	11.5		D	11.5	20	brown, firm, silty	
				D	13.0	16		
20.2.70.	29.6	15.0		D U4	15.0	16	brown, firm, sandy, stoney	
				D	16.5	16		
				D	18.0	15		
	24.6	20.0		D	20.0	16	Bottom of borehole	

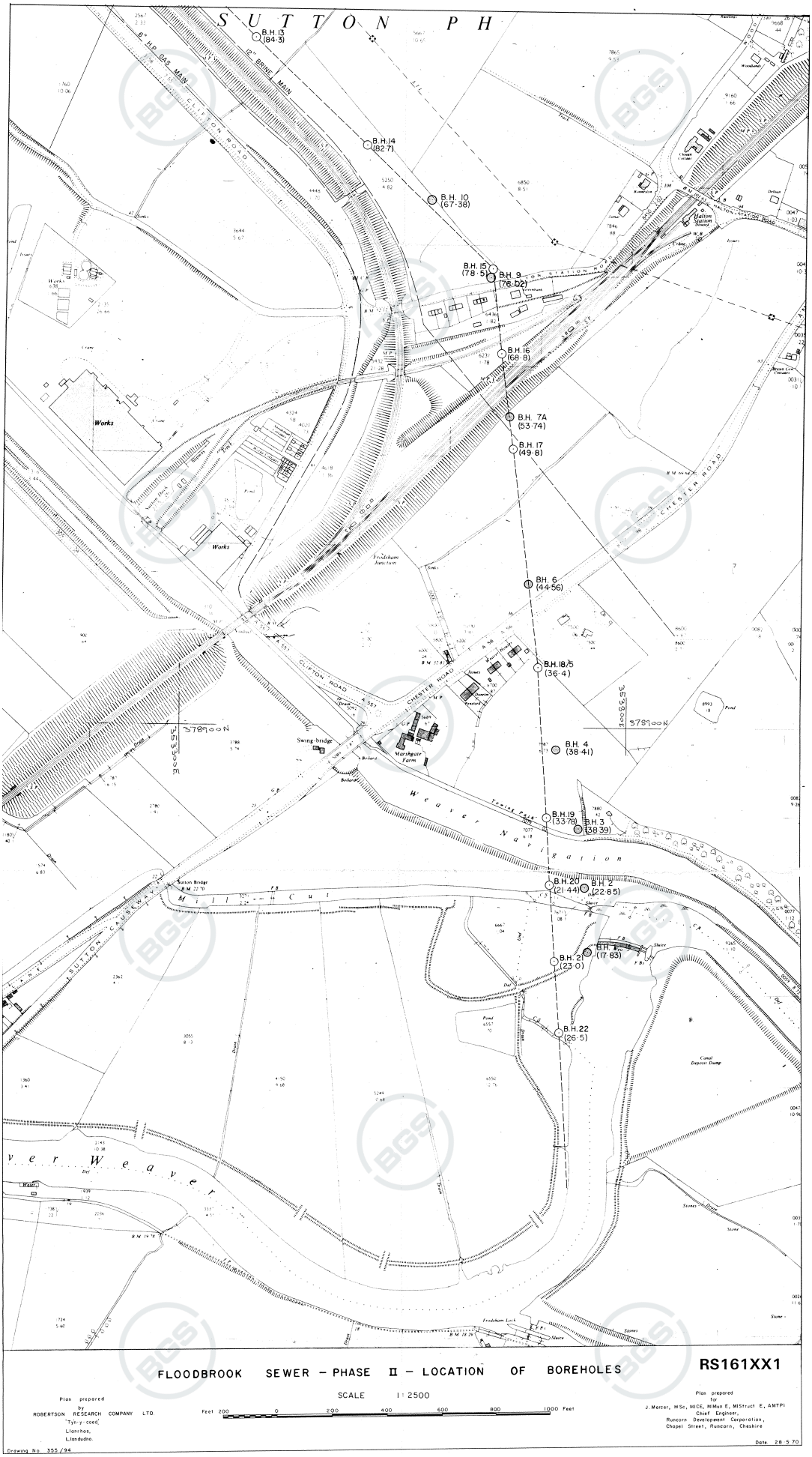
~~CONTINUED~~

U(4) = 4" Dia. Undisturbed Sample
D = Disturbed Sample
△ = Water Sample
S( ) = Standard Penetration Test
C( ) = Cone Penetration Test
Figures in Brackets Indicate No. of Blows
✳ Indicates Penetration in ins. for 50 Blows
V = Vane Test

TX = Triaxial Test
CV = Consolidation Test
I = Index Test
O = Compaction Test
Ch = Chemical Test

Borehole No. 6

Contact BGS: ngdc@bgs.ac.uk


S U T T O N P H
B.H.13 (84·3)
6" H.P. GAS MAIN
12" BOWLE MAIN
B.H.14 (82·7)
B.H. 10 (67·38)
B.H. 15 (78·5)
B.H. 9 (76·02)
B.H. 16 (68·8)
B.H. 7A (53·74)
B.H. 17 (49·8)
B.H. 6 (44·56)
B.H.18/5 (36·4)
B.H. 4 (38·41)
B.H.19 (33·79)
B.H. 3 (38·39)
B.H.20 (21·44)
B.H. 2 (22·65)
B.H. 1 (17·83)
B.H. 21 (23·0)
B.H.22 (26·5)
Works
Works
Swing-bridge
Marshgate Farm
Weaver Navigation
Mill Cut
Sutton Bridge
Canal Deposit Dump
Stones
Stone
Sluice
Pond
Tunnel
Culvert
Drain
Water
CLIFTON ROAD
CHESTER ROAD
SUTTON CAUSEWAY
HALTON STATION ROAD
Frodsham Junction
Frodsham Lock
378900N
353600E
FLOODBROOK SEWER – PHASE II – LOCATION OF BOREHOLES
RS161XX1
SCALE 1:2500
Feet 200 0 200 400 600 800 1000 Feet
Plan prepared by ROBERTSON RESEARCH COMPANY LTD. Ty-n-y-coed, Llanrhos, Llandudno.
Plan prepared for J. Mercer, M.Sc., M.I.C.E., M.I.Mun.E., M.I.Struct.E., A.M.T.P.I. Chief Engineer, Runcorn Development Corporation, Chapel Street, Runcorn, Cheshire
Drawing No. 355/94
Date. 28.5.70

British Geological Survey

BGS ID: 16117027 : BGS Reference: SJ57NW203
EPSG: 27700 : 353670,379250

PROJECT: [illegible]

LOCATION: Flood Brook Sewer Phase II

GROUND LEVEL: 53.7 DIA. OF CASING: 6 INS. TO FT.

INCLINATION: Vertical INS. TO FT.

SCALE OF LOG: 1" = 4' SHEET 1 OF 1

TYPE OF BORING: Shell and auger

Daily Progress	Reduced Level	Depth ft.	Legend	Sampling Type	Sampling Depth	Nat. m %	Description and Remarks, including Water Observations.	Key to Laboratory Tests
	51.7	2.0		D U4	2.0	13	TOPSOIL - black, sandy, fibrous	
				D	3.5	13	SAND - dark brown, fine grained, medium dense	
	48.7	5.0		D U4	5.0	14	▽ GWL 5.0'	
				D	6.5		dark brown, fine grained, medium dense, stoney	
	45.7	8.0		D	8.0	15		
	43.7	10.0		D S(18)	10.0	18	CLAY - firm, brown, sandy	
6.4.70.				D	11.5	20	SAND - fine grained, loose, silty, wet	
	40.7	13.0		D	13.0	10		
				D U4	15.0	12	MARL - grey/brown, hard, weathered	
				D	16.5	13		
				D	18.0	14		
	33.7	20.0		D	20.0	7	blue/grey, hard, unweathered	
	30.7	23.0					Bottom of borehole	

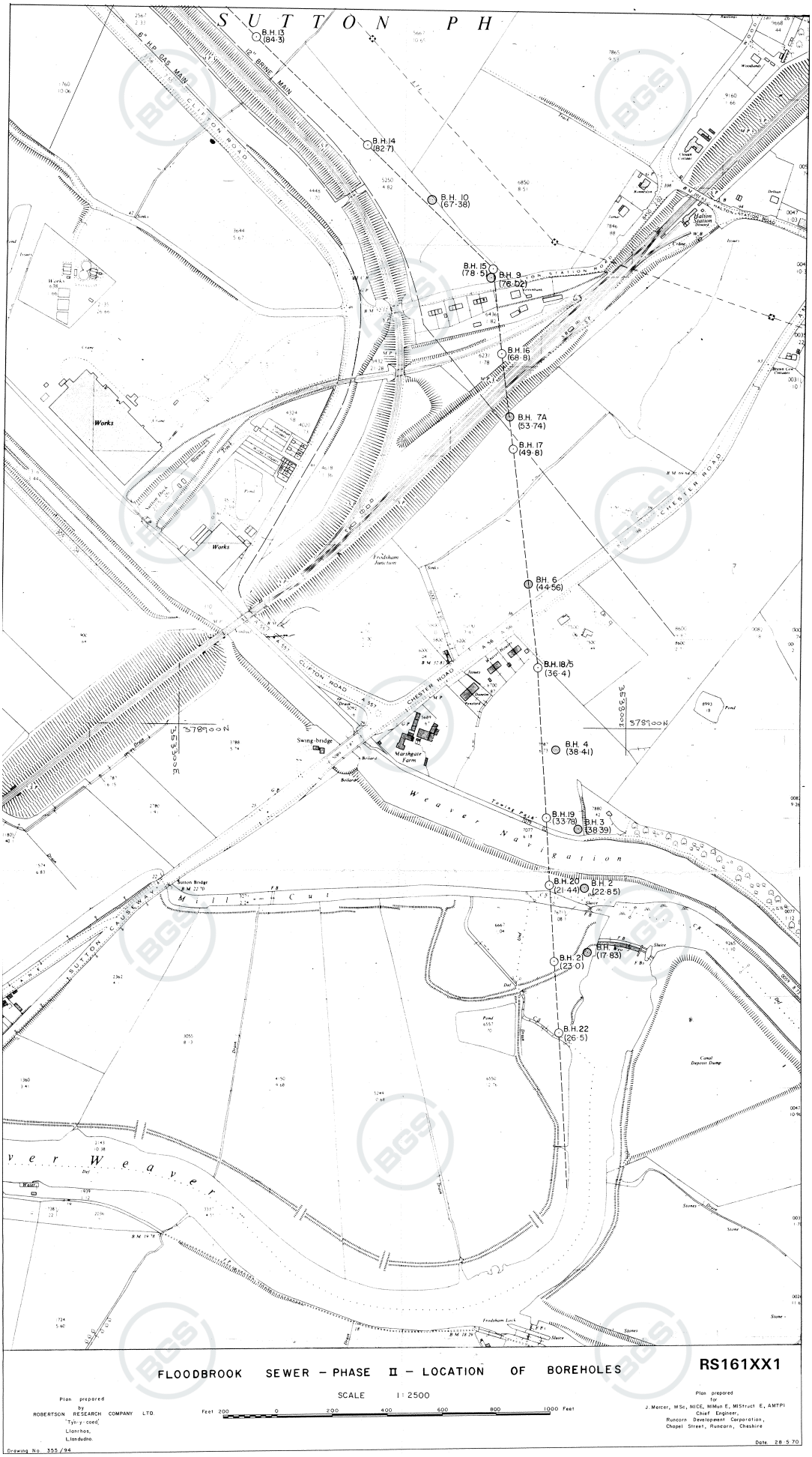
~~CONTINUED~~

U(4) = 4" Dia. Undisturbed Sample
D = Disturbed Sample
Δ = Water Sample
S( ) = Standard Penetration Test
C( ) = Cone Penetration Test
Figures in Brackets indicate No. of Blows
✱ Indicates Penetration in ins. for 50 Blows
V = Vane Test

TX = Triaxial Test
CV = Consolidation Test
I = Index Test
O = Compaction Test
Ch = Chemical Test

Borehole No. 7A

Contact BGS: ngdc@bgs.ac.uk


S U T T O N P H
B.H.13 (84·3)
6" H.P. GAS MAIN
12" BOWLE MAIN
B.H.14 (82·7)
B.H. 10 (67·38)
B.H. 15 (78·5)
B.H. 9 (76·02)
B.H. 16 (68·8)
B.H. 7A (53·74)
B.H. 17 (49·8)
B.H. 6 (44·56)
B.H.18/5 (36·4)
B.H. 4 (38·41)
B.H.19 (33·79)
B.H. 3 (38·39)
B.H.20 (21·44)
B.H. 2 (22·65)
B.H. 1 (17·83)
B.H. 21 (23·0)
B.H.22 (26·5)
Works
Works
Swing-bridge
Marshgate Farm
Weaver Navigation
Mill Cut
Sutton Bridge
Sutton Causeway
Chester Road
Clifton Road
Halton Station
Frodsham Junction
Frodsham Lock
Canal Deposit Dump
Stones
Stone
Pond
Sluice
Sluice
Sluice

British Geological Survey

BGS ID: 16117034 : BGS Reference: SJ57NW204
British National Grid (27700) : 353640,379400

LOCATION : Flood Brook Sewer Phase II

GROUND LEVEL: 76.0 DIA. OF CASING : 6 INS. TO FT.

INCLINATION : Vertical INS. TO FT.

SCALE OF LOG : 1" = 4' SHEET 1 OF 2

TYPE OF BORING: Shell and auger

Daily Progress	Reduced Level	Depth ft.	Legend	Sampling Type	Sampling Depth	Nat. m %	Description and Remarks, including Water Observations.	Key to Laboratory Tests
7.4.70.	75.7	0.3					TARMACADAM	
	74.7	1.3					FILL - aggregate and sand	
	74.1	1.9		D			TOPSOIL - sandy, fibrous	
				S(12)	2.0	8	SAND - red/brown, fine grained, loose	
				D	4.0	8		
				D	5.0			
				D	6.0	9		
				D	8.0	8		
	67.0	9.0		D				
				U4	10.0	8	CLAY - hard, brown, sandy, stoney	
				D	11.5	9	▼GWL 12.0'	
	63.5	12.5		D	13.0	21	SAND - red/brown, fine grained, clayey	
	61.5	14.0						
				D				
				U4	15.0	10	CLAY - hard, brown, sandy, stoney	
				D	16.5	8		
				D	18.0	15		
				D				
				U4	20.0	19		
8.4.70.	54.5	21.5		D	21.5	27		
				D	23.0	22	SILT - brown, sandy	
				D				
				S(68)	25.0	23		
	50.0	26.0		D	26.0	17		
							CLAY - hard, brown, sandy, stoney	
	48.0	28.0		D	28.0			
							SAND - red, fine grained, running, loose	
				D				
				S(16)	30.0		CONTINUED	

U(4) = 4" Dia. Undisturbed Sample
D = Disturbed Sample
Δ = Water Sample
S( ) = Standard Penetration Test
C( ) = Cone Penetration Test
Figures in Brackets Indicate No. of Blows
* Indicates Penetration in ins. for 50 Blows
V = Vane Test

TX = Triaxial Test
CV = Consolidation Test
I = Index Test
O = Compaction Test
Ch = Chemical Test

Borehole No. 9

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 16117034 : BGS Reference: SJ57NW204
British National Grid (27700) : 353640,379400

LOCATION : Flood Brook Sewer Phase II

GROUND LEVEL: 76.0 DIA. OF CASING: 6 INS. TO FT.

INCLINATION : Vertical INS. TO FT.

SCALE OF LOG: 1" = 4' SHEET 2 OF 2

TYPE OF BORING: Shell and auger

Daily Progress	Reduced Level	Depth ft.	Legend	Sampling Type	Sampling Depth	Nat. m %	Description and Remarks, including Water Observations.	Key to Laboratory Tests
							SAND - fine grained, red, loose, running	
	44.5	31.5		D	32.0	20	CLAY - firm, brown, sandy, stoney	
				D	34.0	16		
	41.0	35.0		S(25)	35.0	16	SAND - coarse grained, medium dense	
8.4.70.				D	38.0	20		
	36.5	39.5		D S(69)	40.0	6	GRAVEL - dense, graded	
				D	42.0	6		
	33.0	43.0					Bottom of borehole	

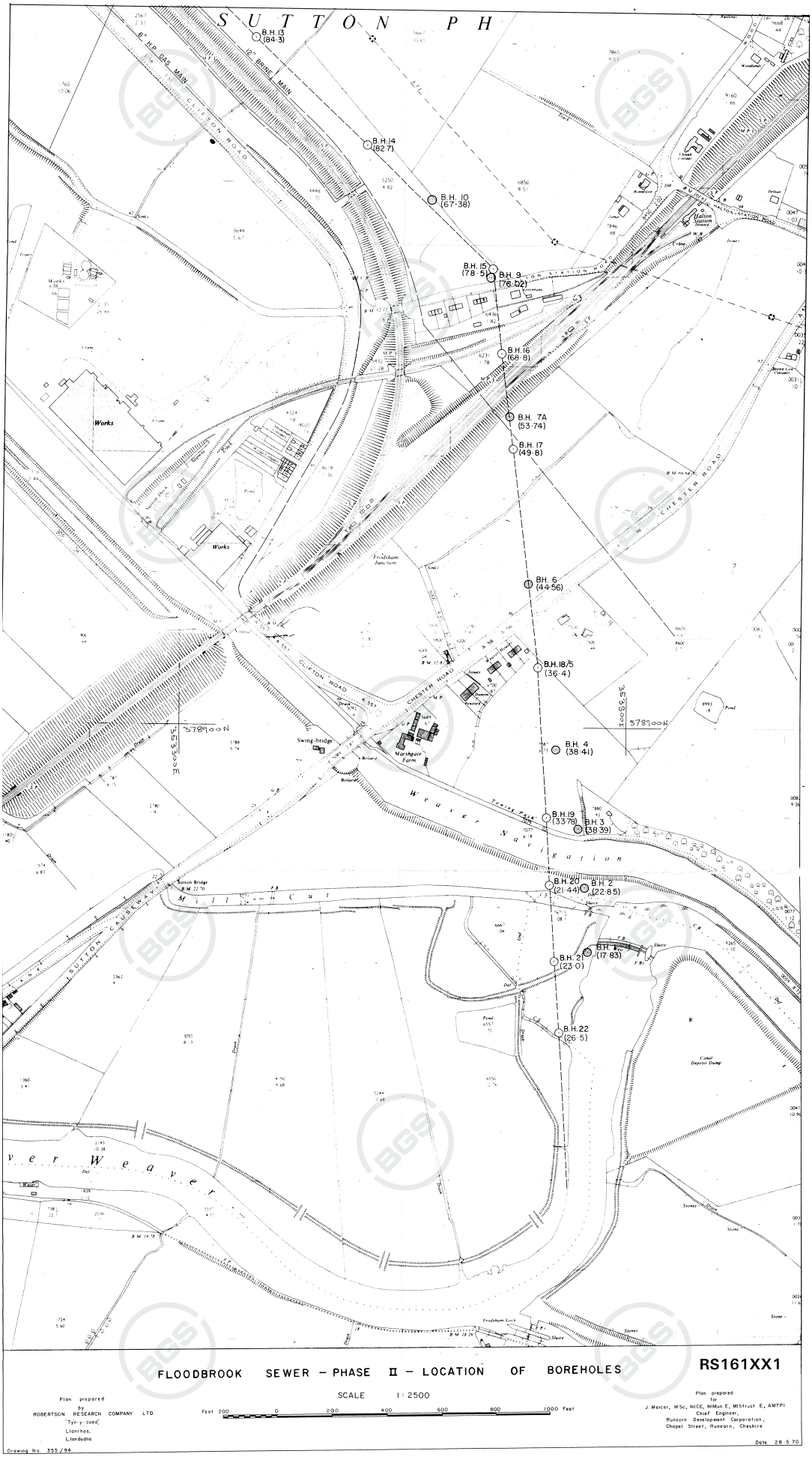
CONTINUED

U(4) = 4" Dia. Undisturbed Sample
D = Disturbed Sample
Δ = Water Sample
S( ) = Standard Penetration Test
C( ) = Cone Penetration Test
Figures in Brackets Indicate No. of Blows
* Indicates Penetration in ins. for 50 Blows
V = Vane Test

TX = Triaxial Test
CV = Consolidation Test
I = Index Test
O = Compaction Test
Ch = Chemical Test

Borehole No. 9

Contact BGS: ngdc@bgs.ac.uk



FLOODBROOK SEWER – PHASE II – LOCATION OF BOREHOLES

RS161XX1

SCALE 1:2500

Feet 200 0 200 400 600 800 1000 Feet

Plan prepared by ROBERTSON RESEARCH COMPANY LTD. 'Tyn-y-coed' Llanrhos, Llandudno.

Drawing No. 355/94

Plan prepared for J. Mercer, M.Sc., M.I.C.E., M.I.Mun.E., M.I.Struct.E., A.M.T.P.I. Chief Engineer, Runcorn Development Corporation, Chapel Street, Runcorn, Cheshire

Date. 28.5.70

British Geological Survey

BGS ID: 17088191 : BGS Reference: SJ57NW270
British National Grid (27700) : 353597,379450

PROJECT: RUNCORN NEW TOWN
LOCATION : Beechwood East

GROUND LEVEL : 20.64 DIA. OF CASING: 154 mm. to metres
mm. to metres

INCLINATION : Vertical

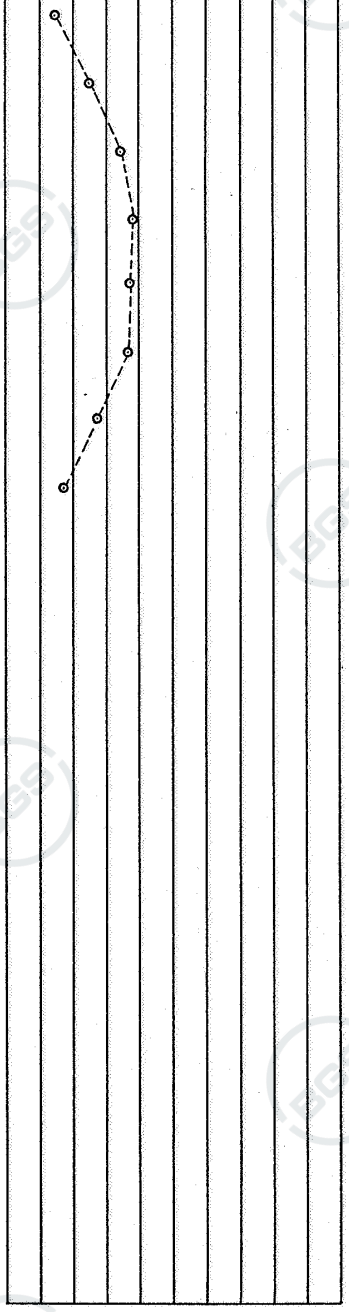
SCALE OF LOG : 1:50 DATE DRILLED: 4.10.71.

TYPE OF BORING: Shell and Auger

Reduced Level	Depth	Legend	Sampling Type	Sampling Depth	Soil Description	Key to Laboratory Tests
			D		FILL - dense marl	
			N(46)	0.5		
			D	1.0		
19.14	1.5		D	1.5		
			D		MARL - soft, weathered	
			U(100)	2.0		
			D	2.5		
17.64	3.0		D	3.0		
			D		hard, unweathered	
			M(5)*	3.5		
16.64	4.0		D	4.0		
					BOTTOM OF BOREHOLE	

Moisture Content and plot of Atterberg Limits

Percent 10 20 30 40



Ground water encountered at
Quantity

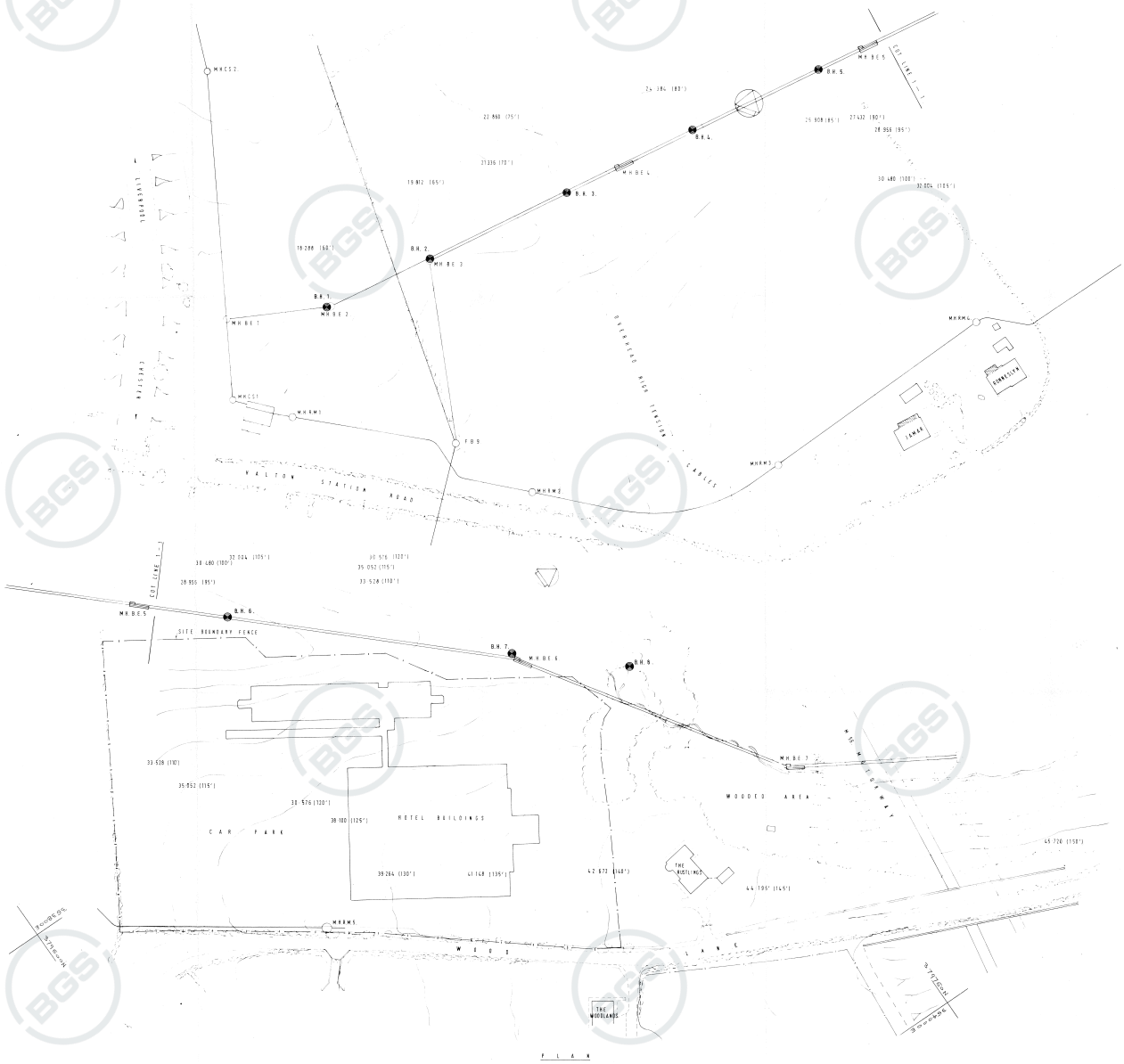
SHEET 1 OF 1

Borehole No. 2

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 17088191 : BGS Reference: SJ57NW270
British National Grid (27700) : 353597,379450



Notes

BOREHOLE	GROUND LEVELS
B.H. 1.	20·059 M.
B.H. 2.	20·631 M.
B.H. 3.	22·273 M.
B.H. 4.	24·396 M.
B.H. 5.	26·330 M.
B.H. 6.	28·425 M.
B.H. 7.	32·052 M.
B.H. 8.	33·560 M.

Revisions

RS338XX1

Job
BEECHWOOD EAST AND ESSO HOTEL SITE.

TRUNK STORM AND FOUL SEWERS.

BOREHOLE LOCATION PLAN.

Scale 1:500
Drawn by J.B.C.
Date OCTOBER 1971.

Runcorn Development Corporation
Chapel St., Runcorn Cheshire Tel RUN 73477

Chief Engineer
J. Mercer MSc(Eng) FICE FIMunE FStructE AMTPI

Drawing no
E/2/9/3.

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 17100378 : BGS Reference: SJ57NW294
British National Grid (27700) : 353641,379406

PROJECT: RUNCORN NEW TOWN
LOCATION: Flood Brook Sewer
GROUND LEVEL: 78.5
INCLINATION: Vertical
SCALE OF LOG: 1" = 4 ft.

DIA. OF CASING: 6 INS. TO FT.
INS. TO FT.
SHEET 1 OF 2

TYPE OF BORING: Shell & Auger

Daily Progress	Reduced Level	Depth	Legend	Sampling Type	Sampling Depth	Nat. m %	Description and Remarks, including Water Observations.	Key to Laboratory Tests
	77.0	1.5					TOPSOIL - Organic	
26/3/68				D U4	2.0	21	SAND - Light Brown, fine	
				D	3.5	24		
				D	5.0	25		
							▼ G.W.L. 6.0	
				D	7.0	23		
				D	9.0	25		
27/3/68				D	11.0	21		
				D	13.0	18		
	63.5	15.0		D	15.0	19		
28/3/68				D	17.0	19	Running	
				D	20.0	26		
29/3/68	56.5	22.0		D	22.0	10		
							CLAY - Boulder, brown, firm, sandy	
				D	24.0	12		
				D C(7")	25.0	9		
				D	26.0	14		
1/4/68				D	28.0	12		
				C(7") D	30.0	6		

CONTINUED

U(4) = 4" Dia. Undisturbed Sample
D = Disturbed Sample
Δ = Water Sample
S( ) = Standard Penetration Test
C( ) = Cone Penetration Test
Figures in Brackets Indicate No. of Blows
✳ Indicates Penetration in Ins. for 50 Blows
V = Vane Test

TX = Triaxial Test
CV = Consolidation Test
I = Index Test
O = Compaction Test
Ch = Chemical Test

Borehole No. 15

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 17100378 : BGS Reference: SJ57NW294
British National Grid (27700) : 353641,379406

PROJECT: RUNCORN NEW TOWN
LOCATION: Flood Brook Sewer
GROUND LEVEL: 78.5 DIA. OF CASING: 6 INS. TO FT.
INCLINATION: Vertical INS. TO FT.
SCALE OF LOG: 1" = 4 ft. SHEET 2 OF 2

TYPE OF BORING: Shell & Auger

Daily Progress	Reduced Level	Depth	Legend	Sampling Type	Sampling Depth	Nat. m %	Description and Remarks, Including Water Observations.	Key to Laboratory Tests
	48.2	30.3						
2/4/68	47.5	31.0					CLAY - Brown, boulder, firm, sandy	
	47.0	31.5					SAND - Brown, coarse	
				D	32.0	12	CLAY - Boulder, brown, firm	
				D	34.0	10		
	43.5	35.0					Bottom of Borehole	

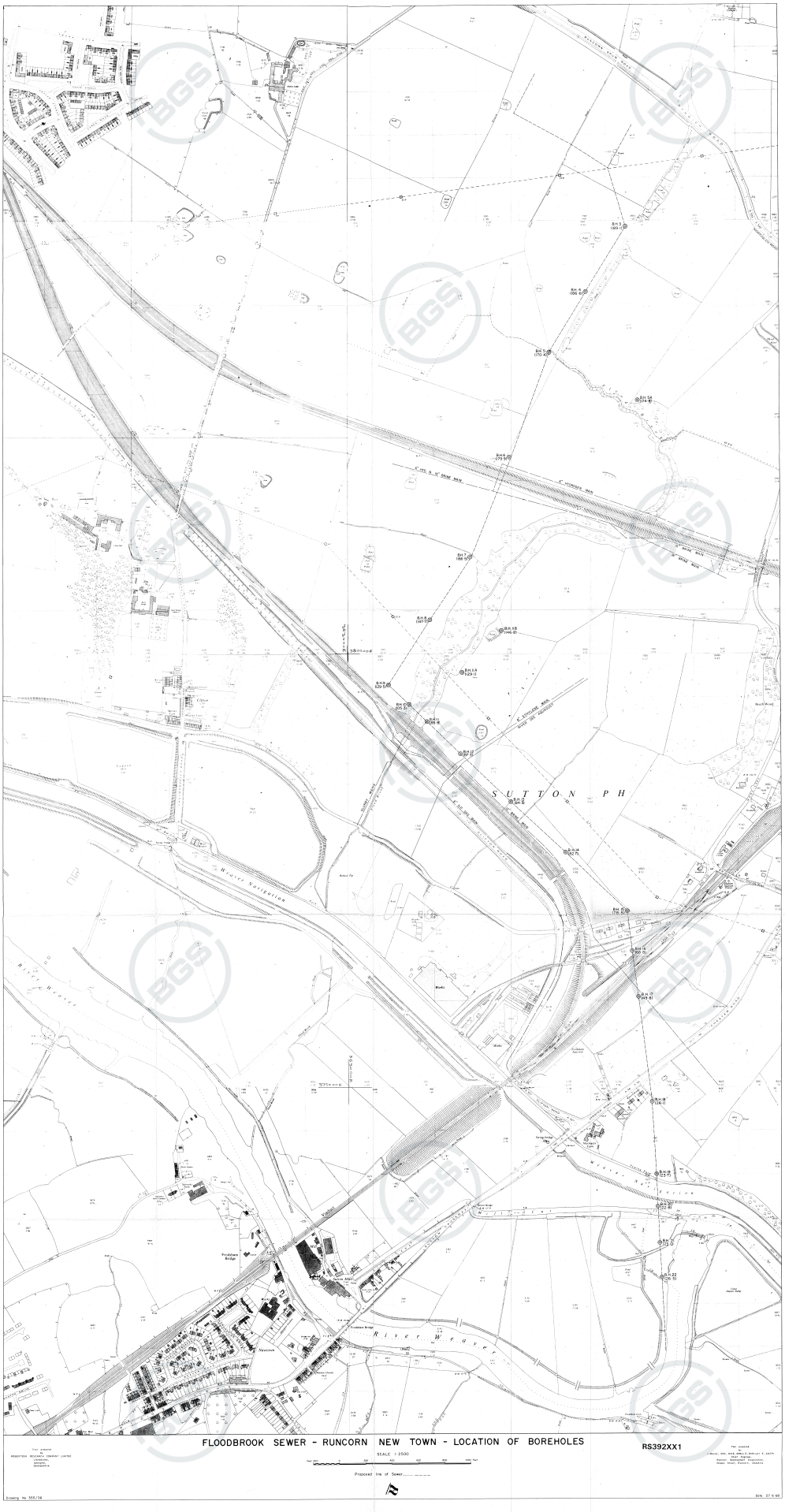
CONTINUED

U(4) = 4" Dia. Undisturbed Sample
D = Disturbed Sample
△ = Water Sample
S( ) = Standard Penetration Test
C( ) = Cone Penetration Test
Figures in Brackets Indicate No. of Blows
✻ Indicates Penetration in Ins. for 50 Blows
V = Vane Test

TX = Trioxial Test
CV = Consolidation Test
I = Index Test
O = Compaction Test
Ch = Chemical Test

Borehole No. 15

Contact BGS: ngdc@bgs.ac.uk


FLOODBROOK SEWER - RUNCORN NEW TOWN - LOCATION OF BOREHOLES
RS392XX1
SCALE 1:2500
SUTTON PH
River Weaver
River Weaver Navigation

British Geological Survey

BGS ID: 17100380 : BGS Reference: SJ57NW296
EPSG: 27700 : 353668,379209

PROJECT: [illegible] NEW TOWN
LOCATION: Flood Brook Sewer
GROUND LEVEL: 49.8
INCLINATION: Vertical
SCALE OF LOG: 1" = 4 ft.

DIA. OF CASING: 6 INS. TO FT.
INS. TO FT.
SHEET 1 OF 2

TYPE OF BORING: Shell & Auger

Daily Progress	Reduced Level	Depth	Legend	Sampling Type	Sampling Depth	Nat. m %	Description and Remarks, Including Water Observations.	Key to Laboratory Tests
	48.8	1.0					TOPSOIL - Organic	
				D	2.0	19	CLAY - Sandy, soft, brown	
	47.3	2.5		U4	2.5			
				D	4.0	16	SAND - Red, coarse	
				S(16)	5.0			
26/3/68	43.3	6.5					Clayey, wet with pebbles	
	41.8	8.0		D	8.0	18	CLAY - Sandy, soft, brown	
				D	10.0	18		
	37.8	12.0		D	12.0	29	SAND - Fine, saturated, red	
				D	14.0	28		
				D	16.0	29		
				D	18.0	18		
				D	20.0	34		
27/3/68				D	22.0	23		
	27.3	22.5		U4	22.5		CLAY - Soft, light brown, silty	
				D	24.0	17		
	24.8	25.0					SAND - Fine grained saturated	
				D	26.0	21		
				D	28.0	21		
				D	30.0	1		

CONTINUED

U(4) = 4" Dia. Undisturbed Sample
D = Disturbed Sample
Δ = Water Sample
S( ) = Standard Penetration Test
C( ) = Cone Penetration Test
Figures in Brackets Indicate No. of Blows
* Indicates Penetration in Ins. for 50 Blows
V = Vane Test

TX = Triaxial Test
CV = Consolidation Test
I = Index Test
O = Compaction Test
Ch = Chemical Test

Borehole No. 17

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 17100380 : BGS Reference: SJ57NW296
EPSG: 27700 : 353668,379209

PROJECT: KONGOLIN NEW TOWN

LOCATION: Flood Brook Sewer.

GROUND LEVEL: 49.8 DIA. OF CASING: 6 INS. TO FT.

INCLINATION: Vertical INS. TO FT.

SCALE OF LOG: 1" = 4 ft. SHEET 2 OF 2

TYPE OF BORING: Shell & Auger

Daily Progress	Reduced Level 19.8	Depth 30.0	Legend	Sampling Type	Sampling Depth	Nat. m %	Description and Remarks, Including Water Observations.	Key to Laboratory Tests
27/3/68				D	32.0	3	GRAVEL - Coarse	
	15.8	34.0		D	34.0	16	MARL - Weathered, with clay laminations	
				D	36.0	17		
28/3/68	11.8	38.0		D	38.0			
				C($\frac{1}{2}$")	38.5		Hard	
	9.8	40.0		D	40.0	12	Bottom of Borehole	

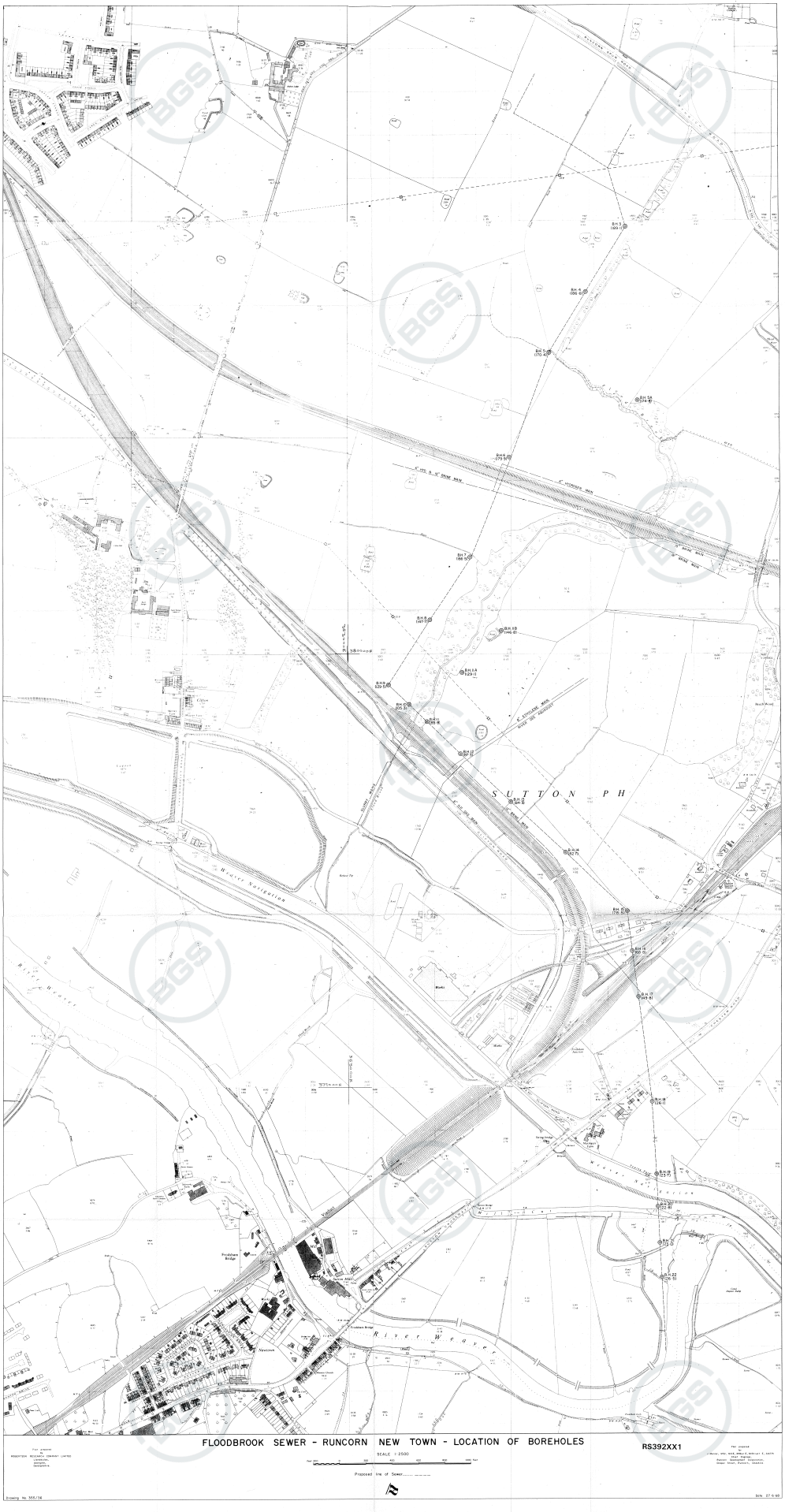
~~CONTINUED~~

U(4) = 4" Dia. Undisturbed Sample
D = Disturbed Sample
△ = Water Sample
S( ) = Standard Penetration Test
C( ) = Cone Penetration Test
Figures in Brockets Indicate No. of Blows
✱ Indicates Penetration in Ins. for 50 Blows
V = Vane Test

TX = Triaxial Test
CV = Consolidation Test
I = Index Test
O = Compaction Test
Ch = Chemical Test

Borehole No. 17

Contact BGS: ngdc@bgs.ac.uk


FLOODBROOK SEWER - RUNCORN NEW TOWN - LOCATION OF BOREHOLES
RS392XX1
SCALE 1:2500
SUTTON PH
River Weaver
River Weaver Navigation

British Geological Survey

BGS ID: 17116417 : BGS Reference: SJ57NW302
British National Grid (27700) : 353568,379382

LOCATION : CLIFTON - SUTTON TRUNK FOUL SEWER

GROUND LEVEL 63.4 DIA. OF CASING : 6 INS. TO FT.

INCLINATION : VERTICAL INS. TO FT.

SCALE OF LOG : 1" = 4 ft SHEET 1 OF 1

TYPE OF BORING : SHELL AND AUGER

Daily Progress	Reduced Level	Depth	Legend	Sampling Type	Sampling Depth	Nat. m %	Description and Remarks, including Water Observations.	Key to Laboratory Tests
	62.4	1.0					TOPSOIL - organic	
				D U4	2.0	11	SAND - red-brown, coarse grained	
21.10.1968	59.9	3.5		D	3.5	14	CLAY - red-brown, sandy, boulder	
				D U4	5.0	16		
	56.9	6.5		D	6.5	17	▼ G.W.L. 6.5'	
				D	8.0	18	SAND - red, medium grained, saturated	
				D	10.0	22		
	51.4	12.0		D	12.0	18		
				D	14.0	12	CLAY - brown, boulder, sandy with cobbles to 4"	
				D	16.0	10		
22.10.1968				D	18.0	10		
	43.4	20.0		D	20.0	14	with silt laminations	
	42.4	21.0					MARL - grey-green, weathered	
				D	22.0	18		
	40.4	23.0		D	23.0	5	unweathered	
	38.4	25.0					BOTTOM OF BOREHOLE	

~~CONTINUED~~

U(4) = 4" Dia. Undisturbed Sample
D = Disturbed Sample
Δ = Water Sample
S( ) = Standard Penetration Test
C( ) = Cone Penetration Test
Figures in Brackets Indicate No. of Blows
* Indicates Penetration in Ins. for 50 Blows
V = Vane Test

TX = Triaxial Test
CV = Consolidation Test
I = Index Test
O = Compaction Test
Ch = Chemical Test

Borehole No. 1

Contact BGS: ngdc@bgs.ac.uk

6" HYDROGEN MAIN
15" BRINE MAIN
6" HYD & 18" BRINE MAINS
12" BRINE MAIN
6" HYDROGEN MAIN
CEGB 132 KV OH LINE
8" ETHYLENE MAIN
RIVER DEE
SUTTON PH
Weaver Navigation
B.H. 1 (63·4)
B.H. 2 (132·2)
B.H. 3 (135·6)
B.H. 4 (146·8)
B.H. 5 (167·8)
B.H. 6 (173·9)
B.H. 7 (194·1)
380700N
380000N
CLIFTON - SUTTON TRUNK FOUL SEWER - LOCATION OF BOREHOLES
SCALE 1:2500
RS414XX1

HyNet North West Hydrogen Pipeline

Delivering clean growth

Annex 14A 2
Bold Heath Borehole Logs

British Geological Survey

BGS ID: 168304 : BGS Reference: SJ58NW20
British National Grid (27700) : 354291,388490

SJ 58 NW

11.5NW 12.

Trial bore at BOLD HEATH near St Helens, Lancashire.

115NW

6" map Lancashire 12.

115NW

No.1 Bore. Horsfield Estate, Sutton Manor Colliery Co. 300 yards south of Hayfield Farm.
Shown on 6inch field slip Lancashire 115NW.E.
1" map: 97 (Runcorn)
6" map: Lancashire 115NW
Surface 60·7 ft. O.D.
Boring { commenced 21.V.1943
finished at 510ft. on 30.VI.1943.
Borers: Messrs. J. Thom & Co., Patricroft, Manchester.
Journal from Mr. French, Manager & Agent, Sutton Manor Collieries.

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168304 : BGS Reference: SJ58NW20
British National Grid (27700) : 354291,388490

SJ 58 NW 4

115 NW 12

20

Section of No.1 Borehole. Horsfield's Estate.

Commenced 21st May 1943.

	Strata	Thickness. Ft.	ins.	Metres	Depth. Ft.	ins.	Metres
Drift 11ft. 3.35	Soil	1	0	0.30	1	0	0.30
	Variegated sand and gravel	1	6	0.46	2	6	0.76
	Brown clay and stones	8	6	2.59	11	0	3.35
	Soft red sandstone	4	0	1.22	15	0	4.57
	Soft red sandstone	6	0	1.83	21	0	6.40
	Red sandstone	2	0	0.61	23	0	7.01
24.5.1943.	Red sandstone	11	0	3.35	34	0	10.36
	Red sandstone	5	0	1.52	39	0	11.89
	Red and grey sandstone	2	0	0.61	41	0	12.50
27.5.1943.	Red sandstone	4	0	1.22	45	0	13.72
Bunter (Pebble Beds). 499ft.+ to 546ft.	Red sandstone	13	0	3.96	58	0	17.68
	Soft red sandstone	5	0	1.52	63	0	19.20
	Red and Grey Sandstone	2	0	0.61	65	0	19.81
	Red Sandstone	3	0	0.91	68	0	20.73
	Red Sandstone with thin bands of Grey Sandstone	1	0	0.31	69	0	21.03
U.M. 5	Red Sandstone	3	0	0.91	72	0	21.95
	Red marl			30.08	72	3	22.09
28.5.1943 29/5. 91' 31/5.120'	Red Sandstone (with thin bands of Grey Sandstone at 76') 23.16	7		92.36	80	0	24.38
	Red Sandstone	49	0	14.94	129	0	39.32

-1-

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168304 : BGS Reference: SJ58NW20
British National Grid (27700) : 354291,388490

SJ 58 NW 115 20

Section of No.1 Borehole. Horsfield's Estate.

	(contd.)	Thickness. Ft.	ins.	Depth. Ft.	ins.	
	Grey Sandstone		30·08	129	3	39·40
	Red Sandstone	5	91·75	135	0	41·15
	Grey Sandstone		20·05	135	2	41·20
U.M.S. 16146/R.	Red Sandstone	5	41·63	140	6	42·82
	Red and Grey Sandstone (grey sandstone vertical)		60·15	141	0	42·98
1.6.1943	Red Sandstone	5	01·52	146	0	44·50
	Red Sandstone with few pebbles	1	00·31	147	0	44·81
	Variegated Sandstone	1	00·31	148	0	45·11
	Yellow Sandstone		60·15	148	6	45·26
	Red Sandstone with few pebbles	5	61·68	154	0	46·94
Pebble Beds 155·45	Red sandstone with few pebbles	4	01·22	158	0	48·16
16510/K.	Red sandstone	12	63·81	170	6	51·97
	Red marl		20·05	170	8	52·02
2.6.1943 183'	Red sandstone	2	40·71	173	0	52·73
3.6.1943	Red sandstone with few pebbles	30	09·14	203	0	61·87
	Red marly sandstone	9	02·74	212	0	64·62
4.6.1943 Water Level 38' 11·58	Red sandstone with few pebbles	10	03·05	222	0	67·67
	Red Sandstone	2	00·61	224	0	68·28
	Variegated sandstone with few pebbles	2	00·61	226	0	68·88
	Red sandstone with few pebbles	6	01·83	232	0	70·71
	Red Sandstone	1	00·31	233	0	71·02
	Red and Grey Sandstone with few pebbles	1	00·31	234	0	71·34
	Red Sandstone with pebbles	6	01·83	240	0	73·15
	Red Sandstone	3	00·91	243	0	74·07
	Red Sandstone with few pebbles	1	00·31	244	0	74·37
	Red Sandstone	6	01·83	250	0	76·20
	Red and blue marl	1	00·31	251	0	76·50
	Red Sandstone	5	01·52	256	0	78·03
	Grey Sandstone		10·03	256	1	78·05
8.6.43 (W.L.36') 10·97	Red Sandstone with few pebbles	1	110·58	258	0	78·64

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168304 : BGS Reference: SJ58NW20
British National Grid (27700) : 354291,388490

Section of No. 1 Borehold. Horsfield's Estate. SJ 58 NW 115 202

(Contd)

		Thickness. Ft.	Ins.	Depth. Ft.	Ins.	
	Red Sandstone with few pebbles	3	00·91	261	0	79·55
	Grey Sandstone		60·15	261	6	79·71
	Red Sandstone	1	60·66	263	0	80·16
8/6/43 268 Ft. 81·69	Red Sandstone with odd pebbles	5	61·68	268	6	81·84
	Grey Sandstone		30·08	268	9	81·91
	Red Sandstone	4	31·30	273	0	83·21
	Variegated Sandstone few pebbles		30·08	273	3	83·29
	Red Sandstone	1	90·53	275	0	83·82
	Red Sandstone jointy	2	00·61	277	0	84·43
	Red and grey (or mottled) sand stone	5	01·52	282	0	85·95
9/6/43 284 ft 86·56	Red and grey (or mottled) sand stone	2	00·61	284	0	86·56
14/6/43	(294 ft. 4" dia. wrought iron tubes put into borehole. cores 2½" dia.)					
15/6/43 294 ft. 89·61	Red sandstone with pebbles	2	00·61	286	0	87·17
	Red sandstone with pebbles	8	02·44	294	0	89·61
16/6/43 9.30.a.m. 305 ft. 92·96	Soft red sandstone with pebbles	26	07·92	320	0	97·54
	Soft red sandstone with few pebbles	7	02·13	327	0	99·67
	Grey sandstone		60·15	327	6	99·82
	Red sandstone	8	62·59	336	0	102·41
	Red and grey sandstone	1	00·31	337	0	102·72
17/6/43 11.00.a.m. 340 ft. 103·63 W.L. 35 ft. 10·67	Red sandstone with few pebbles	3	00·91	340	0	103·63
	Red sandstone	10	03·05	350	0	106·68
	Red sandstone	5	01·52	355	0	108·20
	Grey sandstone		60·15	355	6	108·36
	Red sandstone with few pebbles	4	61·37	360	0	109·73
	Red sandstone with few pebbles	10	03·05	370	0	112·78
	Red sandstone with few pebbles	5	01·52	375	0	114·30
	Grey sandstone		30·08	375	3	114·38
	(Pebbles)(376 ft.)					
19/6/43	Soft red sandstone with few pebbles	4	91·45	380	0	115·82

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168304 : BGS Reference: SJ58NW20
British National Grid (27700) : 354291,388490

SJ 58 NW 64 115202

Section of No.1 Borehole, Horsfield's Estate.

(Contd.)

		Thickness. Ft.	ins.	Depth. Ft.	ins.
	Red sandstone	8	0	388	0\118·26
	Red sandstone	3	0	391	0\119·18
	Red and grey sandstone with few pebbles	1	6	392	6\119·63
	Red sandstone	2	6	395	0\120·40
	Red and grey sandstone	1	0	396	0\120·70
21/6/43 W.L.35'10·47	Red sandstone	7	0	403	0\122·83
22/6/43	Soft red sandstone with few pebbles.	14	0	417	0\127·10
	Soft red sandstone with large pebbles	13	0	430	0\131·06
	Soft red sandstone with band of marl.	2	0	432	0\131·67
	Soft red sandstone with pebbles	5	0	437	0\133·20
	Red and grey sandstone		3	437	3\133·27
	Red sandstone with pebbles	4	9	442	0\134·72
23/6/43 454 ft.	Red sandstone with pebbles	10	0	452	0\137·77
138·38	Red sandstone with pebbles	12	0	464	0\141·43
	Red sandstone with large pebbles	2	0	466	0\142·04
24/6/43 475 ft.	Red and grey sandstone	1	0	467	0\142·34
144·78	Soft red sandstone	6	0	473	0\144·17
	Red sandstone with pebbles	6	0	479	0\146·00
	Red and grey sandstone	1	0	480	0\146·30
	Red sandstone with thin bands red marl	6	0	486	0\148·13
25/6/43 490 ft.	Red sandstone	3	0	489	0\149·05
149·35	Soft red sandstone with pebbles	6	0	495	0\150·88
	Red sandstone	7	0	502	0\153·01
	Red sandstone (with 1 pebble)	3	0	505	0\153·92
	Red marl		6	505	6\154·08
30/6/43	Red sandstone with pebbles	4	6	510	0\155·45

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168305 : BGS Reference: SJ58NW21
British National Grid (27700) : 353611,388904

SJ 58 NW 21

115 NW 13.

Trial bore at BOLD HEATH, near St. Helens, Lancashire.

115NW 13.

6" map. Lancashire 115 NW.

No 2 Bore: Horsfield Estate. ~~Sutton Manor~~ Colliery Co. 260 yards due south of Bold Heath Farm.
Shown on 6" field slip. Lancashire 115NW.E.

1" map: 97. (Runcorn).
6" map: Lancashire 115NW.
Surface 77.15 ft. O.D. 28-52
Boring began 15. VII. 1943; completed 18. VIII. 1943.
Borers: Messrs J. Thom & Co. Patricroft. Manchester.
Journal from Mr. French. Manager Agent. Sutton Manor Collieries.

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168305 : BGS Reference: SJ58NW21
British National Grid (27700) : 353611,388904

SJ 58 NW 15 21 13

No.5 Borehole NW Horsfield Estate.

Commenced. 15th.July.1943.

	Section.	Thickness. Ft.	ins.	Metres	Depth. Ft.	ins.	Metres
DRIFT 16ft.	Soil	1	0	0·31	1	0	0·31
	Variegated sand with stones	1	0	0·31	2	0	0·61
	Brown sand	8	0	2·44	10	0	3·05
16/7/43 14'	Red loamy sand	5	0	1·52	15	0	4·57
	Red sand	1	0	0·31	16	0	4·88
	Soft red sandstone	10	0	3·05	26	0	7·92
	Red sandstone	10	0	3·05	36	0	10·97
26/7/43	Soft red sandstone with pebbles	15	0	4·57	51	0	15·54
	Soft red sandstone with pebbles	5	0	1·52	56	0	17·07
	Red and grey sandstone with pebbles	2	0	0·61	58	0	17·68
	Red sandstone with pebbles	1	0	0·53	59	0	18·21
	Red marl		0	0·08	59	0	18·29
	Red and grey sandstone	1	0	0·31	61	0	18·59
	Red sandstone with band of grey sand	4	0	1·22	65	0	19·81
Bunter (Pebble Beds) 323ft. 98·45	Red sandstone with pebbles	3	0	0·91	68	0	20·73
	Red and grey sandstone with pebbles	2	0	0·61	70	0	21·34
	Red sandstone with pebbles	3	0	0·91	73	0	22·25
	Red sandstone	5	0	1·52	78	0	23·77
	Red sandstone with large pebbles	11	0	3·51	89	0	27·28
27/7/43 92' 28·04	Grey sandstone		0	0·15	90	0	27·43
	Red sandstone with pebbles	4	0	1·22	94	0	28·65
	Red sandstone	1	0	0·31	95	0	28·96
	Red and grey sandstone	1	0	0·31	96	0	29·26
	Red sandstone with pebbles	3	0	0·91	99	0	30·18
	Red and grey sandstone with pebbles	6	0	1·83	105	0	32·00
	Red sandstone with pebbles	5	0	1·52	110	0	33·53
	Red sandstone with pebbles	10	0	3·05	120	0	36·58
	Red and grey sandstone with pebbles	4	0	1·22	124	0	37·80
	Red sandstone with pebbles	5	0	1·52	129	0	39·32
	Grey sandstone		0	0·05	129	0	39·37
	Red sandstone		0	0·25	130	0	39·62
	Red sandstone	3	0	0·91	133	0	40·54
	Red and grey sandstone		0	0·15	133	0	40·69

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168305 : BGS Reference: SJ58NW21
British National Grid (27700) : 353611,388904

No.2 Borehole (contd.)

SJ 58 NW 21 NW 13

Section

		Thickness Ft.	ins	Depth. Ft.	ins.	
	Soft red sandstone	3.20	10 6	144	0	43.89
	Soft red sandstone	0.31	1 0	145	0	44.20
	Red mottled sandstone	0.61	2 0	147	0	44.81
	Soft red sandstone	0.31	1 0	148	0	45.11
	Red and grey sandstone	0.15	6	148	6	45.26
29/7/43 152' 46.33	Red sandstone with pebbles	1.07	3 6	152	0	46.33
	Red sandstone with pebbles	2.44	8 0	160	0	48.77
	Soft red sandstone with pebbles	1.22	4 0	164	0	49.99
	Soft red sandstone	0.91	3 0	167	0	50.90
	Soft red sandstone with pebbles	0.91	3 0	170	0	51.82
	Soft red sandstone with pebbles	0.31	1 0	171	0	52.12
Bunter (Pebble Beds).	Red sandstone	0.61	2 0	173	0	52.73
	Red sandstone with pebbles	0.31	1 0	174	0	53.04
	Red sandstone ~~with pebbles~~	1.83	6 0	180	0	54.86
	Red marly sandstone	0.91	3 0	183	0	55.78
	Red marl	0.31	1 0	184	0	56.08
	Red sandy marl	1.22	4 0	188	0	57.30
	Red sandstone with pebbles	0.61	2 0	190	0	57.91
	Red sandstone with pebbles	0.46	1 6	191	6	58.37
31/7/43 194' 59.13	Red sandstone	2.13	7 0	198	6	60.50
	Red sandstone with pebbles	0.46	1 6	200	0	60.96
	Red sandstone with pebbles	3.96	13 0	213	0	64.92
	Red and grey sandstone with pebbles	0.61	2 0	215	0	65.53
	Red sandstone with pebbles	1.22	4 0	219	0	66.75
	Red sandstone	1.22	4 0	223	0	67.97
	Red sandstone with pebbles	0.31	1 0	224	0	68.28
	Soft red and grey sandstone	0.31	1 0	225	0	68.58
3/8/43.	Red sandstone	1.52	5 0	230	0	70.10
	Red and grey sandstone	0.31	1 0	231	0	70.41
	Red sandstone with pebbles	2.74	9 0	240	0	73.15
	Red sandstone with pebbles	1.83	6 0	246	0	74.98
	Red and grey sandstone	0.31	1 0	247	0	75.29
	Red sandstone with pebbles	3.05	10 0	257	0	78.33
	Red and grey sandstone	0.91	3 0	260	0	79.25
	Red sandstone	0.91	3 0	263	0	80.16
	Grey sandstone	0.15	6	263	6	80.31

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British Geological Survey

BGS ID: 168305 : BGS Reference: SJ58NW21
British National Grid (27700) : 353611,388904

No.2 Borehole (contd.)

SJ 58 NW 64 • 21 NW 13

	Section.	Thickness. Ft.	ins.	Depth. Ft.	ins.
	Red sandstone with pebbles	1·07 3	6	267	081·38
	Red and grey sandstone	0·31 1	0	268	081·69
5/8/43 272' 82·91	Red sandstone	2·74 9	0	277	084·43
	Yellow sandstone	0·46 1	6	278	684·89
	Red sandstone	1·22 4	0	282	686·11
	Variegated marly sandstone	0·15	6	283	086·26
Bunter (Pebble Beds)	Red sandstone with red marl	0·61 2	0	285	086·87
	Red and yellow sandstone	0·15	6	285	687·02
	Red sandstone with few pebbles	0·46 1	6	287	087·48
	Red sandstone with few pebbles	0·31 1	0	288	087·78
	Red and grey sandstone with marl	0·15	6	288	687·93
323 ft. 98·45	Red sandstone with few pebbles	1·52 5	0	293	689·46
	Yellow sandstone	0·15	6	294	089·61
6/8/43	Red sandstone with pebbles	0·91 3	0	297	090·53
	Red sandstone with few pebbles	2·44 8	0	305	092·96
	Variegated sandstone with pebbles	0·61 2	0	307	093·57
	Red sandstone with few small pebbles	1·52 5	0	312	095·10
	Red sandstone	2·44 8	0	320	097·54
9/8/43	Red sandstone with few small pebbles	0·61 2	0	322	098·15
	Variegated sandstone	0·91 3	0	325	099·06
	Red sandstone with odd pebbles	2·13 7	0	332	0101·19
	Soft red sandstone with marl	0·61 2	0	334	0101·80
	Soft red sandstone	1·22 4	0	338	0103·02
	Red sandstone with pebbles	0·31 1	0	339	0103·33
	Yellow sandstone	0·08	3	339	3103·40
10/8/43	Soft red sandstone	0·84 2	9	342	0104·24
11/8/43 348' 106·07	Soft red sandstone	3·05 10	0	352	0107·29
Bunter Lower Mottled Sandstone	Variegated sandstone	0·15	6	352	6107·44
	Soft red sandstone	1·07 3	6	356	0108·51
	Soft red sandstone	0·31 1	0	357	0108·81
35ft. + 10·67	Red and grey sandstone	0·31 1	0	358	0109·12
12/8/43	Soft red sandstone	1·83 6	0	364	0110·95
13/8/43	Soft red sandstone	3·05 10	0	374	0114·00

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British Geological Survey

BGS ID: 168307 : BGS Reference: SJ58NW23
British National Grid (27700) : 353036,388335

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RECORD OF SHAFT OR BORE FOR MINERALS 15.

SJ 68 NW 71

115NW. 15.
County Lancashire
6" Quarter Sheet 115NW
1" N.S. Geol. Map 97
1" O.S. Geol. Map —
Whether Confidential
—

Name and Number of Shaft or Bore given by Geological Survey: Trial Bore No. 4: Sutton Manor Colliery.

Name and Number given by owner (if different from above): Mill Green Farm, Farnworth

Town or Village FARNWORTH Date of sinking 1944

Exact site See site map Lancashire 115 NW. 200 yards east of Mill Green Farm

A sketch-map or tracing from a large-scale map is desirable.

Purpose for which made

Level at which bore commenced relative to O.D. c. 150 ft. If not down bore, state if horizontal or up —

Made by Messrs. J. Thom & Co. for Messrs. Sutton Manor Collieries

Information from Mr. J.H. French Agent Date received 18/July/44

Specimens Sutton Manor Collieries Dip of strata

Geological Classification	Description	Thickness			Depth		
Drift 13ft. 3ins.	Surface soil	-	-	9	-	-	9
	Stiff reddish marly clay	-	12	6	-	13	3
Bunter Pebble Beds 391ft. 9ins.	Soft red sandstone	-	29	9	-	43	0
	Red sandstone (no core)	-	-	9	-	43	9
	Red sandstone with quartzite pebbles throughout	-	151	9	-	195	6
	Red marl band	-	-	6	-	196	0
	Brownish sandstone	-	1	0	-	197	0
	Red sandstone with quartzite pebbles	-	17	0	-	214	0
	Red sandstone	-	8	0	-	222	0
	Red sandstone with very occasional quartzite pebbles	-	11	6	-	233	6
	Band of grey sandstone	-	-	9	-	234	3
	Red sandstone with occasional quartzite pebbles	-	10	3	-	244	6
	Red sandstone with abundant quartzite pebbles	-	5	6	-	250	0
	Red sandstone with very occasional quartzite pebbles	-	29	3	-	279	3
	Band of grey sandstone	-	-	9	-	280	0
	Red sandstone with very occasional pebbles	-	5	6	-	285	6
	Band of grey sandstone	-	-	6	-	286	0
	Softish red sandstone with very occasional quartzite pebbles	-	17	8	-	303	8
	Band of grey sandstone	-	-	4	-	304	0
	Red sandstone with slight trace of quartzite pebbles	-	6	0	-	310	0
	Red sandstone	-	13	6	-	323	6
	Band of grey sandstone	-	-	10	-	324	4
	Red sandstone	-	2	8	-	327	0
	Red sandstone with quartzite pebbles very occasional to 405ft.	-	78	0	-	405	0
Lower mottled Sandstone 19ft+	Soft red sandstone	-	19	0	-	424	0

Geological Survey and Museum, South Kensington, London, S.W.7.

G.S.M. Office File No.	Site marked on 6" Map by	Site marked on 1" Map by

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British Geological Survey

BGS ID: 168307 : BGS Reference: SJ58NW23
British National Grid (27700) : 353036,388335

SJ 58 NW 23 SJ 58 NW 15

Horsfield Estate. No 4 Borehole.

Surface soil	0·23		9		90·23
Marly clay (stiff)	3·81	12	6	13	34·04
Soft red sandstone	0·23		9	14	04·27
Soft red sandstone	3·05	10	0	24	07·32
Soft red sandstone	4·88	16	0	40	012·19
Soft red sandstone	0·91	3	0	43	013·11
Red sandstone (no core)	0·23		9	43	913·34
Red sandstone and pebbles	0·48	1	7	45	913·82
Red sandstone and pebbles	2·95	9	8	55	016·76
Red sandstone and pebbles	4·27	14	0	69	021·03
Red sandstone and pebbles	1·52	5	0	74	022·56
Red sandstone and pebbles	9·75	32	0	106	032·31
Red sandstone and pebbles	8·23	27	0	133	040·54
Red sandstone and pebbles	5·18	17	0	150	045·72
Red sandstone and pebbles	3·05	10	0	160	048·77
Red sandstone and pebbles	4·27	14	0	174	053·04
Red sandstone and pebbles	5·49	18	0	192	058·52
Red sandstone and pebbles	1·07	3	6	195	659·59
Marl	0·15		6	196	059·74
Brownish sandstone	0·31	1	0	197	060·05
Red sandstone and pebbles	1·52	5	0	202	061·57
Red sandstone and pebbles (no core)	1·52	5	0	207	063·09
Red sandstone with pebbles	2·13	7	0	214	065·23
Red sandstone	2·44	8	0	222	067·67
Red sandstone with traces of pebbles	3·51	11	6	233	671·17
Grey sandstone	0·23		9	234	371·40
Red sandstone with traces of pebbles	3·12	10	3	244	674·52
Red sandstone many pebbles	1·68	5	6	250	076·20
Red sandstone with a few pebbles	5·33	17	6	267	681·53
Red sandstone with few pebbles	0·76	2	6	270	082·30
Red sandstone slight trace of pebbles	2·82	9	3	279	385·12
Grey sandstone	0·23		9	280	085·34
Red sandstone slight trace of pebbles	1·68	5	6	285	687·02
Grey sandstone	0·23		6	286	087·17
Red sandstone shade softer and slight trace of pebbles	1·22	4	0	290	088·39
Red sandstone slight trace of pebbles	4·17	13	8	303	892·56
Grey sandstone	0·10		4	304	092·66
Red sandstone slight trace of pebbles	1·83	6	0	310	094·49
Red sandstone	4·11	13	6	323	698·60
Grey sandstone	0·25		10	324	498·86
Red sandstone	0·81	2	8	327	099·67
Red sandstone odd pebble	1·22	4	0	331	0100·89
Red sandstone	1·22	4	0	335	0102·11
Red sandstone	4·57	15	0	350	0106·68
Red sandstone	8·23	27	0	377	0114·91
Red sandstone	7·01	23	0	400	0121·92
Red sandstone	7·01	23	0	423	0128·93
Red sandstone	0·31	1	0	424	0129·24

Note:- Dr. R.C.B. Jones defined the base of Pebble Beds at 405.0
123·44

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British Geological Survey

BGS ID: 168308 : BGS Reference: SJ58NW24
British National Grid (27700) : 353666,387969

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RECORD OF SHAFT OR BORE FOR MINERALS

43 16.

115NW. 16.

County Lancashire.
6" Quarter Sheet 115NW
1" N.S. Geol. Map 97
1" O.S. Geol. Map –
Whether Confidential
–

Name and Number of Shaft or Bore given by Geological Survey: Trial Bore No 5 : Sutton Manor Colliery

Name and Number given by owner (if different from above): South Lane Farm, Barrows Green

Town or Village FARNWORTH Date of sinking 1944

Exact site See site map Lancashire 115NW Alongside pond to immediate west of South Lane Farm

A sketch-map or tracing from a large-scale map is desirable.

Purpose for which made –

Level at which bore commenced relative to O.D. c. (22.56) 174ft. If not down bore, state if horizontal or up –

Made by Messrs J. Thornley & Co. for Messrs. Sutton Manor Collieries

Information from Mr J.W. French, Agent Sutton Manor Collieries Cores examined by D.A. Wray Date received 18 July 1944

Specimens – Dip of strata –

Geological Classification	Description	Thickness Metres	Thickness		Depth Metres	Depth	
Drift 13ft.	Surface soil	0·31	1	0	0·31	1	0
	Hard clay and stones	1·75	5	9	2·06	6	9
	Sand and gravel	1·91	6	3	3·96	13	0
Bunter Pebble Beds 832ft.	Broken ground, mostly red sandstone	1·52	5	0	5·49	18	0
	Soft sandstone	1·83	6	0	7·32	24	0
	Rather harder red sandstone	3·25	10	8	10·57	34	8
	Red sandstone with odd quartzite pebbles	0·61	2	0	11·18	36	8
	Red sandstone with many grey bands and scattered quartzite pebbles	19·76	64	10	30·94	101	6
	Sandy marl and soft marly sandstone	7·92	26	0	38·86	127	6
	Red and grey sandstone with numerous flattened marl pellets	9·91	32	6	48·77	160	0
	Red sandstone with grey bands and occasional quartzite pebbles	34·14	112	0	82·91	272	0
	Red sandstone	5·49	18	0	88·39	290	0
	Red sandstone with occasional grey bands and scattered quartzite pebbles.	26·52	87	0	114·91	377	0
	Red sandstone crowded with quartzite pebbles.	0·91	3	0	115·82	380	0
	Red sandstone with grey bands and occasional quartzite pebbles scattered throughout	41·15	135	0	160·02	525	0
	Sandy chocolate coloured marl	0·31	1	0	160·32	526	0
	Red sandstone with grey bands and scattered quartzite pebbles	7·32	24	0	167·64	550	0
	Marly sandstone	0·15	–	6	167·79	550	6
	Red sandstone	0·61	2	0	168·40	552	6
	Red and grey sandstone	0·46	1	6	168·86	554	0
	Red sandstone full of quartzite pebbles	1·83	6	0	170·69	560	0
	Red sandstone with scattered quartzite pebbles	3·05	10	0	173·74	570	0
	Red sandstone full of quartzite pebbles	0·31	1	0	174·04	571	0

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G.S.M. Office File No.	Site marked on 6" Map by	Site marked on 1" Map by

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British Geological Survey

BGS ID: 168308 : BGS Reference: SJ58NW24
British National Grid (27700) : 353666,387969

GEOLOGICAL SURVEY AND MUSEUM. BOREHOLES AND SHAFTS.

SJ 58 NW 24 115 NW 16

Folio County

6 in. Map

Description.	THICKNESS. Feet.	THICKNESS. Inches.	DEPTH. Feet.	DEPTH. Inches.
Red sandstone with scattered quartzite pebbles	2·29 7	6	578	6176·33
Red and grey sandstone with marl pellets	0·31 1	0	579	6176·63
Red sandstone with grey bands and occasional marl pellets and quartzite pebbles.	5·64 18	6	598	0182·27
Red sandstone with abundant quartzite pebbles	4·27 14	0	612	0186·54
Red sandstone with grey bands and scattered quartzite pebbles.	10·52 34	6	646	6197·05
Red sandstone crowded with quartzite pebbles up to 4 inches across	0·76 2	6	649	0197·82
Red sandstone with occasional quartzite pebbles	2·29 7	6	656	6200·10
Red sandstone with grey bands and numerous rounded quartzite pebbles	4·42 14	6	671	0204·5
Red sandstone	1·83 6	0	677	0206·35
Grey sandstone	0·31 1	0	678	0206·65
Red sandstone with grey bands and occasional quartzite pebbles.	22·94 75	3	753	3229·59
Red sandstone crowded with quartzite pebbles and marl pellets	0·23	9	754	0229·82
Red and grey sandstone with very occasional quartzite pebbles	4·42 14	6	768	6234·24
Chocolate coloured marl band	0·08	3	768	9234·32
Red and grey sandstones with very occasional quartzite pebbles	10·13 33	3	802	0244·45
Red and grey sandstone	1·98 6	6	808	6246·43
Grey sandstone with red bands and very occasional quartzite pebbles	0·51 1	8	870	346·94 2
Red sandstone	1·17 3	10	814	0 248·11
Softish red sandstone. Core largely washed away	2·44 8	0	822	250·55 0
Red and grey sandstone with an occasional quartzite pebble	3·05 10	0	832	253·59 0
Hardish red and grey even grained sandstone	3·96 13	0	845	257·56 0
Red even grained softish rather incoherent sandstone with grey spottings throughout	6·71 22	0	867	264·26 0
Red softish sandstone (about 5ft. of core ground away)	3·51 11	6	878	267·77 6

Lower Mottled Sandstone 33 ft. 6 ins

Wt. 18119—0014 5000 9.27 Gp. 160 O.A.

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British Geological Survey

BGS ID: 168308 : BGS Reference: SJ58NW24
British National Grid (27700) : 353666,387969

SJ 5367 8797 SJ58/21

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RECORD OF SHAFT OR BORE FOR MINERALS 16.

115NW. 16.

County Lancashire.
6" Quarter Sheet 115NW
1" N.S. Geol. Map 97
1" O.S. Geol. Map -
Whether Confidential
-

Name and Number of Shaft or Bore given by Geological Survey: Trial Bore No 5 : Sutton Manor Colliery
Name and Number given by owner (if different from above): South Lane Farm, Barrows Green
Town or Village FARNWORTH Date of sinking 1944
Exact site See site map Lancashire 115NW Alongside pond to immediate west of South Lane Farm.

A sketch-map or tracing from a large-scale map is desirable.

Purpose for which made -
Level at which bore commenced: Iative to O.D. c. 74ft. If not down bore, state if horizontal or up -
Made by Messrs J. Thom & Co. for Messrs. Sutton Manor Collieries.
Information from Mr J.W. French, Agent Date received 18 July 1944
Specimens Sutton Manor Collieries Dip of strata -
Cores examined by D.A. Wray

Geological Classification	Description	Thickness			Depth		
Drift 13ft.	Surface soil	-	1	0	-	1	0
	Hard clay and stones	-	5	9	-	6	9
	Sand and gravel	-	6	3	-	13	0
	Broken ground, mostly red sandstone	-	5	0	-	18	0
	Soft sandstone	-	6	0	-	24	0
	Rather harder red sandstone	-	10	8	-	34	8
	Red sandstone with odd quartzite pebble	-	2	0	-	36	8
	Red sandstone with many grey bands and scattered quartzite pebbles	-	64	10	-	101	6
	Sandy marl and soft marly sandstone	-	26	0	-	127	6
	Red and grey sandstone with numerous flattened marl pellets	-	32	6	-	160	0
	Red sandstone with grey bands and occasional quartzite pebbles	-	112	0	-	272	0
	Red sandstone	-	18	0		290	0
Bunter Pebble Beds 832ft.	Red sandstone with occasional grey bands and scattered quartzite pebbles.	-	87	0	-	377	0
	Red sandstone rounded with quartzite pebbles	-	3	0	-	380	0
	Red sandstone with grey bands and occasional quartzite pebbles scattered throughout	-	135	0	-	525	0
	Sandy chocolate coloured marl	-	1	0	-	526	0
	Red sandstone with grey bands and scattered quartzite pebbles	-	24	0	-	550	0
	Marly sandstone	-	-	6	-	550	6
	Red sandstone	-	2	0	-	552	6
	Red and grey sandstone	-	1	6	-	554	0
	Red sandstone full of quartzite pebbles	-	6	0	-	560	0
	Red sandstone with scattered quartzite pebbles	-	10	0	-	570	0
	Red sandstone full of quartzite pebbles	-	1	0	-	571	0

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G.S.M. Office File No	Site marked on 6" Map by	Site marked on 1" Map by

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British Geological Survey

BGS ID: 168308 : BGS Reference: SJ58NW24
British National Grid (27700) : 353666,387969

SJ 58/21

GEOLOGICAL SURVEY AND MUSEUM. BOREHOLES AND SHAFTS.

No. 1 Folio County
6 in. Map

Description.	THICKNESS. Feet.	Inches.	DEPTH. Feet.	Inches.
Red sandstone with scattered quartzite pebbles	7	6	578	6
Red and grey sandstone with marl pellets	1	0	579	6
Red sandstone with grey bands and occasional marl pellets and quartzite pebbles.	18	6	597	0
Red sandstone with abundant quartzite pebbles	14	0	612	0
Red sandstone with grey bands and scattered quartzite pebbles.	34	6	646	6
Red sandstone crowded with quartzite pebbles up to 4 inches across	2	6	649	0
Red sandstone with occasional quartzite pebbles	7	6	656	6
Red sandstone with grey bands and numerous rounded quartzite pebbles	14	6	671	0
Red sandstone	6	0	677	0
Grey sandstone	1	0	678	0
Red sandstone with grey bands and occasional quartzite pebbles	75	3	753	3
Red sandstone crowded with quartzite pebbles and marl pellets	-	9	754	0
Red and grey sandstone with very occasional quartzite pebbles	14	6	768	6
Chocolate coloured marl	-	3	768	9
Red and grey sandstones with very occasional quartzite pebbles	33	3	802	0
Red and grey sandstone	6	6	808	6
Grey sandstone with red bands and very occasional quartzite pebbles	1	8	810	2
Red sandstone	3	10	814	0
Softish red sandstone. Core largely washed away	8	0	822	0
Red and grey sandstone with an occasional quartzite pebble	10	0	832	0
Hardish red and grey even grained sandstone	13	0	845	0
Red even grained softish rather incoherent sandstone with grey spottings throughout	22	0	867	0
Red softish sandstone (about 5ft. of core ground away)	11	6	878	6

Bunter Pebble Beds

Lower Mottled Sandstone 33 ft. 6 ins.

(B12297) Wt. 18119/4- 9014 5000 9 27 Gp. 160 O A.

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168312 : BGS Reference: SJ58NW28
British National Grid (27700) : 352706,388475

(No 7.) SJ 58 NW 174

RECORD OF ~~WELL~~ (SHAFT ~~or~~ BORE)

1" N.S. 97
1" O.S.
Grid Ref. 115NW 7.

At St. Helen's Corporation No 1 Borehole. Lancashire 115 NW

Town or Village Farnworth County Lancs. Six-inch quarter sheet 115 NW

Exact site 60 ~~ft~~ yds N.NE of Tee Lands, & 750 yds NNE of Farnworth Bold Station. in parish of

(A rough sketch-map or a tracing from a map is very desirable)

Level of ground surface above sea-level (O.D.) 130·77 ft. If well starts below ground surface, state how far Surface ft.

Shaft ft., diameter ft. Bore ft. Diameter of bore: at top 12 ins.; at bottom 10½ ins.

Details of permanent lining tubes (internal diameters preferred) 12" ~~6"~~

Water struck at depths of (feet) Not known

Rest-level of water below ~~above~~ ~~top of well~~ Surface 88 feet. Suction at feet. Yield on hours' days' test gallons per (with pump of capacity g.p.h.); depressing water level to feet below top. Time of recovery hrs. Amount normally pumped daily g.p.h. for hours.

Quality (attach copy of analysis if available)

Sunk by ~~1902~~ ? for ~~My~~ St Helens Corporation Date of well 1902

Information from Sutton Manor Colliery.

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).		THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.
	Top soil	0·46	1	6	1	6 0·46
	Loamy clay	4·72	15	6	17	05·18
	Soft Sandstone with pebbles	3·81	12	6	29	68·99
	Red sandstone	52·88	173	6	203	061·87

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.

For Survey use only

Date received	G.S.M. Office File No.	Site marked on 1" map (use symbol)

(7993) Wt.36064/0349 5,000 12/38 A.&E.W.Ltd. Gp.686

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British Geological Survey

BGS ID: 168312 : BGS Reference: SJ58NW28
British National Grid (27700) : 352706,388475

SJ 58/107

(No 7.) SJ 5271 8854

RECORD OF ~~WELL~~ ~~(SHAFT or~~ BORE)

1" N.S. 97
1" O.S.
Grid Ref. 115NW 7.

At St. Helen's Corporation No 1 Borehole. Lancashire 115NW

Town or Village Farnworth County Lancs. Six-inch quarter sheet 115NW

Exact site 60 yds N.NE of the Church, & 750 yds NNE of Farnworth Bold Station; in parish of ... (A rough sketch-map or a tracing from a map is very desirable)

Level of ground surface above sea-level (O.D.) 130 ft. If well starts below ground surface, state how far Surface ft.

Shaft ... ft., diameter ... ft. Bore ... ft. Diameter of bore: at top 12 ins.; at bottom 10¼ ins.

Details of permanent lining tubes (internal diameters preferred) 12" ~~steel~~

Water struck at depths of (feet) Not for Water

Rest-level of water below ~~above~~ ~~top of well~~ Surface 98 feet. Suction at ... feet. Yield on ... hours' ~~days'~~ test ... gallons per ... (with pump of capacity ... g.p.h.); depressing water level to ... feet below top. Time of recovery ... hrs. Amount normally pumped daily ... g.p.h. for ... hours.

Quality (attach copy of analysis if available)

Sunk by ~~Topp~~ ? for ~~W~~ St Helens Corporation Date of well 1902

Information from Sutton Manor Colliery

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.
	Top soil	1	6	1	6
	Loamy clay	15	6	17	0
	Soft Sandstone with pebbles	12	6	29	6
	Red sandstone	173	6	203	0

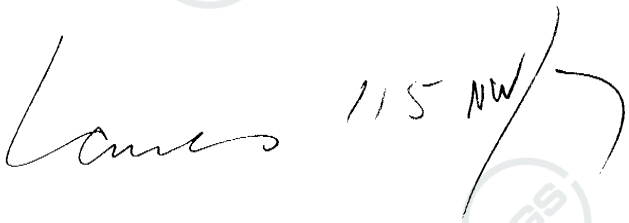
GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON S.W.7

For Survey use only

Date received	G.S.M. Office File No	Site marked on 1" map (use symbol)

(7993) Wt.36064/0349 5,000 12/38 A.&E.W.Ltd. Gp.686

Contact BGS: ngdc@bgs.ac.uk


115 NW

British Geological Survey

BGS ID: 168319 : BGS Reference: SJ58NW35
British National Grid (27700) : 352699,388444

(*11932) Wt.30370/0370 10,000 9/39 A.&E.W.Ltd. Gp.685

115 NW / 29 (3rd) 115 NW/29

RECORD OF SHAFT OR BORE FOR MINERALS

SJ 58 NW

County Lancs
6" Quarter Sheet 115 NW
1" N.S. Geol. Map 97
1" O.S. Geol. Map
Whether Confidential 35

Name and Number of Shaft or Bore given by Geological Survey:
N.C.B. NW.Division, No.3 St.Helens Area A3/4/8

Name and Number given by owner (if different from above):

Town or Village Date of sinking Aug 1949

Exact site

A sketch-map or tracing from a large-scale map is desirable.

Purpose for which made

Level at which bore commenced relative to O.D. 133 ft If not down bore, state if horizontal or up

Made by Craelius Ltd for Messrs. N.C.B.

Information from Examined by J.M. Trotter Date received

Specimens Dip of strata

Geological Classification	Description	Thickness			Depth		
	Soil	0·30	1	0	0·30	1	0
	Drift, Red brown boulder clay	10·06	33	0	10·36	34	0
	Coarse red sandstone with pebbles and pellets						
	Dip 1 in 5.5 @48'6". (14·78)	3·05	10	0	13·41	44	0
	Coarse red sandstone with pebbles	9·45	31	0	22·86	75	0
	Red sandstone	4·42	14	6	27·28	89	6
	Red sandstone with occasional pebbles	1·68	5	6	28·96	95	0
	Fine red and grey sandstone	1·07	3	6	30·02	98	6
	Coarse red rounded grained sandstone with occasional coarse and gritty layers	5·03	16	6	35·05	115	0
Base of pebble beds 122'-6". 132 ft.	Red sandstone with a rare quartz pebble.	2·29	7	6	37·34	122	6
	Dip 1 in 5½ @ 120'0" (36·58)						
	Coarse grained red sandstone	1·37	4	6	38·71	127	0
	Grey yellow sandstone	0·18		7	38·89	127	7
	Medium to coarse red sandstone	1·17	3	10	40·06	131	5
	Dip 1 in 9.3 @ 127'0" (38·71)						
	Grey yellow band of sandstone (a quartz pebble at 132'0" (40·23)	0·30	1	0	40·36	132	5"
	Coarse grained red sandstone	2·51	8	3	42·87	140	8
	Red marl	0·01	0	½	42·89	140	8½
	Brownish yellow sandstone	0·17		6½	43·05	141	3
	Coarse red sandstone with yellow spots	13·34	43	9	56·39	185	0
	Dip 1 in 2.5 @ 165'0" (50·29)						
	Coarse red sandstone	3·96	13	0	60·35	198	0
	Very coarse red sandstone (very soft)	3·66	12	0	64·01	210	0
	Red marly sandstone	1·52	5	0	65·53	215	0
	Coarse grained red sandstone	3·05	10	0	68·58	225	0
	Coarse grained red sandstone dominantly coarse	3·05	10	0	71·63	235	0
	Red marly sandstone	0·61	2	0	72·24	237	0
	Medium grained red sandstone	3·35	11	0	75·59	248	0
	Red sandy marl, gritty in places	1·52	5	0	77·11	253	0
	Red sandstone	0·76	2	6	77·88	255	6
	Red sandy marl	0·30	1	0	78·18	256	6
	Marly sandstone gritty in places	1·07	3	6	79·25	260	0
	Red sandy marl	0·61	2	0	79·86	262	0

Geological Survey and Museum,
South Kensington,
London, S.W.7.

G.S.M. Office File No.	Site marked on 6" Map by	Site marked on 1" Map by

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168319 : BGS Reference: SJ58NW35
British National Grid (27700) : 352699,388444

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Name and Number of Shaft or Bore given by Geological Survey: SJ 58 NW 205

County

6" Quarter Sheet 35

Geological Classification	Description	Thickness			Depth		
	Brt.forward				79·86	262	0
	Marly sandstone marly in places	4·88	16	0	84·73	278	0
	Sandy marl	0·76	2	6	85·50	280	6
	Marly sandstone	1·27	4	2	86·77	284	8
	Red sandy marl	1·52	5	0	88·29	289	8
	Very soft fine greyish grained sandstone	0·25		10	88·54	290	6
	Red and grey sandy marl	0·30	1	0	88·85	291	6
	Grey sandstone	0·30	1	0	89·15	292	6
	Soft red coarse grained sandstone	43·13	141	6	132·13	433	6
	Dip 1 in 7.3 @ 408'0" (124·36)						
	Medium grained red sandstone with occasional coarse bands	9·91	32	6	142·04	466	0
	Red coarse soft grained sandstone	16·15	53	0	158·19	519	0
	Dip 1 in 11						
	Red coarse gritty sandstone	0·61	2	0	158·80	521	0
Base of New Red sandstone 521'5"	Grey marly sandstone with pellets	0·13		5	158·93	521	5
	Greyish purple sandstone, haematized film at base	0·15		6	159·08	521	11
	Purple shale with greenish bands	0·63	2	1	159·72	524	0
	Purple mottled marl	1·22	4	0	160·93	528	0
	Purple grey flaggy sandstone	0·30	1	0	161·24	529	0
	Dip 1 in 5½						
	Purple marl	1·14	3	9	162·38	532	9
	Purple, red and green mottled marl	4·34	14	3	166·73	547	0
	Base of bore.						

Contact BGS: ngdc@bgs.ac.uk

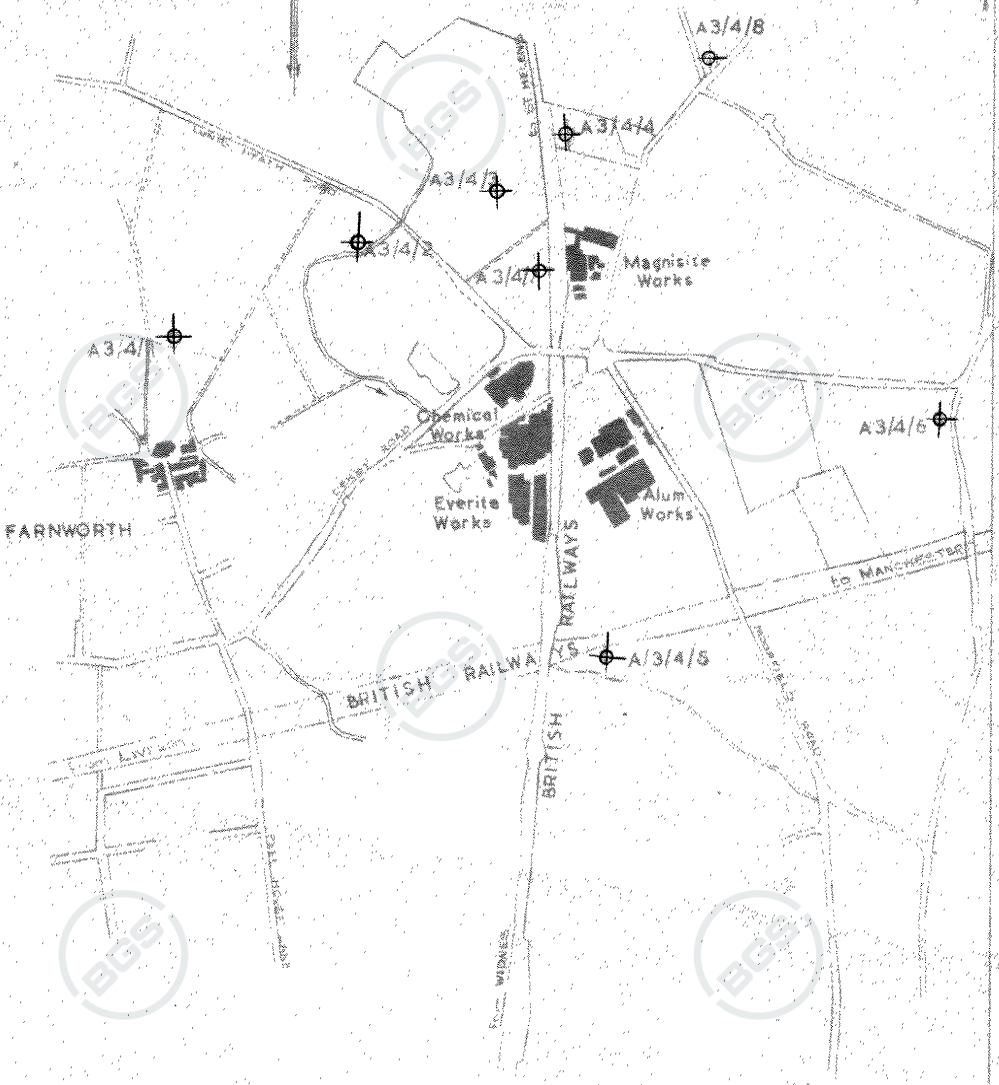
British Geological Survey

BGS ID: 168319 : BGS Reference: SJ58NW35
British National Grid (27700) : 352699,388444

SJ 58 NW 35

NATIONAL COAL BOARD
NORTH WESTERN DIVISION
NO. 3 (ST. HELENS) AREA
BOREHOLES A3/4 SERIES

115 NW/29



Scale :—1/10560

N. C. B.
A.P.O.
-4 OCT 1949
No. 3 (St. Helens) AREA

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British Geological Survey

BGS ID: 168319 : BGS Reference: SJ58NW35
British National Grid (27700) : 352699,388444

SJ58/12

(*11932) Wt.80370/0370 10,000 9/39 A.& E.W.Ltd. Gp.665 115 NW 1 21

115 NW/29

RECORD OF SHAFT OR BORE FOR MINERALS

SJ 5271 8850

Name and Number of Shaft or Bore given by Geological Survey:
N.C.B. N.W. Division, No.3 St.Helens Area 63/4/6

Name and Number given by owner (if different from above):

Town or Village ____ Date of sinking Aug 1949

Exact site ____

Purpose for which made ____

Level at which bore commenced relative to O.D. 133 ft If not down bore, state if horizontal or up ____

Made by Craelius Ltd for Messrs. N.C.B.

Information from Examined by J.M. Trotter Date received ____

Specimens ____ Dip of strata ____

County Lancs
6" Quarter Sheet 115 NW
1" N.S. Geol. Map 97
1" O.S. Geol. Map ____
Whether Confidential ____

A sketch-map or tracing from a large-scale map is desirable.

Geological Classification	Description	Thickness		Depth	
	Soil	1	0	1	0
	Drift, Red brown boulder clay	33	0	34	0
	Coarse red sandstone with pebbles and pellets Dip 1 in 5.5 @ 40'6".	10	0	44	0
	Coarse red sandstone with pebbles	31	0	75	0
	Red sandstone	14	6	89	6
	Red sandstone with occasional pebbles	5	6	95	0
	Fine red and grey sandstone	3	6	98	6
	Coarse red rounded grained sandstone with occasional coarse and gritty layers	16	6	115	0
Base of pebble beds 122' 6".	Red sandstone with a rare quartz pebble. Dip 1 in 5½ @ 120'0"	7	6	122	6
	Coarse grained red sandstone	4	6	127	0
	Grey yellow sandstone		7	127	7
	Medium to coarse red sandstone Dip 1 in 9.3 @ 127'0"	3	10	131	5
	Grey yellow band of sandstone (a quartz pebble at 132'0")	1	0	132'5"	
	Coarse grained red sandstone	8	3	140	8
	Red marl	0	6½	140	8½
	Brownish yellow sandstone			141	3
	Coarse red sandstone with yellow spots Dip 1 in 2.5 @ 165'0"	43	9	185	0
	Coarse red sandstone	13		198	0
	Very coarse red sandstone (very soft)	12	0	210	0
	Red marly sandstone	5	0	215	0
	Coarse grained red sandstone	10	0	225	0
	Coarse grained red sandstone dominantly coarse	10	0	235	0
	Red marly sandstone	2	0	237	0
	Medium grained red sandstone	11	0	248	0
	Red sandy marl, gritty in places	5	0	253	0
	Red sandstone	2	6	255	6
	Red sandy marl	1	0	256	6
	Marly sandstone gritty in places	3	6	260	0
	Red sandy marl	2	0	262	0

Geological Survey and Museum,
South Kensington,
London, S.W.7.

G.S.M. Office File No.	Site marked on 6" Map by	Site marked on 1" Map by

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168319 : BGS Reference: SJ58NW35
British National Grid (27700) : 352699,388444

SJ58 12.

(*11932) Wt.30370/0370 10,000 9/39 A.& E.W.Ltd. Gp.685

Name and Number of Shaft or Bore given by Geological Survey:

County Ches W. 1

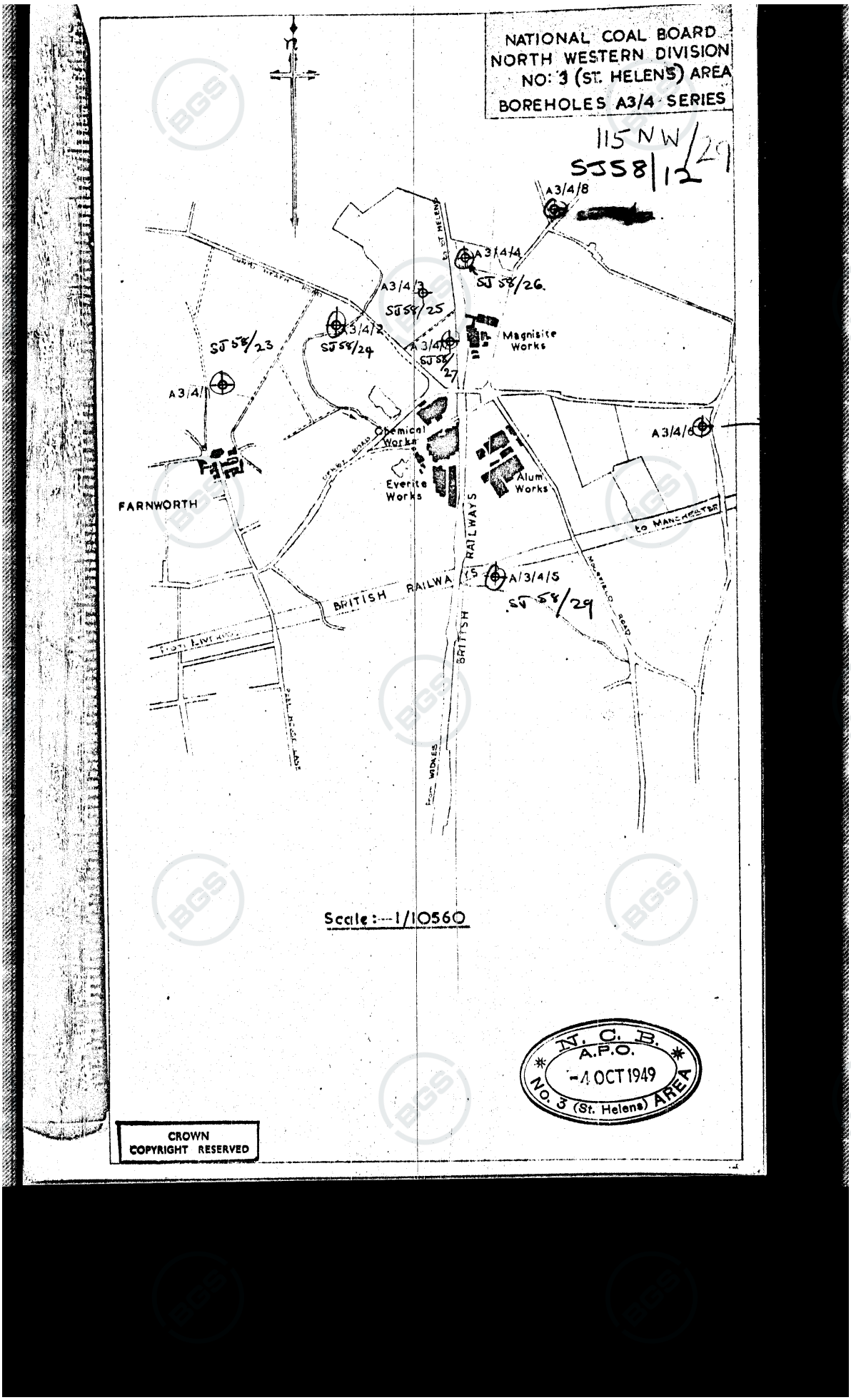
6" Quarter Sheet

Geological Classification	Description	Thickness		Depth	
	Brt.forward			262	0
	Marly sandstone marly in places	10	0	272	0
	Sandy marl	2	6	280	6
	Marly sandstone	4	2	284	8
	Red sandy marl	5	0	289	8
	Very soft fine greyish grained sandstone		10	290	6
	Red and grey sandy marl	1	0	291	6
	Grey sandstone	1	0	292	6
	Soft red coarse grained sandstone	141	6	433	6
	Dip 1 in 7.3 @ 40°0"				
	Medium grained red sandstone with occasional coarse bands	32	6	466	0
	Red coarse soft grained sandstone	53	0	519	0
	Dip 1 in 11				
	Red coarse gritty sandstone	2	0	521	0
Base of New Red Sandstone 521'5"	Grey marly sandstone with pellets		5	521	5
	Greyish purple sandstone, haematized film at base		6	521	11
	Purple shale with greenish bands	2	1	524	0
	Purple mottled marl	4	0	528	0
	Purple grey flaggy sandstone	1	0	529	0
	Dip 1 in 52				
	Purple marl	3	9	532	9
	Purple, red and green mottled marl	14	3	547	0
	Base of bore.				

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168319 : BGS Reference: SJ58NW35
British National Grid (27700) : 352699,388444



Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168323 : BGS Reference: SJ58NW39
British National Grid (27700) : 353127,389021

(*11932) Wt.80379/0370 10,000 9/[illegible] & E.W.Ltd. Gp.685

SJ 58 NW 39

Name and Number of Shaft or Bore given by Geological Survey: Final bore at BOLD HEATH, South of St Helens

231

County LANCASHIRE

6" Quarter Sheet 108SW

108SW 5.

Geological Classification	Description	Thickness			Depth		
	5532/3590 No. 3 Bore { Horsfield Estate. Sutton Manor Colliery bore.						
	280 yards S.S.W. of Bold Cross and Cross roads.						
	Site shown on 6" field slip; Lancashire 108SW.E.						
	1" map: 97 (Runcorn)						
	6" map: Lancashire 108SW						
	Surface 93.24 ft. O.D.						
	Cores examined by D.A. Wray 10/IX/1943						
	Boring commenced 31/VIII/1943						
	completed 10/IX/1943						
	Borers: Messrs J. Thom & Co. Patricroft, Manchester.						
Drift 15ft. 4-57	Soil	0·30	1	0	0·30	1	0
	Brown sand and clay	0·30	1	0	0·61	2	0
	Brown clay	2·44	8	0	3·05	10	0
	Brown clay with stones	0·91	3	0	3·96	13	0
	Red sand	0·61	2	0	4·57	15	0
Bunter (Pebble Beds)	Soft red sandstone	1·52	5	0	6·10	20	0
	Red sandstone	3·35	11	0	9·45	31	0
	Red and grey sandstone with a few quartzite pebbles	0·50	1	0	9·75	32	0
	Red sandstone with pebbles	0·91	3	0	10·67	35	0
	Red and yellow sandstone with a few pebbles	0·61	2	0	11·28	37	0
	Red sandstone with a few pebbles	1·52	5	0	12·80	42	0
	Strongly falsebedded red sandstone with a few pebbles	1·52	5	0	14·33	47	0
	Yellowish sandstone with red bands	0·30	1	0	14·63	48	0
	Red sandstone	1·52	5	0	16·15	53	0
	Red sandstone with a few pebbles of quartzite	0·30	1	0	16·46	54	0
	Red sandstone	0·91	3	0	17·37	57	0
	Soft red and yellow variegated sandstone with a few rounded pebbles of quartzite and pellets of marl	0·91	3	0	18·29	60	0
	Soft red sandstone	0·30	1	0	18·59	61	0
	Soft grey sandstone, rather coarse in grain	0·30	1	0	18·90	62	0
	Variegated red and yellow sandstone	0·61	2	0	19·51	64	0
	Soft red sandstone	0·61	2	0	20·12	66	0
	Variegated red and yellow sandstone	0·30	1	0	20·42	67	0
	Soft red sandstone	1·83	6	0	22·25	73	0

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 168323 : BGS Reference: SJ58NW39
British National Grid (27700) : 353127,389021

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Name and Number of Shaft or Bore given by Geological Survey: SJ 58 NW 5

County 39

6" Quarter Sheet

Geological Classification	Description	Thickness			Depth		
Bunter (Pebble Beds) 84ft.	Variegated red and yellow sandstone	0.61	2	0	22.86	75	0
	Soft red sandstone with rounded quartzite pebble	1.98	6	6	24.84	81	6
	Light yellow & greyish sandstone with micaceous layers	0.30	1	0	25.15	82	6
	Variegated red and yellow sandstone	0.30	1	0	25.45	83	6
	Red sandstone	0.46	1	6	25.91	85	0
	Variegated sandstone	0.30	1	0	26.21	86	0
	Deep chocolate coloured marl layer	0.08	-	3	26.29	86	3
	Red sandstone	0.30	1	0	26.59	87	3
	Thin bedded flaggy micaceous yellow sandstone	0.23	-	9	26.82	88	0
	Red sandstone	0.91	3	0	27.74	91	0
	Variegated red & yellow sandstone	0.30	1	0	28.04	92	0
	Red sandstone	0.91	3	0	28.96	95	0
	Yellow sandstone	0.15	-	6	29.12	95	6
	Red sandstone with rounded quartzite pebble. At base is a layer of rounded chocolate coloured marl pellets	1.07	3	6	30.18	99	0
Bunter (Lower Mottled Sandstone) 165ft+	Soft mottled red and yellow sandstone	0.91	3	0	31.09	102	0
	Alternating beds of red and yellow sandstone	0.91	3	0	32.00	105	0
	Lightish yellow grey sandstone, very fine grained	0.61	2	0	32.61	107	0
	Variegated red and yellow marl	0.08	-	3	32.69	107	3
	Falsebedded red sandstone with yellow mottling and bands	10.29	33	9	42.98	141	0
	Soft incoherent red sandstone, core washes away	2.13	7	0	45.11	148	0
	Deepish red falsebedded mottled sandstone	1.98	6	6	47.09	154	6
	Yellow and red mottled sandstone	0.76	2	6	47.85	157	0
	Soft red and yellow variegated sandstone	1.22	4	0	49.07	161	0
	Soft red sandstone	0.91	3	0	49.99	164	0

Contact BGS: ngdc@bgs.ac.uk

HyNet North West Hydrogen Pipeline

Delivering clean growth

Annex 14A 3
Antrobus and Lower Whitley Borehole Log

British Geological Survey

BGS ID: 763680 : BGS Reference: SJ67NE196
British National Grid (27700) : 367400,378010

SJ67NE 196

STRATA SURVEYS LIMITED

Job No.: **9062/A**

Location **Nether Tabley to Winnington Pipeline**

Client: **Kvaerner John Brown Ltd** Project Ref.: **6709**

Borehole No. **3**

Equipment and methods **Light Cable Percussion**

Start Date:	End Date:	Final Depth:	Casing Diameter	Casing Depth
16/05/97	16/05/97	6.15m		

FIELD RECORDS	Samples / Tests: Casing (Water) Depth (m)	Depth (m) from	Depth (m) to	SAMPLE Type & No	SPT (N) (Cu)	Description	Strata: Depth & Thickness m	Reduced Level (m)	Legend
		0.20		D 1		MADE GROUND (dark brown sandy topsoil with some gravel hardcore)	(0.30) 0.30		
		0.40		D 2		Stiff brown sandy CLAY with occasional fine to medium gravel.	(1.00)		
		1.00	1.45	U 3	{51}		1.30		
		1.50		D 4		Firm brown sandy CLAY with occasional fine to medium gravel.	(1.20)		
		2.00	2.45	U 5	{74}		2.50		
		2.50	2.95	D 6	(92)	Very dense brown slightly clayey fine to medium SAND and fine to coarse subrounded GRAVEL, gravel becoming more angular with depth.			
		2.50		S 7					
		3.00	3.50	B 8					
		3.50	3.85	S 9	(154)		(2.40)		
		4.30	4.45	S 10	(200)				
		4.70	5.15	S 11	(47)				
		4.90		W 14			4.90		
		5.00	5.70	B 12		Dense brown fine to medium SAND	(1.10)		
		5.70	6.15	S 13	(40)		6.00		
						Firm light brown fine to medium SAND **Borehole Completed**	(0.15) 6.15		

Remarks 1) Water struck at 5.00m rising to 4.90m after 5 minutes, no further rise after 20 minutes from initial strike.

Logged by **GHarwood** Drilled by **SSS**

Ground level

Co-ordinates:

Contact BGS: ngdc@bgs.ac.uk

HyNet North West Hydrogen Pipeline

Delivering clean growth

Annex 14A 4
Dunham Massey Borehole Logs

British Geological Survey

BGS ID: 765653 : BGS Reference: SJ78NW57
British National Grid (27700) : 371890,388450

Norwest Holst Soil Engineering Ltd.

Borehole No. **1A**

BOREHOLE LOG

7189 8845

Contract No. F5805
Location Warburton - Holford Pipeline
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm

Sheet 1 of 1
Chainage
Ground Level m.A.O.D.
Date 23/11/83-24/11/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL		0.25					
Medium dense pale brown medium SAND.					0.55	19	
					1.55	19	
		2.35					
Pale brown SAND with clay partings.		2.50			2.55	12	
Medium dense pale brown medium SAND.					3.55	21	
					4.55	10	
					5.55	10	
					6.55	12	
		7.60			7.55 (42)		
Firm brown laminated silty CLAY with occasional fine gravel.							
					9.05 (53)		
		9.50					

Type of Sample

- Is S.P.T.
- Ic. C.P.T.
- O Jar
- ● Bulk
- ■ Undisturbed
- × Vane
- Δ Water
- Piezometer

Remarks (Observations of Ground Water etc.) (42) U100 blows.

Water added from 2.00m.
Overnight standing level 1.30m.
Sealed by casing 8.50m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765654 : BGS Reference: SJ78NW58
British National Grid (27700) : 371890,388450

SJ 78 NW 58

Norwest Holst Soil Engineering Ltd.

BOREHOLE LOG

Borehole No. **1B**

Contract No. F5805
Location Warburton - Holford Pipeline 7189 8845
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm
Sheet 1 of 2
Chainage
Ground Level m.A.O.D.
Date 19/12/83-20/12/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Sandy TOPSOIL.		0.35					
Loose brown SAND.		0.90			0.55	4	
Firm brown silty sandy CLAY.		1.70			1.55 (41)		
Medium dense pale brown medium SAND.					2.55	13	
					3.55	19	
					4.55	13	
					5.55	11	
					6.55	11	
		7.50			7.55 (40)		
Firm brown laminated silty CLAY.					8.55 (56)		
		9.00					
Firm brown laminated silty CLAY with occasional fine gravel.							

Type of Sample

Is S.P.T. ■ Undisturbed
Ic. C.P.T. × Vane
O Jar Δ Water
● Bulk ▣ Piezometer

Remarks (Observations of Ground Water etc.) (40) U100 blows.

Water struck at 0.85m.
Overnight standing level 0.75m.
Final standing level 0.75m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765654 : BGS Reference: SJ78NW58
British National Grid (27700) : 371890,388450

Norwest Holst Soil Engineering Ltd.

Borehole No. 1B

BOREHOLE LOG

Contract No. F5805
Location Warburton - Holford Pipeline
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm

Sheet 2 of 2
Chainage
Ground Level m.A.O.D.
Date 19/12/83 - 20/12/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Firm brown laminated silty CLAY with occasional fine gravel.		15.50			10.55 (61) 12.05 (63) 13.55 (70) 15.05 (69)		

Type of Sample

- Is S.P.T.
- Ic. C.P.T.
- O Jar
- ● Bulk
- ■ Undisturbed
- × Vane
- Δ Water
- Piezometer

Remarks (Observations of Ground Water etc.) (61) U100 blows.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765655 : BGS Reference: SJ78NW59
British National Grid (27700) : 371940,388440

SJ 78 NW 57

Norwest Holst Soil Engineering Ltd.

Borehole No. **1C**

7194 8844

BOREHOLE LOG

Contract No. F5805
Location Warburton - Holford Pipeline
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm

Sheet 1 of 2
Chainage
Ground Level m.A.O.D.
Date 20/12/83 - 21/12/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL		0.25					
Medium dense brown medium SAND with occasional gravel.		1.75			0.55	13	
					1.55	15	
Firm to stiff brown silty CLAY with occasional gravel and some laminated zones.					2.55 (41)		
					4.05 (38)		
					5.55 (40)		
					7.05 (42)		
					8.55 (46)		

Type of Sample

Is	S.P.T.	■	Undisturbed
Ic.	C.P.T.	×	Vane
O	Jar	Δ	Water
●	Bulk		Piezometer

Remarks (Observations of Ground Water etc.) (41) U100 blows.
Slight seepage at 1.80m.
Sealed by casing at 2.00m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765655 : BGS Reference: SJ78NW59
British National Grid (27700) : 371940,388440

SJ 78NW 59

Norwest Holst Soil Engineering Ltd.

Borehole No. 1C

BOREHOLE LOG

Contract No. F5805
Location Warburton - Holford Pipeline
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm

Sheet 2 of 2
Chainage
Ground Level m.A.O.D.
Date 20/12/83-21/12/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Firm to stiff brown silty CLAY with occasional gravel and some laminated zones.		10.05 (47)					
		11.55 (48)					
		13.05 (53)					
		14.55 (61)					
		15.00					

Type of Sample

Is S.P.T. ■ Undisturbed
Ic. C.P.T. × Vane
O Jar △ Water
● Bulk ▮ Piezometer

Remarks (Observations of Ground Water etc.)

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765656 : BGS Reference: SJ78NW60
British National Grid (27700) : 371950,388460

SJ 18NW 60

Norwest Holst Soil Engineering Ltd.

Borehole No. **1D**

BOREHOLE LOG

7195 8846

Contract No. F5805
Location. Warburton - Holford Pipeline
Client. North West Gas
Method of Boring. Percussion
Diameter of Borehole. 150mm

Sheet 1 of 2
Chainage.
Ground Level. m.A.O.D.
Date. 3/1/84 - 4/1/84

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Medium dense brown medium SAND.					0.55	13	
					1.55	13	
					2.55	12	
		3.30					
Firm brown silty CLAY with sand pockets.					3.55 (26)		
					5.05 (27)		
		6.60			6.55 (12)		
Medium dense brown clayey SAND.		7.00					
Medium dense pale brown medium SAND.					7.55	16	
					8.55	14	
					9.55	13	

Type of Sample

Is	S.P.T.	■	Undisturbed
Ic.	C.P.T.	×	Vane
O	Jar	Δ	Water
●	Bulk		Piezometer

Remarks (Observations of Ground Water etc.) (26) U100 blows.

Water struck at 6.60m.
Level rose after 20mins to 5.70m.
Standing level 2.10m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765656 : BGS Reference: SJ78NW60
British National Grid (27700) : 371950,388460

Norwest Holst Soil Engineering Ltd.

Borehole No. **1D**

BOREHOLE LOG

Contract No. F5805
Location Warburton - Holford Pipeline
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm

Sheet 2 of 2
Chainage
Ground Level m.A.O.D.
Date 3/1/84 - 4/1/84

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Medium dense pale brown medium SAND.					10.55	15	
					11.55	46	
					12.55	52	
		13.15					
Brown clayey SAND with bands of brown stony clay.		13.45			13.55	55	
Medium dense pale brown medium SAND.					14.55	60	
		15.00					

Type of Sample

- Is S.P.T.
- Ic. C.P.T.
- O Jar
- ● Bulk
- ■ Undisturbed
- × Vane
- △ Water
- Piezometer

Remarks (Observations of Ground Water etc.)

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765657 : BGS Reference: SJ78NW61
British National Grid (27700) : 371900,388430

SJ 78 NW 61

Norwest Holst Soil Engineering Ltd.

Borehole No. **2**

BOREHOLE LOG

7190 8843

Contract No. F5805
Location Warburton - Holford Pipeline
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm

Sheet 1 of 1
Chainage
Ground Level m.A.O.D.
Date 24/11/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL		0.25					
Loose pale brown SAND.		0.80			0.55	7	
Soft to firm brown laminated silty CLAY.					1.55 (28) 2.55 (23) 4.05 (27) 5.55 (29) 7.05 (31)		
		8.50			8.55 (45)		
Firm brown silty CLAY with occasional fine gravel.		9.00					

Type of Sample

Is S.P.T. ■ Undisturbed
Ic. C.P.T. × Vane
O Jar Δ Water
● Bulk ▣ Piezometer

Remarks (Observations of Ground Water etc.)

(28) U100 blows.

Borehole dry.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765658 : BGS Reference: SJ78NW62
EPSG: 27700 : 371740,387950

SJ 78 NW 62

Norwest Holst Soil Engineering Ltd.

BOREHOLE LOG

Borehole No. 3

7174 8795

Contract No. F5805
Location. Warburton - Holford Pipeline
Client. North West Gas
Method of Boring. Percussion
Diameter of Borehole. 150mm

Sheet 1 of 2
Chainage.
Ground Level..... m.A.O.D.
Date. 24/11/83-25/11/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Sandy TOPSOIL.		0.30					
Firm brown very sandy CLAY with sand pockets.		3.00			0.55 (28) 1.55 (18) 2.55 (19)		
Loose pale brown medium SAND with occasional gravel.		6.90			3.05 4.05 5.05 6.05	3 3 3 4	
Soft brown very silty CLAY.		8.55			7.05 (14)		
Firm brown laminated silty CLAY.					8.55 (34)		

Type of Sample

Is	S.P.T.	■	Undisturbed
Ic.	C.P.T.	×	Vane
O	Jar	Δ	Water
●	Bulk		Piezometer

Remarks (Observations of Ground Water etc.)

(14) U100 blows.
Borehole at 3.00m overnight seepage to 2.80m.
Sealed by casing at 9.00m.
Final standing level 2.30m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765658 : BGS Reference: SJ78NW62
EPSG: 27700 : 371740,387950

SJ 78NW 62

Norwest Holst Soil Engineering Ltd.

Borehole No. 3

BOREHOLE LOG

Contract No. F5805
Location Warburton - Holford Pipeline
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm

Sheet 2 of 2
Chainage
Ground Level m.A.O.D.
Date 24/11/83-25/11/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Firm brown laminated silty CLAY.		12.00			10.05 (38) 11.55 (41)		

Type of Sample

- Is S.P.T. ■ Undisturbed
- Ic. C.P.T. × Vane
- O Jar △ Water
- ● Bulk ▮ Piezometer

Remarks (Observations of Ground Water etc.) (41) U100 blows.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765659 : BGS Reference: SJ78NW63
EPSG: 27700 : 371730,387910

SJ 78NW 63

Norwest Holst Soil Engineering Ltd.

Borehole No. 5

7173 8791

BOREHOLE LOG

Contract No. F5805
Location Warburton - Holford Pipeline
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm

Sheet 1 of 2
Chainage
Ground Level m.A.O.D.
Date 25/11/83-28/11/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL		0.30					
Loose brown SAND.		1.05			0.55	3	
Soft brown silty sandy CLAY.		1.90			1.55 (19)		
Soft grey very sandy CLAY.		2.30					
Soft brown fibrous PEAT.		3.50			2.55 (12)		
Soft grey very sandy CLAY with sand partings.		4.90			3.55	3	
					4.55 (12)		
Brown SAND.		5.75					
Firm to stiff brown silty CLAY.					6.05 (32)		
					7.55 (29)		
					9.05 (34)		

Type of Sample

Is	S.P.T.	■	Undisturbed
Ic.	C.P.T.	×	Vane
O	Jar	Δ	Water
●	Bulk		Piezometer

Remarks (Observations of Ground Water etc.) (19) U100 blows.

Water struck at 3.40m.
Level rose after 20mins to 2.90m.
Final standing level 0.85m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765659 : BGS Reference: SJ78NW63
EPSG: 27700 : 371730,387910

SJ 78 NW 63

Norwest Holst Soil Engineering Ltd.

Borehole No. 5

BOREHOLE LOG

Contract No. F5805
Location Warburton - Holford Pipeline
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm

Sheet 2 of 2
Chainage
Ground Level m.A.O.D.
Date 25/11/83-28/11/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Firm to stiff brown silty CLAY.		12.00			10.30 (55) 11.55 (61)		

Type of Sample

S.P.T.		Undisturbed	
C.P.T.		Vane	
Jar		Water	
Bulk		Piezometer	

Remarks (Observations of Ground Water etc.) (55) U100 blows.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765660 : BGS Reference: SJ78NW64
EPSG: 27700 : 371680,387170

SJ 78 NW 64

Norwest Holst Soil Engineering Ltd.

Borehole No. 6

7168 8717

BOREHOLE LOG

Contract No. F5805
Location. Warburton - Holford Pipeline
Client. North West Gas
Method of Boring. Percussion
Diameter of Borehole. 200mm

Sheet 1 of 1
Chainage.
Ground Level. m.A.O.D.
Date. 9/2/84

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL		0.40					
Grey/brown clayey organic SAND.		1.50			0.60 (12)		
Loose brown SAND.		4.00			1.40 (49) 2.00 3.50	7 10	
Brown sandy CLAY with sand pockets.		5.00			4.20 (24)		
Firm brown laminated silty CLAY.		8.00			5.00 (86) 6.10 (72) 7.50 (89)		

Type of Sample

- S.P.T. / Undisturbed
- C.P.T. / Vane
- Jar / Water
- Bulk / Piezometer

Remarks (Observations of Ground Water etc.) (12) - U100 blows.
Water struck at 1.50m.
Level rose after 20mins to 0.90m.
Morning standing level 0.75m.

Water [illegible] are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765661 : BGS Reference: SJ78NW65
EPSG: 27700 : 371660,386810

SJ 78 NW 65

Norwest Holst Soil Engineering Ltd.

Borehole No. 7

7166 8681

BOREHOLE LOG

Contract No. F5805
Location Warburton - Holford Pipeline
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm

Sheet 1 of 1
Chainage
Ground Level m.A.O.D.
Date 28/11/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL		0.35					
Firm brown very sandy CLAY.		0.80			0.55 (31)		
Medium dense brown medium SAND.		3.30			1.55 2.55	20 14	
Stiff brown slightly laminated silty CLAY.		5.50			3.55 (61) 5.05 (63)		

Type of Sample

Is	S.P.T.	■	Undisturbed
Ic.	C.P.T.	×	Vane
O	Jar	Δ	Water
●	Bulk		Piezometer

Remarks (Observations of Ground Water etc.) (61) U100 blows.

Water struck at 1.50m.
Standing level 2.40m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765662 : BGS Reference: SJ78NW66
EPSG: 27700 : 371710,386650

SJ 78NW 66

Norwest Holst Soil Engineering Ltd.

7171 8665

Borehole No. 8

BOREHOLE LOG

Contract No. F5805
Location. Warburton - Holford Pipeline
Client. North West Gas
Method of Boring. Percussion
Diameter of Borehole. 150mm

Sheet. 1 of 1
Chainage.
Ground Level. m.A.O.D.
Date. 29/11/83

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL		0.30					
Medium dense dark brown SAND.		1.20			0.55	15	
Medium dense pale brown medium SAND.		3.40			1.55 2.55	21 13	
Soft to firm brown very silty occasionally laminated CLAY.		7.80			3.55 (58) 5.05 (56) 6.55 (55)		
Firm to stiff brown silty laminated CLAY with sand and silt partings.		10.00			8.05 (48) 9.55 (41)		

Type of Sample

Is	S.P.T.	■	Undisturbed
Ic.	C.P.T.	×	Vane
O	Jar	Δ	Water
●	Bulk		Piezometer

Remarks (Observations of Ground Water etc.)

(58) U100 blows.
Water seepage from 1.50m.
Water added from 2.00m.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765663 : BGS Reference: SJ78NW67
EPSG: 27700 : 371710,386600

SJ 78NW 67

Norwest Holst Soil Engineering Ltd.

Borehole No. 9

7171 8660

BOREHOLE LOG

Contract No. F5805
Location. Warburton-Holford Pipeline
Client North West Gas
Method of Boring Percussion
Diameter of Borehole 150mm

Sheet 1 of 1
Chainage
Ground Level m.A.O.D.
Date 5/12/83

Description of Strata	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL	0.25					
Brown medium SAND	0.70			0.55	18	
Medium dense dark brown medium SAND	1.60			1.55	29	
Medium dense pale brown fine to medium SAND	3.55			2.55	24	
Firm to stiff brown silty, occasionally laminated, CLAY with occasional gravel	8.40			3.60 (28) 5.05 (26) 6.55 (30) 8.05 (29)		
Medium dense brown silty SAND with bands of brown silty clay	10.00			9.55	18	

Type of Sample

Is	S.P.T.	■	Undisturbed
Ic.	C.P.T.	×	Vane
O	Jar	Δ	Water
●	Bulk		Piezometer

Remarks (Observations of Ground Water etc.) (28) - U100 blows

Water struck at 2.00m
Level rose after 20 mins to 1.50m
Sealed by casing at 4.50m
Water struck at 8.00m
Level rose after 20 mins to 4.30m
Final standing level 1.50m

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765678 : BGS Reference: SJ78NW82
British National Grid (27700) : 372035,387815

Norwest Holst Soil Engineering Ltd.

Borehole No. 86

BOREHOLE LOG

Contract No. F9349
Location Warburton to Audley Pipeline
Client British Gas plc
Method of Boring Cable Percussion
Diameter of Borehole 150mm

SJ78NW/82

Sheet 1 of 1
Co-ords 72035E 87815N
Ground Level 14.80 m.A.O.D.
Date 31/10/91 - 01/11/91

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
TOPSOIL.		0.25	14.55				
Loose reddish brown very clayey very silty fine SAND.		1.20	13.60		0.50-0.95 s 1.20	"8"	
Soft to firm reddish brown very silty very fine sandy CLAY.		1.80	13.00		1.50-1.95 (10)		
Very loose reddish brown very silty fine SAND with clay bands.		2.80	12.00		2.20 2.30-2.50 2.50-2.95	"1"	
Very loose becoming loose greyish brown thinly interbedded very silty medium SAND with occasional gravel and fine sandy SILT. Locally very clayey.		5.70	9.10		s 3.00-3.50 3.50-3.95 s 4.00-4.50 4.50-4.95 s 5.00-5.80	"2" "6"	31/10 1/11
Medium dense brown medium SAND and coarse subrounded GRAVEL with occasional cobbles.		8.00	6.80		6.00-6.45 s 6.80-7.30 7.50-7.95 s	"15" "14"	
Firm reddish brown slightly silty CLAY with occasional fine rounded gravel and thin laminations of sand. Borehole complete at 9.30m.		9.30	5.50		8.10 8.50-8.95 (60) 9.30		

Type of Sample

Is	S.P.T.	■	Undisturbed
Ic	C.P.T.	x	Vane
0	Jar	△	Water
●	Bulk	▮	Piezometer

Remarks (Observations of Ground Water etc.) ( ) U100 blows

31/10/91: Water struck at 3.30m, casing to 3.30m, rising to 2.90m after 20 minutes standing.
01/11/91: 8.30am Standing water level 1.90m, casing to 4.50m.
: Water sealed at 8.30m.
: Final standing water level 1.90m (11.30am)

Contact BGS: ngdc@bgs.ac.uk

IAN FARMER ASSOCIATES	Plant used: Dando 2000	Project: HyNet North West - Hydrogen Pipeline	Location ID: **BH106**
	Dates: 29/09/2022	Client: Cadent	Sheet 1 of 2
Cable Percussion Borehole Log	Location: 372281.03E 388603.95N	Ground level: 23.43mOD / Logged by: TB / Vertical scale: 1:50	Project ID: 2230746

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
0.00 - 0.60	B1				MADE GROUND: Dark brown, slightly gravelly, silty, organic, fine to coarse SAND. Gravel is subangular to subrounded, fine to coarse including sandstone, siltstone, mudstone, slate and glass fragments.			
0.20	ES2			(0.60)				
0.60 - 1.00	B3		22.83	0.60	MADE GROUND			
0.70	ES4			(0.40)	Light brown, silty, fine to coarse SAND. SHIRDLEY HILL SAND FORMATION			
1.00 - 1.20	B5		22.43	1.00				
1.10	ES6			(0.30)	Firm, brown, locally mottled light grey, slightly sandy CLAY. ALLUVIUM			
1.20		SPT(S) N=11 (2,2/2,3,3,3)	22.13	1.30				
1.20 - 1.65	D7				Medium dense, brown, slightly clayey, very silty, fine and medium SAND. ALLUVIUM			
1.30 - 1.80	B8							
2.20		SPT(S) N=10 (2,1/2,3,2,3)						
2.20 - 2.65	D10							
2.20 - 2.70	B9							
3.00		SPT(S) N=11 (2,2/3,3,2,3)			*Between 3.00m and 5.00m: with occasional bands and lenses of clay.*			
3.00 - 3.45	D12							
3.00 - 3.50	B11							
4.20		SPT(S) N=15 (2,3/3,4,4,4)		(5.70)				
4.20 - 4.65	D14							
4.20 - 4.70	B13							
5.20		SPT(S) N=5 (1,1/2,1,1,1)			*Below 5.20m: loose.*			
5.20 - 5.65	D16							
5.20 - 5.70	B15							
6.70		SPT(S) N=4 (1,1/0,1,1,2)						
6.70 - 7.15	D17							
7.00 - 7.50	B18		16.43	7.00	Firm, thinly to thickly laminated, brown silty CLAY. ALLUVIUM			
8.00 - 8.45	UT19	30 blows. 90% recovery			*At 8.00m: medium strength.*			
8.50	D20			(3.10)				
9.00		SPT(S) N=11 (2,2/2,3,3,3)						
9.50 - 9.95	D21							
					Continued next sheet			

Chiselling			
From (m)	To (m)	Time (mins)	Remarks

Borehole Diameter	
Depth (m)	Dia (mm)
11.00	121

Boring Progress				
Date	Time	Depth (m)	Cased (m)	Water (m)
29/09	16:03	11.00	11.00	9.00

Remarks:
Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: AR2371 Energy Ratio: 62%

Casing Diameter	
Depth (m)	Dia (mm)
11.00	150

Water Strikes					
Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Monitoring Installations			
Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	MHW	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used: Dando 2000	Project: HyNet North West - Hydrogen Pipeline	Location ID: **BH106**	
Dates: 29/09/2022	Client: Cadent	Sheet 2 of 2	
Cable Percussion Borehole Log	Location: 372281.03E 388603.95N	Ground level: 23.43mOD	Logged by: TB	Vertical scale: 1:50	Project ID: 2230746

Samples & In Situ Testing			Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend		Water Strike	Backfill/ Installation
			13.33	10.10	Firm, thinly to thickly laminated, brown silty CLAY. ALLUVIUM				
				(0.90)	Brown, silty, fine and medium SAND. ALLUVIUM				
			12.43	11.00	End of Borehole at 11.00m		11		
							12		
							13		
							14		
							15		
							16		
							17		
							18		
							19		
							20		

Chiselling				Borehole Diameter		Boring Progress					Remarks:
From (m)	To (m)	Time (mins)	Remarks	Depth (m)	Dia (mm)	Date	Time	Depth (m)	Cased (m)	Water (m)	SPT Hammer: AR2371 Energy Ratio: 62%

Casing Diameter		Water Strikes						Monitoring Installations			
Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)

Checked by:	MHW	IFA CP v01.01
Log status:	FINAL	

IAN FARMER ASSOCIATES

Plant used:	Project:	Location ID:
Dando 2000	HyNet North West - Hydrogen Pipeline	**BH114**
Dates:	Client:	Sheet 1 of 1
29/09/2022	Cadent	

Cable Percussion Borehole Log	Location:	Ground level:	Logged by:	Vertical scale:	Project ID:
	372153.01E 388551.97N	25.20mOD	FH	1:50	2230746

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation
0.00 - 0.40	B1				Dark greyish brown, very silty, fine SAND with rare gravel. Gravel is subrounded to rounded, fine and medium including sandstone. TOPSOIL			
0.20	D2			(0.40)				
			24.80	0.40	Brownish orange, slightly silty, fine SAND. SHIRDLEY HILL SAND FORMATION			
0.50	ES3							
0.50 - 1.00	B4							
0.60	D5							
1.00	ES6				*At 1.20m: medium dense.*			
1.50		SPT(S) N=11 (2,1/4,3,2,2)						
1.50 - 1.95	D7			(2.60)				
1.80 - 2.20	B8							
2.00		SPT(S) N=8 (2,2/2,2,2,2)			*Below 2.00m: loose.*			
2.00	ES9							
2.00 - 2.45	D10							
3.00		SPT(S) N=7 (1,3/2,2,1,2)	22.20	3.00	Loose, brown, very silty, fine SAND. ALLUVIUM			
3.00 - 3.45	D11			(0.50)				
			21.70	3.50	Firm, brown, silty CLAY with frequent bands of brown, fine sand. ALLUVIUM			
3.80	D12							
4.00		SPT(S) N=8 (2,2/2,2,2,2)						
4.00 - 4.45	D14							
4.00 - 4.50	B13							
4.80	D15							
5.00	U	82 blows. No recovery						
5.00 - 5.50	B16							
5.80	D17							
6.00		SPT(S) N=16 (2,3/3,4,4,5)						
6.00 - 6.45	D18							
6.80	D19			(6.50)				
7.00	U	49 blows. No recovery						
7.00 - 7.50	B20							
7.80	D21							
8.20		SPT(S) N=16 (2,3/3,4,4,5)						
8.20 - 8.65	D22							
8.80	D23							
9.50		SPT(S) N=17 (2,4/4,4,4,5)						
9.50	D24							
			15.20	10.00	End of Borehole at 10.00m			

Chiselling			
From (m)	To (m)	Time (mins)	Remarks

Borehole Diameter	
Depth (m)	Dia (mm)
10.00	150

Boring Progress				
Date	Time	Depth (m)	Cased (m)	Water (m)
29/09	14:00	10.00	9.50	

Remarks:
Service inspection pit hand excavated from GL to 1.20m.

SPT Hammer: LSI2 Energy Ratio: 62%

Casing Diameter	
Depth (m)	Dia (mm)
9.50	150

Water Strikes					
Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
2.50	1.50	2.60	20	2.10	

Monitoring Installations			
Top (m)	Base (m)	Pipe Type	Dia (mm)
0.00	1.00	Plain	50
1.00	3.50	Slotted	50

Checked by:	MHW	IFA CP v01.01
Log status:	FINAL	

HyNet North West Hydrogen Pipeline

Delivering clean growth

Annex 14A 5
Partington Borehole Logs

British Geological Survey

BGS ID: 802667 : BGS Reference: SJ79SW1
British National Grid (27700) : 374365,390042

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RECORD OF SHAFT OR BORE FOR MINERALS

SJ79SW/1

County Cheshire

6" Quarter Sheet 79SW/1

1" N.S. Geol. Map

1" O.S. Geol. Map

Whether Confidential

Name and Number of Shaft or Bore given by Geological Survey: GSM bore No 2 Hogswood Farm

Name and Number given by owner (if different from above):

Town or Village Date of sinking Oct – Nov. 1953

Exact site 750 yds E. of Green Lane Farmhouse, 620 yds S of Brookheys Farmhouse, on site of demolished Hogswood Farm. c. 10 yds E of western angle of site.

A sketch-map or tracing from a large-scale map is desirable. [743790041]

Purpose for which made Proving Structure

Level at which bore commenced relative to O.D. c. 65' If not down bore, state if horizontal or up

Made by John Thom Ltd., for Messrs. Geological Survey

Information from Date received 1953

Specimens Representative bulk samples at intervals. Dip of strata as in log.

Geological Classification	Description	Thickness		Depth		Thickness metres	Depth metres
	Notes by B. J. Taylor: –						
Superficial Deposits and Glacial Drift	Sandy soil	3	0	3	0		0·91
	Medium brown sand with abundant larger rounded grains	3	0	6	0		1·83
	Medium grained dark brown, sand, somewhat harder in drilling	3	0	9	6		2·90
	Medium to coarse yellowish brown sand. Many rounded grains and small pebbles	2	0	11	0		3·35
	Stiff red boulder clay with stones	24	6	35	6		10·82
	Sandy boulder clay with stones	6	6	42	0		12·80
	Greyish red boulder clay with material apparently of Carboniferous origin. (Black shale, grey shale)	2	0	44	0		13·41
	Stiff red boulder clay	2	0	46	0		14·02
	Sandy boulder clay	7	0	53	0		16·15
	Red sandy clay with soft red sandstone fragments up to 2" in size	7	0	60	0		18·29
	Reddish slightly loamy fine-grained sand	18	0	78	0		23·77
	Yellow fine grained sand very clean	8	0	~~89~~ 86	0		26·21
	Soft, ill graded ~~sandstone~~ red sandstone with yellowish red patches, and a large proportion of coarse rounded grains	4	6	90	6		27·58
Fallen down hole.	Andesitic Volcanic rock		2¼	90	8¼		27·64
	Red soft ill graded sandstone with a large proportion of rounded grains						
	Mottled with yellowish red from 107/– to 110/6. and from 152/8 to 153/11, Occasional thin coarse bands of dominantly of rounded grains	64	0	154	8		47·14

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G.S.M. Office File No.	Site marked on 6" Map by	Site marked on 1" Map by

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British Geological Survey

BGS ID: 802667 : BGS Reference: SJ79SW1
British National Grid (27700) : 374365,390042

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Name and Number of Shaft or Bore given by Geological Survey: Hogswood Farm SJ79SW/1

County Cheshire

6" Quarter Sheet 98 NW/1

Geological Classification	Description	Thickness			Depth		Thickness (m)	Depth (m)
					194	8		47·14
	Alternating bands of coarse and medium grained sandstone. The coarse layers have a high proportion of rounded grains		2	1	156	9		47·78
	Soft massive red sandstone with nodular calcareous concretions			7	158	4		48·26
	Soft massive medium - coarse sandstone with a proportion of rounded grains		1	0	159	4		48·56
	Red sandy micaceous mudstone, with an included irregular mass of grey green argillaceous sandstone c. 3" thick			10	160	2		48·82
	Soft coarse greenish grey sandstone with abundant rounded grains			2	160	4		48·87
	Red sandy micaceous mudstone		1	11	162	3		49·45
	Medium to coarse light green-grey sandstone			3	162	6		49·53
	Mottled red and green sandy mudstone			1	162	7		49·55
	Red sandy micaceous mudstone showing sun cracks			1	162	8		49·58
	Medium grained red sandstone, an occasional thin micaceous red shale parting showing sun cracks and mottlings of green-grey at intervals. Rare rounded grains		16	2	168	10		51·46
	Medium to coarse soft red sandstone			6	169	4		51·61
	Coarse soft greenish white sandstone mottled with red sandstone. Infrequent larger rounded grains			4	169	8		51·72
	Soft red medium sandstone with light green mottlings; a little mica		1	3	170	11		52·10
	Red micaceous mudstone with sun cracks			8	171	7		52·30
	Medium even grained soft massive red sandstone. Subangular grains. No large rounded grains.							
	Micaceous partings on false bedding planes.		6	9	178	4		54·35
	Medium grained red sandstone somewhat coarser and softer than the bed above		1	5	179	9		54·79
	Light buff sandstone, medium to coarse grained with greenish tinged false bedding planes of finer material			9	180	6		55·02
	Red sandstone medium grained, soft			6	181	0		55·17
	Soft and coarse light red sandstone with bands in which larger rounded grains are abundant							
	1" band of small red shale pellets at 735/12		10	0	191	—		58·22

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SJ79SW/1

Name and Number of Shaft or Bore given by Geological Survey: No. 9 Hogswood Farm

County: Cheshire

Quarter Sheet: 9SW/1

Geological Classification	Description	Thickness			Depth		Thickness (m)	Depth (m)
					191			58·22
	Medium to coarse red sandstone with bands in which larger rounded and etched grains are common	3	9		194	9		59·36
	Red micaceous mudstone		5½		195	2½		59·49
	Coarse red and buff mottled sandstone with abundant rounded grains		2½		195	5		59·46
	Micaceous red mudstone		2		195	7		59·61
	Red medium to coarse sandstone with many coarse bands with abundant rounded grains	10	11		206	6		62·94
	Light red argillaceous micaceous sandstone		3		206	9		63·02
	Medium to coarse sandstone with bands rich in rounded grains		10		207	7		63·27
	Soft coarse red sandstone, rich in rounded grains (Core probably mainly lost in this bed; 206/6 to 222/5 (15/11) is represented by 8/7 core)	10	4		217	11		66·42
	Coarse soft sandstone with abundant larger rounded grains. Thin layers of medium sandstone	2	8		220	7		67·23
	Light red coarse well cemented sandstone		4		220	11		67·34
	Light red hard medium sandstone, well cemented		5		221	4		67·46
	Interbanded medium and coarse sandstone. Coarse bed have rounded grains	3	1		224	5		68·40
	Medium even grained (angular) red sandstone. Irregular calcareous concretions	5	9		230	2		70·16
	Slickensided red micaceous mudstone		2		230	4		70·20
	Coarse soft red sandstone with thin bands of medium sandstone. Abundant rounded grains. Rock hardened from 231/2 to 231/5 by calcareous cementation. Mottled with green colouration at base	1	11		232	3		70·79
	Red fine to medium argillaceous micaceous sandstone		11		233	2		71·07
	[10ft. of core lost between 235/5 and 268/6]							
	Red medium grained sandstone, recemented with calcite at intervals. Well sorted with few rounded grains	20	1		253	3		77·19
	Medium grained well sorted red micaceous sandstone		5		253	11		77·39
	Soft coarse red sandstone, hardened by calcareous cementation from 254/6 – 255/1 and 265/6 – 266/5							

(cont. on next sheet)

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Name and Number of Shaft or Bore given by Geological Survey: No. 2 Hough Green

SJ79SW/1

County Cheshire

Quarter Sheet 95W/1

Geological Classification	Description	Thickness			Depth		
					253	11	77·39
	(cont. from last sheet.) Thin partings of red shale in lower foot		14	1	268	0	81·69
	As above, with Buff Calcareous nodules			4	268	4	81·79
	Interbanded fine greenish sandstone and red micaceous shale			1½	268	5½	81·81
	Medium grained soft slightly micaceous Sandstone			10	269	3½	82·07
	Slickensides red blocky micaceous mudstone showing Suncracks			3½	269	7	82·17
	[3'6" core lost between 268/6 and 284/11]						
	Medium grained soft sandstone, few rounded grains, occasional grey green mottling		1	4	270	11	82·58
	Slickensided red blocky micaceous mudstone with Suncracks			11	271	10	82·85
	Very soft coarse pinte Sandstone, grains almost all rounded		2	6	274	4	83·62
	Coarse red sandstone with a high proportion of large rounded grains		7	1	281	5	85·78
	As above, brecciated with fragments of green and red mottled mudstone			1	281	6	85·80
	Medium grained flaggy Sandstone. Thin layers very rich in mica			9	282	3	86·03
	Medium - coarse grained Buff Sandstone		3	5	285	8	87·07
	Medium grained red flaggy sandstone with very micaceous partings		2	3	287	11	87·76
	Soft red and buff sandstone with some large rounded grains		1	6	289	5	88·22
	[3½ core missing between 284/10 and 300/10]						
	Medium grained harder red Sandstone mottled with green at top		1	0	290	5	88·52
	Sandy micaceous mudstone with layers of sandstone			6	290	11	88·67
	Contemporaneous breccia of red shale in Sandstone			5	291	4	88·80
	Red medium grained Sandstone with layers of sandy micaceous shale		1	0	292	4	89·10
	Coarse buff sandstone with an appreciable proportion of rounded larger grains. Rare greenish shale pellets		6	2	298	6	90·98
	Medium grained Soft red sandstone, with bands rich in rounded coarser grains		1	10	300	4	91·54
	Medium grained red micaceous Sandst., thin red shale layers and pellets of red shale at intervals.		3	3	303	7	92·53
	[3ft. core missing between 300/10 and 304/10]						
	Medium - coarse red sandstone with a few rounded grains; and red mudstone nodules.		1	6	305	1	92·99
	Contemporaneous breccia of fine grained micaceous sandstone in medium grained red Sandstone		3	0	308		93·90

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Name and Number of Shaft or Bore given by Geological Survey: No. 2 (Foryd Rd Flint) SJ79SW/1

County: Cheshire

6" Quarter Sheet: 9SW/1.

Geological Classification	Description	Thickness			Depth			Thickness (m)	Depth (m)
					308	1			93·90
	Fairly hard fine to medium Sandstone with irregular layers of micaceous shale. Mottled at intervals with greenish yellow		8	11	317	0			96·62
	Soft coarse red sandstone with layers rich in larger rounded grains. Small green mottlings at intervals; occasional red shale pellets in lower half		16	0	333	0			101·50
	[4/5 core missing between 316/10 and 333/1.]								
	Medium even-grained red sandstone, soft, with a little mica		3	11	336	11			102·69
	[1/6 core missing between 333/11 and 341/1.]								
	Soft coarse Sandstone with abundant rounded grains. 2 pebbles		4	1	341	0			103·94
	Fine grained argillaceous and micaceous sandstone with thin bands of micaceous shale			10	341	10			104·19
	Soft Coarse red sandstone with pellets of red shale. Abundant rounded grains		1	8	343	6			104·70
	Medium-grained micaceous sst. with few fine-grained grains		1	7	345	1			105·18
	Interbanded medium grained & fine grained sandstone with thin layers of greenish sandstone			8	345	9			105·38
	Soft medium grained Sandst.			10	346	7			105·64
	Alternating layers of medium grained red sandstone and coarse grained soft sandstone with abundant rounded grains				350	0			106·6
	As above				360	0			109

[redacted]

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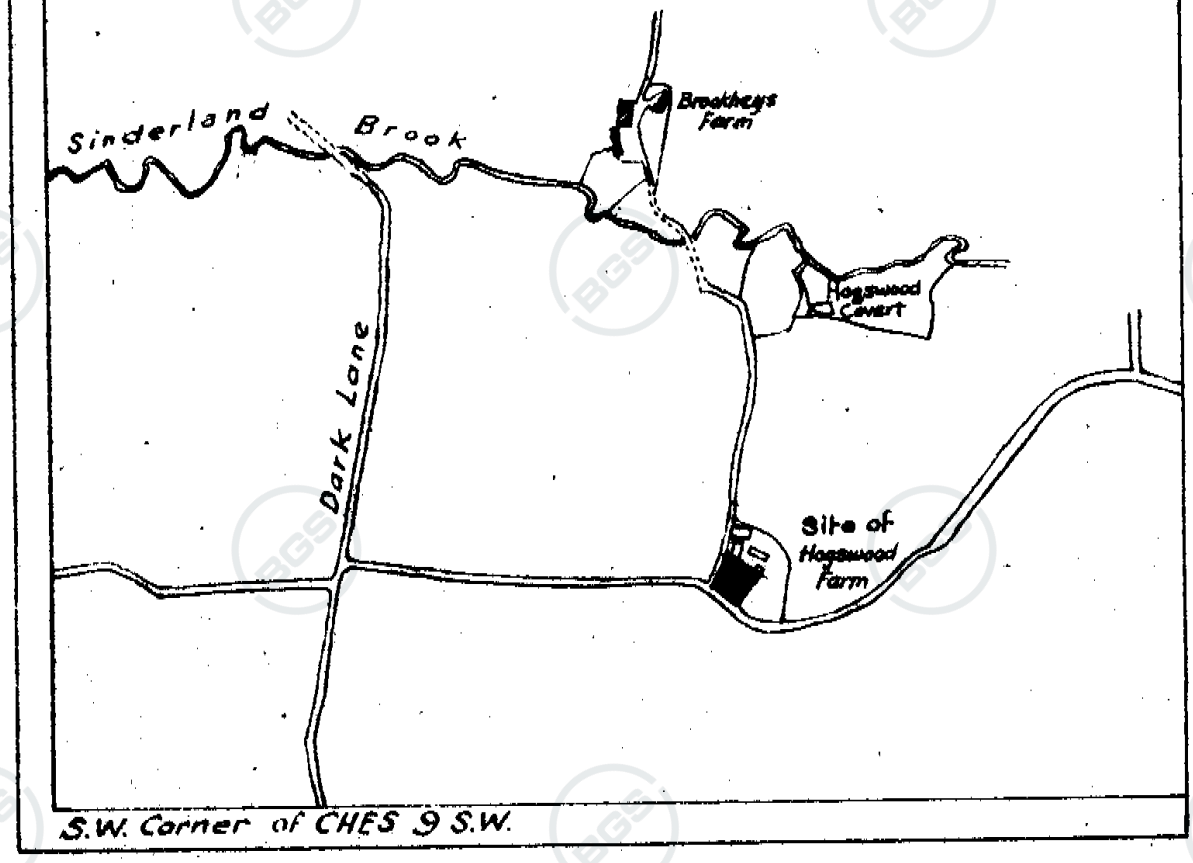
BGS ID: 802667 : BGS Reference: SJ79SW1
British National Grid (27700) : 374365,390042

No. 2 Hogswood Farm

SJ79SW/1

Scale
0 500 1000 2000
feet

Chesh 9SW/1



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British Geological Survey

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SJ 79 SW

SJ 79/84

RECORD OF SHAFT OR BORE FOR MINERALS

SJ 7437 9004

County Cheshire
6" Quarter Sheet 79SW/1
1" N.S. Geol. Map
1" O.S. Geol. Map
Whether Confidential

Name and Number of Shaft or Bore given by Geological Survey: GSM bore No 2 Hogswood Farm

Name and Number given by owner (if different from above):

Town or Village Date of sinking Oct – Nov. 1953

Exact site 750 yds E. of Green Lane Farmhouse, 620 yds S of Brookheys Farmhouse, on site of demolished Hogswood Farm. c. 10 yds E of Western angle of site.

A sketch-map or tracing from a large-scale map is desirable. [743790 94]

Purpose for which made Proving Structure

Level at which bore commenced relative to O.D. c. 665' If not down bore, state if horizontal or up

Made by John Thom Ltd., for Messrs. Geological Survey

Information from Date received 1953

Specimens Representative lith. Samples at intervals. Dip of strata see in log.

Geological Classification	Description	Thickness		Depth	
	Notes by B.J. Taylor: –				
Superficial Deposits and Glacial Drift	Sandy Soil	3	0	3	0
	Medium Brown Sand with abundant large rounded grains	3	0	6	0
	Medium grained dark brown, Sand, somewhat harder in drilling	3	0	9	6
	Medium to Coarse yellowish brown sand. Many rounded grains and small pebbles	2	0	11	0
	Stiff red boulder clay with stones	24	6	35	6
	Sandy boulder clay with stones	6	6	42	0
	Greyish red boulder clay with material apparently of Carboniferous origin (Rock shale (grey shale)	2	0	44	0
	Stiff red boulder clay	2	0	46	0
	Sandy boulder clay	7	0	53	0
	Red sandy clay with soft red sandstone fragments up to 2" in size	7	0	60	0
	Reddish slightly loamy fine-grained Sand	18	0	78	0
	Yellow fine grained sand very clean	8	0	~~89~~ 86	0 ~~11~~
	Soft, ill graded ~~sandstone~~ red sandstone with yellowish red patches, and a large proportion of coarse rounded grains	4	6	90	6
Fallen down hole.	Andesitic Volcanic rock		2¼	90	8¼
	Red soft ill graded sandstone with a large proportion of rounded grains				
	Mottled with yellowish red from 107/- to 110/6. and from 152/8 – 153/11, Occasional thin coarse bands of dominantly of rounded grains	64	0	154	8

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G.S.M. Office File No.	Site marked on 6" Map by	Site marked on 1" Map by

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British Geological Survey

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British National Grid (27700) : 374365,390042

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Name and Number of Shaft or Bore given by Geological Survey: a SJ 79 / 84

County Cheshire

6" Quarter Sheet SJ 87 SW 1.

Geological Classification	Description	Thickness			Depth	
					194	8
	Alternating bands of coarse and medium grained sandstone. The coarse layers have a high proportion of rounded grains	2	1		156	9
	Soft massive red sandstone with nodular calcareous concretions		7		158	4
	Soft massive medium – coarse sandstone with a proportion of rounded grains	1	0		159	4
	Red sandy micaceous mudstone, with an included irregular mass of grey green argillaceous sandstone c. 3" thick		10		160	2
	Soft coarse greenish grey sandstone with abundant rounded grains		2		160	4
	Red sandy micaceous mudstone	1	11		162	3
	Medium to coarse light green-grey sandstone		3		162	6
	Mottled red and green sandy mudstone		1		162	7
	Red sandy micaceous mudstone showing sun cracks		1		162	8
	Medium grained red sandstone, an occasional thin micaceous red shale parting showing sun cracks and mottlings of green-grey at intervals. Rare rounded grains	26	2		168	10
	Medium to coarse soft red sandstone		6		169	4
	Coarse soft greenish white sandstone mottled with red sandstone. Infrequent larger rounded grains		4		169	8
	Soft red medium sandstone with light green mottlings; a little mica	1	3		170	11
	Red micaceous mudstone with sun cracks		8		171	7
	Medium even grained soft massive red sandstone. Subangular grains No large rounded grains. Micaceous partings on false bedding planes.	6	9		178	4
	Medium grained red sandstone somewhat coarser and softer than the bed above	1	5		179	9
	Light buff sandstone, medium to coarse grained with greenish tinged false bedding planes of finer material		9		180	6
	Red sandstone medium grained, soft		6		181	0
	Soft and coarse light red sandstone with bands in which larger rounded grains are abundant					
	1" band of small red shale pellets at 135/2	10	0		191	–

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 802667 : BGS Reference: SJ79SW1
British National Grid (27700) : 374365,390042

(°40549) Wt.10120/a161 5,000 4/50 A.& E.W.Ltd. Gp.685

Name and Number of Shaft or Bore given by Geological Survey: SJ79SW 5/84

County Cheshire

6" Quarter Sheet 95W/1

Geological Classification	Description	Thickness			Depth	
					253	11
	(cont. from last sheet.) Thin partings of red shale in lower part.	14	1		268	0
	As above, with Smaller Calcareous nodules		4		268	4
	Interbanded fine greenish sandstone and red micaceous shale		1½		268	5½
	Medium grained soft slightly micaceous Sandstone		10		269	3½
	Slickensided red blocky micaceous mudstone showing Sun cracks		3½		269	7
	[3'6" core lost between 268/6 and 284/11]					
	Medium grained soft Sandstone, few rounded grains, occasional gray green mottlings	1	4		270	11
	Slickensided red blocky micaceous mudstone with Sun cracks		11		271	10
	Very soft coarse pink Sandstone, grains almost all rounded	2	6		274	4
	Coarse red Sandstone with a high proportion of large rounded grains	7	1		281	5
	As above, brecciated with fragments of green and red mottled mudstone		1		281	6
	Medium grained Flaggy Sandstone. Thin layers very rich in mica		9		282	3
	Medium - coarse grained buff Sandstone	3	5		285	8
	Medium grained red flaggy sandstone with very micaceous partings	2	3		287	11
	Soft red and buff sandstone with some large rounded grains	1	6		289	5
	[3/2 core missing between 284/10 and 300/10]					
	Medium grained harder red Sandstone mottled with green at top	1	0		290	5
	Sandy micaceous mudstone with layers of sandstone		6		290	11
	Contemporaneous breccia of red shale in Sandstone		5		291	4
	Red medium grained Sandstone with layers of sandy micaceous shale	1	0		292	4
	Coarse buff Sandstone with an appreciable proportion of rounded larger grains. Red greenish shale pellets	6	2		298	6
	Medium grained Soft red Sandstone, with bands rich in rounded coarser grains	1	10		300	4
	Medium grained red micaceous Sandst., thin red shale layers and pellets of red shale at intervals.	3	3		303	7
	[3ft. core missing between 300/10 and 316/10]					
	Medium - coarse red Sandstone with a few rounded grains; and occasional nodules.	1	6		305	1
	Contemporaneous breccia of fine grained micaceous sandstone in medium	2			305	

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 802667 : BGS Reference: SJ79SW1
British National Grid (27700) : 374365,390042

(*40549) Wt.10120/a161 5,000 4/50 A.& E.W'Ltd. Gp.685

Name and Number of Shaft or Bore given by Geological Survey: 10 SJ 37 9/84

County Cheshire

Quarter Sheet 95W 1.

Geological Classification	Description	Thickness			Depth	
						191
	Medium to coarse red sandstone with bands in which larger rounded and etched grains are common		3	9	194	9
	Red micaceous mudstone			5½	195	2½
	Coarse red and buff mottled sandstone with abundant rounded grains			2½	195	5
	Micaceous red mudstone			2	195	7
	Red medium to coarse sandstone with many coarse bands with abundant rounded grains		10	11	206	6
	Light red argillaceous micaceous sandstone			3	206	9
	Medium to coarse sandstone with bands rich in rounded grains			10	207	7
	Soft coarse red sandstone, rich in rounded grains (Core probably mainly lost in this bed: 206/6 to 222/5 (15/11) is represented by 8/7 core)		10	4	217	11
	Coarse soft sandstone with abundant larger rounded grains.					
	Thin layers of medium sandstone		2	8	220	7
	Light red coarse well cemented sandstone			4	220	11
	Light red hard medium sandstone well cemented			5	221	4
	Interbanded medium and coarse sandstone. Coarse beds have rounded grains		3	1	224	5
	Medium even grained (angular) red sandstone. Irregular calcareous concretions		5	9	230	2
	Slickensided red micaceous mudstone			2	230	4
	Coarse soft red sandstone with thin bands of medium sandstone. Abundant rounded grains. Rock hardened from 231/2 to 231/5 by calcareous cementation. Mottled with green colouration at base		1	11	232	3
	Red fine to medium argillaceous micaceous sandstone			11	233	2
	[10ft. of core lost between 235/5 and 268/6]					
	Red medium grained sandstone, recemented with calcite at intervals. Well sorted with few rounded grains		20	1	253	3
	Medium grained well sorted red micaceous sandstone			8	253	11
	Soft coarse red sandstone, hard and					

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 802667 : BGS Reference: SJ79SW1
British National Grid (27700) : 374365,390042

(°40549) Wt.10120/a161 6,000 4/50 A.& E.W.Ltd. Gp.685

Name and Number of Shaft or Bore given by Geological Survey: No 2 Hegginson Fm. SJ79SW 12

County Cheshire

Quarter Sheet 79SW/.

5579/84

Geological Classification	Description	Thickness			Depth	
					308	1
	Fairly hard fine to medium sandstone with irregular layers of micaceous shale. Mottled at intervals with greenish yellow	8	11		317	0
	Soft coarse red sandstone with layers rich in larger rounded grains. Small green mottlings at intervals; occasional red shale pellets in lower half	16	0		333	0
	[4/5 core missing between 316/10 and 333/0]					
	Medium even grained red sandstone, soft, with a little mica	3	11		336	11
	[1/6 core missing between 333/11 and 341/0]					
	Soft coarse sandstone with abundant rounded grains. 2 pebbles	4	1		341	0
	Fine grained argillaceous and micaceous sandstone with thin bands of micaceous shale		10		341	10
	Soft coarse red sandstone with pellets of red shale. Abundant rounded grains	1	8		343	6
	Medium grained micaceous sst. with few rounded grains Interbanded medium grained & fine grained sandstone with thin layers of greenish sandstone	1	7		345	1
			8		345	9
	Soft medium grained sandst.		10		346	7
	Alternating layers of medium grained red sandstone and coarse grained soft sandstone with abundant rounded grains				350	0
	As above				360	0

Contact BGS: ngdc@bgs.ac.uk

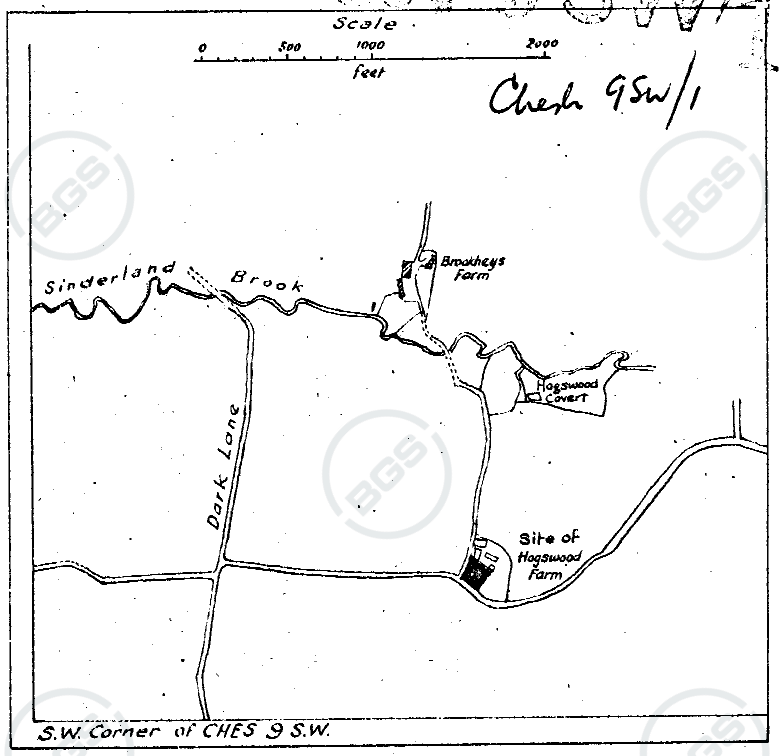
British Geological Survey

BGS ID: 802667 : BGS Reference: SJ79SW1
British National Grid (27700) : 374365,390042

5579/84.

No. 2 Hogswood Farm 13

SJ79SW/



Contact BGS: ngdc@bgs.ac.uk

British Geological Survey
BGS ID: 765623 : BGS Reference: SJ78NW27
British National Grid (27700) : 371277,389194

Appendix (v)

SJ 78 NW/27 - 29

Sheet No 1
Date 30/10/73
Location WARBURTON NO.2

ARC
A member of the Gold Fields Group

Amey Roadstone Corporation Limited
Group Technical Centre Chipping Sodbury Wootton St Ives

Borehole log sheet

FORM P. 747 A.R.C. PRINTING. FROME

SJ 78 NW/27

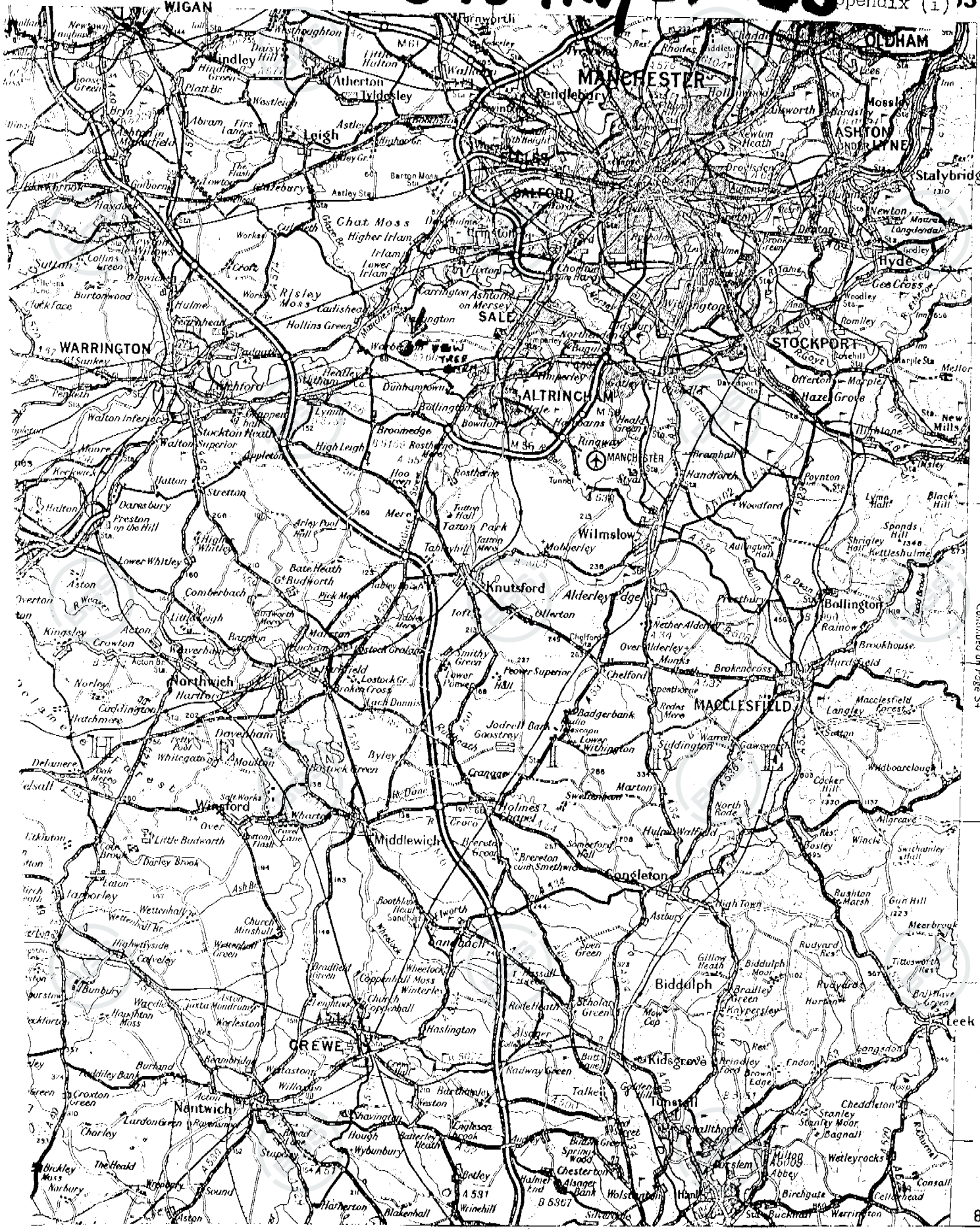
Bore No	Depth	Thickness	Description	Water Table	Sample Depth
1.	0·15 – 4·26 0'6"–14'6"	14'0"	Brownish red sand possible some silt contamination.		
4·41 – 5·94	14'6"–19'6"	5'0"	Finer brown sand with some silt.		
5·94 – 10·66	19'6"–35'0"	15'6"	Clayey fine sand with one or two fragments of small gravel.		
	35'0"–41'0" 12·49	6'0"	Stiff brown clay with some sand.		
			Blue marly clay.	7'6"	
			SJ 78 NW 28		
2.	0' – 6"	6"	Topsoil overburden, peaty texture, no sand or gravel.		
	0'6"– 3'6" 1·06	3'0"	Sand mainly fine-medium grade damp with some small amount of silty streaky clay.		
	3'6"–26'0" 7·92	22'6"	Sand fine-medium grade, clean with no silt or clay. Reddish in colour.		
	26'0"–29'6" 8·99	3'6"	Band of silty clay with a little sand content.		
	29'6"–40'0" 12·19	10'6"	Sample of slightly finer sand with a slight amount of silt, no clay.		
	40'0"–54'0" 16·45	14'0"	Sand no change in appearance from above but containing one or two particles of small gravel and a few pieces of coal.		
			Light grey blue marl.	6'6"	
			SJ 78 NW 29		
3.	0' – 6"	6"	Topsoil fine peaty texture, no sand or gravel.		
	6"– 3'0" 0·91	2'6"	Light yellowish white sand, fine-medium grade and damp with an occasional silty streak.		
	3'0"–18'0" 5·68	15'0"	Fine-medium reddish sand, clean with no silt or clay.		
	18'0"–25'0" 7·62	7'0"	Band of clay bound sand very stiff with several pieces of small gravel in it.		
	25'0"–52'0" 15·84	27'0"	Sand fine-medium some silty contamination with an occasional small streak of clay and a few pieces of small gravel and coal.		
			Light grey blue marl, no sand.	6'0"	

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765623 : BGS Reference: SJ78NW27
British National Grid (27700) : 371277,389194

SJ 78 NW/27-40



Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765623 : BGS Reference: SJ78NW27
British National Grid (27700) : 371277,389194

SJ78 NW/27-40

LEGEND.

- Over 50 ft. Sand.
- 45' - 50' Sand.
- 40' - 45' "
- 35' - 40' "
- 30' - 35' "
- 25' - 30' "
- 20' - 25' "
- 15' - 20' "
- 10' - 15' "
- 5' - 10' "
- 0 - 5' "
- Borehole Location
- Sand Isopach (thickness in feet).
- Buried Gas Pipeline.
- Overhead Electric Power Line.

SCALE 1:2500	DATE 8.1.74	ISSUE	REVISION	DATE	BY
DRG. No. MAP 2.	DRAWN				
	CHECKED				
	APPROVED				

YEW TREE FARM, WARBURTON.
DISTRIBUTION OF SAND.

AMEY ROADSTONE CORPORATION LIMITED
TECHNICAL DEPARTMENT
CHIPPING SODBURY, GLOS.

X 3241

Contact BGS: ngdc@bgs.ac.uk

YEW TREE FARM (A)

SJ 78/50 A

Owner		Licence No.	Nat. Grid Ref. SJ 7129 8921
Occupier		IGS Ref. No. SJ78NW27	Status Inuse
Ground Level	m OD	ft. OD	Aquifer
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Summary of Geological Section	Thickness	Depth
Silty sand	14	
Fine brown sand	5	
Clayey sand	15	
Stiff clay	6	w.l. 7'
Blue marly clay		

Abstraction Rates
gph
gpd

Type of Pump
Chem./Bact. Anal. YES NO
Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

YEW TREE FARM (B)

SJ 78/50 B

Owner		Licence No.	Nat. Grid Ref. SJ 7138 8918
Occupier		IGS Ref. No. SJ78NW28	Status
Ground Level	m OD	ft. OD	Aquifer
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Summary of Geological Section	Thickness	Depth
Medium/fine brown sand	29'	
Silty sand	10'	
Sand & some gravel	14'	w.l. 6'
Blue marl		

Abstraction Rates
gph
gpd

Type of Pump
Chem./Bact. Anal. YES NO
Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

British Geological Survey
BGS ID: 765624 : BGS Reference: SJ78NW28
British National Grid (27700) : 371360,389153

Appendix (v)

SJ 78 NW/27 - 29

Sheet No 1
Date 30/10/73
Location WARBURTON NO.2

ARC
A member of the Gold Fields Group

Amey Roadstone Corporation Limited
Group Technical Centre Chipping Sodbury Wootton St Ives

Borehole log sheet

FORM P. 747 A.R.C. PRINTING. FROME

SJ 78 NW/27

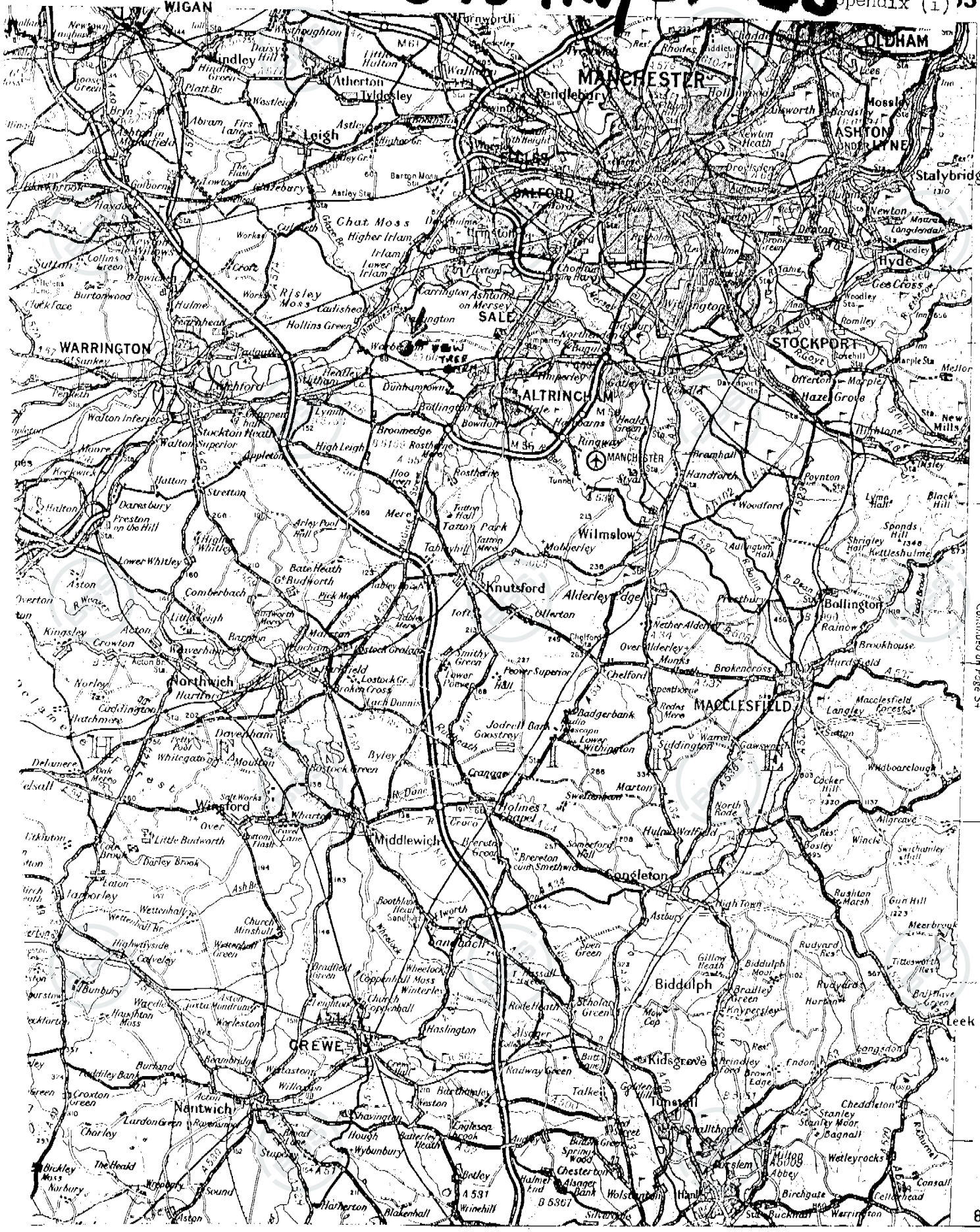
Bore No	Depth	Thickness	Description	Water Table	Sample Depth
1.	0·15 – 4·26 0'6"–14'6"	14'0"	Brownish red sand possible some silt contamination.		
4·41 – 5·94	14'6"–19'6"	5'0"	Finer brown sand with some silt.		
5·94 – 10·66	19'6"–35'0"	15'6"	Clayey fine sand with one or two fragments of small gravel.		
	35'0"–41'0" 12·49	6'0"	Stiff brown clay with some sand.		
			Blue marly clay.	7'6"	
			SJ 78 NW 28		
2.	0' – 6"	6"	Topsoil overburden, peaty texture, no sand or gravel.		
	0'6"– 3'6" 1·06	3'0"	Sand mainly fine-medium grade damp with some small amount of silty streaky clay.		
	3'6"–26'0" 7·92	22'6"	Sand fine-medium grade, clean with no silt or clay. Reddish in colour.		
	26'0"–29'6" 8·99	3'6"	Band of silty clay with a little sand content.		
	29'6"–40'0" 12·19	10'6"	Sample of slightly finer sand with a slight amount of silt, no clay.		
	40'0"–54'0" 16·45	14'0"	Sand no change in appearance from above but containing one or two particles of small gravel and a few pieces of coal.		
			Light grey blue marl.	6'6"	
			SJ 78 NW/29		
3.	0' – 6"	6"	Topsoil fine peaty texture, no sand or gravel.		
	6"– 3'0" 0·91	2'6"	Light yellowish white sand, fine-medium grade and damp with an occasional silty streak.		
	3'0"–18'0" 5·68	15'0"	Fine-medium reddish sand, clean with no silt or clay.		
	18'0"–25'0" 7·62	7'0"	Band of clay bound sand very stiff with several pieces of small gravel in it.		
	25'0"–52'0" 15·84	27'0"	Sand fine-medium some silty contamination with an occasional small streak of clay and a few pieces of small gravel and coal.		
			Light grey blue marl, no sand.	6'0"	

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765624 : BGS Reference: SJ78NW28
British National Grid (27700) : 371360,389153

SJ 78 NW/27-40



Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765624 : BGS Reference: SJ78NW28
British National Grid (27700) : 371360,389153

SJ78 NW/27-40

LEGEND.

- Over 50 ft. Sand.
- 45' - 50' Sand.
- 40' - 45' "
- 35' - 40' "
- 30' - 35' "
- 25' - 30' "
- 20' - 25' "
- 15' - 20' "
- 10' - 15' "
- 5' - 10' "
- 0 - 5' "
- Borehole Location
- Sand Isopach (thickness in feet).
- Buried Gas Pipeline.
- Overhead Electric Power Line.

SCALE 1:2500	DATE 8.1.74	ISSUE	REVISION	DATE	BY
DRG. No. MAP 2.	DRAWN				
	CHECKED				
	APPROVED				

YEW TREE FARM, WARBURTON.
DISTRIBUTION OF SAND.

AMEY ROADSTONE CORPORATION LIMITED
TECHNICAL DEPARTMENT
CHIPPING SODBURY, GLOS.

X 3241

Contact BGS: ngdc@bgs.ac.uk

YEW TREE FARM (A)

SJ 78/50 A

Owner		Licence No.	Nat. Grid Ref. SJ 7129 8921
Occupier		IGS Ref. No. SJ78NW27	Status Invest~
Ground Level	m OD	ft. OD	Aquifer
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Silty sand	14	
Fine brown sand	5	
Clayey sand	15	
Stiff clay	6	w.l. 7'
Blue marly clay		

YEW TREE FARM (B)

SJ 78/50 B

Owner		Licence No.	Nat. Grid Ref. SJ 7138 8918
Occupier		IGS Ref. No. SJ78NW28	Status
Ground Level	m OD	ft. OD	Aquifer
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Medium/fine brown sand	29'	
Silty sand	10'	
Sand & some gravel	14'	w.l. 6'
Blue marl		

British Geological Survey
BGS ID: 765625 : BGS Reference: SJ78NW29
British National Grid (27700) : 371447,389114

Appendix (v)

SJ 78 NW/27 - [redacted] 29

Sheet No 1
Date 30/10/73
Location WARBURTON NO.2

ARC
A member of the Gold Fields Group

Amey Roadstone Corporation Limited
Group Technical Centre Chipping Sodbury Wootton St Ives

Borehole log sheet

FORM P. 747 A.R.C. PRINTING. FROME

SJ 78 NW/27

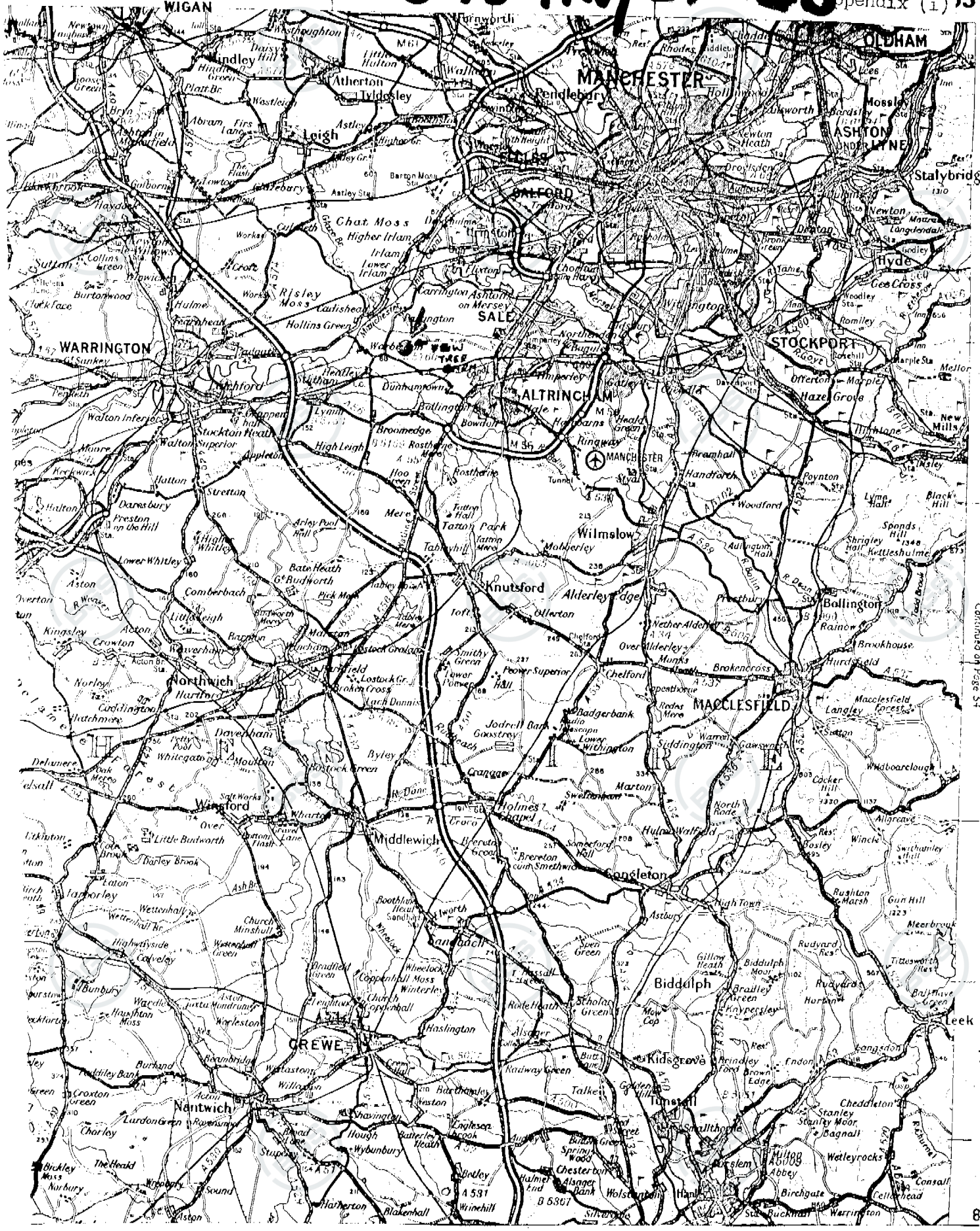
Bore No	Depth	Thickness	Description	Water Table	Sample Depth
1.	0·15 – 4·26 0'6"–14'6"	14'0"	Brownish red sand possible some silt contamination.		
4·41 – 5·94	14'6"–19'6"	5'0"	Finer brown sand with some silt.		
5·94 – 10·66	19'6"–35'0"	15'6"	Clayey fine sand with one or two fragments of small gravel.		
	35'0"–41'0" 12·49	6'0"	Stiff brown clay with some sand.		
			Blue marly clay.	7'6"	
			SJ 78 NW 28		
2.	0' – 6"	6"	Topsoil overburden, peaty texture, no sand or gravel.		
	0'6"– 3'6" 1·06	3'0"	Sand mainly fine-medium grade damp with some small amount of silty streaky clay.		
	3'6"–26'0" 7·92	22'6"	Sand fine-medium grade, clean with no silt or clay. Reddish in colour.		
	26'0"–29'6" 8·99	3'6"	Band of silty clay with a little sand content.		
	29'6"–40'0" 12·19	10'6"	Sample of slightly finer sand with a slight amount of silt, no clay.		
	40'0"–54'0" 16·45	14'0"	Sand no change in appearance from above but containing one or two particles of small gravel and a few pieces of coal.		
			Light grey blue marl.	6'6"	
			SJ 78 NW 29		
3.	0' – 6"	6"	Topsoil fine peaty texture, no sand or gravel.		
	6"– 3'0" 0·91	2'6"	Light yellowish white sand, fine-medium grade and damp with an occasional silty streak.		
	3'0"–18'0" 5·68	15'0"	Fine-medium reddish sand, clean with no silt or clay.		
	18'0"–25'0" 7·62	7'0"	Band of clay bound sand very stiff with several pieces of small gravel in it.		
	25'0"–52'0" 15·84	27'0"	Sand fine-medium some silty contamination with an occasional small streak of clay and a few pieces of small gravel and coal.		
			Light grey blue marl, no sand.	6'0"	

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765625 : BGS Reference: SJ78NW29
British National Grid (27700) : 371447,389114

SJ 78 NW/27-40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Atherton
Tyldesley
MANCHESTER
Pendlebury
OLDHAM
ASHTON UNDER LYNE
Stalybridge
Hyde
Mossley
Denton
Droylsden
Eccles
SALFORD
Irlam
Chat Moss
Higher Irlam
Lower Irlam
Partington
Carrington
Ashton on Mersey
SALE
Sale Water Park
WARRINGTON
Stockton Heath
Walton Inferior
Walton Superior
Appleton
Grappenhall
Lymm
Broomedge
Bowdon
Dunham Town
ALTRINCHAM
Hale
Hale Barns
Ringway
MANCHESTER AIRPORT
STOCKPORT
Hazel Grove
Offerton
Marple
Mellor
Romiley
Woodley
Gee Cross
Werneth
Reddish
Heaton Norris
Northenden
Wythenshawe
Baguley
Timperley
Broadheath
Sale Water Park
Wilmslow
Handforth
Woodford
Poynton
Bramhall
Adlington
Prestbury
Bollington
Rainow
Brookhouse
Knutsford
Alderley Edge
Mobberley
Tatton Park
Tabley Hill
Toft
Ollerton
Nether Alderley
Over Alderley
Chelford
Brownhill
Brocklehurst
Macclesfield Forest
Langley
Sutton
Lyme Park
Disley
Whaley Bridge
Northwich
Hartford
Lostock Gralam
Broken Cross
Lach Dennis
Davenham
Moulton
Whitegate
Byley
Rudheath
Winsford
Middlewich
Wharton
Over
Little Budworth
Barley Brook
Cledford
Croxton
Sandbach
Wheelock
Elworth
Haslington
Crewe
Nantwich
Willaston
Wybunbury
Hough
Batherton
Englesea Brook
Audley
Bignall End
Chesterton
Alsager
Talke
Kidsgrove
Tunstall
Biddulph
Biddulph Moor
Rudyard
Leek
Cheddleton
Stanley
Bagnall
Wetley Rocks
Consall
Birchgate
Cellarhead
Congleton
Astbury
High Town
Somerford
Holmes Chapel
Goostrey
Jodrell Bank
Lower Withington
Swettenham
Marton
Gawsworth
Siddington
Capesthorne
Chelford
Broken Cross
Rode Heath
Scholar Green
Mow Cop
Brindley Ford
Endon
Longsdon
Rushton Spencer
Meerbrook
Tittesworth
Allgreave
Winclough
Cockerhill
Windgather
Shutlingsloe
Bosley
Switchstanley Hill
Gun Hill
Rudyard Res.
Gillow Heath
Bradley Green
Knypersley
Horton
Ball Have Green
Endon
Brown Edge
Stallthorne
Milton
Abbey
Wetley Rocks
Consall
Birchgate
Cellarhead
Warrington
Buckman
Hanchurch
Wolstanton
Silverdale
Chesterton
Alsager Bank
Wrinehill
Blakenhall
Haslington
Weston
Shavington
Willaston
Worleston
Houghton Moss
Coppenhall
Coppenhall Moss
Winterley
Church Coppenhall
Bradfield Green
Wheelock
Elworth
Sandbach
Church Minshull
Wettenhall
Highwayside
Cotton Edmund
Bunbury
Burland
Beambridge
Wrenbury
Baddiley
Burleydam
Audlem
Stapeley
Acton
Croxton Green
Lurdon Green
Ravensmoor
Charley
Bickley Moss
The Heath
Norbury
Wrenbury
Sound
Aston
Harthorne
Wrinehill
Blakenhall
A 51
A 500
A 534
A 54
A 556
A 5111
A 5103
A 5102
A 5145
A 5149
A 5143
A 5034
A 5033
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A 5031
A 5004
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A 5022
A 5023
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A 5025
A 5026
A 5027
A 5028
A

British Geological Survey

BGS ID: 765625 : BGS Reference: SJ78NW29
British National Grid (27700) : 371447,389114

SJ78 NW/27-40

LEGEND.

- Over 50 ft. Sand.
- 45' - 50' Sand.
- 40' - 45' "
- 35' - 40' "
- 30' - 35' "
- 25' - 30' "
- 20' - 25' "
- 15' - 20' "
- 10' - 15' "
- 5' - 10' "
- 0 - 5' "
- Borehole Location
- Sand Isopach (thickness in feet).
- Buried Gas Pipeline.
- Overhead Electric Power Line.

SCALE 1:2500	DATE 8.1.74	ISSUE	REVISION	DATE	BY
DRG. No. MAP 2.	DRAWN				
	CHECKED				
	APPROVED				

YEW TREE FARM, WARBURTON.
DISTRIBUTION OF SAND.

AMEY ROADSTONE CORPORATION LIMITED
TECHNICAL DEPARTMENT
CHIPPING SODBURY, GLOS.

X 3241

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

YEWTREE FARM (C)

SJ 78/50 C

Owner		Licence No.	
Occupier		IGS Ref. No.	SJ78NW29
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7144 8914

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Summary of Geological Section	Thickness	Depth
Silty red sand	15'	
Stiff clay + stones	7'	
Medium/fine sand with some clay streaks	27'	w.l. 6
Blue marl		

Abstraction Rates

gph

gpd

Type of Pump

Chem./Bact. Anal. YES NO

Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

YEWTREE FARM (D)

SJ 78/50 D

Owner		Licence No.	
Occupier		IGS Ref. No.	SJ78NW30
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7123 8928

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Summary of Geological Section	Thickness	Depth
Silty red sand with some clay streaks	14'	w.l. 6
Blue marl		

Abstraction Rates

gph

gpd

Type of Pump

Chem./Bact. Anal. YES NO

Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

British Geological Survey

BGS ID: 765626 : BGS Reference: SJ78NW30
British National Grid (27700) : 371214,389267

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SJ 78 NW/30

30 Sheet No 2
32 Date 30/10/73
Location WARBURTON

Amey Roadstone Corporation Limited
Group Technical Centre Chipping Sodbury Wootton St Ives

Borehole log sheet

FORM P. 747 A.R.C. PRINTING, FROME

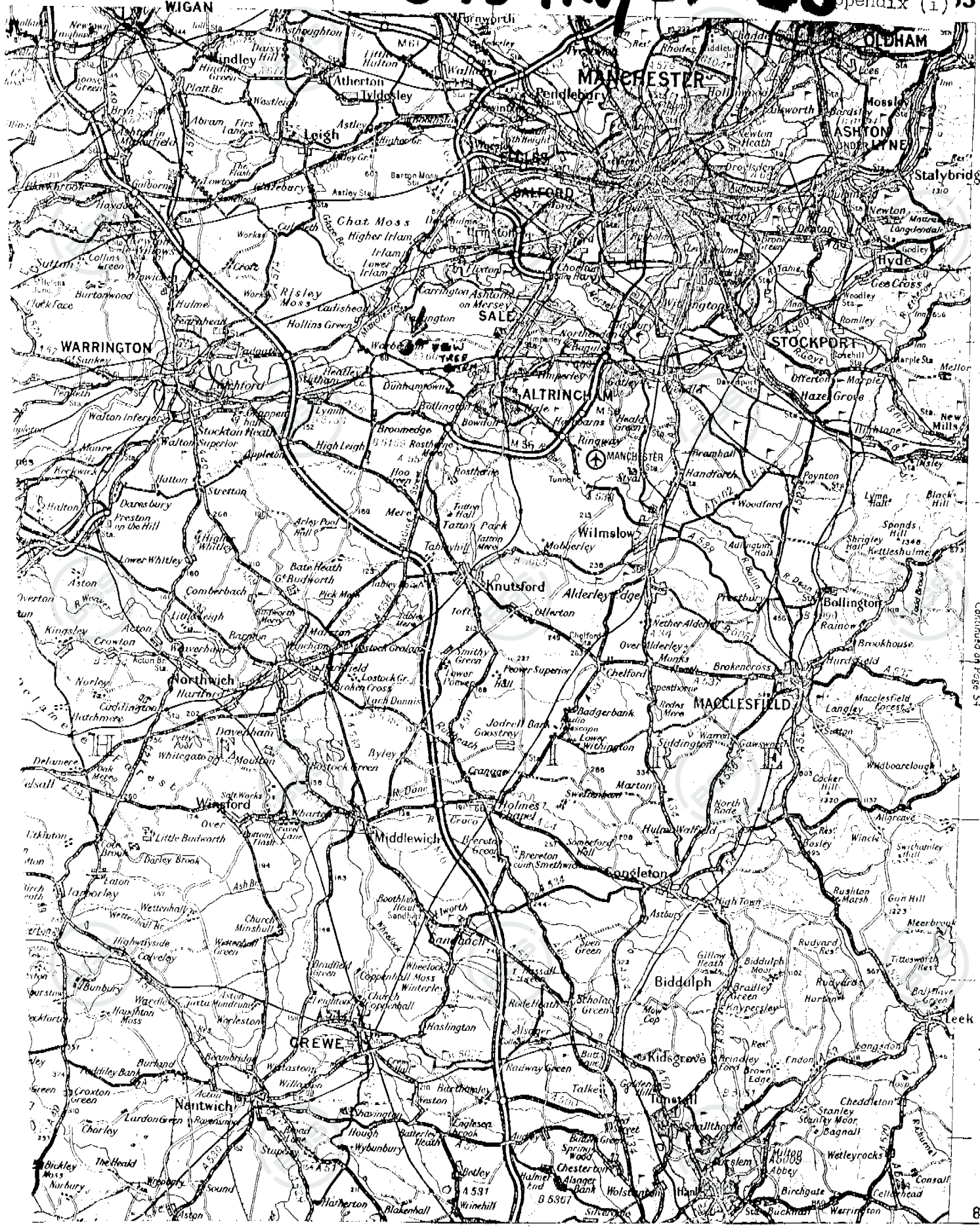
Bore No	Depth	Thickness	Description	Water Table	Sample Depth
			SJ 78 NW/30		
4.	0.15 0' - 6"	6"	Topsoil fine peaty texture, no sand.		
	0.45 0'6"- 1'6"	1'0"	Very fine yellowish sand with peaty streaks in light brown clay and stiff.		
	1.67 1'6"- 5'6"	4'0"	Yellowish fine sand with peaty streaks and several pieces of coal or ligmite. Some silt		
	3.06 5'6"-10'0"	4'6"	contamination but not much.		
	6.09 10'0"-20'0"	10'0"	Reddish fine sand clean with only a small amount of silt and some small pieces of coal.		
			Red fine grade sand clean as before, only slightly silty.		
	10.21 20'0"-33'6"	13'6"	A small amount of small pebbles in very fine silty red sand.		
			Light white-blue clay marl.	4'6"	
			SJ 78 NW/31		
5.	0' - 6"	6"	Topsoil peaty texture, no sand content.		
	6"- 1'6"	1'0"	Whitish brown fairly stiff clay, no sand content.		
	1.98 1'6"- 6'6"	5'0"	Sand fine-medium grade with only a little silt content. Redish yellow in colour.		
	6.70 6'6"-22'0"	15'6"	Red clay marl very stiff with no sand content and a few particles of small gravel.	6'6"	
			SJ 78 NW/32		
6.	0' - 1'0"	1'0"	Topsoil peaty texture, no sand.		
	1'0"- 3'6"	2'6"	Greenish coloured fine-medium sand a little silty and some clay contamination.		
	2.43 3'6"- 8'0"	4'6"	Fine red sand and quite silty.		
	3.04 8'0"-10'0"	2'0"	Fine-medium sand with no silt contamination.		
	5.29 10'0"-19'0"	9'0"	Sand fine-medium some course reddish in colour only a little silt. A few particles of coal and very small grit, no clay.		
	8.22 19'0"-27'0"	8'0"	Band of stiff brown clay no sand. A few particles of small gravel in clay.		

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765626 : BGS Reference: SJ78NW30
British National Grid (27700) : 371214,389267

SJ 78 NW/27-40



Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765626 : BGS Reference: SJ78NW30
British National Grid (27700) : 371214,389267

SJ78 NW/27-40

LEGEND.

- Over 50 ft. Sand.
- 45' - 50' Sand.
- 40' - 45' "
- 35' - 40' "
- 30' - 35' "
- 25' - 30' "
- 20' - 25' "
- 15' - 20' "
- 10' - 15' "
- 5' - 10' "
- 0 - 5' "
- Borehole Location
- Sand Isopach (thickness in feet).
- Buried Gas Pipeline.
- Overhead Electric Power Line.

SCALE 1:2500	DATE 8.1.74	ISSUE	REVISION	DATE	BY
DRG. No. MAP 2.	DRAWN				
	CHECKED				
	APPROVED				

YEW TREE FARM, WARBURTON.
DISTRIBUTION OF SAND.

AMEY ROADSTONE CORPORATION LIMITED
TECHNICAL DEPARTMENT
CHIPPING SODBURY, GLOS.

X 3241

Contact BGS: ngdc@bgs.ac.uk

YEWTREE FARM (C)

SJ 78/50 C

Owner		Licence No.	
Occupier		IGS Ref. No. SJ78NW29	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7144 8914

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Summary of Geological Section	Thickness	Depth
Silty red sand	15'	
Stiff clay + stones	7'	
Medium/fine sand with some clay streaks	27'	w.l. 6
Blue marl		

Abstraction Rates

gph

gpd

Type of Pump

Chem./Bact. Anal. YES NO

Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

YEWTREE FARM (D)

SJ 78/50 D

Owner		Licence No.	
Occupier		IGS Ref. No. SJ78NW30	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7123 8928

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Summary of Geological Section	Thickness	Depth
Silty red sand with some clay streaks	14'	w.l. 6
Blue marl		

Abstraction Rates

gph

gpd

Type of Pump

Chem./Bact. Anal. YES NO

Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

British Geological Survey

BGS ID: 765627 : BGS Reference: SJ78NW31
British National Grid (27700) : 371650,389247

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SJ 78 NW/30

30 Sheet No 2
32 Date 30/10/73
Location WARBURTON

Amey Roadstone Corporation Limited
Group Technical Centre Chipping Sodbury Wootton St Ives

Borehole log sheet

FORM P. 747 A.R.C. PRINTING, FROME

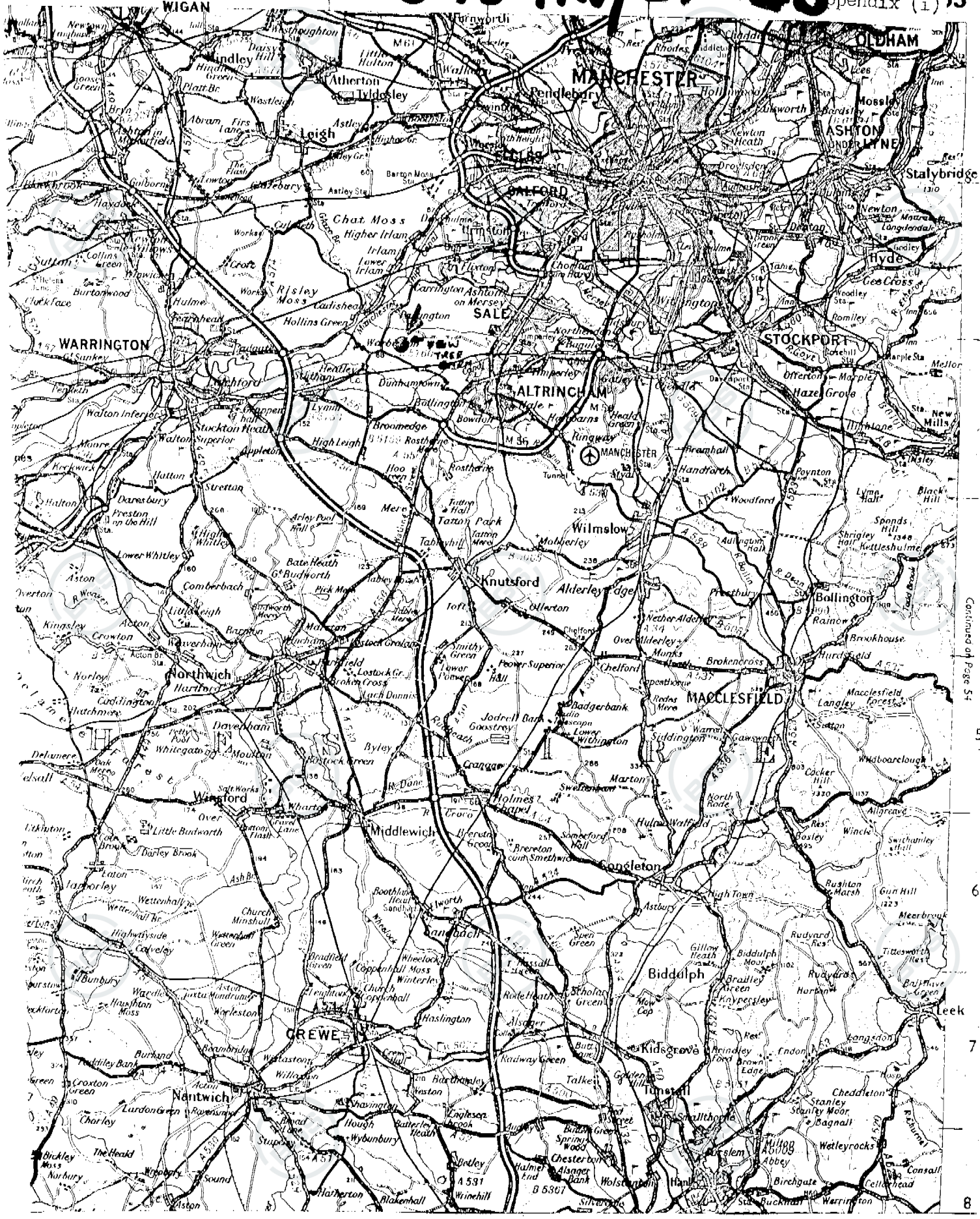
Bore No	Depth	Thickness	Description	Water Table	Sample Depth
			SJ 78 NW/30		
4.	0' - 6" (0.15)	6"	Topsoil fine peaty texture, no sand.		
	0'6" - 1'6" (0.45)	1'0"	Very fine yellowish sand with peaty streaks in light brown clay and stiff.		
	1'6" - 5'6" (1.67)	4'0"	Yellowish fine sand with peaty streaks and several pieces of coal or ligmite. Some silt		
	5'6" - 10'0" (3.04)	4'6"	contamination but not much.		
	10'0" - 20'0" (6.09)	10'0"	Reddish fine sand clean with only a small amount of silt and some small pieces of coal.		
			Red fine grade sand clean as before, only slightly silty.		
	20'0" - 33'6" (10.21)	13'6"	A small amount of small pebbles in very fine silty red sand.		
			Light white-blue clay marl.	4'6"	
			SJ 78 NW/31		
5.	0' - 6"	6"	Topsoil peaty texture, no sand content.		
	6" - 1'6"	1'0"	Whitish brown fairly stiff clay, no sand content.		
	1'6" - 6'6" (1.98)	5'0"	Sand fine-medium grade with only a little silt content. Redish yellow in colour.		
	6'6" - 22'0" (6.70)	15'6"	Red clay marl very stiff with no sand content and a few particles of small gravel.	6'6"	
			SJ 78 NW/32		
6.	0' - 1'0"	1'0"	Topsoil peaty texture, no sand.		
	1'0" - 3'6"	2'6"	Greenish coloured fine-medium sand a little silty and some clay contamination.		
	3'6" - 8'0" (2.43)	4'6"	Fine red sand and quite silty.		
	8'0" - 10'0" (3.04)	2'0"	Fine-medium sand with no silt contamination.		
	10'0" - 19'0" (5.79)	9'0"	Sand fine-medium some course reddish in colour only a little silt. A few particles of coal and very small grit, no clay.		
	19'0" - 27'0" (8.22)	8'0"	Band of stiff brown clay no sand. A few particles of small gravel in clay.		

Contact BGS: ngdc@bgs.ac.uk

SJ 78 NW/27-40

Pages 58 & 59

Appendix (i) 53



British Geological Survey

BGS ID: 765627 : BGS Reference: SJ78NW31
British National Grid (27700) : 371650,389247

SJ78 NW/27-40

LEGEND.

- Over 50 ft. Sand.
- 45' - 50' Sand.
- 40' - 45' "
- 35' - 40' "
- 30' - 35' "
- 25' - 30' "
- 20' - 25' "
- 15' - 20' "
- 10' - 15' "
- 5' - 10' "
- 0 - 5' "
- Borehole Location
- Sand Isopach (thickness in feet).
- Buried Gas Pipeline.
- Overhead Electric Power Line.

SCALE 1:2500	DATE 8.1.74	ISSUE	REVISION	DATE	BY
DRG. No. MAP 2.	DRAWN				
	CHECKED				
	APPROVED				

YEW TREE FARM, WARBURTON.
DISTRIBUTION OF SAND.

AMEY ROADSTONE CORPORATION LIMITED
TECHNICAL DEPARTMENT
CHIPPING SODBURY, GLOS.

X 3241

Contact BGS: ngdc@bgs.ac.uk

YEW TREE FARM (E)

SJ 78/50 E

Owner		Licence No.	
Occupier		IGS Ref. No. SJ78NW31	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7168 8926

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Summary of Geological Section	Thickness	Depth
Stiff clay - no sand	2'	
Fine/medium red-yellow sand	5'	
Red clay marl, very stiff with some stones	15'	w.s.w.b.b'

Abstraction Rates		Type of Pump	
gph		Chem./Bact. Anal.	YES NO
gpd		Well Driller	

If insufficient space has been allowed, continue in 'Notes' overleaf.

YEW TREE FARM (F)

SJ 78/50 F

Owner		Licence No.	
Occupier		IGS Ref. No. SJ78NW32	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7176 8931

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Summary of Geological Section	Thickness	Depth
Soil	1	
Fine/medium sand	17	
Stiff brown clay	8	
Silty sand stiff marl	5	w.s. 5'6"

Abstraction Rates		Type of Pump	
gph		Chem./Bact. Anal.	YES NO
gpd		Well Driller	

If insufficient space has been allowed, continue in 'Notes' overleaf.

British Geological Survey
BGS ID: 765629 : BGS Reference: SJ78NW33
British National Grid (27700) : 371812,389357

ARC
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SJ 78 NW/32-34

Sheet No 3
Date October, 1973.
Location WARBURTON

Amey Roadstone Corporation Limited
Group Technical Centre Chipping Sodbury Wootton St Ives

Borehole log sheet

FORM P. 747 A.R.C. PRINTING, FROME

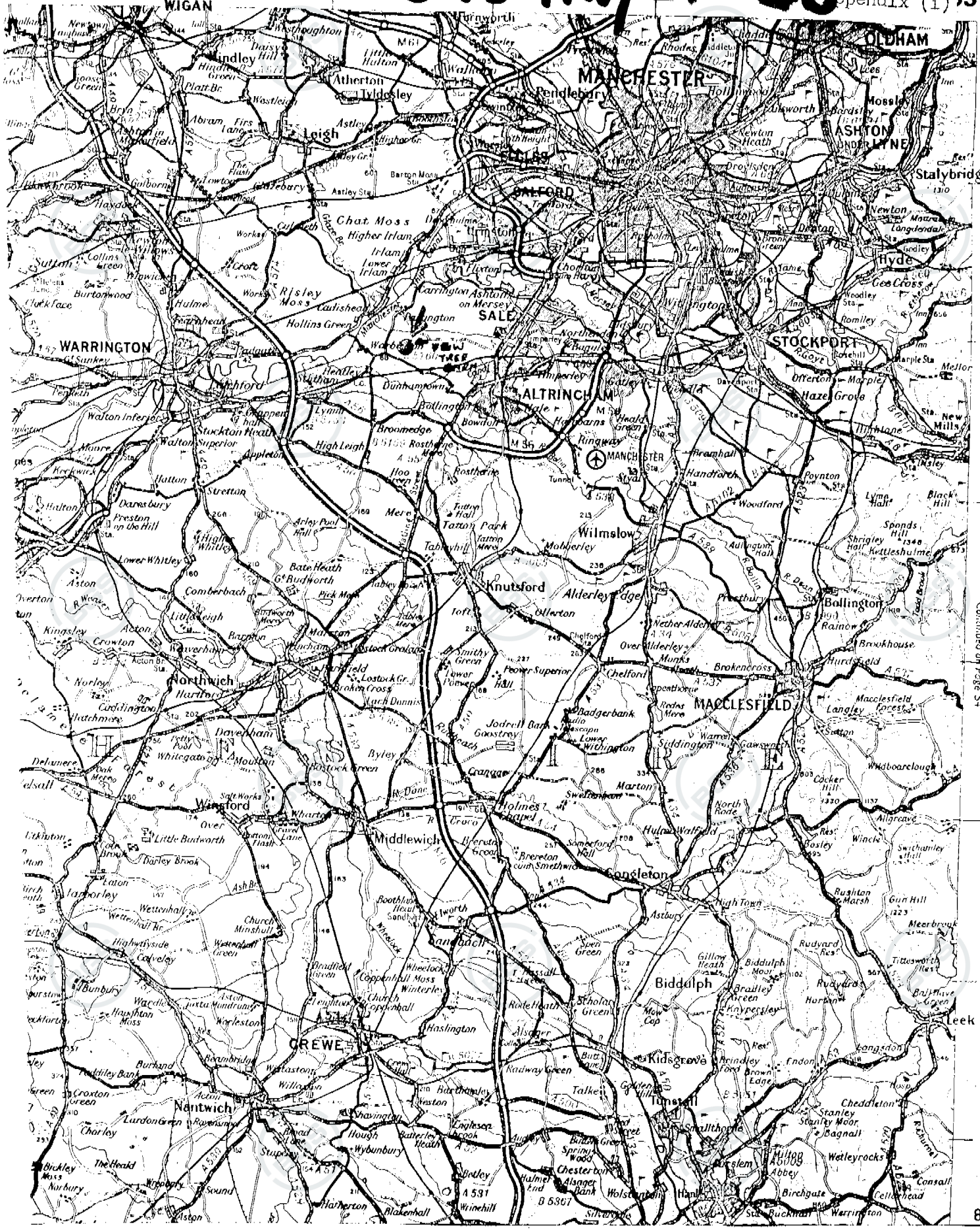
Bore No	Depth	Thickness	Description	Water Table	Sample Depth
6. Cont'd	9.90 27'0"-32'6"	5'6"	SJ 78 NW/32 Sand silty fine-medium. Stiff blue marl clay.	5'6"	
7.	0' - 6"	6"	November, 1973. SJ 78 NW/33 Topsoil, no sand content.		
	2.13 6"- 7'0"	6'6"	Fawny reddish fairly stiff clay with a few small sandy streaks.		
	3.20 7'0"-10'6"	3'6"	Very silty reddish sand-fine grade mostly some medium. A few streaks of soft red clay contamination.		
	3.50 10'6"-11'6"	1'0"	Band of slightly cleaner sand unable to get enough for sample.		
	6.09 11'6"-20'0"	8'6"	Same texture and appearance as above sample 7'-10'6". Fine silty sand.		
	8.22 20'0"-27'0"	7'0"	Clay marl blueish with some brownish streaks and a few particles of very small gravel.	5'0"	
8.	0.30 0' - 1'0"	1'0"	SJ 78 NW/34 Topsoil no sand content.		
	0.91 1'0"- 3'0"	2'0"	Fawny red plastic-stiff clay with no real sand content apart from a few silty streaks.		
	5.18 3'0"-17'0"	14'0"	Redish brown very silty sandy clay, sand not washable.		
	6.70 17'0"-22'0"	5'0"	Brown stiff clay with a few particles of very small gravel and an occasional piece of fragmented coal or lignite.	4'6"	

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765629 : BGS Reference: SJ78NW33
British National Grid (27700) : 371812,389357

SJ 78 NW/27-40



Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765629 : BGS Reference: SJ78NW33
British National Grid (27700) : 371812,389357

SJ78 NW/27-40

LEGEND.

- Over 50 ft. Sand.
- 45' - 50' Sand.
- 40' - 45' "
- 35' - 40' "
- 30' - 35' "
- 25' - 30' "
- 20' - 25' "
- 15' - 20' "
- 10' - 15' "
- 5' - 10' "
- 0 - 5' "
- Borehole Location
- Sand Isopach (thickness in feet).
- Buried Gas Pipeline.
- Overhead Electric Power Line.

SCALE 1:2500	DATE 8.1.74	ISSUE	REVISION	DATE	BY
DRG. No. MAP 2.	DRAWN				
	CHECKED				
	APPROVED				

YEW TREE FARM, WARBURTON.
DISTRIBUTION OF SAND.

AMEY ROADSTONE CORPORATION LIMITED
TECHNICAL DEPARTMENT
CHIPPING SODBURY, GLOS.

X 3241

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765629 : BGS Reference: SJ78NW33
British National Grid (27700) : 371812,389357

YEW TREE FARM (G)

SJ 78/50 G

Owner		Licence No.	
Occupier		IGS Ref. No. SJ 78 NW 33	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7181 8935

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Top soil	6"	
Red stiff clay	6	
Silty red sand	3	
Sandy silt	9	
clay marl, blue with gravels particles	7	W.L.S

YEW TREE FARM (H)

SJ 78/50 H

Owner		Licence No.	
Occupier		IGS Ref. No. SJ 78 NW 34	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7177 8942

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Top soil	1	
Red stiff clay	2	
Silty sandy clay	14	
Brown stiff clay with few particles of very small gravel	5	

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey
BGS ID: 765630 : BGS Reference: SJ78NW34
British National Grid (27700) : 371754,389395

ARC
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SJ 78 NW/32-34

Sheet No 3
Date October, 1973.
Location WARBURTON

Amey Roadstone Corporation Limited
Group Technical Centre Chipping Sodbury Wootton St Ives

Borehole log sheet

FORM P. 747 A.R.C. PRINTING, FROME

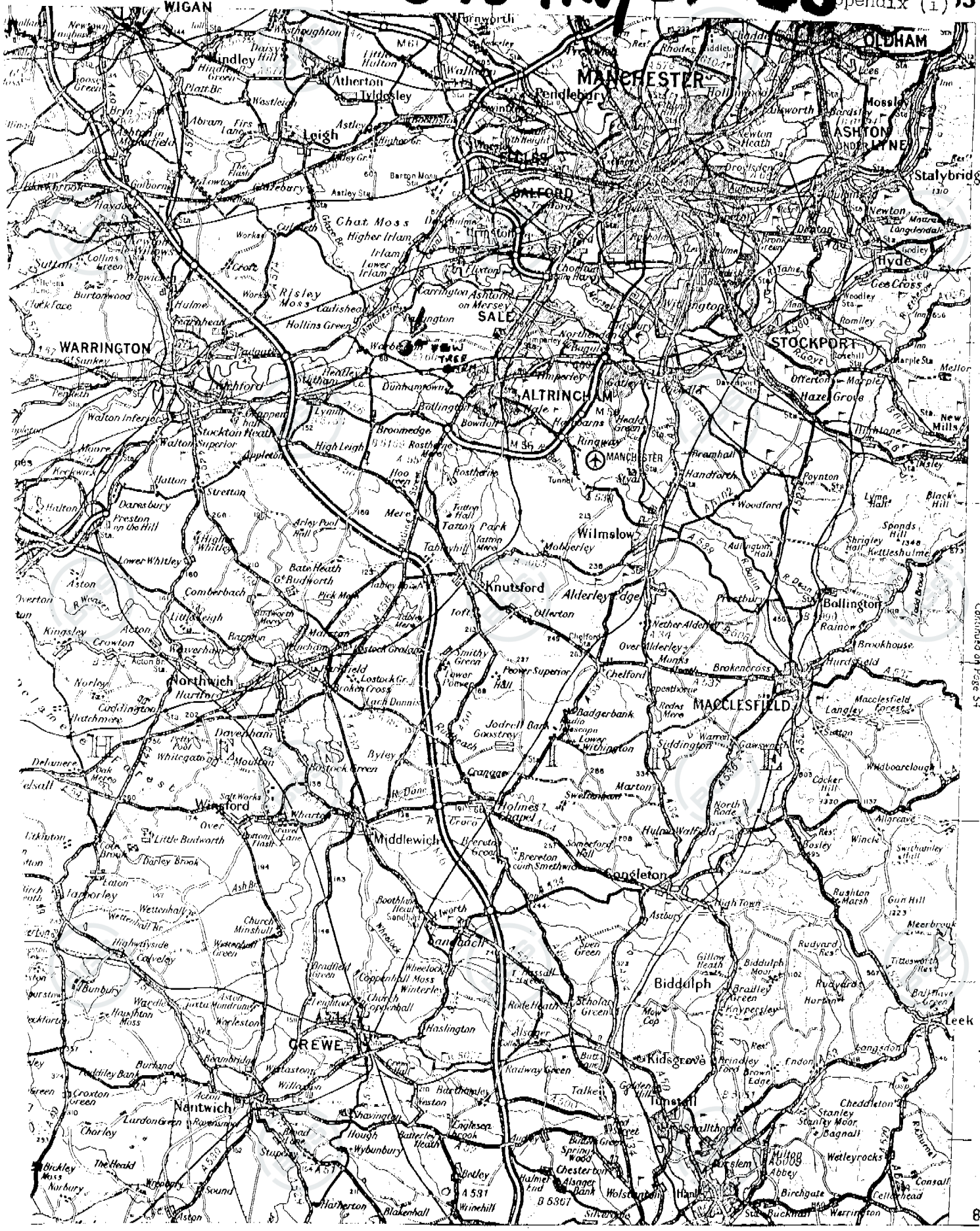
Bore No	Depth	Thickness	Description	Water Table	Sample Depth
6. Cont'd	9.90 27'0"-32'6"	5'6"	SJ 78 NW/32 Sand silty fine-medium. Stiff blue marl clay.	5'6"	
7.	0' - 6"	6"	November, 1973. SJ 78 NW/33 Topsoil, no sand content.		
	2.13 6"- 7'0"	6'6"	Fawny reddish fairly stiff clay with a few small sandy streaks.		
	3.20 7'0"-10'6"	3'6"	Very silty reddish sand-fine grade mostly some medium. A few streaks of soft red clay contamination.		
	3.50 10'6"-11'6"	1'0"	Band of slightly cleaner sand unable to get enough for sample.		
	6.09 11'6"-20'0"	8'6"	Same texture and appearance as above sample 7'-10'6". Fine silty sand.		
	8.22 20'0"-27'0"	7'0"	Clay marl blueish with some brownish streaks and a few particles of very small gravel.	5'0"	
8.	0.30 0' - 1'0"	1'0"	SJ 78 NW/34 Topsoil no sand content.		
	0.91 1'0"- 3'0"	2'0"	Fawny red plastic-stiff clay with no real sand content apart from a few silty streaks.		
	5.18 3'0"-17'0"	14'0"	Redish brown very silty sandy clay, sand not washable.		
	6.70 17'0"-22'0"	5'0"	Brown stiff clay with a few particles of very small gravel and an occasional piece of fragmented coal or lignite.	4'6"	

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765630 : BGS Reference: SJ78NW34
British National Grid (27700) : 371754,389395

SJ 78 NW/27-40


WIGAN
Leigh
Atherton
Tyldesley
Lindley Hill
Abram
Ashton in Makerfield
Platt Br.
Westleigh
Astley
Chat Moss
Higher Irlam
Irlam
Lower Irlam
Irlam Locks
Glazebrook
Cadishead
Partington
Carrington
Ashton on Mersey
SALE
Sale Water Park
Northenden
Wythenshawe
Baguley
Sharston
Manchester Airport
Ringway
MANCHESTER
Manchester Ship Canal
Trafford Park
Stretford
Urmston
Flixton
Davyhulme
Barton Moss
Eccles
Salford
Pendlebury
Swinton
Worsley
Boothstown
Ellenbrook
Walkden
Little Hulton
Farnworth
Bolton
Daisy Hill
Hindley Green
Platt Br.
Westleigh
Abram
Firs Lane
Astley
Astley Green
Mosley Common
Tyldes

British Geological Survey

BGS ID: 765630 : BGS Reference: SJ78NW34
British National Grid (27700) : 371754,389395

SJ78 NW/27-40

LEGEND.

- Over 50 ft. Sand.
- 45' - 50' Sand.
- 40' - 45' "
- 35' - 40' "
- 30' - 35' "
- 25' - 30' "
- 20' - 25' "
- 15' - 20' "
- 10' - 15' "
- 5' - 10' "
- 0 - 5' "
- Borehole Location
- Sand Isopach (thickness in feet).
- Buried Gas Pipeline.
- Overhead Electric Power Line.

SCALE 1:2500	DATE 8.1.74	ISSUE	REVISION	DATE	BY
DRG. No. MAP 2.	DRAWN				
	CHECKED				
	APPROVED				

YEW TREE FARM, WARBURTON.
DISTRIBUTION OF SAND.

AMEY ROADSTONE CORPORATION LIMITED
TECHNICAL DEPARTMENT
CHIPPING SODBURY, GLOS.

X 3241

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765630 : BGS Reference: SJ78NW34
British National Grid (27700) : 371754,389395

YEW TREE FARM (G)

SJ 78/50 G

Owner		Licence No.	
Occupier		IGS Ref. No. SJ 78 NW 33	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7181 8935

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Top soil	6	
Red stiff clay	6	
Silty red sand	3	
Sandy silt	9	
clay rock, blue with gravels particles	7	W.L. 5

YEW TREE FARM (H)

SJ 78/50 H

Owner		Licence No.	
Occupier		IGS Ref. No. SJ 78 NW 34	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7177 8942

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Top soil	1	
Red stiff clay	2	
Silty sandy clay	14	
Brown stiff clay with few particles of very small gravel	5	

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765631 : BGS Reference: SJ78NW35
British National Grid (27700) : 371568,389243

*SJ 78 NW/~~22~~ 35-37

ARC
A member of the Gold Fields Group

Sheet No 4
Date November, 1973.
Location WARBURTON

Amey Roadstone Corporation Limited
Group Technical Centre Chipping Sodbury Wootton St Ives

Borehole log sheet

FORM P. 747 A.R.C. PRINTING, FROME

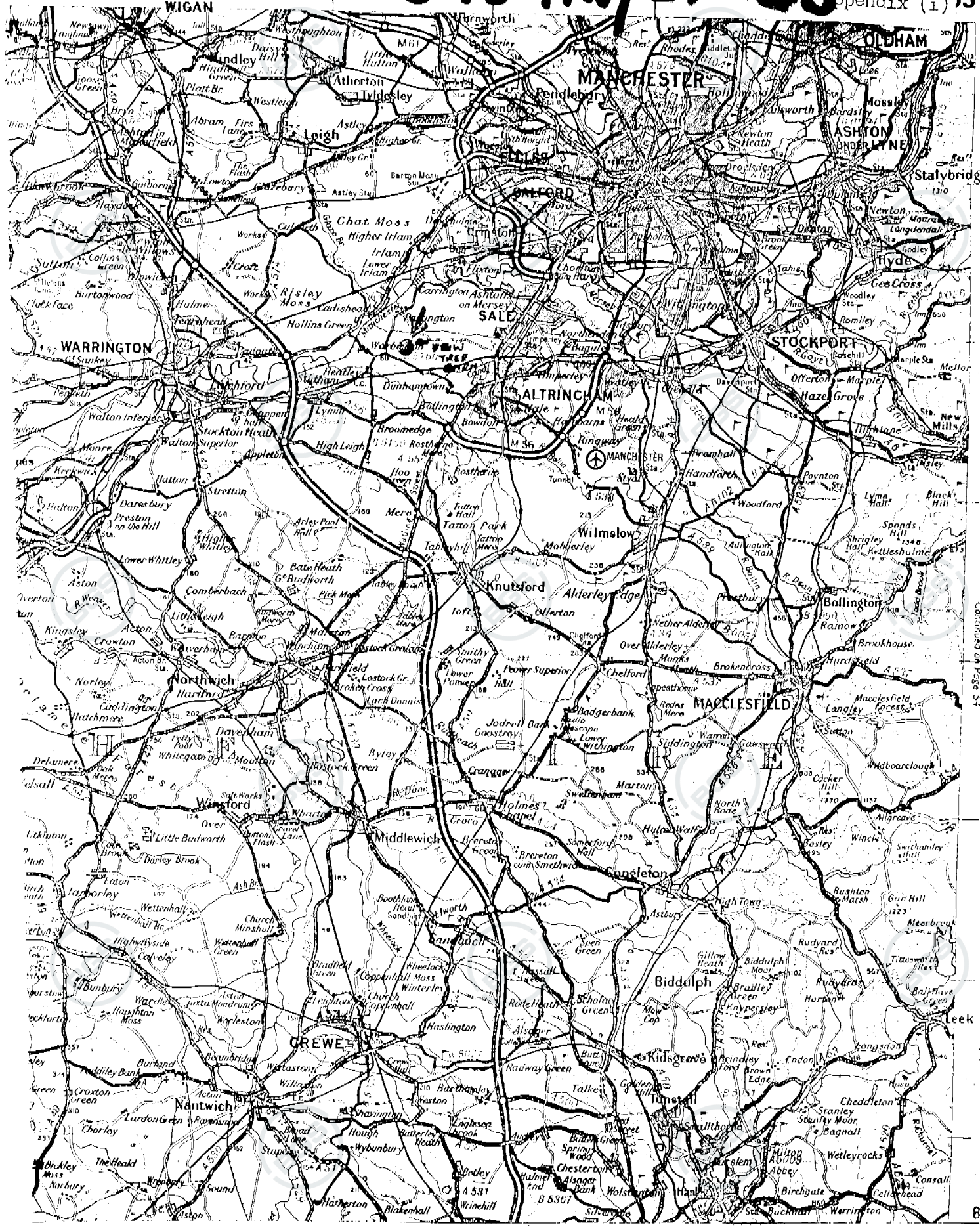
Bore No	Depth	Thickness	Description	Water Table	Sample Depth
9.			SJ 78 NW/35		
	0' -1'0"	1'0"	Topsoil peaty texture, no sand.		
	1'0"- 5'6"	4'6"	Foamy streaky brown sandy clay.		
	5'6"-17'0"	11'6	Fine-medium grade sand, only a little silt contamination.		
	17'0"-22'0"	5'0"	Silty reddish fine sand with some clay (soft) contamination. A few pieces of very small gravel.		
	22'0"-27'0"	5'0"	Grey brown blue marl clay with a few particles of very small gravel.	5'0"	
10.			SJ 78 NW/36		
	0' - 1'0"	1'0"	Topsoil peaty texture, no sand.		
	1'0"- 5'0"	4'0"	Mixture of foamy brown sandy clay.		
	5'0"-12'0"	7'0"	Silty red fine sand with an occasional band of fine soft red silty clay.		
	12'0"-15'6"	3'6"	Band of very silty clay bound sand, fine grade.		
	15'6"-20'0"	4'6"	Silty red fine sand with a little clay contamination.		
	20'0"-20'6"	6"	Brown marl clay with light blue streaks, some small particles of gravel.	4'6"	
11.			SJ 78 NW/37		
	0' - 1'0"	1'0"	Topsoil peaty texture.		
	1'0"- 2'6"	1'6"	Fine yellowish very silty sand, with some soft streaks of clay.		
	2'6"-10'0"	7'6"	Fine reddish silty sand with small amount of silty clay and an occasional small piece of gravel.		
	10'0"-15'0"	5'0"	Silty sand with fair amount of clay contamination and a few small pebbles.		
	15'0"-22'0"	7'0"	Marl clay brown with blueish grey streak of clay some small particles of gravel.	4'6"	

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765631 : BGS Reference: SJ78NW35
British National Grid (27700) : 371568,389243

SJ 78 NW/27-40



Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765631 : BGS Reference: SJ78NW35
British National Grid (27700) : 371568,389243

SJ78 NW/27-40

LEGEND.

- Over 50 ft. Sand.
- 45' - 50' Sand.
- 40' - 45' "
- 35' - 40' "
- 30' - 35' "
- 25' - 30' "
- 20' - 25' "
- 15' - 20' "
- 10' - 15' "
- 5' - 10' "
- 0 - 5' "
- Borehole Location
- Sand Isopach (thickness in feet).
- Buried Gas Pipeline.
- Overhead Electric Power Line.

SCALE 1:2500	DATE 8.1.74	ISSUE	REVISION	DATE	BY
DRG. No. MAP 2.	DRAWN				
	CHECKED				
	APPROVED				

YEW TREE FARM, WARBURTON.
DISTRIBUTION OF SAND.

AMEY ROADSTONE CORPORATION LIMITED
TECHNICAL DEPARTMENT
CHIPPING SODBURY, GLOS.

X 3241

Contact BGS: ngdc@bgs.ac.uk

YEW TREE FARM (I)

SJ 78/50 I

Owner		Licence No.	
Occupier		IGS Ref. No. SJ78NW35	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7157 8926

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Top soil	1	
Brown clay	4	
Fine/medium sand	11	
Fine sand	5	
Grey brown marl	5	

YEW TREE FARM (J)

SJ 78/50 J

Owner		Licence No.	
Occupier		IGS Ref. No. SJ78NW36	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7147 8927

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Top soil	1	
Fawny brown clay	4	
Silty red sand	7	
Silty clay sand	3	
Silty red sand	4	
Brown marl, clay & gravel	6"	

British Geological Survey

BGS ID: 765632 : BGS Reference: SJ78NW36
British National Grid (27700) : 371471,389256

*SJ 78 NW/~~22~~ 35-37

ARC
A member of the Gold Fields Group

Sheet No 4
Date November, 1973.
Location WARBURTON

Amey Roadstone Corporation Limited
Group Technical Centre Chipping Sodbury Wootton St Ives

Borehole log sheet

FORM P. 747 A.R.C. PRINTING, FROME

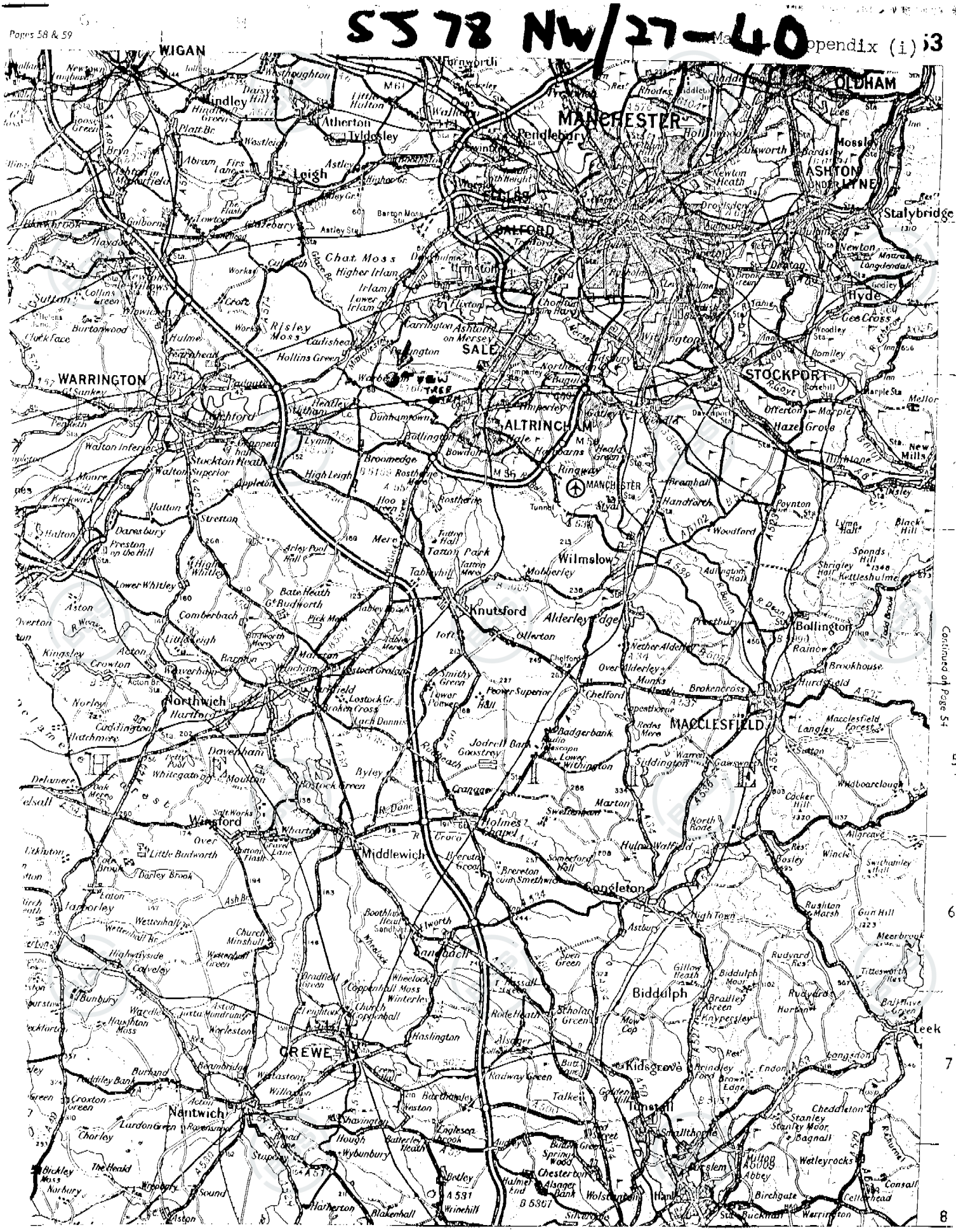
Bore No	Depth	Thickness	Description	Water Table	Sample Depth
9.			SJ 78 NW/35		
	0' -1'0"	1'0"	Topsoil peaty texture, no sand.		
	1'0"- 5'6" (1.67)	4'6"	Foamy streaky brown sandy clay.		
	5'6"-17'0" (5.18)	11'6	Fine-medium grade sand, only a little silt contamination.		
	17'0"-22'0" (6.76)	5'0"	Silty reddish fine sand with some clay (soft) contamination. A few pieces of very small gravel.		
	22'0"-27'0" (8.22)	5'0"	Grey brown blue marl clay with a few particles of very small gravel.	5'0"	
10.			SJ 78 NW/36		
	0' - 1'0" (0.30)	1'0"	Topsoil peaty texture, no sand.		
	1'0"- 5'0" (1.52)	4'0"	Mixture of foamy brown sandy clay.		
	5'0"-12'0" (3.65)	7'0"	Silty red fine sand with an occasional band of fine soft red silty clay.		
	12'0"-15'6" (4.72)	3'6"	Band of very silty clay bound sand, fine grade.		
	15'6"-20'0" (6.09)	4'6"	Silty red fine sand with a little clay contamination.		
	20'0"-20'6" (6.24)	6"	Brown marl clay with light blue streaks, some small particles of gravel.	4'6"	
11.			SJ 78 NW/37		
	0' - 1'0" (0.30)	1'0"	Topsoil peaty texture.		
	1'0"- 2'6" (0.76)	1'6"	Fine yellowish very silty sand, with some soft streaks of clay.		
	2'6"-10'0" (3.04)	7'6"	Fine reddish silty sand with small amount of silty clay and an occasional small piece of gravel.		
	10'0"-15'0" (4.57)	5'0"	Silty sand with fair amount of clay contamination and a few small pebbles.		
	15'0"-22'0" (6.70)	7'0"	Marl clay brown with blueish grey streak of clay some small particles of gravel.	4'6"	

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765632 : BGS Reference: SJ78NW36
British National Grid (27700) : 371471,389256

SJ 78 NW/27-40



Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765632 : BGS Reference: SJ78NW36
British National Grid (27700) : 371471,389256

SJ78 NW/27-40

LEGEND.

- Over 50 ft. Sand.
- 45' - 50' Sand.
- 40' - 45' "
- 35' - 40' "
- 30' - 35' "
- 25' - 30' "
- 20' - 25' "
- 15' - 20' "
- 10' - 15' "
- 5' - 10' "
- 0 - 5' "
- Borehole Location
- Sand Isopach (thickness in feet).
- Buried Gas Pipeline.
- Overhead Electric Power Line.

SCALE 1 2500	DATE 8 : 1 74	ISSUE	REVISION	DATE	BY
DRG. No. MAP 2.	DRAWN				
	CHECKED				
	APPROVED				

YEW TREE FARM, WARBURTON.
DISTRIBUTION OF SAND.

AMEY ROADSTONE CORPORATION LIMITED
TECHNICAL DEPARTMENT
CHIPPING SODBURY, GLOS.

X 3241

Contact BGS: ngdc@bgs.ac.uk

YEW TREE FARM (I)

SJ 78/50 I

Owner		Licence No.	
Occupier		IGS Ref. No. SJ78NW36	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7157 8926

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Top soil	1	
Brown clay	4	
Fine/medium sand	11	
Fine sand	5	
Grey brown marl	5	

YEW TREE FARM (J)

SJ 78/50 J

Owner		Licence No.	
Occupier		IGS Ref. No. SJ78NW36	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7147 8927

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Top soil	1	
Fawny brown clay	4	
Silty red sand	7	
Silty clay sand	3	
Silty red sand	4	
Brown marl, clay & gravel	6"	

British Geological Survey

BGS ID: 765633 : BGS Reference: SJ78NW37
British National Grid (27700) : 371387,389295

*SJ 78 NW/~~22~~ 35-37

ARC
A member of the Gold Fields Group

Sheet No 4
Date November, 1973.
Location WARBURTON

Amey Roadstone Corporation Limited
Group Technical Centre Chipping Sodbury Wootton St Ives

Borehole log sheet

FORM P. 747 A.R.C. PRINTING, FROME

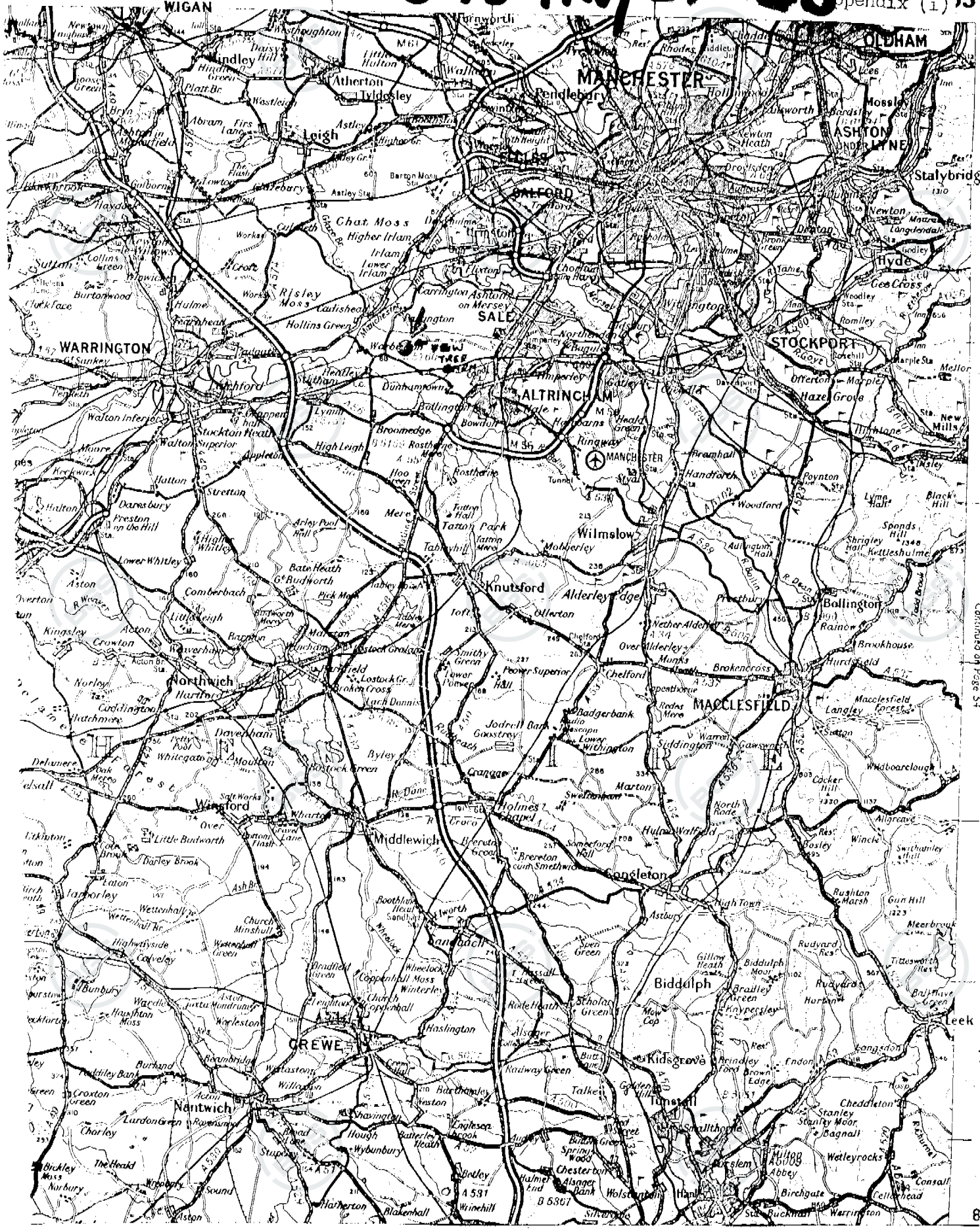
Bore No	Depth	Thickness	Description	Water Table	Sample Depth
9.			SJ 78 NW/35		
	0' -1'0"	1'0"	Topsoil peaty texture, no sand.		
	1'0"- 5'6" (1.67)	4'6"	Foamy streaky brown sandy clay.		
	5'6"-17'0" (5.18)	11'6	Fine-medium grade sand, only a little silt contamination.		
	17'0"-22'0" (6.76)	5'0"	Silty reddish fine sand with some clay (soft) contamination. A few pieces of very small gravel.		
	22'0"-27'0" (8.22)	5'0"	Grey brown blue marl clay with a few particles of very small gravel.	5'0"	
10.			SJ 78 NW/36		
	0' - 1'0" (0.30)	1'0"	Topsoil peaty texture, no sand.		
	1'0"- 5'0" (1.52)	4'0"	Mixture of foamy brown sandy clay.		
	5'0"-12'0" (3.65)	7'0"	Silty red fine sand with an occasional band of fine soft red silty clay.		
	12'0"-15'6" (4.72)	3'6"	Band of very silty clay bound sand, fine grade.		
	15'6"-20'0" (6.09)	4'6"	Silty red fine sand with a little clay contamination.		
	20'0"-20'6" (6.24)	6"	Brown marl clay with light blue streaks, some small particles of gravel.	4'6"	
11.			SJ 78 NW/37		
	0' - 1'0" (0.30)	1'0"	Topsoil peaty texture.		
	1'0"- 2'6" (0.76)	1'6"	Fine yellowish very silty sand, with some soft streaks of clay.		
	2'6"-10'0" (3.04)	7'6"	Fine reddish silty sand with small amount of silty clay and an occasional small piece of gravel.		
	10'0"-15'0" (4.57)	5'0"	Silty sand with fair amount of clay contamination and a few small pebbles.		
	15'0"-22'0" (6.70)	7'0"	Marl clay brown with blueish grey streak of clay some small particles of gravel.	4'6"	

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765633 : BGS Reference: SJ78NW37
British National Grid (27700) : 371387,389295

SJ 78 NW/27-40



Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765633 : BGS Reference: SJ78NW37
British National Grid (27700) : 371387,389295

SJ78 NW/27-40

LEGEND.

- Over 50 ft. Sand.
- 45' - 50' Sand.
- 40' - 45' "
- 35' - 40' "
- 30' - 35' "
- 25' - 30' "
- 20' - 25' "
- 15' - 20' "
- 10' - 15' "
- 5' - 10' "
- 0 - 5' "
- Borehole Location
- Sand Isopach (thickness in feet).
- Buried Gas Pipeline.
- Overhead Electric Power Line.

SCALE 1:2500	DATE 8.1.74	ISSUE	REVISION	DATE	BY
DRG. No. MAP 2.	DRAWN				
	CHECKED				
	APPROVED				

YEW TREE FARM, WARBURTON.
DISTRIBUTION OF SAND.

AMEY ROADSTONE CORPORATION LIMITED
TECHNICAL DEPARTMENT
CHIPPING SODBURY, GLOS.

X 3241

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 765633 : BGS Reference: SJ78NW37
British National Grid (27700) : 371387,389295

YEW TREE FARM (K)

SJ 78/50 K

Owner		Licence No.	
Occupier		IGS Ref. No. SJ78NW37	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7140 8931

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Soil	1	
Yellow silty sand	1 6	
Fine red silt	7 6	
Silty sand	5	
Marl, clayey, brown with bluish grey streaks	7	

YEW TREE FARM (L)

SJ 78/50 L

Owner		Licence No.	
Occupier		IGS Ref. No. SJ78NW38	
Ground Level	m OD	ft. OD	
Level of Well Top	m OD	ft. OD	
Rest Water Level	m bwt	ft. bwt	
(Date)	m OD	ft. OD	

Nat. Grid Ref. SJ 7122 8939

Status

Aquifer

Construction

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type

Abstraction Rates	Type of Pump
gph	Chem./Bact. Anal. YES NO
gpd	Well Driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

Summary of Geological Section	Thickness	Depth
Soil	1	
Red/grey clay	7	
Silty sand	5	
clay marl	9	

Contact BGS: ngdc@bgs.ac.uk

HyNet North West Hydrogen Pipeline

Delivering clean growth

Annex 14A 6
Acton Bridge Borehole Logs

British Geological Survey

BGS ID: 166803 : BGS Reference: SJ57NE2
British National Grid (27700) : 359950,376030

RECORD OF WELL

For Institute use only Licence No.

SJ 57/61 NN.....
SJ 57 NE/2
97/68
97/68

At ACTON BRIDGE
BRINE BORING
Town or Village ACTON
County CHESHIRE

EXACT SITE OF WELL

Six-inch National Grid sheet and reference SJ 5995 76cA SJ 57 NE

For .....

State whether owner, tenant, builder, contractor, consultant, etc.: .....

Address (if different from above) .....

.....

Level of ground surface above sea level (O.D.) 29 ft (.....m)

*DELETE AS NECESSARY

If well top is not at ground level state how far above:* below: .....ft (.....m)

SHAFT.....ft (.....m); diameter.....ft (.....m);

HEADINGS (please attach details—dimensions and directions)

BORE 2300 ft (.....m); diameter: at top.....in (.....mm);

at bottom.....in (.....mm)

Full details of permanent lining tubes (position, length, inner and outer diameters, plain slotted etc.):

.....

.....

.....

.....

TEST CONDITIONS

Water struck at depths of .....ft (.....m) below well top

Rest level of water ARTESIAN ft (.....m) above* below* well top. Suction at..... ft (.....m)

Yield on hours'* days'* test pumping at.....galls per ..... (..... l/s) with

depression to.....ft (.....m) below well top. Recovery to rest level in ..... mins* hours*

Capacity of pump.....g.p.h. (.....l/s)

Date of measurements.....

NORMAL CONDITIONS

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

Make and/or type ..... Motive power.....

Capacity.....galls (.....m^3) per hour. Suction at ..... ft (.....m)

below well top. Amount pumped.....galls (.....m^3) per day. Estimated

consumption .....galls (.....m^3) per week

Well made by ..... Date of sinking 1899

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

LOG OF STRATA OVERLEAF

INSTITUTE OF GEOLOGICAL SCIENCES
HYDROGEOLOGY UNIT
EXHIBITION ROAD
LONDON SW7 2DE

IGS 2494 10 000 7/79

Received from MANKHOUSE
.....
.....
Date 24.2.82
Observation well.....
Recorder .....
ER log .....
Site marked on
1" map .....○.....
6" map—Grid Sheet.....○.....
(use symbol)
Copy to NW. ENGLAND
.....
Date .....

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166803 : BGS Reference: SJ57NE2
British National Grid (27700) : 359950,376030

For Institute use only

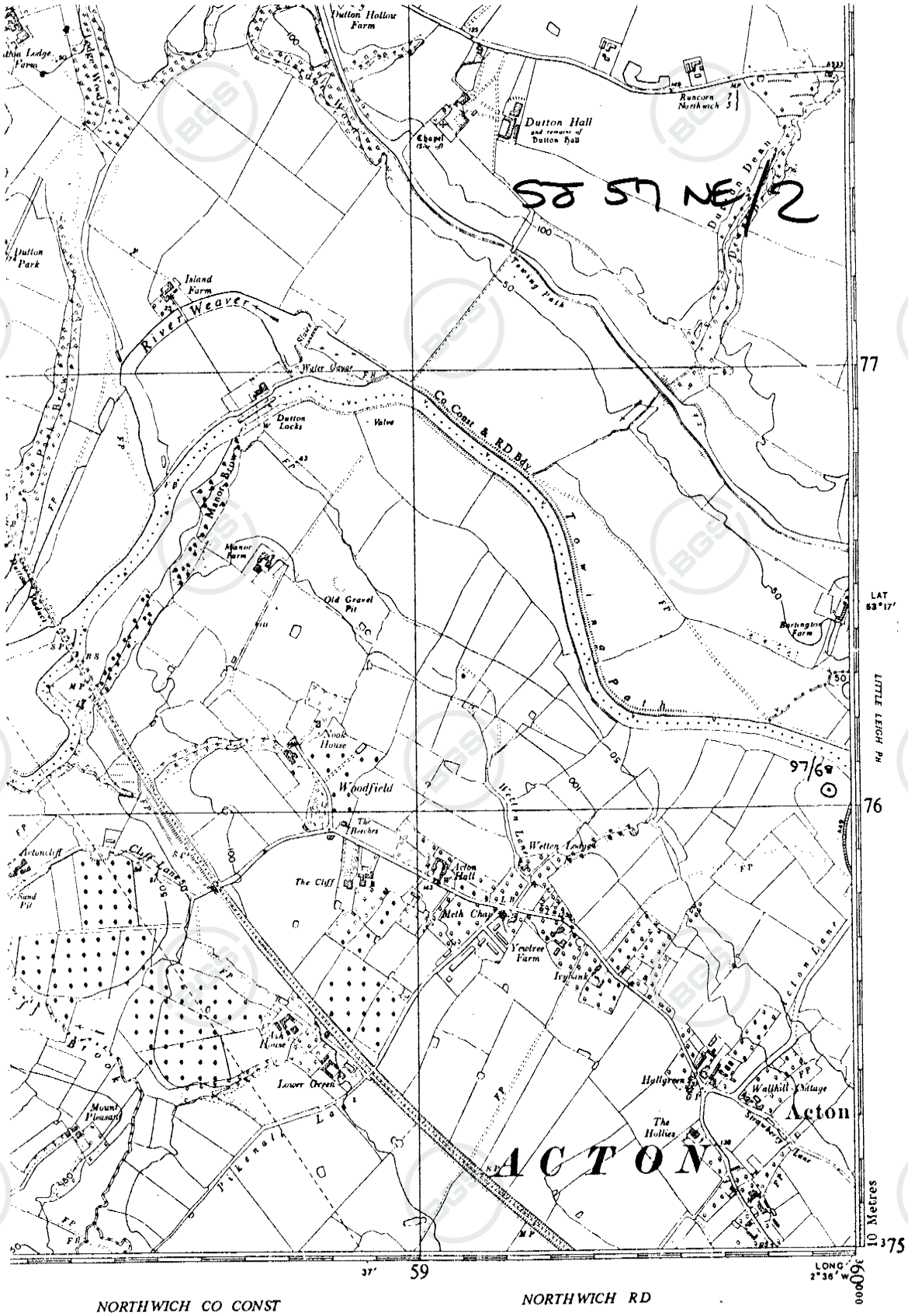
SO 57 NE/2

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA *If measurements start below ground surface, state how far.*	THICKNESS Feet	Inches	Metres	DEPTH Feet	Inches	Metres
ALLUVIAL DEPOSITS.	SANDY CLAY	24			24		
	GRAVEL	12	6		36	6	
PERMO-TRIASSIC / KEUPER MARL	KEUPER MARL	564	6		601		
	KEUPER MARL	1499			2100		
KEUPER SANDSTONE	RED SANDSTONE	200			2300		

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166803 : BGS Reference: SJ57NE2
British National Grid (27700) : 359950,376030



Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166803 : BGS Reference: SJ57NE2
British National Grid (27700) : 359950,376030

RECORD OF WELL

For Institute use only Licence No.

SJ 57/61 NN.....

97/68

97/68

At ACTON BRIDGE

BRINE BORING

Town or Village ACTON

County CHESHIRE

EXACT SITE OF WELL

Six-inch National Grid sheet and reference SJ 5995 7604 SJ 57 NE/2

For .....

State whether owner, tenant, builder, contractor, consultant, etc.: .....

Address (if different from above) .....

.....

Level of ground surface above sea level (O.D.) 29 ft (.....m)

*DELETE AS NECESSARY

If well top is not at ground level state how far above:* below: .....ft (.....m)

SHAFT.....ft (.....m); diameter.....ft (.....m);

HEADINGS (please attach details—dimensions and directions)

BORE 2300 ft (.....m); diameter: at top.....in (.....mm);

at bottom.....in (.....mm)

Full details of permanent lining tubes (position, length, inner and outer diameters, plain slotted etc.):

.....

.....

.....

.....

Water struck at depths of .....ft (.....m) below well top

TEST CONDITIONS

Rest level of water ARTESIAN ft (.....m) above* below well top. Suction at..... ft (.....m)

Yield on.....hours'* days' test pumping at.....galls per ..... (..... l/s) with

depression to.....ft (.....m) below well top. Recovery to rest level in ..... mins* hours

Capacity of pump.....g.p.h. (.....l/s)

Date of measurements.....

NORMAL CONDITIONS

DESCRIPTION OF PERMANENT PUMPING EQUIPMENT:

Make and/or type ..... Motive power.....

Capacity.....galls (.....m^3) per hour. Suction at ..... ft (.....m)

below well top. Amount pumped.....galls (.....m^3) per day. Estimated

consumption .....galls (.....m^3) per week

Well made by ..... Date of sinking 1899

ADDITIONAL NOTES ANALYSIS (please attach copy if available)

LOG OF STRATA OVERLEAF

Received from MANKHOUSE

.....

.....

Date 24.2.82

Observation well.....

Recorder .....

ER log .....

Site marked on

1" map ..... O

6" map—Grid Sheet..... O

(use symbol)

Copy to NW. ENGLAND

.....

Date .....

INSTITUTE OF GEOLOGICAL SCIENCES
HYDROGEOLOGY UNIT
EXHIBITION ROAD
LONDON SW7 2DE

IGS 2404 10 000 7/79

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166803 : BGS Reference: SJ57NE2
British National Grid (27700) : 359950,376030

97/68

For Institute use only

Geological Classification	Nature of Strata *If measurements start below ground surface, state how far.*	Thickness Feet	Thickness Inches	Thickness Metres	Depth Feet	Depth Inches	Depth Metres
Permo-Triassic / Keuper Alluvial Deposits	SANDY CLAY	24			24		
Keuper Marl	GRAVEL	12	6		36	6	
	KEUPER MARL	564	6		601		
Keuper Sandstone	KEUPER MARL	1499			2100		
	RED SANDSTONE	200			2300		

I.P.S.
15/3/82

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166803 : BGS Reference: SJ57NE2
British National Grid (27700) : 359950,376030

ACTON BRIDGE Boring for Brine

SJ 57/61

Owner		Licence no. Appn no.	697/68	Nat. grid ref.	59957604 [redacted]
Occupier		IGS ref. no.	57/NE/2	Status	
Ground level	m OD	29	ft. OD	Aquifer	
Level of well top	m OD		ft. OD	Code	
Rest water level	m bwt	a Neap ?	ft. bwt		
(Date)	m OD		ft. OD		
Construction: Method		Date	1899		

Depth bwt	Dia.	Linings (below well top) From	To	Dia.	Type
2300'					

Summary of geological section	Thickness	Depth
Sandy clay	24	
Gravel	12'6"	
Keuper Marl	564' 6"	601'
	1499	2100'
Red Silt	200'	2300'

Abstraction rates
gph PWL
gpd

Type of pump
Chem./bact. anal. YES/NO
Well driller

If insufficient space has been allowed, continue in 'Notes' overleaf.

PTO.

1/5/79/207

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166803 : BGS Reference: SJ57NE2
British National Grid (27700) : 359950,376030

SJ57/61

1" N.S. 97
1" O.S. 1
Grid Ref. 33NE

RECORD OF WELL (SHAFT OR BORE)

At ACTON BRIDGE BORING FOR BRINE
Town or Village County CHESHIRE Six-inch quarter sheet 33 NE
Exact site South bank of River Weaver alongside Acton Bridge in parish (A rough sketch-map or a tracing from a map is very desirable)
Level of ground surface above sea-level (O.D.) +29 ft. If well starts below ground surface, state how far ft.
Shaft ft., diameter ft. Bore 2300 ft. Diameter of bore: at top ins.; at bottom ins.
Details of permanent lining tubes (internal diameters preferred)
Water struck at depths of (feet)
Rest-level of water below / above top of well feet. Suction at feet. Yield on hours' / days' test
gallons per (with pump of capacity g.p.h.); depressing water level to feet
below top. Time of recovery hrs. Amount normally pumped daily g.p.h. for hours.
Quality (attach copy of analysis if available)
Sunk by Messrs Simpson and for Mr Allen. Date of well 1894
Information from Lab Journal Mar.

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.
Drift 36½	Sandy clay	24	0	24	0
	Gravel	12	6	36	6
Keuper Marl 1063½	Red and grey marl and occasional hard bands of marlstone	564	6	601	0
	Marl	1499	-	2100	-
Sandstone? or Keuper Sandstone?	Red sandstone	200	-	2300	-
	Yielded 600,000 gallons per day at 1700 ft.				
	Yielded 750,000 gallons per day at 2100 ft.				
	Rock Salt (100% NaCl).				
	Running water, outfall brine placed several feet under River Weaver.				
	Bored to 601 ft. by Messrs Simpson and bored 2300 ft by Messrs Allen.				
	Temperature of water taken by Simpson 1899 was 66° Fah. at bored depth 601 ft.				

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.

For Survey use only

Date received	O.S.M. Office Plan No.	Site marked on 1" map (see symbol)

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166825 : BGS Reference: SJ57NE16
EPSG: 27700 : 359903,376178

Soil Mechanics

BOREHOLE No. 1

Sheet 1 of 4

Equipment & Methods
Cable tool boring, 200mm diameter to 8.50m, then 150mm to 9.00m. Rotary core drilling, 74mm diameter, with water flush and mylar lining.

Location No. 7703
Location SJ57NE16
A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

Carried out for
Department of Transport

Ground Level
8.97 m A.O.D.

Coordinates
359903.00mE
376178.00mN

Date
09.07.91 to 11.07.91

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	8.97		(0.30)					
	8.67		0.30	0.50	D	1		Inspection pit to 1.30m
Soft to firm orange brown sandy becoming very sandy CLAY with occasional dark grey organic pockets. (Alluvial Deposits)			(1.40)	0.80 - 1.25	U	2		22 blows
				1.30	D	3		
	7.27		1.70					
				1.70 - 2.15	U	4		22 blows
				2.20	D	5		
Loose orange brown locally slightly clayey fine to coarse SAND. Below about 2.50m, with some subrounded quartzite gravel. (Alluvial Deposits)				2.50	W	8		Water entry at 2.50m
			(1.80)	2.70 - 3.45	D	6	S N-7	1,1/1,2,2,2 /2,3,3,3
				2.70 - 3.50	B	7		
	5.47		3.50					
Loose to medium dense subrounded to rounded fine to coarse quartzite GRAVEL. (Alluvial Deposits)		o o o		3.70 - 4.15	D	8	S N-10	1,2/2,2,3,3
with much sand and rare cobbles		o o o		3.70 - 4.20	B	9		
		o o o	(1.40)					
		o o o		4.70 - 5.15			S N-13	2,2/3,3,3,4
	4.07	o o o	4.90	4.70 - 5.20	B	10		
Stiff extremely closely fissured CLAY with occasional silt pockets. Fissures; planar to curved and smooth. (Glacial Deposits)				5.30	D	11		
soft sandy clay with a little gravel				5.30 - 5.75	U	12		70 blows
			(1.40)	5.80	D	13		
Very stiff red brown slightly sandy CLAY with some fine to coarse subangular to subrounded gravel occasional cobbles. (Glacial Deposits)	2.67		6.30	6.30 - 6.75	D	14	S N-45	2,3/6,12,18,9
				6.30 - 6.80	B	15		
			(0.60)					
Very stiff red brown slightly sandy CLAY with some fine to coarse subrounded mudstone and quartzite gravel. (Glacial Deposits)	2.07		6.90	7.00	D	16		
				7.20 - 7.65	D	17	S N-24	3,8/7,7,5,5
			(0.60)	7.20 - 7.70	B	18		
	1.47		7.50					
Stiff red brown mottled grey green locally very silty CLAY with some angular mudstone lithorelicts, very weak to weak. (Keuper Marl: Zone 3/4a)			(1.40)	8.30	D	19		9.00m: Sample 22 Type D.
				8.70 - 9.00	U			U100 attempted no recovery after 80 blows
	0.07		8.90	8.80	D	20		
				8.90	D	21		
MUDSTONE (As sheet 2.) (Keuper Marl: Zone 2.)				W	TCR	SCR	RQD	If
Muddy sandstone, Mod.strong.			(3.68)	9.00 - 10.50	100	100	39	0	NI NI 25	9.00m, D22 PLT at 9.77m (D). PLT at 9.90m (A).

Remarks
1. Hand excavated inspection pit (1.00*0.80*1.30m dimensions)
2. Water entry at 2.50m, no rise after 20mins.
3. Chiselling from 6.40m to 6.90m for one hour.

Logged by JAS

Scale 1:50

Fig. 2

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 24.09.91/10.08 (Ver 4.1.27)
All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166825 : BGS Reference: SJ57NE16
EPSG: 27700 : 359903,376178

Soil Mechanics

BOREHOLE No. 1

Sheet 2 of 4

Equipment & Methods: As sheet 1	Location No. 7703
	Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT
Carried out for: Department of Transport	Ground Level: Coordinates: As sheet 1 — Date

SJ 57 NE 16

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
(A) Red brown extremely closely fractured to 9.80m MUDSTONE, weak with occasional gypsum pockets, partings and lenses. Below 9.80m, mod.weak and very closely fractured. Below 11.50m, grey green mottling and thinly to thickly interlaminated with SILTSTONE, Mod.strong. Fractures; Subh.Pl.Ro. (Keuper Marl: Zone 2)		Completely weathered to stiff red brown clay. Muddy sandstone, mod.strong. Siltstone, mod.weak to mod.strong. Completely weathered to a stiff red brown clay. Completely weathered to a stiff red brown clay	(3.68)	9.00 - 10.50	100	100	39	0		9.00m, D22 PLT at 9.77m (D). PLT at 9.90m (A).
				10.50 - 11.50	100	100	55	10		
				11.50 - 12.00	100	100	98	40	NI 40 100	PLT at 11.65m (A,D)
	-3.61		12.58							
Red brown becoming by 12.74m grey green very closely to closely fractured thinly to thickly interlaminated MUDSTONE and SILTSTONE, mod. strong with occasional extremely to very closely spaced gypsum partings and lenses. Fractures; Subh.Pl Ro. Below 14.15m, red brown and grey green. (Keuper Marl: Zone 1)		Muddy sandstone, mod.strong. Muddy sandstone, mod.strong. Light grey green with much gypsum veining. Some gravel size gypsum pockets. Muddy sandstone, mod.strong.	(3.17)	12.00 - 13.50	100	95	92	15		PLT at 12.99m (A,D)
				13.50 - 15.00	100	96	93	13	NI 40 200	PLT at 13.75m (A,D). PLT at 14.32 (A)
	-6.78		15.75	15.00 - 16.50	100	99	93	23		PLT at 15.68m (A,D)
Red brown closely fractured laminated MUDSTONE, Moderately weak with occasional gypsum partings and lenses. Fractures; Subh.Pl.Ro (Keuper Marl: Zone 1)			(0.75)						NI 80 250	
	-7.53	Sandstone, strong.	16.50							
Grey green and red brown very closely to closely fractured, thinly to thickly interlaminated MUDSTONE and SILTSTONE, mod.strong with occasional closely spaced gypsum laminae and lenses. Fractures; Subh.Pl.Ro. (Keuper Marl: Zone 1)		Sandstone, strong. Sandstone, strong. Sandstone, strong. Sandstone, strong. Weak.	(2.80 pen)	16.50 - 18.00	100	90	87	7	NI 55 110	PLT at 16.55m (A) PLT at 17.58m (A)
				18.00 - 19.30	100	98	98	32		PLT at 18.35m (A,D) PLT at 19.16m (A,D)
BOREHOLE ENDS AT 19.30 m.	-10.33		19.30							

Remarks

4. For overdriven SPT's N value given for first 300mm test drive. Blows given for all 75mm increments.

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Scale: 1:50

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 04.10.91/09.54 (Ver 4.1.27)

Fig. 2

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166825 : BGS Reference: SJ57NE16
EPSG: 27700 : 359903,376178

Soil Mechanics

BOREHOLE No. 1

Sheet 3 of 4

Equipment & Methods

As sheet 1

Location No. 7703

Location SJ 57 NE 16

A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

Carried out for

Department of Transport

Ground Level | Coordinates | Date

As sheet 1

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1991					
09.07	-	2.00	2.00	DRY	
09.07	-	2.50	2.50	2.50	Water entry after 20mins. Topped up below 2.50m
09.07	-	2.50	2.50	2.50	
09.07	-	5.30	5.20	4.00	
09.07	-	6.30	6.00	5.00	
09.07	-	7.20	7.20	4.50	
09.07	-	8.70	8.50	7.00	
09.07	-		-		
09.07	1800	9.00	9.00	7.00	
10.07	0800	9.00	9.00	4.00	Rotary core drilling.
10.07	1800	12.00	9.00	7.00	
11.07	0800	12.00	9.00	3.00	

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results

Remarks

Logged by JAS

Scale 1:50

Fig. 2

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.09.91/10.08 (Ver 4.1.27)

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166825 : BGS Reference: SJ57NE16
EPSG: 27700 : 359903,376178

Soil Mechanics

BOREHOLE No. 1

Sheet 4 of 4

Location No. 7703
Location A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

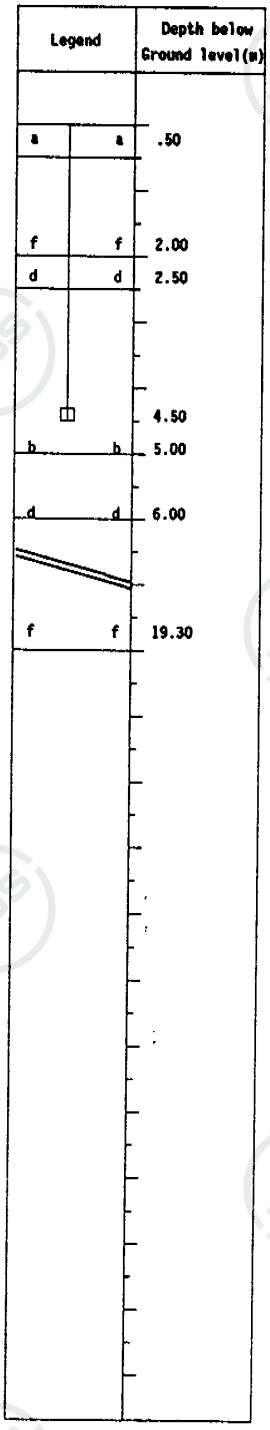
Carried out for Department of Transport

Type of installation Standpipe piezometer
Date of installation 12/07/91
Internal diameter of tubing 19 mm
Length of filter 2500 mm
Diameter of filter 200 mm

SJ 57 NE 16

SUMMARY OF INSTALLATION

Depth (m) From	Depth (m) To	
		Surface protection : Stopcock cover
0.00	.50	Concrete
.50	2.00	Backfill
2.00	2.50	Bentonite seal
4.50	4.50	Piezometer tip
2.50	5.00	Sand
5.00	6.00	Bentonite seal
6.00	19.30	Backfill



key

a	Concrete	d	Bentonite seal
b	Sand filter	e	Bentonite/cement grout
c	Gravel filter	f	Backfill

Remarks

1. Ground level and coordinates as sheet 1

(C) Soil Mechanics V1.0 09-24-1991 10:40:23

DETAILS OF INSTRUMENTS

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166826 : BGS Reference: SJ57NE17
EPSG: 27700 : 359937,376085

Soil Mechanics

BOREHOLE No.2

Sheet 1 of 4

Equipment & Methods
Cable tool boring, 200mm diameter to 8.20m, 150mm diameter to 12.00m. Rotary core drilling, 74mm diameter with water flush and mylar lining.

Location No. 7703
Location SJ57NE17
A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

Carried out for
Department of Transport

Ground Level
9.02 m A.O.D.

Coordinates
359937.00mE
376085.00mN

Date
12.07.91 to 15.07.91

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	9.02		(0.30)					
	8.72		0.30	0.60	D	1		Inspection pit to 1.30m. (Damp).
Soft to firm orange brown slightly sandy CLAY with occasional dark grey carbonaceous pockets. Below 2.00m, locally sandy. (Alluvial Deposits)				1.00 - 1.45	U	2		35 blows.
				1.50	D	3		
			(2.60)					
Soft brown sandy CLAY with occasional orange brown and dark grey clayey sand pockets and dark grey carbonaceous sandstone gravel, very weak. Organic odour. (Alluvial Deposits).				2.00 - 2.45	U	4		25 blows.
				2.50	D	5		
	6.12		2.90	2.90	D	6		
			(0.40)					
	5.72		3.30	3.00 - 3.45	U	7		15 blows. (wet)
Loose orange brown fine to coarse SAND with occasional clayey pockets, rare fine gravel (Alluvial Deposits).				3.50	D	8		
			(0.50)					
	5.22		3.80	3.80	W	14		Water entry at 4.00m.
				4.00 - 4.50	B	10		
				4.00 - 4.75	D	9	S N-1	0,0/0,0,1,0 /0,0,0,0
Very loose clayey fine to coarse SAND. (Alluvial Deposits)				4.50 - 5.00	B	11		
Some soft to firm grey organic sandy clay pockets.			(1.90)	5.00 - 5.75	D	12	S N-3	0,1/0,1,1,1 /1,3,2,2
				5.00 - 6.00	B	13		
				5.10	W	24		
	3.32		5.70					Water entry at 5.70m.
Very loose becoming loose brown silty fine to coarse SAND, with occasional fibrous timber fragments. (Alluvial Deposits)				6.00 - 6.75			S N-1	0,0/0,1,0,0 /1,0,1,1 no recovery
			(1.60)	6.00 - 7.00	B	15		
				7.00 - 7.50	B	16		
Loose brown clayey subrounded to rounded fine to coarse quartzite GRAVEL, with some sand Below 7.50m, and COBBLES. (Fluvio-glacial Deposits)	1.72		7.30	7.00 - 7.75			S N-5	0,1/0,1,2,2 /2,2/3,3
			(0.70)	7.50 - 8.00	B	17		
Extremely closely fissured.	1.02		8.00	8.10	D	18		
Stiff to very stiff red brown slightly sandy CLAY with some fine to coarse mudstone and quartzite gravel. (Glacial Deposits)				8.20 - 8.65	U	19		27 blows
				8.70	D	20		
			(2.10)					
Very closely fissured.				9.00 - 9.45	U	21		65 blows
				9.50	D	22		

Remarks
1. Hand excavated inspection pit, (1.00*0.80*1.30m dimensions).
2. Falling head permeability test carried out at 7.50m.
3. Water entry at 4.00m. No rise after 20mins.

Cont...

Logged by JAS
Scale 1:50
Fig. 3

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 24.09.91/10.13 (Ver 4.1.27)
All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166826 : BGS Reference: SJ57NE17
EPSG: 27700 : 359937,376085

Soil Mechanics

BOREHOLE No. 2

Sheet 2 of 4

Equipment & Methods: As sheet 1

Location No. 7703

Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

SJ 57 NE 17

Carried out for: Department of Transport

Ground Level | Coordinates | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Stiff CLAY (As sheet 1.)	-1.08	Sand and gravel.	(2.10) 10.10	10.00 - 10.35	U	23		100 blows, Water entry.
				10.40	D	25		
Very dense very sandy subangular to subrounded mudstone and fine to coarse quartzite GRAVEL with some brown clay and occasional cobbles (Fluvio-glacial Deposits)		Some firm clay matrix.	(1.70)	11.00 - 11.45	D	26	S N=74	15,15/16,13,22,23
				11.00 - 11.50	B	27		
				11.50 - 11.80	B	28		12.00m: Sample 29 Type D.
Stiff red brown CLAY with some angular mudstone lithorelicts, very weak to weak and MUDSTONE, weak. (Keuper Marl: Zone 3 and 4a)	-2.78		11.80 (0.30)					
	-3.08		12.10 (0.40)	12.00 - 12.50	W 100	TCR 80	SCR 14	RQD 0	Lc NI NI 40
Red brown extremely to very closely fractured MUDSTONE, weak to mod.weak. Fractures; Subh.Pl.Ro. (Keuper Marl: Zone 2.)	-3.48		12.50 (1.60)	12.50 - 14.00	100	80	80	7	10 55 110	PLT at 12.71m, (A,D)
Red brown very closely to closely fractured MUDSTONE mod.weak to mod.strong with occ.very closely spaced gypsum laminae and lenses. Fractures; Subh.Pl.Ro. (Keuper Marl: Zone 1.)	-5.08	Sandstone, mod.strong. Sandstone, mod.strong. Sandstone, Mod.strong.	14.10							
				14.00 - 15.50	100	93	93	0	5 30 70	PLT at 14.24m, (A,D). PLT at 15.20m, (A).
Red brown and grey green extremely to very closely fractured thinly to thickly interlaminated MUDSTONE and SILTSTONE, mod. weak to mod.strong with occ. very closely spaced gypsum lenses and laminae. Fractures; Subh.Pl.R. (Keuper Marl: Zone 1.)	-6.68		15.70 (0.85)	15.50 - 16.50	100	98	86	10	NI 35 100	PLT at 16.25m, (A,D).
Grey green extremely to very closely fractured thinly to thinly laminated MUDSTONE, mod weak with occ.very closely spaced siltstone laminae, mod.strong and gypsum lenses and laminae. Fractures; Subh,Pl,Ro (Keuper Marl: Zone 1.)	-7.53		16.55 (0.45p)	16.50 - 17.00	100	92	80	0	NI 10 30	
Red brown and grey green extremely to very closely fractured thinly to thickly interlaminated MUDSTONE and SILTSTONE, mod.weak to mod.strong. Fractures; Subh.Pl.Ro. (Keuper Marl: Zone 1)	-7.98		17.00							
BOREHOLE ENDS AT 17.00 m.										

Remarks

3. Water entry at 5.70m, rose to 3.80m after 15mins, no further rise.
   Water entry at 10.10m, rose to 8.50m after 5mins and 5.10m after 20mins.
4. Chiselling from 11.30 to 12.00m for 1.50 hours.

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 24.09.91/10.13 (Ver 4.1.27)
All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

Logged by: JAS

Scale: 1:50

Fig. 3

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166826 : BGS Reference: SJ57NE17
EPSG: 27700 : 359937,376085

Soil Mechanics

BOREHOLE No.2

Sheet 3 of 4

Equipment & Methods

As sheet 1

Location No. 7703

Location SJ 57 NE 17

A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

Carried out for

Department of Transport

Ground Level | Coordinates | Date

As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1991					
12.07	-	3.00	3.00	DRY	
12.07	-	4.00	4.00	4.00	Water entry
12.07	-	4.00	4.00	4.00	No rise after 20mins.
12.07	-	5.70	5.70	5.70	Water entry.
12.07	-	5.70	5.70	4.60	After 5mins.
12.07	-	5.70	5.70	4.00	After 10mins.
12.07	-	5.70	5.70	3.80	After 15mins.
12.07	-	5.70	5.70	3.80	After 20mins. Topped up below 6.00m
12.07	-	8.20	8.20	6.00	
12.07	1800	9.00	9.00	6.50	
13.07	0800	9.00	9.00	6.10	
13.07	-	10.00	10.00	8.00	
13.07	0802	11.00	11.00	9.00	
15.07	1800	15.50	12.00	2.00	Rotary core drilling.
16.07	0800	15.50	12.00	1.70	

Remarks

5. For overdriven SPT's N value given for first 300mm test drive. Blows given for all 75mm increments.

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 04.10.91/09.55 (Ver 4.1.27)

Logged by JAS

Scale 1:50

Fig. 3

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166826 : BGS Reference: SJ57NE17
EPSG: 27700 : 359937,376085

Soil Mechanics

BOREHOLE No. 2

Sheet 4 of 4

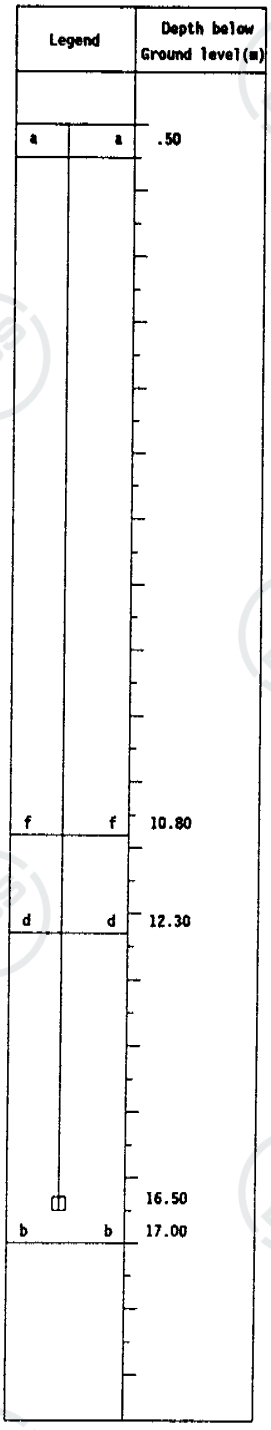
Location No. 7703
Location A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

Carried out for Department of Transport

Type of installation Standpipe piezometer
Date of installation 16/07/91
Internal diameter of tubing 19 mm
Length of filter 4700 mm
Diameter of filter 74 mm

SJ57NE17

Depth (m) From	Depth (m) To	SUMMARY OF INSTALLATION
		Surface protection : Stopcock cover
0.00	.50	Concrete
.50	10.80	Backfill
10.80	12.30	Bentonite seal
16.50	16.50	Piezometer tip
12.30	17.00	Sand



key

a	Concrete	d	Bentonite seal
b	Sand filter	e	Bentonite/cement grout
c	Gravel filter	f	Backfill

Remarks

1. Ground level and coordinates as sheet 1

(C) Soil Mechanics V1.0 09-24-1991 10:48:37

DETAILS OF INSTRUMENTS

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166827 : BGS Reference: SJ57NE18
British National Grid (27700) : 359991,376021

Soil Mechanics

BOREHOLE No.8

Sheet 1 of 2

SJ57NE18

Equipment & Methods
Cable tool boring, 200mm diameter.

Location No. 7703
Location
A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

Carried out for
Department of Transport

Ground Level
8.77 m A.O.D.

Coordinates
359991.00mE
376021.50mN

Date
10.07.91 to 10.07.91

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	8.77		(0.20)					
	8.57		0.20	0.30	D	1		Inspection pit to 0.50m
Firm orange brown sandy CLAY with occasional rootlets. (Alluvial Deposits)			(1.30)					
				1.00 - 1.45	U	2		20 blows.
Firm orange brown slightly sandy CLAY with some dark grey organic pockets. (Alluvial Deposits)	7.27		1.50	1.50	D	3		
Dark grey carbonaceous sandstone gravel, very weak.			(0.50)	1.80	D	4		
	6.77		2.00					Water entry at 2.00m.
				2.00 - 2.45	D	5	S N-4	1,-/1,1,1,1
Soft brown slightly sandy CLAY with occ.orange brown clayey sand pockets and dark grey carbonaceous sandstone gravel, very weak and organic odour. (Alluvial Deposits)			(1.30)	2.50	W	6		
				2.80	D	7		
				3.00 - 3.45	D	8	S N-2	2,1/-,1,1,- No recovery
	5.47		3.30					
Soft grey sandy organic CLAY. (Alluvial Deposits)			(1.20)	3.70	D	9		
				4.00 - 4.45			S N-2	1,-/2,-,-,- Damp. No recovery.
	4.27		4.50					
Soft orange brown with occasional grey mottling locally sandy CLAY with occasional green silt pockets. (Alluvial Deposits)			(1.20)	5.00 - 5.45	D	11	S N-7	1,1/2,2,1,2
	3.07		5.70					
Brown clayey subrounded fine to coarse quartzite GRAVEL and COBBLES, strong (Fluvio-glacial Deposits)			(0.70)	5.70 - 6.20	B	12		Water entry at 5.70m
				6.20	W	13	K	
	2.37		6.40	6.40	D	14		
				6.50 - 6.90	U			U100 attempted no recovery after 100 blows.
				6.80	D	15		
				7.00	D	16		
Stiff red brown slightly sandy locally sandy CLAY with a little fine to coarse mudstone and quartzite gravel. Extremely closely fissured, Planar to curved and smooth.				7.10 - 7.55	U	17		69 blows
Below 8.50m, Sandy. (Glacial Deposits)			(3.50)	8.10	D	18		
Coarse clayey sand.				8.50 - 8.95	D	19	S N-10	1,1/1,1,4,4
				9.40	D	20		
Clayey GRAVEL (As sheet 2.)	-1.13		9.90	10.00	D	21		

Remarks
1. Hand excavated inspection pit (1.00*0.80*0.50m dimensions).
2. Water entry at 2.00m, rose to 1.40m after 20mins.
   Water entry at 5.70m, rose to 3.80m after 20mins.

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 24.09.91/09.31 (Ver 4.1.27)
All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

Logged by JAS
Scale 1:50
Fig. 9

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 166827 : BGS Reference: SJ57NE18
British National Grid (27700) : 359991,376021

Soil Mechanics

BOREHOLE No. 8

Sheet 2 of 2

Equipment & Methods: As sheet 1

Location No. 7703

SJ 57 NE 18

Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

Carried out for: Department of Transport

Ground Level | Coordinates | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Red brown clayey subrounded fine to coarse quartzite GRAVEL, strong (Fluvio-glacial Deposits)	-1.43		(0.30) 10.20	10.20 - 10.65	D	22	S N=79	4,5/8,8,13,50 for 70mm
			(0.80)	10.90	D	23		
Stiff red brown mottled grey green locally very silty CLAY with some angular mudstone lithorelicts, v.weak to weak. (Keuper Marl: Zone 3 and 4a)	-2.23		11.00	11.00 - 11.20	D	24	S 50	8,22/50 for 70mm
Red brown mottled grey green laminated locally very silty MUDSTONE, weak (Keuper Marl: Zone 2.)	-2.43		(0.20p) 11.20					
BOREHOLE ENDS AT 11.20 m.								

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1991					
10.07	-	1.50	1.50	DRY	
10.07	-	2.00	2.00	2.00	Water entry after 20mins.
10.07	-	2.00	2.00	1.40	
10.07	-	4.00	4.00	DAMP	
10.07	-	5.70	5.70	5.70	Water entry after 20mins.
10.07	-	5.70	5.70	3.80	Topped up.
10.07	1800	6.20	5.70	0.30	
11.07	0800	6.20	5.70	0.60	
11.07	-	11.20	10.00	6.90	

Remarks

3. Falling head test at 6.20m.
4. Chiselling from 10.70 to 11.00m for one hour.
5. Backfilled with spoil on completion.

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 24.09.91/10.18 (Ver 4.1.27)
All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

Logged by: JAS

Scale: 1:50

Fig. 9

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704013 : BGS Reference: SJ67NW10
British National Grid (27700) : 360503,375254

Soil Mechanics

BOREHOLE No. 3

Sheet 1 of 2

Equipment & Methods: Cable tool boring, 200mm diameter.

Location No. 7703

SJ 67 NW 10

Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

Carried out for: Department of Transport

Ground Level: 9.41 m A.O.D.

Coordinates: 360503.50mE, 375254.50mN

Date: 15.07.91 to 15.07.91

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	9.41		(0.20)					
	9.21		0.20					
Loose orange brown silty fine SAND. (Alluvial Deposits)			(1.30)	0.80	D	1		Inspection pit to 1.50m
	7.91		1.50					
Loose orange brown very clayey fine to coarse SAND. (Alluvial Deposits) — Occasional soft grey brown sandy organic clay pockets.			(1.30)	1.50 - 1.95	D	2	S N=7	1,-/3,2,1,1
				2.00 - 2.70	B	3		
	6.61		2.80					
Very soft, becoming soft by about 4.30m, brown sandy organic CLAY with occasional dark grey carbonaceous pockets. Below 4.30m, Firm. (Alluvial Deposits)			(2.00)	2.70 - 3.45	D	4	S N=1	1,-/-,-,-,1,-,1
				3.50 - 4.30	B	5		Damp at 4.00m.
Loose brown clayey fine to coarse organic SAND with occ. dark grey carbonaceous gravel, very weak and brown fibrous timber fragments. (Alluvial Deposits)				4.30 - 4.75			S N=8	2,-/3,2,2,1 No recovery
	4.61		4.80	4.80	D	6	S	Water entry
	4.41		(0.20) 5.00	4.90 - 5.35			N=26	2,3/5,6,6,9 No recovery
				4.90 - 6.00	B	7		
Medium dense brown very sandy subrounded fine to coarse GRAVEL with occasional cobbles Below 6.00m, GRAVEL and COBBLES (Fluvio-glacial Deposits)			(2.30)	6.00 - 6.45			S N=18	4,5/5,4,5,4 No recovery
				6.00 - 7.20	B	8		
Some subangular to subrounded quartzite gravel, strong.	2.11		7.30	7.20 - 7.65	D	9	S N=24	2,3/4,4,6,10
Medium dense SAND (As sheet 2.) (Fluvio-glacial Deposits)			(6.50)	7.70 - 9.00	B	10		
				9.00 - 9.45	D	11	S N=27	2,4/5,7,7,8
Some firm red brown clay recovered.				9.50 - 10.60	B	12		

Remarks

1. Hand excavated inspection pit, (1.00*0.80*1.50m dimensions)
2. Water entry at 4.80m, Rose to 4.00m after 20mins.
3. Chiselling from 5.50 to 5.90m for 1. hour.

Logged by: JAS

Scale: 1:50

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 04.10.91/09.56 (Ver 4.1.27)
All depths and reduced levels in metres. Thickness given in brackets in depth column.

Fig. 4

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704013 : BGS Reference: SJ67NW10
British National Grid (27700) : 360503,375254

Soil Mechanics

BOREHOLE No. 3

Sheet 2 of 2

Equipment & Methods: As sheet 1	Location No. 7703 SJ67NW 10 Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT
Carried out for: Department of Transport	Ground Level: Coordinates: As sheet 1 Date:

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Some firm red brown clay recovered.				9.50 - 10.60	B	12		
				10.60 - 11.05	D	13	S N=23	2,3/4,4,6,9
				11.10 - 12.20	B	14		
Medium dense red brown fine to coarse SAND with a trace of fine to medium gravel. (Fluvio-glacial Deposits)			(6.50)	12.20 - 12.65	D	15		3,2/5,5,7,11
				12.70 - 13.80	B	16		
	-4.39		13.80	14.00 - 14.45			C N=35	2,-/3,7,15,10
Medium dense to dense red brown fine to coarse SAND and subrounded quartzite fine to coarse GRAVEL with some cobbles (Fluvio-glacial Deposits)			(2.00)	14.00 - 15.00	B	17		
				15.00 - 15.45			C N=21	3,2/2,5,5,9
				15.00 - 15.80	B	18		
Stiff red brown mottled grey green CLAY with some angular mudstone lithorelicts and mudstone gravel, weak recovered. Probably very thinly interbedded. (Keuper Marl: Zone 3 and 4a)	-6.39		15.80	15.80 - 15.95	D	19	S (63)	13,50
			(0.82 pen)	16.40 - 16.62	D	20	S 50	9,20/50
	-7.21		16.62					
BOREHOLE ENDS AT 16.62 m.								

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1991					
15.07	0000	3.00	3.00	DRY	
15.07	-	4.00	4.00	DAMP	
15.07	-	4.80	4.80	4.80	Water entry after 20mins.
15.07	-	4.80	4.80	4.00	

Remarks

4. Falling head permeability test at 6.00m.
5. Chiselling from 14.60 to 14.80m for 45mins and from 16.00 to 16.40m for one hour. 6. Backfilled on completion.

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 23.09.91/15.24 (Ver 4.1.27)

Logged by: JAS
Scale: 1:50
Fig. 4

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704014 : BGS Reference: SJ67NW11
British National Grid (27700) : 360485,375191

Soil Mechanics

BOREHOLE No.4

Sheet 1 of 2

SJ67NW 11

Equipment & Methods: Cable tool boring, 200mm diameter.	Location No. 7703 Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT
Carried out for: Department of Transport	Ground Level: 13.57 m A.O.D. Coordinates: 360485.00mE 375191.50mN Date: 11.07.91 to 12.07.91

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	13.57		(0.20) 0.20	0.20	D	1		Inspection pit to 1.30m
Made ground: Stiff brown sandy CLAY with occasional fine to coarse gravel.	13.37		(0.20) 0.40	0.60	D	2		
	13.17		(0.15) 0.55	1.10	D	3		
Made ground: TARMAC and aggregate GRAVEL (Old Road Base)	13.02		(1.55)	1.50 - 1.95	D	4	S N=20	2,1/3,3,5,9
Made ground: Medium dense orange brown silty fine to coarse SAND and fine to coarse GRAVEL.	11.47		2.10	2.10 - 3.00	B	5		
				3.00 - 3.45	D	6	S N=30	2,4/5,7,8,10
				3.50 - 4.50	B	7		
				4.50 - 4.95	D	8	S N=21	2,2/3,6,6,6
				5.00 - 6.00	B	9		Water entry at 6.00m
Medium dense red brown silty, becoming slightly silty by 7.50m, coarse SAND with a trace of gravel. (Fluvio-glacial Deposits)			(8.30)	6.00 - 6.45	D	10	S N=29	2,1/3,7,9,10
				6.50 - 7.50	B	11		
				7.50 - 7.95	D	12	S N=23	2,2/2,3,5,13
				8.00 - 9.00	B	13		
				9.00 - 9.45	D	14	S N=16	3,2/2,4,3,7
				9.60	W	15		
				10.00	D	16		

Remarks
1. Hand excavated inspection pit (1.00*0.80*1.30m dimensions).
2. Water entry at 6.00m, Rose to 5.70m after 20mins.
3. Chiselling from 12.00 to 12.40 for 1 hour and 12.70 to 13.00 for 1 hour

Logged by: JAS
Scale: 1:50

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 23.09.91/15.37 (Ver 4.1.27)
All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

Fig. 5

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704014 : BGS Reference: SJ67NW11
British National Grid (27700) : 360485,375191

Soil Mechanics

BOREHOLE No. 4

Sheet 2 of 2

Equipment & Methods: As sheet 1

Location No. 7703

SJ67NW11

Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

Carried out for: Department of Transport

Ground Level | Coordinates | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Medium dense SAND (As sheet 1.)			(8.30)					
	3.17		10.40	10.40	D	17		
				10.50 - 10.90	U	18		100 blows
Firm to stiff red brown slightly sandy locally sandy CLAY with some fine to coarse mudstone and quartzite gravel. (Glacial Deposits)			(1.40)					
				11.50	D	19		
	1.77		11.80	11.80 - 12.00	D	20		U100 attempted, 100 blows.
Stiff red brown mottled grey green CLAY with some angular mudstone lithorelicts and mudstone GRAVEL, weak recovered. Probably very thinly interbedded. (Keuper Marl: Zone 3 and 4a)			(1.32 pen)	12.40 - 12.77	D	21	S 87	6,11/13,24,50 for 70mm
	0.45		13.12	13.00 - 13.12	D	22	S (86)	36,50 for 40mm
BOREHOLE ENDS AT 13.12 m.								

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1991					
11.07	1800	3.50	3.00	DRY	
12.07	0800	3.50	3.00	DRY	
12.07	-	5.00	5.00	DRY	
12.07	-	6.00	6.00	6.00	Water entry
12.07	-	6.00	6.00	5.70	
12.07	-	13.12	12.00	8.50	

Remarks

4. Backfilled on completion.

Logged by: JAS

Scale: 1:50

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 23.09.91/15.37 (Ver 4.1.27)

Fig. 5

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704015 : BGS Reference: SJ67NW12
British National Grid (27700) : 360565,375201

Soil Mechanics

BOREHOLE No. 5

Sheet 1 of 3

Equipment & Methods
Cable tool boring, 200mm diameter to 14.00m, then rotary core drilling 74mm diameter with water flush and mylar lining.

Location No. 7703
Location SJ67NW12
A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

Carried out for
Department of Transport

Ground Level
9.49 m A.O.D.

Coordinates
360565.50mE
375201.00mN

Date
22.07.91 to 22.07.91

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	9.49		(0.30)					
	9.19		0.30					
Loose orange brown clayey SAND. (Alluvial Deposits)			(0.70)	0.70	D	1		Inspection pit to 1.00m
	8.49		1.00	1.00 - 1.45	D	2	S N-11	1,2/3,2,3,3
Medium dense				1.00 - 1.50	B	3		
Soft to firm brown very sandy clay.				2.50 - 2.95	U	4		Water entry
				3.00	D	5		15 blows
			(5.00)					
Very loose orange brown locally clayey fine to coarse SAND.				4.00 - 4.75			S N-1	0,0/1,0,0,0 /1,0,1,1 no recovery
(Alluvial Deposits)				4.00 - 5.00	B	6		
				5.00	W	8		
				5.50 - 6.25	D	7	S N-1	0,1/0,0,0,1 /1,3,5,5 Water entry at 6.00m
	3.49		6.00					
Medium dense orange brown very sandy subrounded to rounded quartzite GRAVEL with some cobbles (Fluvio-glacial Deposits)				6.30 - 6.75			C N-18	3,4/4,5,4,5
				6.30 - 6.80	B	9		
			(1.80)					
Stiff brown slightly sandy CLAY with some fine to coarse subrounded quartzite and mudstone gravel. (Glacial Deposits)				7.30 - 7.75			C N-42	3,7/8,9,11,14 K: Permeability test.
				7.30 - 7.80	B	10		
	1.69		7.80					
	1.49		(0.20) 8.00	8.00	D	11		
With some gravel.				8.20 - 8.65			C N-16	2,2/3,4,4,5
				8.20 - 8.70	B	12		K test at 9.00m.
Medium dense silty SAND. (As sheet 2.) (Fluvio-glacial Deposits)			(5.50)					
				9.50 - 9.95	D	13	C N-14	1,2/3,3,4,4
				9.50 - 10.00	B	14		

Remarks
1. Inspection pit (1.00*0.80*1.00m dimensions).
2. Water entry at 2.50m, no rise after 20mins. Water entry at 6.00m, rose to 5.00m after 20mins.

Logged by JAS

Scale 1:50

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 23.09.91/15.53 (Ver 4.1.27)

Fig. 6

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704015 : BGS Reference: SJ67NW12
British National Grid (27700) : 360565,375201

Soil Mechanics

BOREHOLE No. 5

Sheet 2 of 3

Equipment & Methods: As sheet 1	Location No. 7703
	Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT
Carried out for: Department of Transport	Ground Level: Coordinates: As sheet 1 Date:

SJ67NW12

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
				11.00 - 11.45	D	15	S N=17	2,2/3,4,5,5
				11.00 - 11.50	B	16		
Medium dense red brown silty fine to coarse SAND with a trace of fine gravel. (Fluvio-glacial Deposits)			(5.50)					
				12.30 - 12.75	D	17	S N=12	1,2/3,3,3,3
				12.30 - 12.80	B	18		
Stiff red brown slightly sandy clay with some gravel.				12.90	D	19		
Stiff red brown mottled grey green CLAY with some angular mudstone lithorelicts, weak. (Keuper Marl: Zone 4a and 3.)	-4.01		13.50	13.50 - 13.95	D	20	S N=45	2,3/6,8,15,16
			(0.30)	13.60	D	21		
	-4.31		13.80	13.90	D	22		

Description	W	TCR	SCR	RQD	If
Zone of core loss, possibly zone 4/3. Grey green laminated extremely to very closely fractured slightly weathered MUDSTONE, moderately weak locally weak with occ. gypsum laminae and lenses. Fractures; Subh.Pl.Sm. (Keuper Marl: Zone 2.)					
14.00 - 15.50	100	71	51	0	NI 20 50
Mod.strong.					
(2.44)					
SubV.IRR.SM.fracture.					
-6.75					
16.24					
Very closely spaced very thin beds of muddy fine sandstone, mod.strong to strong.					
15.50 - 17.00	100	100	91	0	
Extremely closely fractured and weak.					
Red brown and green grey very closely fractured thinly to thickly interlaminated MUDSTONE and SILTSTONE, moderately strong with occasional gypsum laminae and lenses. Fractures; Subh.Pl to IRR and Ro.					
17.00 - 18.50	100	93	93	0	NI 35 70
SubV.IRR.Ro.fracture					
(3.76 pen)					
(Keuper Marl: Zone 1.)					
Very closely spaced thin beds of fine grey sandstone, strong.					
18.50 - 20.00	100	93	91	0	
BOREHOLE ENDS AT 20.00 m.					
-10.51					
20.00					

Remarks

3. Falling head permeability tests at 6.90m and 9.00m
4. Chiselling from 6.80 to 7.80m for 2 hours.
5. Backfilled with spoil on completion.

Logged by: JAS

Scale: 1:50

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 24.09.91/10.16 (Ver 4.1.27)
All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

Fig. 6

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704015 : BGS Reference: SJ67NW12
British National Grid (27700) : 360565,375201

Soil Mechanics

BOREHOLE No. 5

Sheet 3 of 3

Equipment & Methods: As sheet 1

Location No. 7703

Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

SJ67NW12

Carried out for: Department of Transport

Ground Level | Coordinates | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	SCR	RQD	If	Field Records and Test Results

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1991					
22.07	-	2.00	2.00	DRY	
22.07	-	2.50	2.50	2.50	Water seepage
22.07	-	2.50	2.50	2.50	No rise after 20mins.
22.07	-	5.00	5.00	DRY	
22.07	-	6.00	6.00	6.00	Water entry
22.07	-	6.00	6.00	5.00	After 20mins topped up below 6.30m
22.07	1800	13.00	13.00	5.00	
23.07	0800	13.00	13.00	2.00	
23.07	-	13.50	13.50	3.00	

Remarks

6. For overdriven SPT's N value given for first 300mm test drive. Blows given for all 75mm increments

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 04.10.91/09.57 (Ver 4.1.27)
All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

Logged by: JAS

Scale: 1:50

Fig. 6

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704016 : BGS Reference: SJ67NW13
British National Grid (27700) : 360556,375135

Soil Mechanics

BOREHOLE No. 6

Sheet 1 of 4

Equipment & Methods: Cable tool boring, 150mm diameter to 14.00m. Then rotary core drilling, 74mm diameter with water flush and mylar linings.	Location No. 7703 SJ67NW 13 Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT	
Carried out for: Department of Transport	Ground Level: 13.99 m A.O.D.	Coordinates: 360556.50mE 375135.50mN Date: 17.07.91 to 17.07.91

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	13.99		(0.10)					
	13.89		0.10					
			(0.30)					
	13.59		0.40					
Made Ground: Tarmac/Hardcore. (Foremans Description)			(0.30)					
	13.29		0.70	0.80	D	1		Inspection pit to 1.50m.
			(0.30)	1.00 - 1.45	D	2	S N-30	3,5/5,8,8,9
	12.99		1.00					
Made Ground: Compacted Limestone Hardcore. (Foremans Description)				1.00 - 1.50	B	3		
Made Ground: Orange brown fine to coarse SAND with occasional quartzite gravel.								
				2.50 - 2.95			C N-20	2,3/4,5,5,6
				2.50 - 3.00	B	4		
Medium dense very sandy subangular to subrounded fine to coarse quartzite and granite GRAVEL with some cobbles			(3.90)					
(Fluvio-glacial Deposits)				4.00 - 4.45			C N-21	3,5/4,6,5,6
				4.00 - 4.50	B	5		
Stiff red brown extremely closely fissured CLAY with a trace of rounded fine quartzite gravel. Fissures; Curved and smooth. (Glacial Deposits)	9.09		4.90					
			(0.40)	5.10	D	6		
	8.69		5.30	5.10 - 5.55	U	7		70 blows
				5.60	D	8		
				6.50 - 6.95	D	9	S N-17	2,2/3,4,5,5
				6.50 - 7.00	B	10		
				7.10	W	15		Water entry.
			(6.60)					
Medium dense red brown fine to coarse SAND with a trace of gravel.				8.00 - 8.45	D	11	S N-13	1,2/2,3,4,4 water entry at 8.00m
				8.00 - 8.50	B	12		
(Fluvio-glacial Deposits)								
				9.50 - 9.95	D	13	S N-16	1,2/3,3,4,6
				9.50 - 10.00	B	14		

Remarks

1. Hand excavated inspection pit (1.00*0.80*1.50m dimensions).
2. Water entry at 8.00m, rose to 7.10m after 20mins.
3. Chiselling from 13.00 to 14.00m for 1.5 hours.

Logged by: JAS

Scale: 1:50

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.09.91/10.17 (Ver 4.1.27)

Fig. 7

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704016 : BGS Reference: SJ67NW13
British National Grid (27700) : 360556,375135

Soil Mechanics

BOREHOLE No. 6

Sheet 2 of 4

Equipment & Methods: As sheet 1	Location No. 7703
	Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT SJ67NW13
Carried out for: Department of Transport	Ground Level: As sheet 1
	Coordinates: As sheet 1
	Date:

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
Medium dense SAND.(As sheet 1.) (Fluvio-glacial Deposits)			(6.60)	11.00 - 11.45	D	16	S N=17	
				11.00 - 11.50	B	17		2,2/3,4,5,5
Very stiff red brown slightly sandy CLAY with some fine to coarse subrounded quartzite and mudstone gravel and occ. grey green silt. (Glacial Deposits)	2.09		11.90	12.00	D	18		
				12.00 - 12.45	U	19		45 blows
Grey green mudstone gravel, weak to mod.weak			(1.10)	12.50	D	20		
MI and in parts completely weathered to a clay.	0.99		13.00	13.20	D	21		
Stiff grey green mottled red brown CLAY with some angular mudstone lithorelicts, weak and occasional gypsum pockets. (Keuper Marl: Zone 4a/3)			(0.80)	13.50 - 13.94	D	22	S 106	
MI and in parts completely weathered to a clay.	0.19		13.80	14.00	D	23	S (106)	3,8/17,18,21,50 for 70mm
Muddy Sandstone, mod.strong.			(0.70)		W	TCR	SCR	RQD
MI and in parts completely weathered to a clay.	-0.51		14.50					MI 35 70
Green grey laminated extremely closely fractured slightly weathered MUDSTONE, mod. weak locally weak with occ.gypsum lenses. Fractures; Subh.Pl.Ro. (Keuper Marl: Zone 2)			(1.45)	14.00 - 15.50	100	79	63	0 PLT at 14.40 (A and D). MI 20 50
Muddy Sandstone, mod.strong								
Green grey laminated extremely to very closely fractured MUDSTONE, mod.weak with occ.gypsum laminae and lenses. Fractures; Subh.Pl.Ro. (Keuper Marl: Zone 1.)	-1.96		15.95	15.50 - 17.00	100	100	90	9 PLT at 16.11 (A and D).
Highly weathered, very weak.								
Red brown with occasional green grey mottling very closely fractured thinly to thickly interlaminated MUDSTONE and SILTSTONE, mod.strong with occasional gypsum laminae and lenses. Below 19.10m, with some grey green mottling. Fractures; Subh.Pl.Ro. (Keuper Marl: zone 1.)				17.00 - 18.50	100	100	98	7 20 40 130 PLT at 18.25m (A and D).
Extremely closely spaced Subh.Pl.Ro.Fractures and locally weak to mod.weak			(4.05)					
Highly weathered, very weak.								
				18.50 - 20.00	100	100	100	15 PLT at 18.67m (A and D).
	-6.01		20.00					

Remarks

Logged by: JAS

Scale: 1:50

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 24.09.91/10.17 (Ver 4.1.27)
All depths and reduced levels in metres. Thickneses given in brackets in depth column.

Fig. 7

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704016 : BGS Reference: SJ67NW13
British National Grid (27700) : 360556,375135

Soil Mechanics

BOREHOLE No. 6

Sheet 3 of 4

Equipment & Methods: As sheet 1	Location No. 7703 SJ67NW13 Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT
Carried out for: Department of Transport	Ground Level: Coordinates: As sheet 1 Date:

Description	Reduced Level	Legend	Depth (Thick)	Drilling Records: Depth	Drilling Records: W	Mechanical core log: TCR	Mechanical core log: SCR	Mechanical core log: RQD	Mechanical core log: If	Field Records and Test Results
Grey green extremely to very closely fractured thinly to thickly interlaminated MUDSTONE and SILTSTONE, moderately strong with occasional gypsum laminae and lenses. Fractures; Subh.Pl.Ro. (Keuper Marl: Zone 1.)		xxx	(2.16)	20.00 - 21.50	100	93	87	0	NI 20 60	PLT at 20.87m (A).
Muddy Sandstone, mod.strong to strong.	-8.17		22.16	21.50 - 23.00	100	100	81	0		PLT at 22.22m (A).
Red brown very closely fractured thinly to thickly interlaminated MUDSTONE and SILTSTONE, moderately strong. Fractures; Subh.Pl.Ro. (Keuper Marl: Zone 1.)										
Muddy Sandstone, mod.strong to strong.										
Grey Sandstone, strong.			(1.84 pen)						NI 50 110	PLT at 23.80m (A and D).
Grey Sandstone,strong.				23.00 - 24.00	100	100	100	20		
BOREHOLE ENDS AT 24.00 m.	-10.01		24.00							

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1991					
17.07	-	7.00	6.50	DRY	
17.07	-	8.00	8.00	8.00	
17.07	-	8.00	8.00	7.10	Water entry. After 20mins topped up below 9.00m
17.07	1800	12.70	12.00	DRY	
18.07	0800	12.70	12.00	5.60	
18.07	-	13.50	13.50	9.00	
19.07	0800	17.00	14.00	7.50	Rotary core drilling.
19.07	1800	24.00	14.00	7.00	
20.07	0800	24.00	14.00	7.50	

Remarks

Logged by: JAS

Scale: 1:50

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics
All depths and reduced levels in metres. Thicknesses given in brackets in depth column. 24.09.91/10.17 (Ver 4.1.27)

Fig. 7

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704016 : BGS Reference: SJ67NW13
British National Grid (27700) : 360556,375135

Soil Mechanics

BOREHOLE No. 6

Sheet 4 of 4

Location No. 7703
Location A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

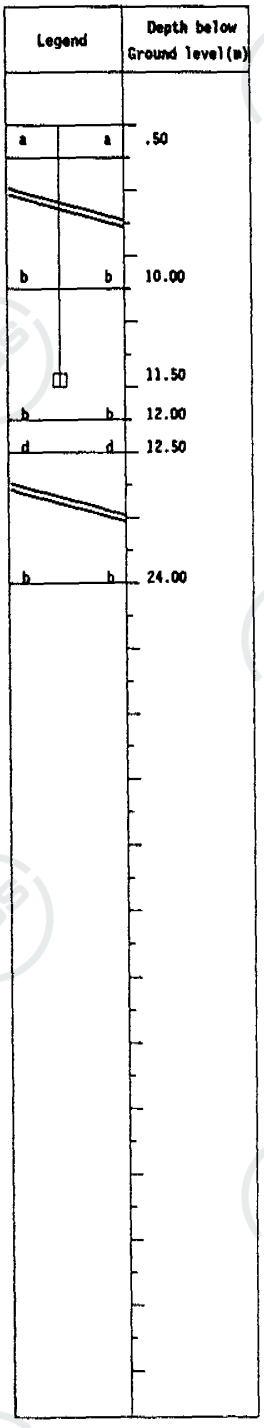
Carried out for Department of Transport

Type of installation Standpipe piezometer
Date of installation 20/07/91
Internal diameter of tubing 19 mm
Length of filter 2000 mm
Diameter of filter 150 mm

SJ 67 NW13

SUMMARY OF INSTALLATION

Depth (m) From	Depth (m) To	
		Surface protection : Stopcock cover
0.00	.50	Concrete
.50	10.00	Sand and backfill
11.50	11.50	Piezometer tip
10.00	12.00	Sand
12.00	12.50	Bentonite seal
12.50	24.00	Sand and backfill



key

a	Concrete	d	Bentonite seal
b	Sand filter	e	Bentonite/cement grout
c	Gravel filter	f	Backfill

Remarks

1. Ground level and coordinates as sheet 1

(C) Soil Mechanics V1.0 09-24-1991 10:48:07

DETAILS OF INSTRUMENTS

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704017 : BGS Reference: SJ67NW14
British National Grid (27700) : 360091,376092

Soil Mechanics

BOREHOLE No.7

Sheet 1 of 2

SJ67NW 14

Equipment & Methods: Cable tool boring, 200mm diameter	Location No. 7703 Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT	
Carried out for: Department of Transport	Ground Level: 12.46 m A.O.D.	Coordinates: 360091.00mE, 376092.50mN Date: 09.07.91 to 10.07.91

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
TOPSOIL	12.46		(0.10)	0.15	D	1		Inspection pit to 1.30m
	12.36		0.10					
Made ground: Angular coarse GRAVEL.	12.26		(0.10)	0.40	D	2		
	11.96		0.20 (0.30)					
			0.50	0.80	D	3		
Made ground: Very stiff red brown CLAY with occasional quartzite gravel.	11.56		(0.40) 0.90	1.10	D	4		
Made ground: GRAVEL and COBBLE size fragments of ash with some dark grey ash sand.			(1.60)	1.50 - 1.95	D	5		U100 attempted 38 blows no recovery
Made ground: Loose brown clayey fine to coarse GRAVEL size fragments of quartzite, brick, ash with some sand and occasional firm brown sandy clay pockets .				2.10 - 2.55	D	6	S N=6	1,1/2,1,1,2
	9.96		2.50					
				2.60 - 3.50	B	7		
Made ground: Loose orange brown clayey fine to coarse SAND with occasional quartzite gravel.			(2.50)	3.50 - 3.95	D	8	S N=7	2,-/1,-,3,3
				4.00 - 5.00	B	9		
	7.46		5.00	5.00 - 5.45			S N=6	1,1/1,2,1,2 No recovery
Loose orange brown fine to coarse SAND with much subangular to subrounded coarse quartzite and granite GRAVEL, strong to very strong (Fluvio-glacial Deposits)				5.00 - 6.00	B	10		
			(1.50)	6.00 - 6.45	D	11	S N=7	3,-/2,2,2,1
Some cobbles, very strong	5.96		6.50	6.50	W	12		Water entry at 6.50m
				6.50 - 6.80	B	13		
				6.90	D	14		
Stiff red brown slightly sandy to sandy CLAY, with a little to some fine to coarse subangular to subrounded mudstone and quartzite gravel. (Glacial Deposits)				7.20 - 7.45	U	-		78 blows U100 attempted no recovery
			(2.30)	7.20 - 8.20	B	15		
Very sandy				8.30 - 8.75	U	16		85 blows
	3.66		8.80					
Loose to medium dense red brown silty fine to coarse SAND. (Fluvio-glacial Deposits)				9.00	W	17		Water entry at 8.80m.
			(0.70)					
	2.96		9.50	9.30 - 9.75	D	18	S N=24	2,4/4,5,7,8
Stiff red brown CLAY. (As sheet 2.) (Glacial Deposits)			(1.10)					

Remarks

1. Hand excavated inspection pit (1.00*0.80*1.30m dimensions)
2. Water entry at 6.50m, rose to 5.50m after 20mins. Water entry at 8.80m, rose to 7.30m after 20mins.

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 24.09.91/14.24 (Ver 4.1.27)
All depths and reduced levels in metres. Thicknesses given in brackets in depth column.

Logged by: JAS
Scale: 1:50
Fig. 8

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704017 : BGS Reference: SJ67NW14
British National Grid (27700) : 360091,376092

Soil Mechanics

BOREHOLE No.7

Sheet 2 of 2

Equipment & Methods: As sheet 1

Location No. 7703

SJ67NW 14

Location: A49 WEAVERHAM TO LOWER WHITLEY IMPROVEMENT

Carried out for: Department of Transport

Ground Level | Coordinates | Date: As sheet 1

Description	Reduced Level	Legend	Depth (Thick)	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field Records
				10.10	D	19		
Stiff red brown with occasional grey green mottling CLAY with some subrounded fine to coarse mudstone and quartzite gravel. (Glacial Deposits)			(1.10)	10.40 - 10.65	U	20		100 blows
	1.86		10.60	10.70	D	21		
Stiff red brown CLAY with much angular mudstone lithorelicts, weak to mod.weak and occasional gypsum pockets, partings and lenses. (Keuper Marl: Zone 3)			(0.65)	11.10 - 11.16	D	22	S (50)	50 for 65mm
	1.21		11.25	11.40	D	23		
Red brown with occasional grey green mottling locally very silty and extremely closely fractured MUDSTONE, weak with occasional gypsum pockets, partings and lenses. (Keuper Marl: Zone 2)			(0.55 pen)	11.60 - 11.72	D	24	S (81)	31,50 for 45mm
	0.66		11.80					

BOREHOLE ENDS AT 11.80 m.

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1991					
09.07	-	4.00	4.00	DRY	
09.07	-	5.10	5.00	DAMP	
09.07	-	6.50	6.50	6.50	Water entry after 20mins.
09.07	-	6.50	6.50	5.50	
09.07	-	8.00	8.00	DRY	
09.07	-	8.80	8.80	8.80	Water entry after 20mins.
09.07	-	8.80	8.80	7.30	
09.07	-	9.80	9.80	8.00	
10.07	0830	9.80	9.80	7.50	

Remarks

3. Chiselling from 6.50m to 6.80m for 45mins, and from 11.25m to 11.60m for one hour.
4. Backfilled with spoil on completion.

Notes:
Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics 24.09.91/14.24 (Ver 4.1.27)

Logged by: JAS

Scale: 1:50

Fig. 8

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704117 : BGS Reference: SJ67NW114
EPSG: 27700 : 360190,375100

SJ6019 7510 SJ67/25

Name and Number of Shaft or Bore given by Geological Survey:
Bore or 'Artesian well' at LITTLE LEIGH on the River Weaver

County CHESHIRE
6" Quarter Sheet 33NE

33NE 2.

Geological Classification	Description	Thickness		Depth	
	1" map. 97 (Warrington & Runcorn).				
	* Site not given [see next sheet]				
	Quoted in Calvert. A.F. 'Salt in Cheshire' 1915. p. 721. Graphic section.				
Drift	Sand and clay	-	14 0	-	14 0
	Sand, waterworn pebbles and blue clay	-	5 0	-	19 0
!	Indurated red clay	-	20 0		39 0
	Indurated blue clay	-	15 0	-	54 0
Keuper Marl	Red and blue clayey marl	-	20 0	-	74 0
	Red marl	-	8 0	-	82 0
	Blue marl	-	8 0		90 0
	Red marl with gypsum	-	10 0	-	100 0
	Blue clay and red marl with bands of gypsum upto ½" thick and very numerous	-	50 0	-	150 0
	At 150ft. weak brine broke in and rose in the borehole above the shaft water 3ft.	-	-	-	150 0
	Red and blue marl with a slaty formation, and in the latter fibrous gypsum interbedded	-	38 0	-	188 0
	Red marl	-	3 0	-	191 0
	Slaty marl with fibrous gypsum	-	18 0	-	209 0
	Red marl with fibrous gypsum	-	21 0	-	230 0
	Slaty marl with gypsum	-	9 0	-	239 0
	marl with gypsum	-	6 0	-	245 0
	Slaty marl with gypsum	-	12 0	-	257 0
	marl with gypsum	-	12 0	-	269 0
	Slaty marl with gypsum	-	6 0	-	275 0
	Red and blue marl with gypsum	-	6 0	-	281 0
	Two cavities were met with here one above the other about 6" diameter. Brine was in the well to overflowing and the last strength became [illegible] more	-	-	-	281 0
	marl with gypsum	-	9 0	-	290 0
	Slaty marl: very much gypsum	-	3 0	-	293 0
	marl with gypsum	-	12 0	-	305 0
	Salty marl with gypsum	-	9 0	-	314 0
	Salty blue indurated clay and gypsum	-	6 0	-	320 0
	marl and gypsum	-	12 0	-	332 0
	Slaty formation with gypsum	-	6 0	-	338 0
	Very salty blue indurated clay	-	6 0	-	344 0
	Very firm marl	-	9 0	-	353 0
	Slaty marl, very little gypsum	-	6 0	-	359 0
	Salty slaty marl	-	9 0	-	368 0
	marl with gypsum	-	24 0	-	392 0
	marl with copious gypsum	-	12 0	-	404 0
	Slaty formation	-	6 0	-	410 0
	Salty slaty marl and gypsum	-	9 0		419 0
	Here met a hard sweet which took 24 hours to break through				
	Track of marl, much gypsum [illegible]	-	12 0		431 0

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 704117 : BGS Reference: SJ67NW114
EPSG: 27700 : 360190,375100

SJ67/25

(1) WL.26570/8570 10,000 9/59 A.& E.W.Ltd. Gp.625

Name and Number of Shaft or Bore given by Geological Survey: 33 NE/2

County

6" Quarter Sheet

Geological Classification	Description	Thickness			Depth	
	Slaty, with traces of marl, plaky & gypsum	-	6	0	- 437	0
	Slaty, copious gypsum	-	11	0	- 448	0
	Marl gypsum	-	2	0	- 450	0

According to Messrs Jones mine the site of this bore is alongside the Inn on the north eastern side of Acton Bridge and in Little Leigh Parish "Leigh Arms" Acton Bridge

1" map. 97 (Runcorn)
6" map Cheshire 33NE.
Surface about 50ft. O. D.

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 15627288 : BGS Reference: SJ67NW129
British National Grid (27700) : 360060,376060

6006
7606

British Waterways Board | MINING ENGINEER – LEEDS | SITE: ACTON SWING BRIDGE | G.L. (m AOD) 9.037 | SHEET: 1 of 1 | BH: 1B

Scale (m)	Casing W.L. Progress	Coring / Sampling Depth / t	Blows	F.I.	R.Q.D.	SPT/S	Description of Strata	Depth (m)	Symbolic Log	Reduced Level (m AOD)
1		0.40				5	loose, black, fine to coarse grained ASH with brick and lithic fragments			
		0.85 1.00								
		1.00								
2		2.19				3				
		2.55				6	- from 3.65 as above with a very soft, black silty clay and wood fragments - FILL -			
3		3.15 3.30				7				
		3.90						4.15		
4		4.60				6	very dark brown, soft to very soft, highly silty organic CLAY with rare gravel content, and rootlets			
		5.40								
5		6.85 6.00				1		5.85		
						50	dense, fine SAND + coarse GRAVEL	6.00		
6			120				stiff, red brown, sandy CLAY with common round to sub-rounded gravel			
								7.40		
7							blueish green, red brown in parts highly weathered, very weak MARL tending to rock with depth.			
		8.55						8.55		
8							BOREHOLE COMPLETE			
9										

Casing | Strike | Stand. | Entry | Progr.
U100 | Dist. | Bulk | Water | t m'/run (mm/m)
Run TCR % / SCR % / Flush F%
No./Run (No./m)
ε (%)
N value (S) kN/m²

Remarks: Piezometer installed at 7.40m

↓ with depth
↕ transitional to

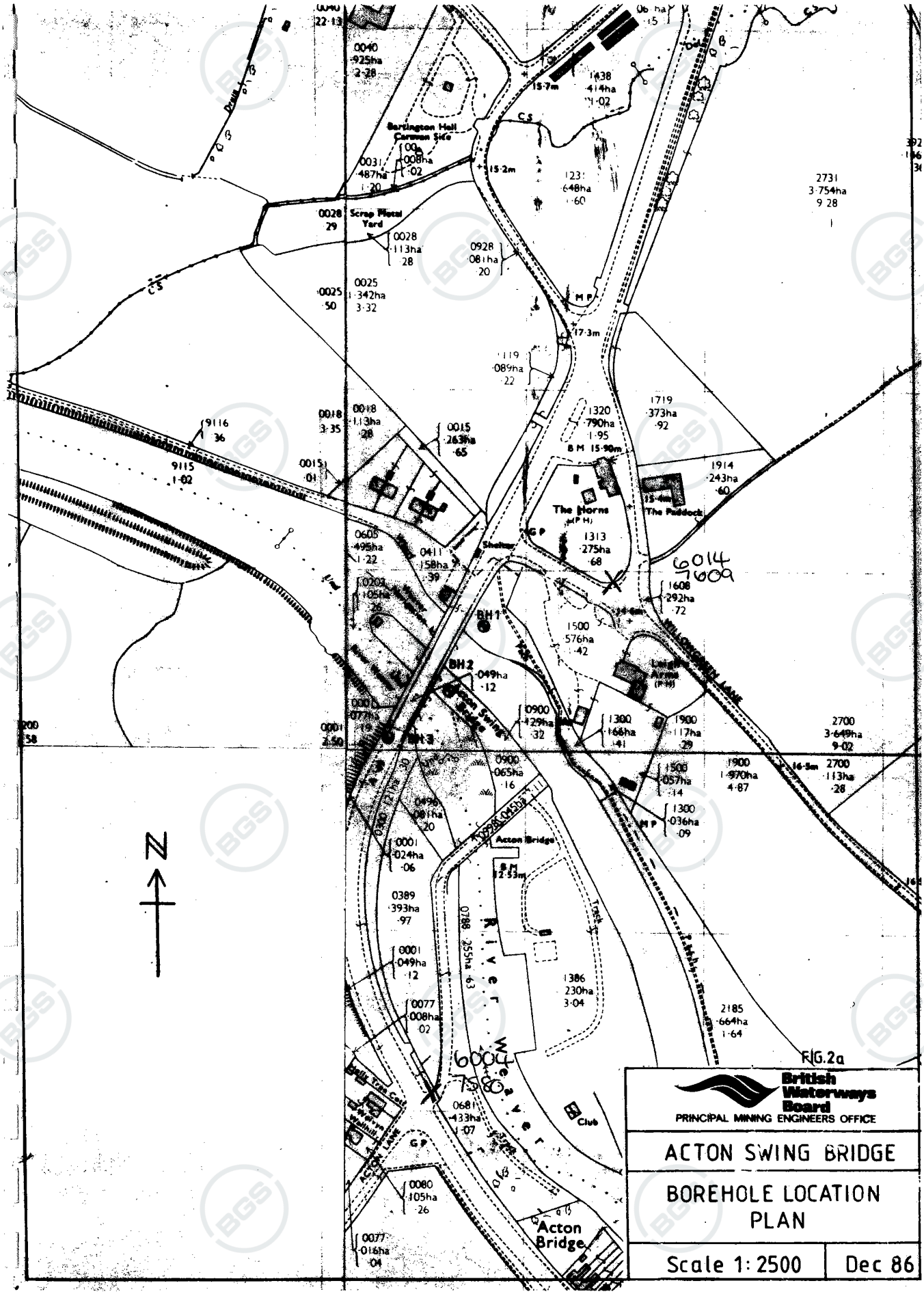
Core Ø:
Casing:
Flush:
Rig: Pilcon

Contractor: B.B. DRILLING

Instrumentation:

Date: 14/11/86 | Logged By: C.P.R.

Contact BGS: ngdc@bgs.ac.uk


Bartington Hall
Caravan Site
Scrap Metal Yard
The Horns (P.H.)
The Paddock
Shelter
BH1
BH2
BH3
Acton Bridge
Acton Swing Bridge
Acton Bridge
Club
River Weaver
Trent & Mersey Canal
Wellington Road
Acton Lane
Brook Tees Cott
N
FIG.2a
British Waterways Board
PRINCIPAL MINING ENGINEERS OFFICE
ACTON SWING BRIDGE
BOREHOLE LOCATION PLAN
Scale 1: 2500
Dec 86

British Geological Survey

BGS ID: 15627289 : BGS Reference: SJ67NW130
British National Grid (27700) : 360040,376020

6004
7602

British Waterways Board | MINING ENGINEER – LEEDS | SITE: ACTON SWING BRIDGE | G.L. (m AOD) 9.070 | SHEET: 1 of 1 | BH: 2

Scale (m)	Casing W.L. Progress	Coring / Sampling Depth/t	Rec	F.I.	R.Q.D.	SPT/S	Description of Strata	Depth (m)	Symbolic Log	Reduced Level (m AOD)
1		0.8					very loose, mid brown, fine to medium grained, slightly soily SAND with common brick fragments and whole bricks + sandstone fragments.			
2		1.25						2.30		
		2.50				2	mid to dark grey brown, very loose, damp, silty, fine to medium grained SAND with occasional gravel and rootlets, with organic "oily" smell - (angular gravel)			
3		3.40								
		3.80				8	fine to coarse grained, light grey and black, angular GRAVEL and fine grained SAND.	4.00		
4										
		4.70								
5		5.15				2	loose, grey angular GRAVEL - with soft, thin, silty clay bands	5.30		
		5.95						5.95		
6						65	coarse rounded to sub-rounded GRAVEL to cobble size + medium SAND	6.25		
		6.40				33	mid grey brown, dense, fine to medium grained SAND becoming light orange brown with depth and rounded GRAVEL with thin bands of red brown, stiff silty clay			
		6.90								
7		7.15				55				
		7.60								
		7.90								
8		8.35				56		8.10		
		8.50					light bluey green, highly weathered MARL with common calcite crystals, tending to a rock with depth.			
		8.60								
		9.00				+ 100				
9		9.45						9.45		
							BOREHOLE COMPLETE			

Casing | Strike | Stand. | Entry | Progr. | U100 | Dist. | Bulk | Water | t m³/run (mm/m) | Run [TCR % (SCR %)] | Flush F% | No./Run (No./m) | m (%) | N value (S) kN/m²

Remarks: Piezometer installed at 5.10m

↓ with depth
↕ transitional to

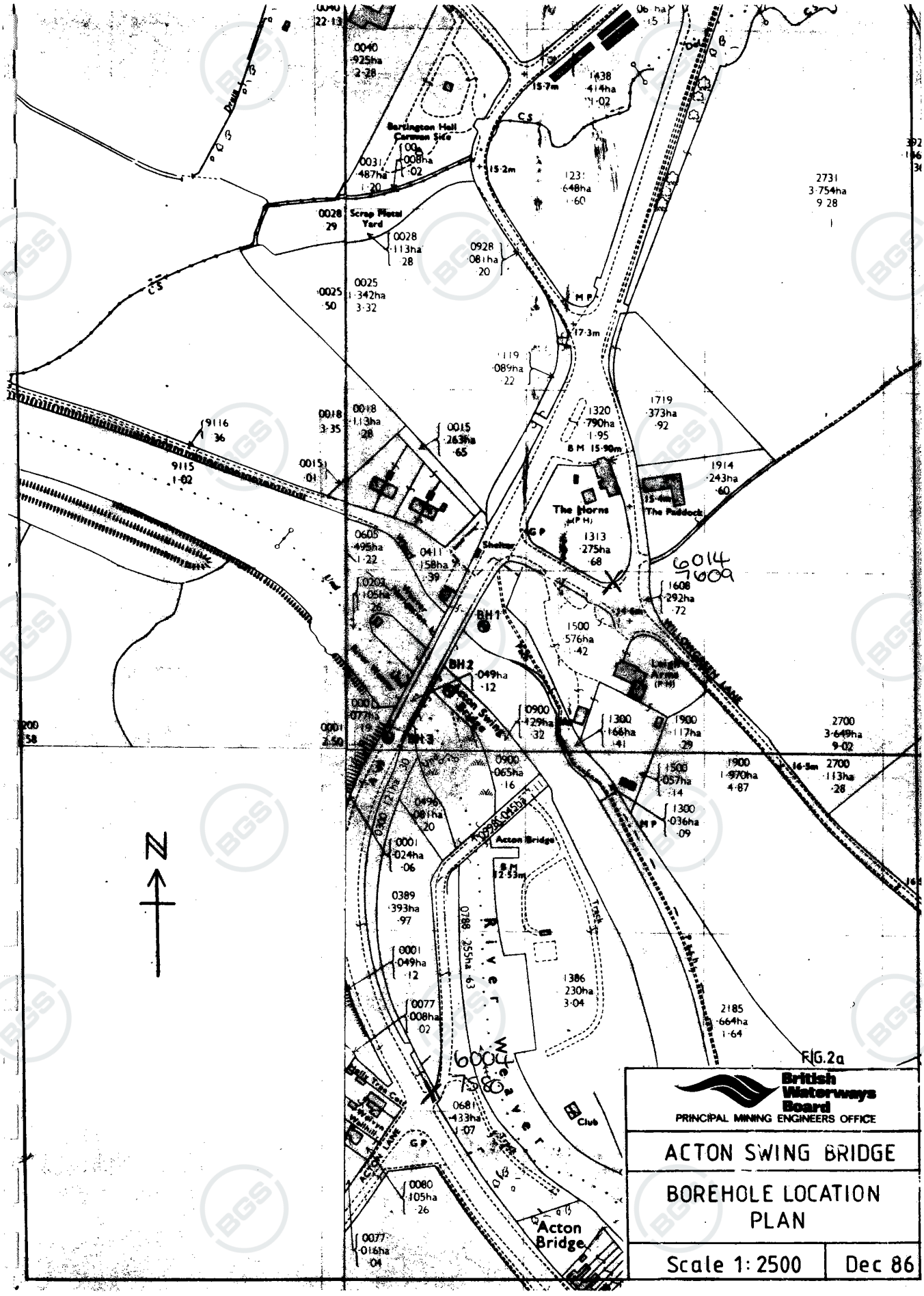
Core Ø:
Casing:
Flush:
Rig: PILCON

Contractor: B.B. DRILLING

Instrumentation:

Date: 22/10/86 Logged By: C.P.R.

Contact BGS: ngdc@bgs.ac.uk


Bartington Hall Caravan Site
Scrap Metal Yard
The Horns (P H)
The Paddock
Shelter
BH1
BH2
BH3
Acton Bridge
Acton Bridge (P H)
Acton Swing Bridge
Wrenbury Old Hall Lane
Mill Cottage Lane
Club
Track
River Weaver
Brine Tips Coal
N
FIG.2a
British Waterways Board
PRINCIPAL MINING ENGINEERS OFFICE
ACTON SWING BRIDGE
BOREHOLE LOCATION PLAN
Scale 1: 2500
Dec 86

British Geological Survey

BGS ID: 15627290 : BGS Reference: SJ67NW131
British National Grid (27700) : 360010,376000

6001
7600

British Waterways Board | MINING ENGINEER – LEEDS | SITE: ACTON SWING BRIDGE | G.L. (m AOD) 12.63 | SHEET: 1 of 2 | BH: 3

Scale (m)	Casing W.L. Progress	Coring / Sampling: Depth/Type	Rec. (%)	F.I.	R.Q.D.	SPT/S	Description of Strata	Depth (m)	Symbolic Log	Reduced Level (m AOD)
							Tarmac	0.40		
							dense, very dark brown ash, with common boulders	1.00		
							red brick rubble	1.20		
		1.35					medium dense, mid brown, fine to medium SAND with common brick fragments. - MADE GROUND -	1.95		
		1.75 / 1.85								
		2.45				13	light buff brown, medium dense, fine to medium grained, slightly clayey SAND	3.10		
		2.80								
		3.40				8	SAND as above with thin bands of red brown, soft, highly sandy CLAY.	3.70		
		3.75								
		4.35				8	soft to very soft, red brown, moist, highly sandy CLAY or a clayey SAND with sand lenses and organic debris, and highly silty sandy clay bands.			
		5.05	14			9				
		5.55 / 5.80	12							
		6.25								
		6.60	18							
		7.05 / 7.25								
		7.80	12					7.60		
		8.15	11				mid grey brown fine grained, clayey, silty SAND with common organic debris			
		8.65					– less clayey → (sand in lenses)	8.75		
		9.00	11				- mid orangey brown, fine to medium grained SAND →	9.60		
		9.50						9.80		
		9.99								

Casing | Strike | Stand. | Entry | Progr. | U100 | Dist. | Bulk | Water | t m³/run (mm/m²) | Run TCR % /SCR % | Flush F% | No./Run (No./m) | R.Q.D. (%) m | N value (S) kN/m²

Remarks: | ↓ with depth ⇩ transitional to

Core Ø: | Casing: | Flush: WATER | Rig: PILCON

Contractor: B.B. DRILLING | Instrumentation: | Date: 29/10/8 | Logged By: C.P.R.

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 15627290 : BGS Reference: SJ67NW131
British National Grid (27700) : 360010,376000

British Waterways Board | MINING ENGINEER – LEEDS | SITE: ACTON SWING BRIDGE | G.L. (m AOD) 12.63 | SHEET: 2 of 2 | BH: 3

Scale (m)	Casing W.L. Progress	Coring / Sampling: Depth/t	Rec. / Core Loss	F.I.	R.Q.D.	SPT/S	Description of Strata	Depth (m)	Symbolic Log	Reduced Level (m AOD)
		10.35				61	coarse GRAVEL & fine to medium grained SAND	10.35		
11		10.75	78				Firm to stiff, mid red brown thinly laminated silty CLAY with silt along laminations and sand lenses, becoming more sandy from 12.75m			
		11.20								
		11.45								
		11.75								
12		12.00	90							
		12.45								
13		13.05	78					13.20		
		13.50					mid orange brown fine to med SAND	13.75		
		13.75								
		13.95					highly weathered, weak to moderately weak, highly fissured MARL grading into a mod strong siltstone in parts with bands of completely weathered soft Marl. (all horizontal joints).			
14		14.25								
			[1.51 63%] (1.01 67%)	numerous	(0%)					
15										
16							(16.23 – 16.60m highly weathered zone)			
		16.65	[0.82 91%] (100%)	2	(0%)		- red brown, slightly blue green, weakly jointed Marl.			
17		17.45								
			[1.06 62%] (100%)	26	0.1 (9%)		- red brown, greenish blue mod weak MARL, grading into a siltstone in parts with soft clay bands			
18										
19		19.15						19.15		
							BOREHOLE COMPLETE			

Casing | Strike | Stand. | Entry | Progr. | U100 | Dist. | Bulk | Water | t m'/run (mm/m) | Run TCR % (SCR %) | Flush F% | No./Run (No./m) | m (%) | N value (S) kN/m²

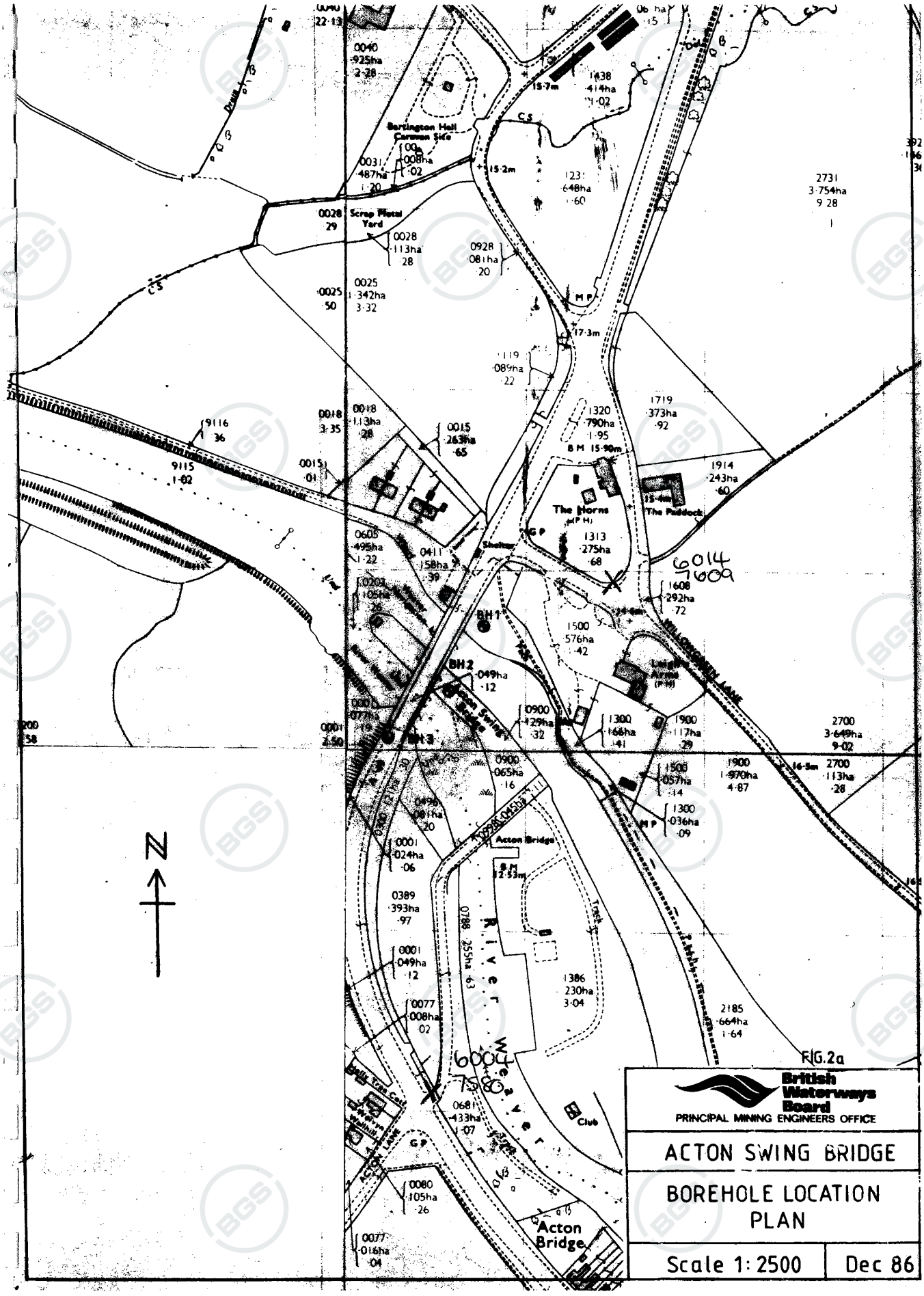
Remarks: CORING FROM 14.10m

↓ with depth ↕ transitional to

Core Ø: | Casing: | Flush: | Rig:

Contractor: | Instrumentation: | Date: | Logged By: C.P.R.

Contact BGS: ngdc@bgs.ac.uk


Barlington Hall Caravan Site
Scrap Metal Yard
The Horns (P.H.)
The Paddock
Shelter
BH1
BH2
BH3
Acton Swing Bridge
Acton Bridge
River Weaver
Club
Acton Bridge
N
FIG.2a
British Waterways Board
PRINCIPAL MINING ENGINEERS OFFICE
ACTON SWING BRIDGE
BOREHOLE LOCATION PLAN
Scale 1: 2500
Dec 86

HyNet North West Hydrogen Pipeline

Delivering clean growth

Annex 14A 7
Sandiway Boreholes

SJ67SW/108

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 2
Sheet 1 of 3.

Job Number : 6999 Location : Ashbank Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo -meter	Daily Prog.
Grass over brown sandy TOPSOIL.	500.00		(0.50)	0.00								
Reddish brown clayey medium SAND.	499.50		(1.20)	0.50	0.50 - 1.00	B 1						
Brown silty fine to medium SAND with occasional thin bands of soft brown sandy clay (Boulder Clay).	498.30		(3.00)	1.70	2.00 - 2.50	B 2						
					3.50 - 4.00	B 3						
Brown silty fine to medium SAND.	495.30		(4.70)	4.70	5.00 - 5.50	B 4						22/4
					6.50 - 7.00	B 5						
					8.00 - 8.50	B 6						
Brown silty fine to medium SAND.	490.60		(5.60)	9.40	9.50 - 10.00	B 7						
Borehole Continued				10.00								

General Remarks :
No water strike noted during drilling. Water added to assist with drilling below 1.70m
Temporary standing level at 18.0m end of shift 23/4
Temporary standing level at 16.0m am 26/4

Dates : 22 to 26 April 93
Driller : TAM
Engineer: MJR

Coordinates :

SJ67SW/ 108

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 2
Sheet 2 of 3.

Job Number : 6999 Location : Ashbank Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo -meter	Daily Prog.
Brown silty fine to medium SAND.				10.00	9.50 - 10.00	B 7						
					11.00 - 11.50	B 8						
			(5.60)		12.50 - 13.00	B 9						
					14.00 - 14.50	B 10						
Soft to firm light brown very silty sandy CLAY.	485.00			15.00	15.50 - 16.00	B 11				▽ Tsl am26/4		
			(1.60)									
Firm brown sandy CLAY (Boulder Clay).	483.40			16.60								
	483.20		(0.20)	16.80								
Brown slightly silty fine to medium SAND.					17.00 - 17.50	B 12						
			(1.60)							TSl pm 23/4		
Very stiff brown sandy CLAY (Boulder Clay)	481.60			18.40	18.50 - 19.00	B 13						
			(1.30)									
Brown fine to medium SAND	480.30			19.70								
			(1.30)	20.00								
Borehole Continued												

General Remarks :
No water strike noted during drilling.Water added to assist with drilling below 1.70m
Temporary standing level at 18.0m end of shift 23/4
Temporary standing level at 16.0m am 26/4

Dates : 22 to 26 April 93
Driller : TAM
Engineer: MJR

Coordinates :

British Geological Survey

BGS ID: 717106 : BGS Reference: SJ67SW108
British National Grid (27700) : 360840,371820

SJ67SW/ 108

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 2
Sheet 3 of 3.

Job Number : 6999 Location : Ashbank Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

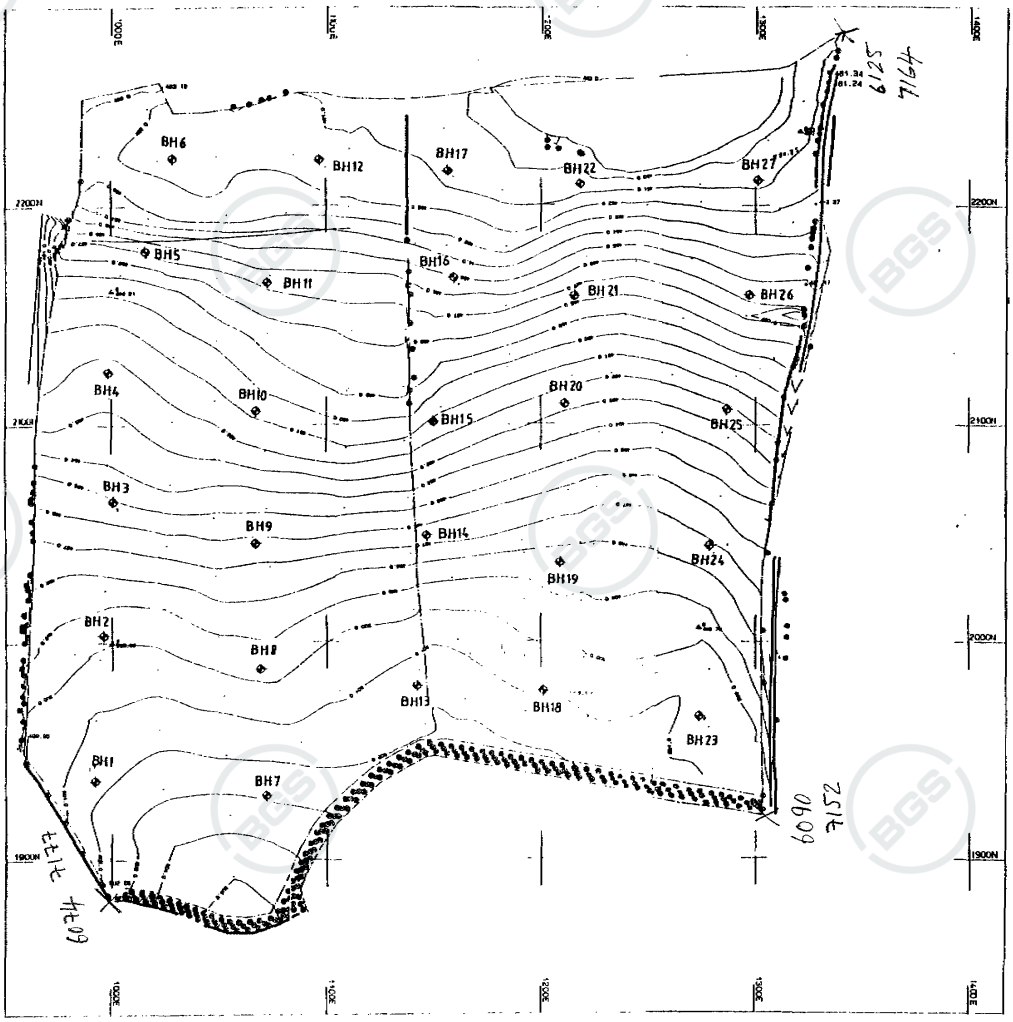
Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo -meter	Daily Prog.
Brown fine to medium SAND			(1.30)	20.00								23/4
Brown slightly silty fine to medium SAND.	479.00		(4.00)	21.00								
Borehole Completed	475.00			25.00								26/4

General Remarks :
No water strike noted during drilling.Water added to assist with drilling below 1.70m
Temporary standing level at 18.0m end of shift 23/4
Temporary standing level at 16.0m am 26/4

Dates : 22 to 26 April 93
Driller : TAM
Engineer: MJR

Coordinates :

Contact BGS: ngdc@bgs.ac.uk



Prepared from Site survey.

Notes.

SJ67SW/107-133

Revisions:

Job title:

LAND AT SANDIWAY FOR DALEFORDS ESTATES.

Scale:	Drawing number:
1	M609
O.S. ref: SJ6071,6171	Revision suffix:
Date: 5-7-93	Drawn by: — / Checked: —

GANDY & SON
Chartered Surveyors

Winnington Hill, Northwich, Cheshire CW8 1AH
Tel 0606-79144

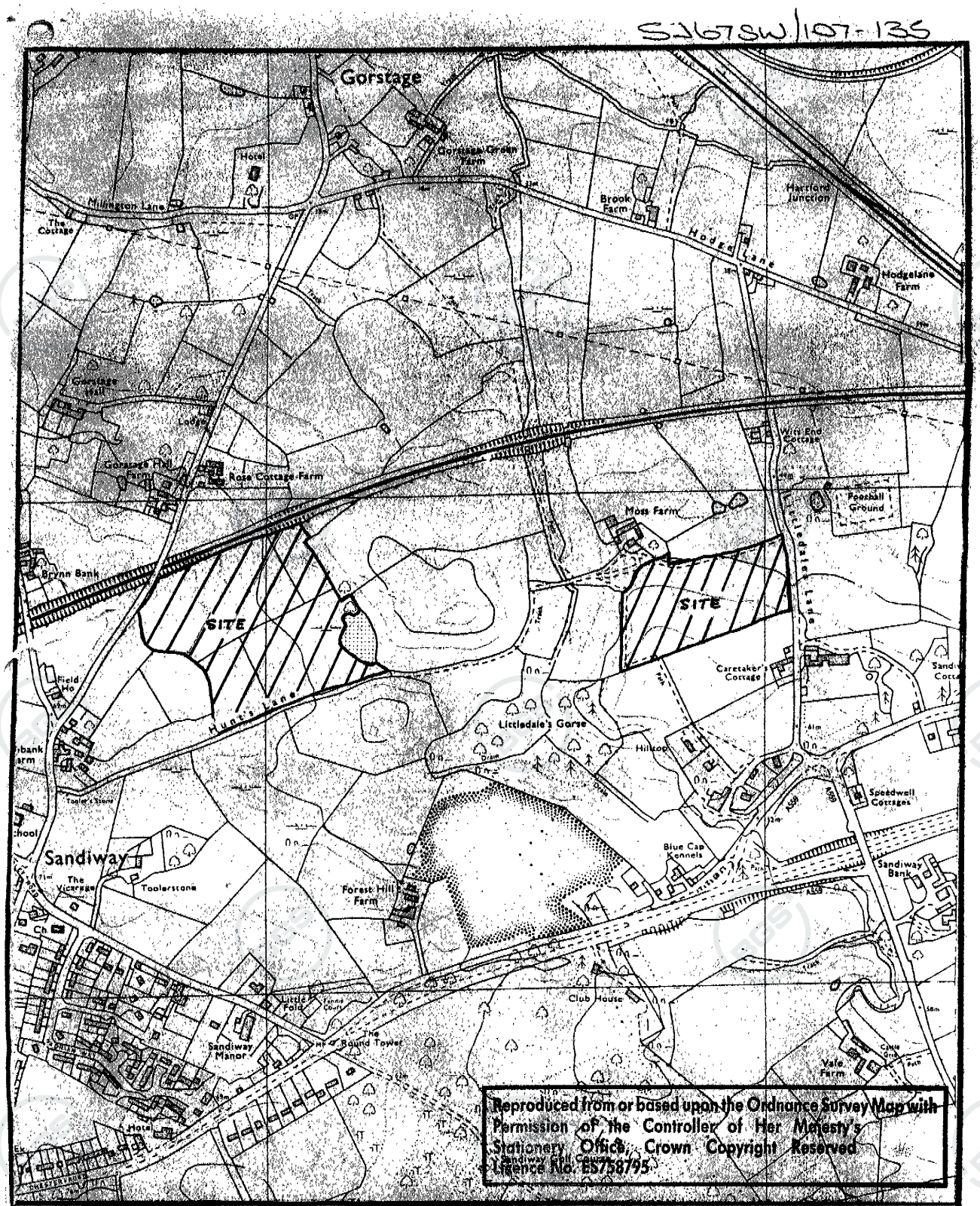
Charlton House, 109 Boughton, Chester CH3 5BH
Tel 0244-41667

Fax: 0606-783234

British Geological Survey

BGS ID: 717106 : BGS Reference: SJ67SW108
British National Grid (27700) : 360840,371820

SJ67SW/107-135



scale 1:10560
date 25-3-93
dwng no. M 937
drawn by
O.S. ref SJ 67SW

GANDY & SON
Chartered Surveyors

Winnington Hill,
Northwich, Cheshire
CW8 1AH
Tel: 0606-79144

Charlton House,
109 Boughton, Chester
CH3 5BH
Tel: 0244-320748

Fax: 0606-783234

0597 293 ORALID (UK) LTD

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717109 : BGS Reference: SJ67SW111
British National Grid (27700) : 361010,371880

SJ67SW / 111

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 5
Sheet 1 of 2.

Job Number : 6999 Location : Ashbank Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo -meter	Daily Prog.
Grass over TOPSOIL.	487.00		(0.30)	0.00								
Brown dry clayey fine to medium SAND with thin bands of firm clay.	486.70		(2.50)	0.30	0.50 - 1.60	B 1						
					2.00 - 2.80	B 2						
Brown dry slightly silty fine to medium SAND.	484.20		(3.70)	2.80	2.80 - 4.10	B 3						
					4.30 - 5.50	B 4						
					5.80 - 6.50	B 5						
Soft brown silty CLAY.	480.50		(0.50)	6.50								
Brown dry silty predominantly fine to medium SAND.	480.00		(5.00)	7.00	7.00 - 8.30	B 6						
					8.50 - 9.30	B 7						
Borehole Continued				10.00								

General Remarks :
Water strike @ 11.0m rising to 10.1m in 20 minutes.
Temporary standing level at 10.5m (pm 29/4).

Dates : 29 April 93
Driller : LB
Engineer: MJR

Coordinates :

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717109 : BGS Reference: SJ67SW111
British National Grid (27700) : 361010,371880

SJ67SW/111

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 5
Sheet 2 of 2.

Job Number : 6999 Location : Ashbank Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

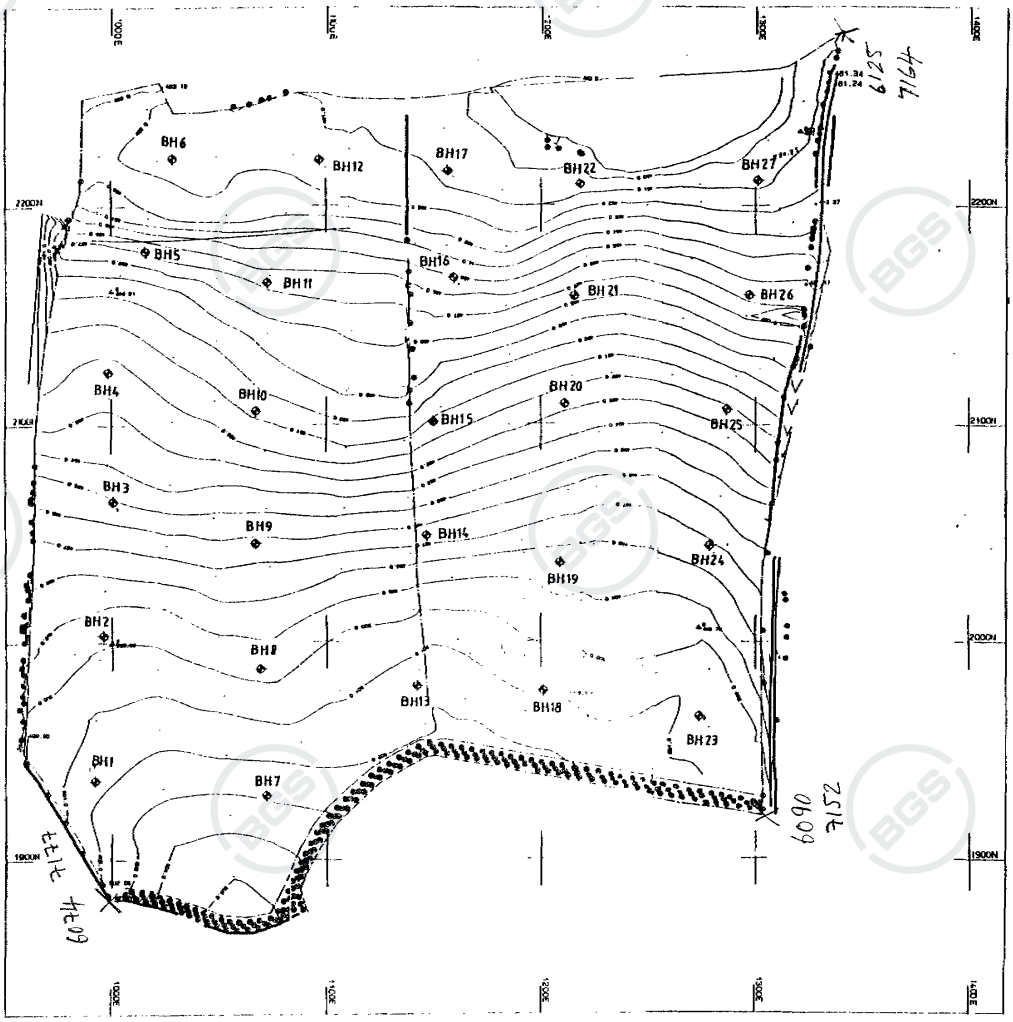
Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo -meter	Daily Prog.
Brown dry silty predominantly fine to medium SAND.			(5.00)	10.00	10.00 - 10.80	B 8				Tsl 20 mins Tsl pm 29/4 ▼ med 29/4		ANS
					11.50 - 12.00	B 9						
Borehole Completed	475.00			12.00								29/4

General Remarks :
Water strike @ 11.0m rising to 10.1m in 20 minutes.
Temporary standing level at 10.5m (pm 29/4).

Dates : 29 April 93
Driller : LB
Engineer: MJR

Coordinates :

Contact BGS: ngdc@bgs.ac.uk



Prepared from Site survey.

Notes.

SJ67SW/107-133

Revisions:

Job title:

LAND AT SANDIWAY FOR DALEFORDS ESTATES.

Scale:	Drawing number:
1	M609
O.S. ref:	Revision suffix:
SJ6071,6171	
Date:	Drawn by: / Checked:
5-7-93	

GANDY & SON
Chartered Surveyors

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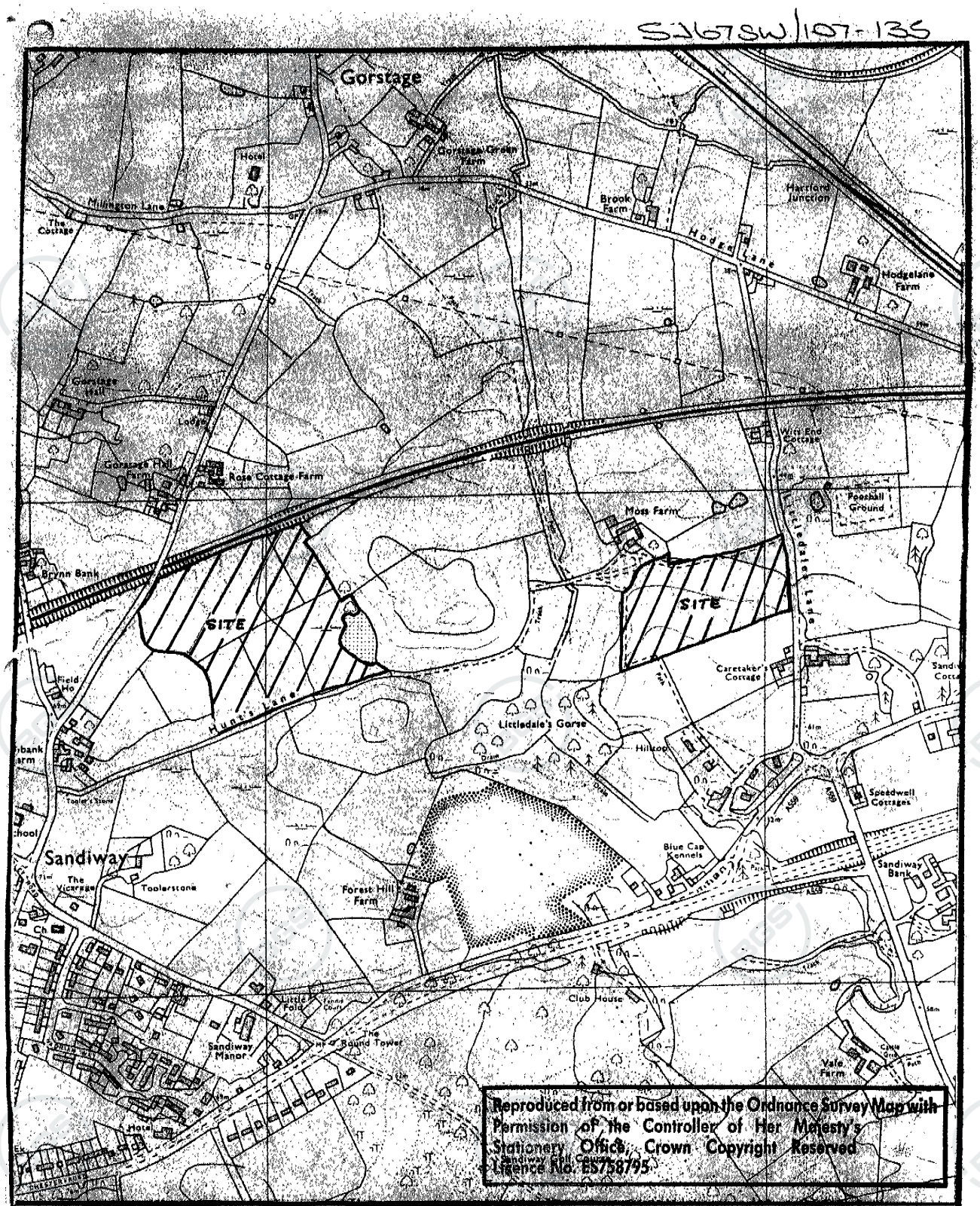
Charlton House, 109 Boughton, Chester CH3 5BH
Tel 0244-41667

Fax: 0606-783234

British Geological Survey

BGS ID: 717109 : BGS Reference: SJ67SW111
British National Grid (27700) : 361010,371880

SJ67SW/107-135



scale 1:10560
date 25-3-93
dwng no. M 937
drawn by
O.S. ref SJ 67SW

GANDY & SON
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CW8 1AH
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109 Boughton, Chester
CH3 5BH
Tel: 0244-320748

Fax: 0606-783234

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717115 : BGS Reference: SJ67SW117
British National Grid (27700) : 361020,371820

SJ67SW/117

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 11
Sheet 1 of 2.

Job Number : 6999 Location : Ashbank Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

Description of Strata	Red. Level	Legend	Thick-ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo-meter	Daily Prog.
Grass over TOPSOIL.	486.80		(0.30)	0.00								
Brown and grey dry slightly silty fine SAND.	486.50		(0.70)	0.30	0.50 - 1.00	B 1						
Brown dry slightly silty fine to medium SAND	485.80		(2.50)	1.00	1.00 - 1.70	B 2						
					2.50 - 3.20	B 3						
Brown dry silty to very silty fine to medium SAND with thin bands of soft sandy clay (boulder clay).	483.30		(1.00)	3.50	3.50 - 4.40	B 4						
Firm brown sandy CLAY. (Boulder Clay)	482.30		(0.50)	4.50								
Brown dry silty fine to medium SAND.	481.80		(3.00)	5.00	5.00 - 5.70	B 5						
					6.50 - 7.50	B 6						
Brown silty fine to medium SAND with thin bands of thinly laminated silty CLAY.	478.80		(4.00)	8.00	8.00 - 8.80	B 7						
					9.50 - 10.00	B 8				Tsl 20 mins 0 Tsl 10/5		
Borehole Continued				10.00								

General Remarks :
Water strike @ 10.0m rising to 9.3m in 20 minutes.
Piezometer installed to 12.0m; Sand filter 12.0 to 1.0m; Bentonite seal 1.0 to 0.5; concrete 0.5 to GL; 6x6 plain cover. Water level before installation at 10.3m (time taken 0.5hrs).
Temporary standing level in piezometer at 9.3 (10/5)

Dates : 5 and 6th May 93
Driller : LB
Engineer: MJR

Coordinates :

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717115 : BGS Reference: SJ67SW117
British National Grid (27700) : 361020,371820

SJ67SW/117

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 11
Sheet 2 of 2.

Job Number : 6999 Location : Ashbank Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo -meter	Daily Prog.
Brown silty fine to medium SAND with thin bands of thinly laminated silty CLAY.				10.00	9.50 - 10.00	B 8				▼ Med		AWS
			(4.00)		11.00 - 12.00	B 9				Isl pm 6/5		
Borehole Completed	474.80			12.00								6/5

General Remarks :
Water strike @ 10.0m rising to 9.3m in 20 minutes.
Piezometer installed to 12.0m; Sand filter 12.0 to 1.0m; Bentonite seal 1.0 to 0.5; concrete 0.5 to 61; 6x6 plain cover. Water level before installation at 10.3m (time taken 0.5hrs).
Temporary standing level in piezometer at 9.3 (10/5)

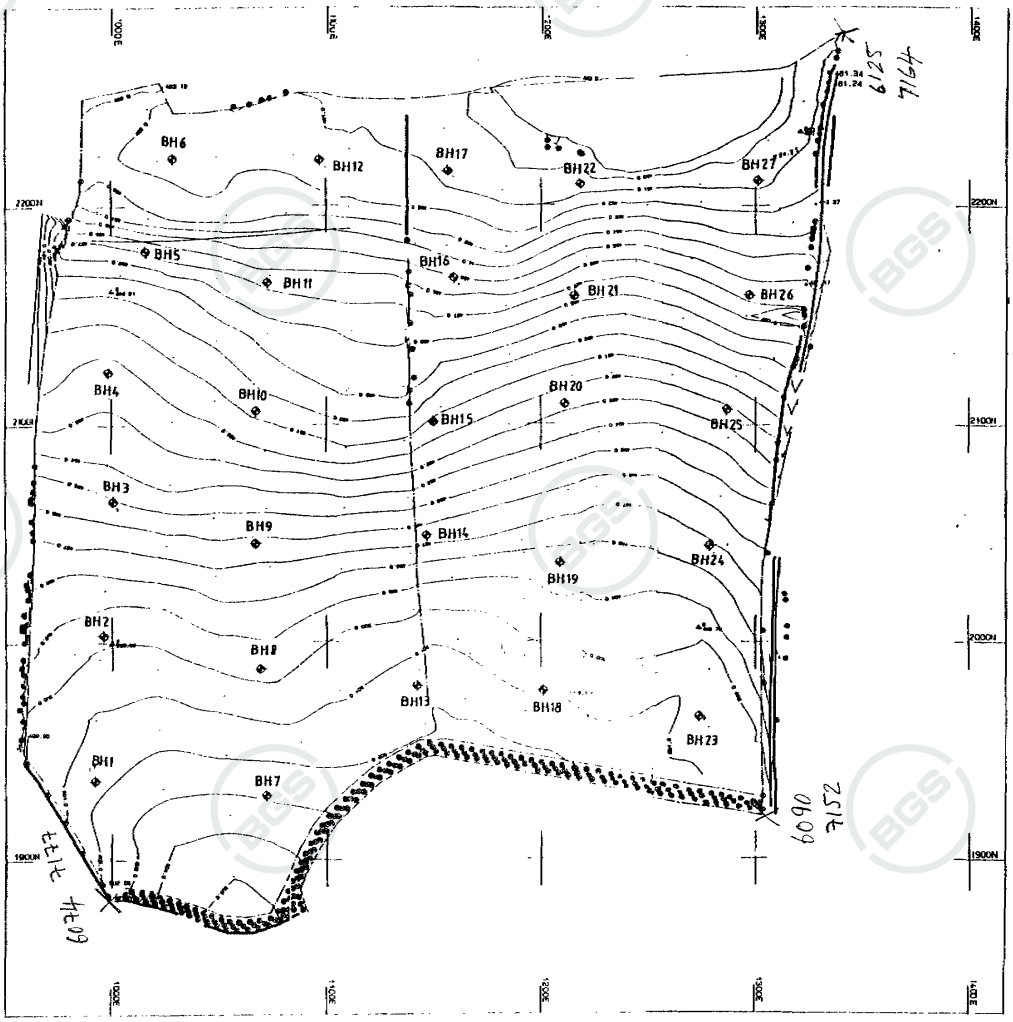
Dates : 5 and 6th May 93
Driller : LB
Engineer: MJR

Coordinates :

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717115 : BGS Reference: SJ67SW117
British National Grid (27700) : 361020,371820



Prepared from Site survey.

Notes.

SJ67SW/107-133

Revisions:

Job title:

LAND AT SANDIWAY FOR DALEFORDS ESTATES.

Scale:	Drawing number:
1	M609
O.S. ref: SJ6071,6171	Revision suffix:
Date: 5-7-93	Drawn by: — Checked: —

GANDY & SON
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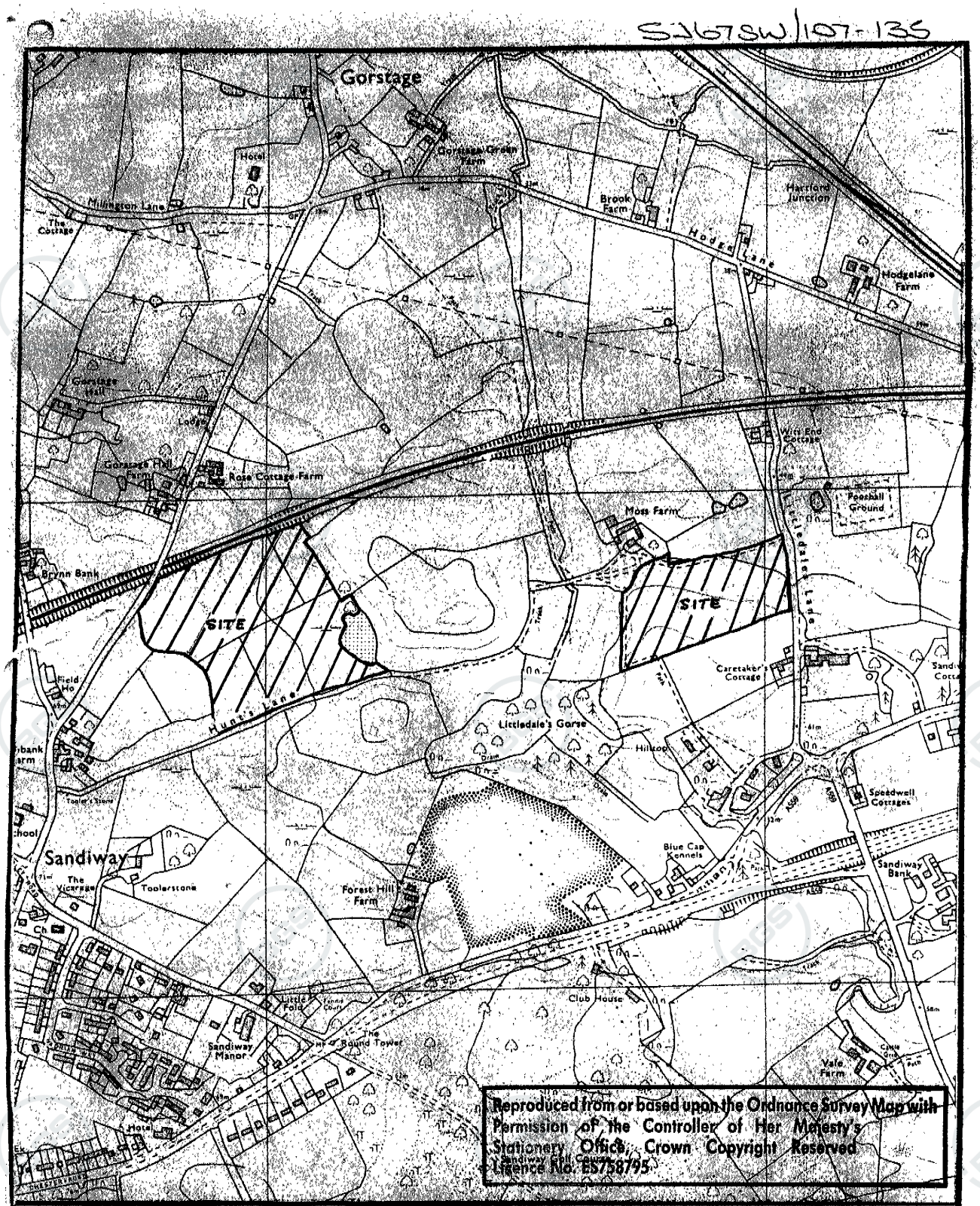
Fax: 0606-783234

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717115 : BGS Reference: SJ67SW117
British National Grid (27700) : 361020,371820

SJ67SW/107-135



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date 25-3-93
dwng no. M 937
drawn by
O.S. ref SJ 67SW

GANDY & SON
Chartered Surveyors

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Charlton House,
109 Boughton, Chester
CH3 5BH
Tel: 0244-320748

Fax: 0606-783234

0597 293 ORALID (UK) LTD

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717132 : BGS Reference: SJ67SW134
British National Grid (27700) : 361720,371690

SJ67SW/134

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 28
Sheet 1 of 3.

Job Number : 6999 Location : Moss Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo -meter	Daily Prog.
TOPSOIL.			(0.60)	0.00								
Brown dry slightly silty fine SAND.				0.60	0.50 - 1.00	B 1						
					2.00 - 2.50	B 2						
			(3.90)									
					3.50 - 4.00	B 3						
Brown dry slightly silty fine to coarse SAND.				4.50								
			(1.50)		5.00 - 5.50	B 4						
Brown dry slightly silty fine to medium SAND.			(0.50)	6.00	6.00 - 6.50	B 5						
Brown dry silty fine to medium with a little coarse SAND.				6.50								11/5
					7.50 - 8.00	B 6						
			(8.50)									
					9.00 - 9.50	B 7						
Borehole Continued				10.00								

General Remarks :
Water strike @ 22.7m rising to 22.0m in 20 minutes.
Temporary standing level at 22.0m (pm 12/5).

Dates : 11 and 12th May 93
Driller : MC
Engineer: MJR

Coordinates :

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717132 : BGS Reference: SJ67SW134
British National Grid (27700) : 361720,371690

SJ67SW/134

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 28
Sheet 2 of 3.

Job Number : 6999 Location : Moss Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo -meter	Daily Prog.
Brown dry silty fine to medium with a little coarse SAND.			(8.50)	10.00	10.50 - 11.00	B 8						
					12.00 - 12.50	B 9						
					13.50 - 14.00	B 10						
Reddish brown slightly silty fine to coarse SAND.			(7.30)	15.00	15.00 - 15.50	B 11						
					16.50 - 17.00	B 12						
					18.00 - 18.50	B 13						
					19.50 - 20.00	B 14						
Borehole Continued				20.00								

General Remarks :
Water strike @ 22.7m rising to 22.0m in 20 minutes.
Temporary standing level at 22.0m (pm 12/5).

Dates : 11 and 12th May 93
Driller : MC
Engineer: MJR

Coordinates :

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717132 : BGS Reference: SJ67SW134
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SJ67SW/134

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 28
Sheet 3 of 3.

Job Number : 6999 Location : Moss Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo -meter	Daily Prog.
Reddish brown slightly silty fine to coarse SAND.			(7.30)	20.00	19.50 - 20.00	B 14						
					21.00 - 21.50	B 15						
										Is] pm 12/5		
Brown silty predominantly fine and medium SAND.				22.30	22.50 - 23.00	B 16				▼ Slow		AWS
			(2.70)		24.00 - 24.50	B 17						
Borehole Completed				25.00								12/5

General Remarks :
Water strike @ 22.7m rising to 22.0m in 20 minutes.
Temporary standing level at 22.0m (pm 12/5).

Dates : 11 and 12th May 93
Driller : MC
Engineer: MJR

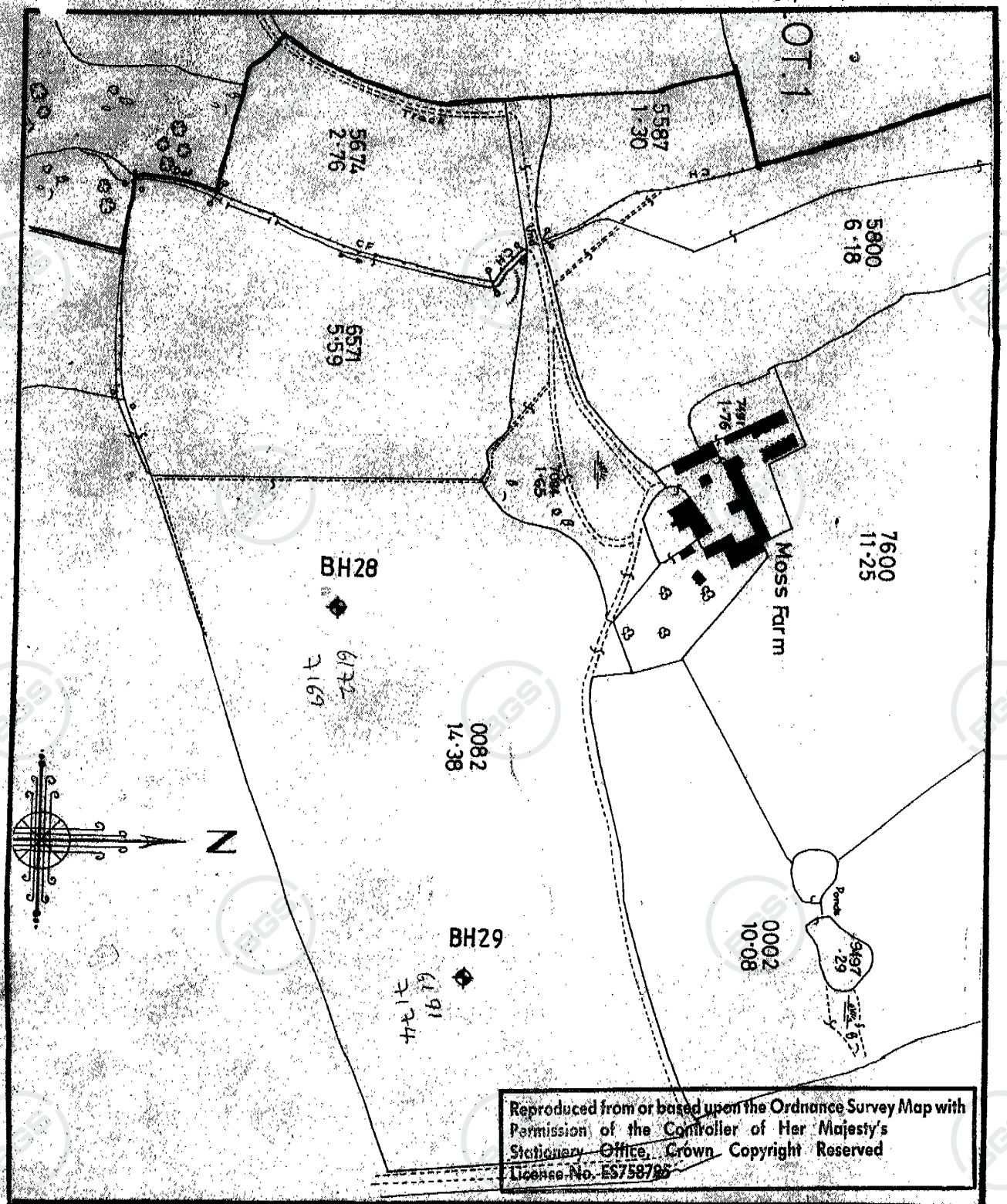
Coordinates :

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717132 : BGS Reference: SJ67SW134
British National Grid (27700) : 361720,371690

SJ67SW 134-135



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scale	1:2500
date	25-3-93
dwng no.	M938
drawn by	—
O.S. ref	SJ6171/6272

GANDY & SON
Chartered Surveyors

Winnington Hill,
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0597-293 OZALID (UK) LTD

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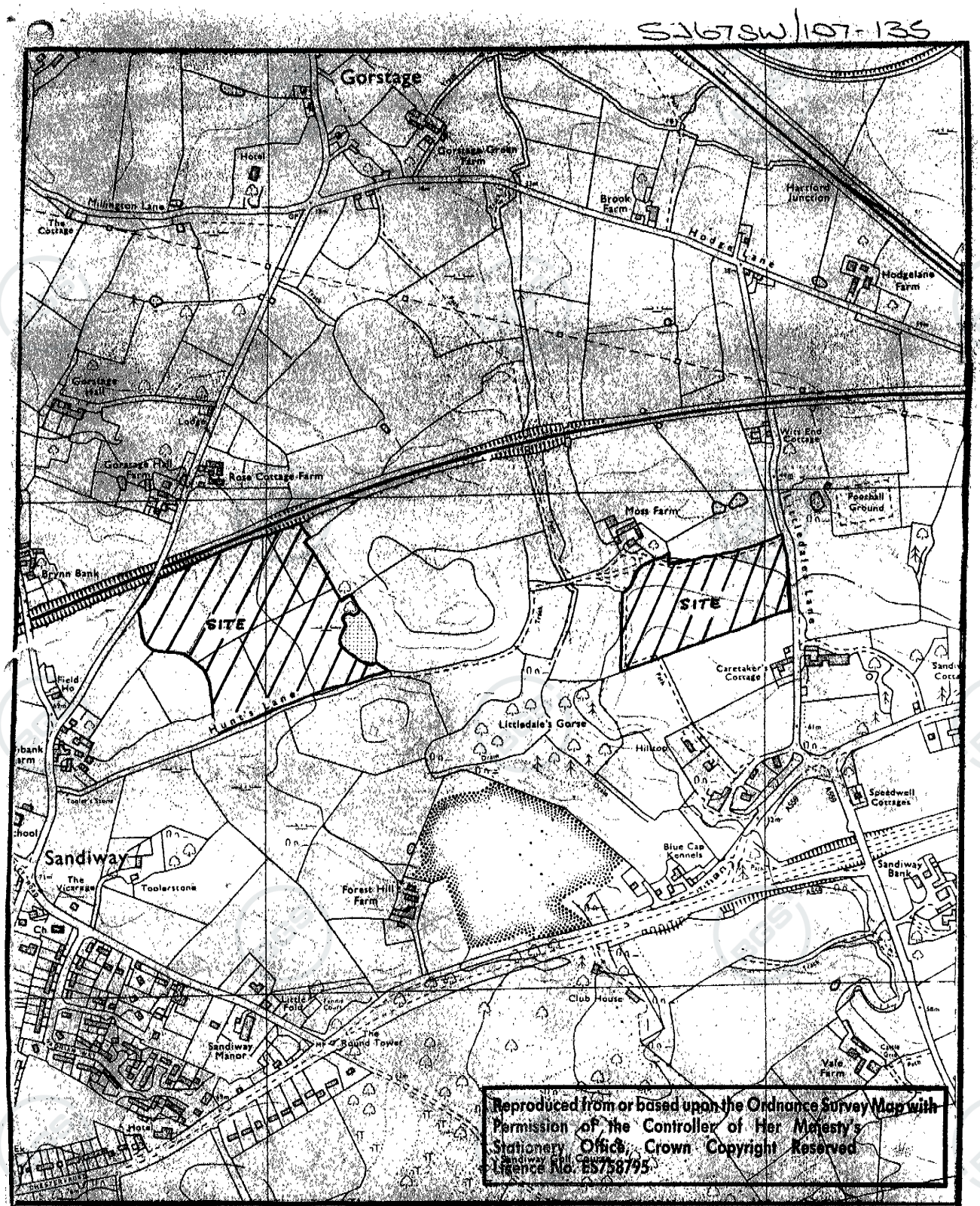
British National Grid (27700) : 361720,371690

SJ67SW/107-135



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date 25-3-93
dwng no. M 937
drawn by
O.S. ref SJ 67SW

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0597 293 ORALID (UK) LTD

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717133 : BGS Reference: SJ67SW135
British National Grid (27700) : 361910,371740

SJ67SW/ 135

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 29
Sheet 1 of 2.

Job Number : 6999 Location : Moss Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo -meter	Daily Prog.
TOPSOIL.			(0.20)	0.00								
Dark brown sandy TOPSOIL with rootlets.				0.20								
			(0.90)									
Brown dry slightly silty fine to medium SAND.				1.10	1.00 - 1.50	B 1						
					2.50 - 3.00	B 2						
					4.00 - 4.50	B 3						
			(8.90)		5.50 - 6.00	B 4						
					7.00 - 7.50	B 5						11/5
					8.50 - 9.00	B 6						
Borehole Continued				10.00								

General Remarks :
Water strike @ 17.2m rising to 17.1m in 20 minutes.
Temporary standing level at 17.40m(pm 12/5)

Dates : 11 and 12 May 93
Driller : T OH
Engineer: MJR

Coordinates :

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717133 : BGS Reference: SJ67SW135
British National Grid (27700) : 361910,371740

SJ67SW 135

STRATA SURVEYS LTD.,
Telephone: 0606 834637 Fax: 0606 836657

Borehole Number : 29
Sheet 2 of 2.

Job Number : 6999 Location : Moss Farm, Sandiway
Client : Gandy and Son

Dia. & Drilling Methods
light cable percussion
150mm diameter

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Piezo -meter	Daily Prog.
Reddish brown slightly silty fine to medium SAND.			(7.20)	10.00	10.00 - 10.50	B 7						
					11.50 - 12.00	B 8						
					13.00 - 13.50	B 9						
					14.50 - 15.00	B 10						
					16.00 - 16.50	B 11						
Reddish brown wet slightly silty fine to medium SAND.			(2.30)	17.20	17.50 - 18.00	B 12				▽ Tal 20 mins ▼ Slow Tal pm 12/5		ANS
					19.00 - 19.50	B 13						
Borehole Completed				19.50								12/5

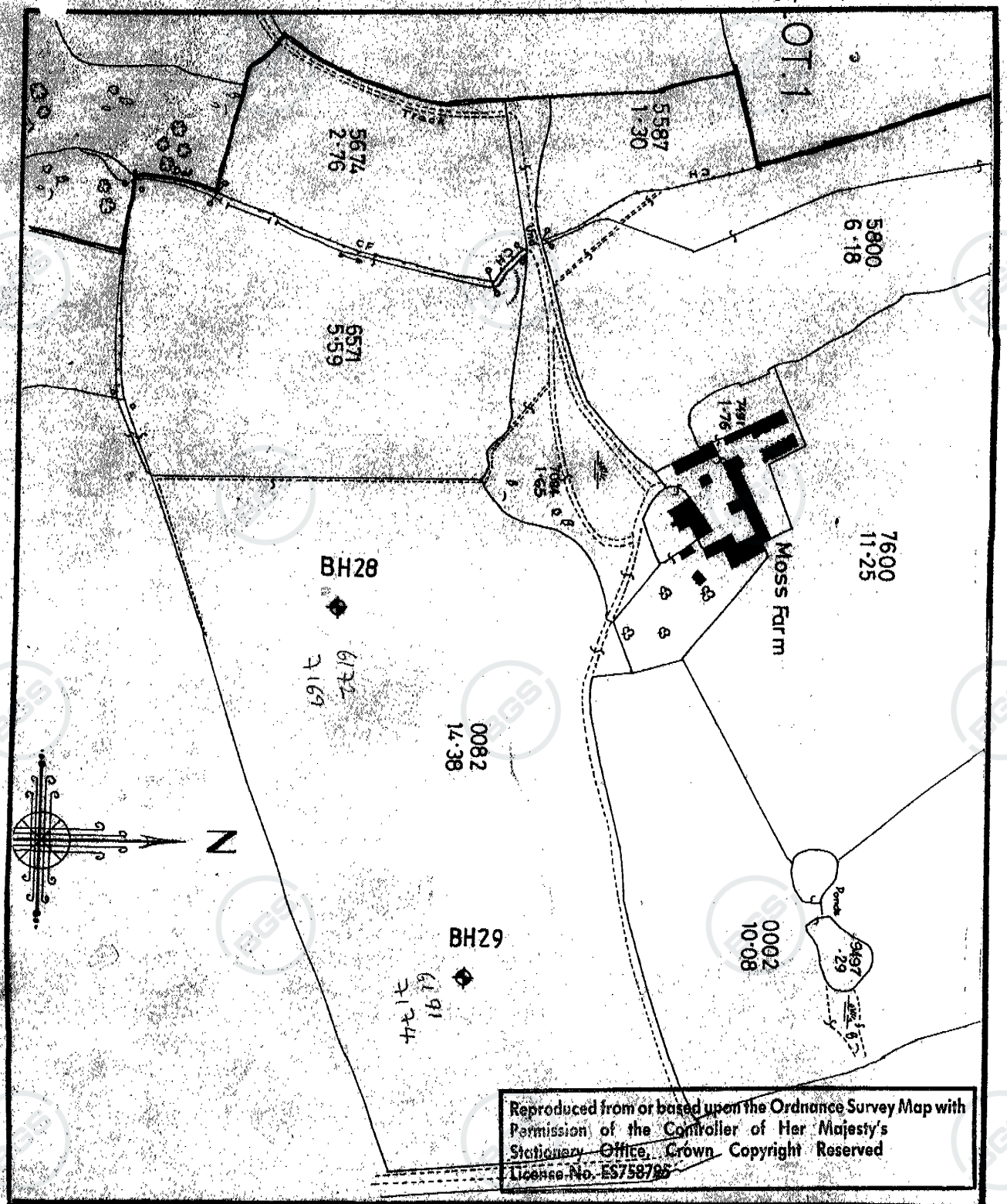
General Remarks :
Water strike @ 17.2m rising to 17.1m in 20 minutes.
Temporary standing level at 17.40m (pm 12/5)

Dates : 11 and 12 May 93
Driller : T OH
Engineer: MJR

Coordinates :

Contact BGS: ngdc@bgs.ac.uk

SJ67SW 134-135



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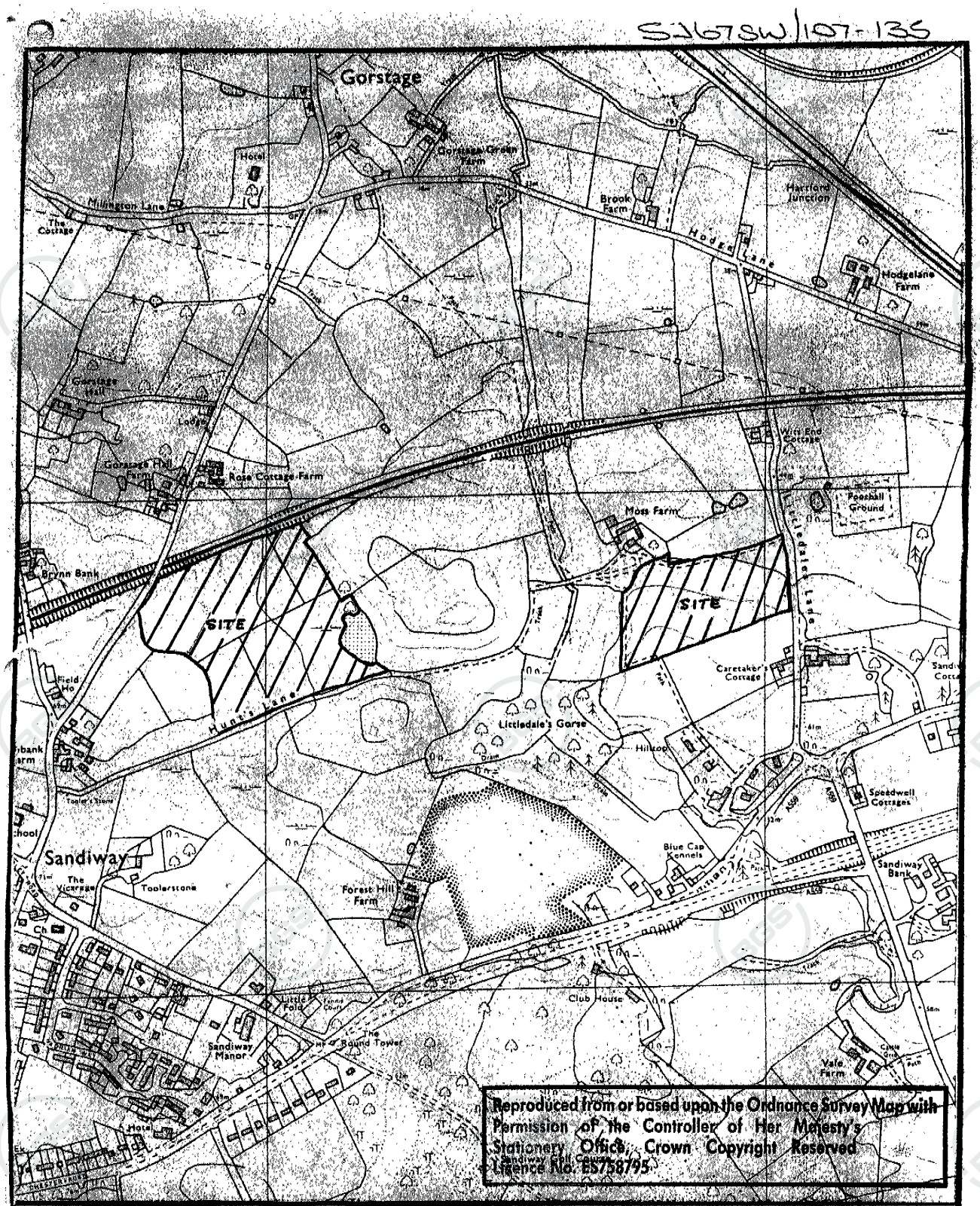
British Geological Survey

BGS ID: 717133 : BGS Reference: SJ67SW135
British National Grid (27700) : 361910,371740

SJ67SW/107-135



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Contact BGS: ngdc@bgs.ac.uk

HyNet North West Hydrogen Pipeline

Delivering clean growth

Annex 14A 8
Moulton Borehole Log

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

SJ66NE

25

8

1" N.S. 109
1" O.S.
Grid Ref. 4 NW

RECORD OF WELL (STAFFORD BORE)

At Newbridge No. 4. Shaft Moulton Hill.

Town or Village Moulton County Cheshire Six-inch quarter sheet 4 (NW)

Exact site Bore made (reference No. 4 Shaft) near 250yds. S.S.E of Hillside Farm, Moulton Hill, WINSFORD (A rough sketch-map or a tracing from a map is very desirable)

in parish of

Level of ground surface above sea-level (O.D.) 127·32 (38·81m) ft. If well starts below ground surface, state how far ft.

Shaft ft., diameter ft. Bore 303 (92·35m) ft. Diameter of bore: at top ins.; at bottom ins.

Details of permanent lining tubes (internal diameters preferred)

Water struck at depths of (feet)

Rest-level of water below / above top of well feet. Suction at feet. Yield on hours' / days' test gallons per (with pump of capacity g.p.h.); depressing water level to feet below top. Time of recovery hrs. Amount normally pumped daily g.p.h. for hours.

Quality (attach copy of analysis if available)

Sunk by for Mr. Date of ~~well~~ 1881

Information from Sinking for salt. No salt found

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.	T/m	D/m
	Wet sand and gravel	20	0	20	0		6·10
	Clay and loam	4	0	24	0		7·32
	Dry red clay	30	0	54	0		16·46
Glacial	Running sand	7	0	61	0		18·59
	Dry sand, loam and clay	21	0	82	0		24·99
303ft.	Dry compound metal (boulder clay)	68	0	150	0		45·72
	Sand and gravel	6	0	156	0		47·55
	Boulder clay and gravel.	147	0	303	0		92·35
	On October 17. 1881. Struck hard substance. Rods dropped 18" and before they could be raised top hole was filled with gravel to a height of 18yards from the bottom.						

GEOLOGICAL SURVEY AND MUSEUM. SOUTH KENSINGTON. LONDON. S.W.7.

For Survey use only

Date received	G.S.M. Office File No.	Site marked on 1" map (use symbol)

(*11815) Wt.29051/O.369 10,000 9/39 A.& E.W.Ltd. Gp.686

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

1063 Wt. 22438/0384 10M 7/45 (51) F.&S.

Record of Shaft or Bore for Minerals

(For Survey use only)
1-inch Map Registered No. 5566 NE/8

Name and Number of Shaft or Bore Newbridge No. 4 (Shaft) Helically bored. Moulton Hall.
[6577 6881]

For Messrs.

Town or Village

County Six-inch quarter sheet

6-inch Map Registered No.

Exact site "250 yds SSE of Hillside Fm"

Attach a tracing from a map, or a sketch-map, if possible.

Purpose for which made Salt. (none found)

Level at which shaft bore commenced relative to O.D. 127·32 (38.81) State if shaft bore is up, down, horizontal or inclined; in latter cases give angle of inclination and direction

Made by

Information from Date of Sinking 1881

Specimens —

Additional Notes in Space Overleaf

(For Survey use only) Geological Classification	Nature of Strata	Thickness	Depth	
Glacial 303	Wet sand and gravel	20	20	6·10
	Clay + loam	4	24	7·32
	Dry red clay	30	54	16·46
	Running sand	7	61	18·59
	Dry sand loam + clay	21	82	24·99
	Dry compound metal (? bed)	68	150	45·72
	Sand + grav.	6	156	47·55
	Bed + grav. [? collapsed mush] *	147 44 80	303	92·35

175.68 ft (53.55 m) below O.D.

Salt rock (end boreholes) reckoned to be a little more than 60 m below O.D., based on nearby RM boreholes (i.e. some 10 m. below the base of this bore).

On Oct. 17/1881 Struck hard substance. Rods dropped 18" and before they could be raised hole was filled w. gravel to a height of 18 yds from bottom.

Drift base as proved in bores in the area, and in the Weaver valley to the west, is much closer to the 47.55 m depth (base of sand + gravel bed) than the total depth of 303 ft (92.35 m). Sherlock quotes this bore as evidence of a deep pre-glacial channel, but it is much more likely that the sequence from 47.55 m to 92.35 m is all collapsed mudstone.

04

Continued Overleaf

Geological Survey and Museum, South Kensington, London, S.W.7.	received	...ond-ence File No.	1" N.S. Map No.	1" O.S. Map No.	Site marked (use symbol) on 1" Map	on 6" Map

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

(*For Survey use only*) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA (*Continued*)	THICKNESS			DEPTH		

ADDITIONAL NOTES

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

WATER RESOURCES BOARD
WELL RECORD
SHEET 1

W.R.B. REF. No. SJ 66/5

R.A. LICENCE No.

1. WELL IDENTITY

NATIONAL GRID REFERENCE SJ

Well at Marlton Hall
Newbridge No. 4. Shaft.

I.G.S. REF. No.

RIVER AUTHORITY

Town Winsford

HYDROMETRIC AREA

County Cheshire

SUB-CATCHMENT

Owner of well

Well made by

Date of sinking

Information from Vol. 18. Rock-Salt & Brine Mannair

Date received 20/5/47

2. WELL DESCRIPTION

Level of ground surface ..... m. If well top is not at above* ..... m.
above sea level (O.D.) ..... ft. ground level how far below ..... ft.

Shaft ..... m. 303 ft. deep; Diameter at top ..... m. ..... ft.; at bottom ..... m. ..... ft.

Bore ..... m. ..... ft. deep; Diameter at top ..... m. ..... ft.; at bottom ..... m. ..... ft.

Details of headings

DETAILS OF PERMANENT LINING TUBES

Length ..... m. ..... ft.; Diam. ..... m. ..... ft.; Plain ..... m. ..... ft.; Slotted ..... m. ..... ft.; Top ..... m. ..... ft. above* below surface

Length ..... m. ..... ft.; Diam. ..... m. ..... ft.; Plain ..... m. ..... ft.; Slotted ..... m. ..... ft.; Top ..... m. ..... ft. above* below surface

Length ..... m. ..... ft.; Diam. ..... m. ..... ft.; Plain ..... m. ..... ft.; Slotted ..... m. ..... ft.; Top ..... m. ..... ft. above* below surface

Details of well screen

DETAILS OF REST WATER LEVELS DURING CONSTRUCTION

Water struck at depths of ..... below well top

Rest level of water ..... m. ..... ft. above* below O.D.* well top when bore ..... m. ..... ft. deep. Date

Rest level of water ..... m. ..... ft. above* below O.D.* well top when bore ..... m. ..... ft. deep. Date

Rest level of water on completion of bore ..... m. ..... ft. above* below O.D.* well top when bore ..... m. ..... ft. deep. Date

Method of drilling

Brief details of well development e.g. acid treatment etc.

* delete as applicable

(46452-1) 1

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British Geological Survey

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EPSG: 27700 : 365777,368794

DETAILS OF PUMPING TEST

Water level depressed from ..... m. / ..... ft. above* / below well top to ..... m. / ..... ft. below well top, pumping at ..... $m^3/s.$ / ..... galls/hr.

Water level depressed from ..... m. / ..... ft. above* / below well top to ..... m. / ..... ft. below well top, pumping at ..... $m^3/s.$ / ..... galls/hr.

Water level depressed from ..... m. / ..... ft. above* / below well top to ..... m. / ..... ft. below well top, pumping at ..... $m^3/s.$ / ..... galls/hr.

Suction at ..... ft. below well top. Capacity of pump ..... . Test from ..../..../19.... to ..../..../19 ....

DETAILS OF PERMANENT PUMPING EQUIPMENT

Make and/or type ..... Motive Power .....

Capacity ..... galls/hr. Suction at ..... m. / ..... ft. below well top.

Amount pumped ..... m^3/day* / galls/day. Pumping for ..... hrs./day.

Estimated consumption ..... m^3/week* / galls/week ..... m^3/year* / galls/year

3. WELL DATA

WELL USE. Abstraction ☐, Recharge ☐, Observation ☐, Disused ☐, Filled-in ☐

WATER USE. Public Supply ☐, Industrial ☐, Irrigation ☐, Agriculture ☐ Domestic ☐, Unused ☐, Misc. ☐

WATER LEVEL OBSERVATIONS

	Rest Water Level	Pumping Water Level	Depression	Rate of Pumping	Date
①	..... m. / ..... ft. O.D.	..... m. / ..... ft. O.D.	..... m. / ..... ft.	..... $m^3/s.$ / ..... galls/hr.	.....
②	..... m. / ..... ft. O.D.	..... m. / ..... ft. O.D.	..... m. / ..... ft.	..... $m^3/s.$ / ..... galls/hr.	.....
③	..... m. / ..... ft. O.D.	..... m. / ..... ft. O.D.	..... m. / ..... ft.	..... $m^3/s.$ / ..... galls/hr.	.....
④	..... m. / ..... ft. O.D.	..... m. / ..... ft. O.D.	..... m. / ..... ft.	..... $m^3/s.$ / ..... galls/hr.	.....

GEOPHYSICAL DATA AVAILABLE

Resistivity ☐ Conductivity ☐ Temperature ☐ Any other logs .....

PARTIAL ANALYSIS DETAILS in milligrams per litre

Date	TDS	Tot H	Carb H	Non-Carb H	Alk	SO4	Cl	E.C.

Site marked on: 1 inch (print) ..... , 1 inch (master) ..... , 2½ inch ..... (use symbol and give data)

DR DLn 46452/1(2)/360 2,500 11/66 TXL

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

WATER RESOURCES BOARD

WELL RECORD

SHEET 2

W.R.B. REF NO. 9) 66/5

R.A. LICENCE No.

4. HYDROGEOLOGY

Topography AT WELL SITE

Local depression ☐, Flat surface ☐, Hill top ☐, Hillside ☐, Valley bottom ☐, Terrace ☐

MAJOR AQUIFER ..... Lithology .....

Depth to top of aquifer ..... m. / ..... ft. Thickness penetrated ..... m. / ..... ft.

Top of aquifer ..... m. / ..... ft. AOD* / BOD Total thickness of aquifer ..... m. / ..... ft.

Coefficient of storage ..... Transmissibility ..... m²/day* / galls/day/ft.

MINOR AQUIFER (a) ..... Lithology .....

Depth to top of aquifer ..... m. / ..... ft. Thickness penetrated ..... m. / ..... ft.

Top of aquifer ..... m. / ..... ft. AOD* / BOD Total thickness of aquifer ..... m. / ..... ft.

Coefficient of storage ..... Transmissibility ..... m²/day* / galls/day/ft.

MINOR AQUIFER (b) ..... Lithology .....

Depth to top of aquifer ..... m. / ..... ft. Thickness penetrated ..... m. / ..... ft.

Top of aquifer ..... m. / ..... ft. AOD* / BOD Total thickness of aquifer ..... m. / ..... ft.

ADDITIONAL NOTES:

* delete as applicable

(46452-2)1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

5. STRATA

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS FEET	THICKNESS IN.	DEPTH FEET	DEPTH IN.	DEPTH METRES
	Sand,					
	Gravel			303	—	
	boulder Clay					

DR DLn 46452/2(2)/360 2,500 11/66 TXL

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717043 : BGS Reference: SJ67SW45
British National Grid (27700) : 364030,370190

SJ67SW 46 US

BB DRILLING LTD.

BORING METHOD(S): CABLE PERCUSSION
MACHINE(S): PILCON 1500
BORE HOLE NO.: VR1
SHEET NO.: 1 of 2
CONTRACT: WEAVER NAVIGATION (VALEROYAL WEIR)
CASING: 200mm

DAILY PROGRESS			SAMPLES AND INSITU TESTS		GROUND LEVEL A.O.D.			DESCRIPTION OF STRATA
Date	Casing Depth	Ground Water	Levels	Type	Legend	Depth	OD Level	
26/3/87						0.10		Topsoil (Drillers description).
			0.35-0.80	J				Coarse to medium dense reddish brown, silty, very fine sandy CLAY.
				N(10)				
			0.80-1.10	B				
						1.10		
			1.20-1.50	B				Reddish brown, slightly fine sandy, very silty CLAY with abundant fine angular gravel. Some light grey silty clay lenses.
			1.55-2.00	U(20)				
			2.10	J				
			2.50-2.95	U(15)				
			3.05	J				From 3.05mBGL to 3.40mBGL no sand present.
3.40	2.70	DRY				3.40		
27/3/87	2.70	DRY	3.54-3.90	U(15)				
			4.00	J				
			4.10-4.50	B				Very soft, dark brown to black slightly sandy silty, very peaty CLAY. Occasional fine angular gravel with bands of very soft brown and grey mottled slightly sandy silty clay.
			4.55-5.00	U(74)				
			5.10	J				
			5.50-5.90	B,Ø				
	5.70	▽						
						6.20		
			6.30-6.75	B				Very loose, dark brown, very clayey, medium grained SAND.
			7.00-7.45	B				
			7.60-8.00			7.60		Dark brown, very sandy, very peaty CLAY with abundance of organic debris (roots, twigs etc).
						8.00		

REMARKS

Groundwater strke at 6.20mBGL. Rose to 3.50mBGL, in 5 minutes, remaining at 3.50mBGL after another 15 minutes.
Chiselling from 9.50mBGL to 10.50mBGL took 2 hours.
Drillers reports SPT test at 6.20mBGL not possible, as rods were sinking into stratum. They came to rest at 7.20mBGL.

Key: U = Undisturbed Sample. B = Bulk (disturbed) sample. W = Ground Water Sample. J = Small (disturbed) Sample. ▽ = Water first met. N = S/CPT 'N' values.

REPORT NO.: 52236J

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717043 : BGS Reference: SJ67SW45
British National Grid (27700) : 364030,370190

SJ67SW 45

BB DRILLING LTD.

BORING METHOD(S): CABLE PERCUSSION
MACHINE(S): PILCON 1500
BORE HOLE NO.: VR1
SHEET NO.: 2 of 2
CASING: 200mm

CONTRACT: WEAVER NAVIGATION (VALEROYAL WEIR)

DAILY PROGRESS			SAMPLES AND INSITU TESTS		GROUND LEVEL A.O.D.			DESCRIPTION OF STRATA
Date	Casing Depth	Ground Water	Levels	Type	Legend	Depth	OD Level	
27/3/87	Cont.		8.00-8.45	B		8.00		Firm, reddish brown, silty CLAY with abundant fine angular friable mudstone gravel.
				N(11)				
			8.50-8.95	U(95)		8.70		(Probably completely weathered Marl, Residual Soil)?
			9.05	J				
			9.10-9.50	B		9.50		Stiff to very stiff reddish brown silty CLAY with abundant fine to coarse angular friable mudstone gravel. (Probably completely weathered Marl, Residual Soil)?
			9.65-10.10	U(170)				
			10.20	J				
10.50	10.50	DRY	10.35-10.42	N(50)*		10.50		Reddish brown, highly weathered, MUDSTONE. Very weak. (Probably Marl)?
								End of Borehole.
								(Piezometer installed, tip at 6.70mBGL).

REMARKS

Instructed by client to pull off at 10.50mBGL.
* Blows for 70mm penetration.

Key: U = Undisturbed Sample. B = Bulk (disturbed) sample. W = Ground Water Sample. J = Small (disturbed) Sample. ▽ = Water first met. N = S/CPT 'N' values.

REPORT NO. 52236J

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717044 : BGS Reference: SJ67SW46
British National Grid (27700) : 364100,370100

SJ67SW46

BB DRILLING LTD.

BORING METHOD(S): CABLE PERCUSSION
MACHINE(S): PILCON 1500
BORE HOLE NO.: VR2
SHEET NO.: 1 of 2
CASING: 200mm
CONTRACT: WEAVER NAVIGATION (VALEROYAL WEIR)

DAILY PROGRESS			SAMPLES AND INSITU TESTS		GROUND LEVEL A.O.D.			DESCRIPTION OF STRATA
Date	Casing Depth	Ground Water	Levels	Type	Legend	Depth	OD Level	
26/3/87						0.30		Topsoil (Drillers description).
			0.40–0.85	J				Very soft to soft, dark brown, very fine to medium sandy, silty, CLAY.
				N(3)				
			0.85–1.30	J				
				N(4)				
			1.35–1.80	B		1.35		
			1.90–2.35	U(20)				Soft reddish brown silty CLAY with some fine sub angular gravel.
			2.45	J				
			2.85	J				Sandy at 2.85mBGL.
			3.00–3.45	U(15)				
			3.55	J		3.55		
			3.60–4.00	B				Soft, mottled grey to brown, slightly sandy, silty CLAY. Rare fine angular gravel. Some organic content.
			4.10–4.55	U(15)				
			4.65	J				
			4.75–5.05	B		4.75		
			5.05–5.50	U(18)				Soft, red-brown, slightly fine sandy, silty CLAY occasional fine angular gravel.
						5.40		
	5.40	▽	5.60	J				Very loose light reddish brown silty clayey fine to medium SAND.
			5.90–6.50	J				
				N(12)*				
			6.50–6.95	B		6.50		
				N(4)				Soft dark brown sandy silty CLAY.
			7.60–8.00	B,Ø		7.60		Soft dark, greyish brown, silty very fine sandy CLAY, with some fine to coarse angular gravel.
						7.90		As sheet 2 of 2

REMARKS

* Blows for 600mm penetration
Groundwater struck at 5.40mBGL and rose to 3.70m in 10 minutes.
Chiselling from 10.10m to 11.00mBGL took 2¾ hours.

Key: U = Undisturbed Sample. B = Bulk (disturbed) sample. W = Ground Water Sample. J = Small (disturbed) Sample. ▽ = Water first met. N = S/CPT 'N' values.

REPORT NO. 52236J

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 717044 : BGS Reference: SJ67SW46
British National Grid (27700) : 364100,370100

SJ67SW 46

BB DRILLING LTD.

BORING METHOD(S): CABLE PERCUSSION
MACHINE(S): PILCON 1500
BORE HOLE NO.: VR2
SHEET NO.: 2 of 2
CASING: 200mm

CONTRACT: WEAVER NAVIGATION (VALEROYAL WEIR)

DAILY PROGRESS			SAMPLES AND INSITU TESTS		GROUND LEVEL A.O.D.			DESCRIPTION OF STRATA
Date	Casing Depth	Ground Water	Levels	Type	Legend	Depth	OD Level	
6/3/87	cont.		8.25	J				Loose dark greyish brown, clayey medium to coarse SAND with abundant fine to medium sub angular to subrounded gravel.
			8.30–8.75	U(50)		8.30		
			8.85	J				Stiff, red, silty, CLAY with abundant fine angular mudstone gravel. (Probably completely weathered Marl, Residual Soil)?
			8.90–9.20	B				
			9.30–9.75	U(100)				
			9.85	J		10.10		
			10.40–10.50	J				Red, highly weathered, MUDSTONE. Very weak.
				N(50)*				
			10.50–11.00	B				(Probably Marl)?
11.00						11.00		End of Borehole. (Piezometer installed with tip at 6.00mBGL).

REMARKS: * Blows for 100mm penetration.

Key: U = Undisturbed Sample. B = Bulk (disturbed) sample. W = Ground Water Sample. J = Small (disturbed) Sample. ▽ = Water first met. N = S/CPT 'N' values.

REPORT NO. 52236J

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732593 : BGS Reference: SJ66NE131
British National Grid (27700) : 365580,369750

SJ 66 NE 131

BeWT

STRATA SURVEYS LIMITED

CABLE PERCUSSION RECORD SHEET

Location Moulton Playing Fields
Job No. 8156-33 Project Ref: 9-00-03-419

Borehole No. BH2
Sheet 1 of 1.

Equipment and methods Light Cable Percussion
Casing Diameter (mm) 150
Casing Depth (m) 3.60

Drilled by T.O'H
Ground level m AOD
Co-ordinates E 6558 N 6975
Date 11-12-95

Casing Depth (m)	Water Depth (m)	Field Records	Samples / Tests: Depth (m) from	to	Sample Type & No	SPT N Value	Description	Depth & Thickness (m)	Reduced Level (m AOD)	Strata Legend
							TOPSOIL	(0.15) 0.15		
			0.50	1.00	B 1		Loose brown slightly clayey fine to medium grained SAND			
NIL		1,2-2,2,2,2	1.00	1.45	S 1	8		(1.75)		
	T1	20 mins 1.30 11-12	1.30	1.30	W 1					
	M1	1.50 11-12								
2.00		50	2.00	2.45	U 1			1.90		
			2.45	2.45	D 1		Firm dark brown sandy CLAY with a little fine gravel and occasional sand bands (Boulder Clay)			
2.90	T2	20 mins 2.95 11-12	2.95	2.95	W 2			(2.15)		
		80	3.00	3.45	U 2					
			3.50	3.50	D 2					
3.60		10,11-12,13,10,11	3.60	4.05	S 2	46				
	M2	3.60 11-12						4.05		
		-(11-12)-					Borehole Complete			

Remarks
1) Service pit dug 0.50m x 0.50m x 1.00m.
2) Groundwater struck at 1.50m rising to 1.30m.
3) Groundwater struck at 3.60m rising to 2.95m after 20 mins.
4) Piezometer installed with tip at 1.80m and seal from 0.50m to 1.00m.
5) Dry before and water level 1.52m after installation.
6) Reading 0.97m 20/12

Scale 1:50 Field Records Column RHS Blows to drive U100s

Logged by GL Date 13-12
Checked by
Approved by
FIG No.

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732594 : BGS Reference: SJ66NE132
British National Grid (27700) : 365550,369850

SJ66NE132

BeWT

STRATA SURVEYS LIMITED

CABLE PERCUSSION RECORD SHEET

Location Moulton Playing Fields
Job No. 8156-33 Project Ref: 9-00-03-419

Borehole No. BH3
Sheet 1 of 1.

Equipment and methods Light Cable Percussion
Casing Diameter (mm) 150
Casing Depth (m) 3.30

Drilled by T.O'H
Ground level m AOD
Co-ordinates E 6555 N 6985
Date 11-12-95

CASING DEPTH (m)	WATER DEPTH (m)	Field Records	SAMPLES / TESTS Depth (m) from	to	SAMPLE Type & No	SPT N Value	Description	Depth & Thickness (m)	Reduced Level (m AOD)	Strata Legend
							Sandy TOPSOIL	(0.35) 0.35		
			0.50	0.80	B 1		Light brown clayey fine to medium grained SAND	(0.40) 0.75		
NIL		30	1.00	1.45	U 1		Firm dark brown CLAY with occasional grey fissures and roots (Boulder Clay)			
			1.50	1.50	D 1			(2.15)		
1.70		70	2.00	2.45	U 2		...becoming stiff below 2.00m	()		
	T1	20 mins 2.50 11-12	2.50	2.50	D 2					
			2.50	2.50	W 1			2.90		
3.20	M1	2,4-6,8,11,10 3.30 11-12	3.30	3.75	S 1	35	Dense brown clayey fine to coarse grained SAND with occasional fine to medium gravel	(1.10)		
			3.50	3.95	B 2					
		-(11-12)-					Borehole Complete	4.00		

Remarks
1) Service pit dug 0.50m x 0.50m x 1.00m.
2) Groundwater struck at 3.30m rising to 2.50m after 20 mins.
3) Piezometer installed with tip at 3.50m and seal from 1.50m to 2.50m.
4) Water level 2.50m before and 3.14m after installation.
5) Reading 1.98m 20/12

Scale 1:50 Field Records Column RHS Blows to drive U100s

Logged by	Date
GL	13-12
Checked by	
Approved by	
FIG No.	

SSL-NWB-cable per -10/93 Rev B

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732592 : BGS Reference: SJ66NE130
British National Grid (27700) : 365640,369680

SJ66NE130

BeWT

STRATA SURVEYS LIMITED

CABLE PERCUSSION RECORD SHEET

Location Moulton Playing Fields
Job No. 8156-33 Project Ref: 9-00-03-419

Borehole No. BH1
Sheet 1 of 1.

Equipment and methods Light Cable Percussion
Casing Diameter (mm) 150
Casing Depth (m) 3.50

Drilled by T.O'H
Ground level m AOD
Co-ordinates E 6564 N 6968
Date 09-12-95

CASING DEPTH (m)	WATER DEPTH (m)	Field Records	SAMPLES / TESTS Depth (m) from	to	SAMPLE Type & No	SPT N Value	Description	Depth & Thickness (m)	Reduced Level (m AOD)	Strata Legend
							Sandy TOPSOIL	(0.40)		
			0.60	1.00	B 1		Dark brown fine grained SAND	0.40 (0.20) 0.60		
NIL		4,4-6,7,8,8	1.00	1.45	B 2		Medium dense light brown slightly clayey silty fine to medium grained SAND			
			1.00	1.45	S 1	29		(1.50)		
	T1	20 mins 1.50 09-12								
	M1	1.70 09-12								
2.00		1,1-2,3,4,4	2.00	2.45	S 2	13		2.10		
							Soft dark brown slightly sandy CLAY			
2.40		35	2.50	2.95	U 1			(0.90)		
	T2	20 mins 2.90 09-12								
	M2	3.00 09-12						3.00		
							Dense brown slightly clayey fine grained SAND	(0.70)		
3.50		2,2-11,13,13,12	3.50	3.95	S 3	49		3.70		
		-(09-12)-					Very stiff dark brown slightly sandy CLAY with occasional fine gravel (Boulder Clay)	(0.30) 4.00		
							Borehole Complete			

Remarks
1) Service pit dug 0.60m x 0.60m x 1.00m.
2) Groundwater struck at 1.70m rising to 1.50m after 20 mins.
3) Groundwater struck at 3.00m rising to 2.90m after 20 mins.
4) Piezometer installed with tip at 3.50m and seal from 1.70m to 2.50m.
5) Water level 2.20m before and 3.08m after installation.
6) Reading 1.91m 20/12

Scale 1:50 Field Records Column RHS Blows to drive U100s

Logged by GL Date 13-12
Checked by
Approved by
FIG No.

Contact BGS: ngdc@bgs.ac.uk

HyNet North West Hydrogen Pipeline

Delivering clean growth

Annex 14A 9
Bostock Green Borehole Logs

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

SJ66NE

25

8

1" N.S. 109
1" O.S.
Grid Ref. 4 NW

RECORD OF WELL (STAFFORD BORE)

At Newbridge No. 4. Shaft Moulton Hill.

Town or Village Moulton County Cheshire Six-inch quarter sheet 4 (NW)

Exact site Bore made (reference No. 4 Shaft) near 250yds. S.S.E of Hillside Farm, Moulton Hill, WINSFORD (A rough sketch-map or a tracing from a map is very desirable)

in parish of

Level of ground surface above sea-level (O.D.) 127·32 (38·81m) ft. If well starts below ground surface, state how far ft.

Shaft ft., diameter ft. Bore 303 (92·35m) ft. Diameter of bore: at top ins.; at bottom ins.

Details of permanent lining tubes (internal diameters preferred)

Water struck at depths of (feet)

Rest-level of water below / above top of well feet. Suction at feet. Yield on hours' / days' test gallons per (with pump of capacity g.p.h.); depressing water level to feet below top. Time of recovery hrs. Amount normally pumped daily g.p.h. for hours.

Quality (attach copy of analysis if available)

Sunk by for Mr. Date of ~~well~~ 1881

Information from Sinking for salt. No salt found

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.	T/m	D/m
	Wet sand and gravel	20	0	20	0		6·10
	Clay and loam	4	0	24	0		7·32
	Dry red clay	30	0	54	0		16·46
Glacial	Running sand	7	0	61	0		18·59
	Dry sand, loam and clay	21	0	82	0		24·99
303ft.	Dry compound metal (boulder clay)	68	0	150	0		45·72
	Sand and gravel	6	0	156	0		47·55
	Boulder clay and gravel.	147	0	303	0		92·35
	On October 17. 1881. Struck hard substance. Rods dropped 18" and before they could be raised top hole was filled with gravel to a height of 18yards from the bottom.						

GEOLOGICAL SURVEY AND MUSEUM. SOUTH KENSINGTON. LONDON. S.W.7.

For Survey use only

Date received	G.S.M. Office File No.	Site marked on 1" map (use symbol)

(*11815) Wt.29051/O.369 10,000 9/39 A.& E.W.Ltd. Gp.686

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

1063 Wt. 22438/0384 10M 7/45 (51) F.&S.

Record of Shaft or Bore for Minerals

(For Survey use only)
1-inch Map Registered No. 5566 NE/8

Name and Number of Shaft or Bore Newbridge No. 4 (Shaft) Helically bored. Moulton Hall.
[6577 6881]

For Messrs.

Town or Village

County Six-inch quarter sheet

6-inch Map Registered No.

Exact site "250 yds SSE of Hillside Fm"

Attach a tracing from a map, or a sketch-map, if possible.

Purpose for which made Salt. (none found)

Level at which shaft bore commenced relative to O.D. 127·32 (38.81) State if shaft bore is up, down, horizontal or inclined; in latter cases give angle of inclination and direction

Made by

Information from Date of Sinking 1881

Specimens —

Additional Notes in Space Overleaf

(For Survey use only) Geological Classification	Nature of Strata	Thickness	Depth	
Glacial 303	Wet sand and gravel	20	20	6·10
	Clay + loam	4	24	7·32
	Dry red clay	30	54	16·46
	Running sand	7	61	18·59
	Dry sand loam + clay	21	82	24·99
	Dry compound metal (? bed)	68	150	45·72
	Sand + grav.	6	156	47·55
	Bed + grav. [? collapsed mush] *	147 44 80	303	92·35

175.68 ft (53.55 m) below O.D.

Salt rock (end boreholes) reckoned to be a little more than 60 m below O.D., based on nearby RM boreholes (i.e. some 10 m. below the base of this bore).

On Oct. 17/1881 Struck hard substance. Rods dropped 18" and before they could be raised hole was filled w. gravel to a height of 18 yds from bottom.

Drift base as proved in bores in the area, and in the Weaver valley to the west, is much closer to the 47.55 m depth (base of sand + gravel bed) than the total depth of 303 ft (92.35 m). Sherlock quotes this bore as evidence of a deep pre-glacial channel, but it is much more likely that the sequence from 47.55 m to 92.35 m is all collapsed mudstone.

04

Continued Overleaf

Geological Survey and Museum, South Kensington, London, S.W.7.	received	...ond-ence File No.	1" N.S. Map No.	1" O.S. Map No.	Site marked (use symbol) on 1" Map	on 6" Map

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

(*For Survey use only*) GEOLOGICAL CLASSIFICATION	NATURE OF STRATA (*Continued*)	THICKNESS			DEPTH		

ADDITIONAL NOTES

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

WATER RESOURCES BOARD
WELL RECORD
SHEET 1

W.R.B. REF. No. SJ 66/5

R.A. LICENCE No.

1. WELL IDENTITY

NATIONAL GRID REFERENCE SJ

Well at Marlton Hall
Newbridge No. 4. Shaft.

I.G.S. REF. No.

RIVER AUTHORITY

Town Winsford

HYDROMETRIC AREA

County Cheshire

SUB-CATCHMENT

Owner of well

Well made by

Date of sinking

Information from Vol. 18. Rock-Salt & Brine Mannair

Date received 20/5/47

2. WELL DESCRIPTION

Level of ground surface ..... m. If well top is not at above* ..... m.
above sea level (O.D.) ..... ft. ground level how far below ..... ft.

Shaft ..... m. 303 ft. deep; Diameter at top ..... m. ..... ft.; at bottom ..... m. ..... ft.

Bore ..... m. ..... ft. deep; Diameter at top ..... m. ..... ft.; at bottom ..... m. ..... ft.

Details of headings

DETAILS OF PERMANENT LINING TUBES

Length ..... m. ..... ft.; Diam. ..... m. ..... ft.; Plain ..... m. ..... ft.; Slotted ..... m. ..... ft.; Top ..... m. ..... ft. above* below surface

Length ..... m. ..... ft.; Diam. ..... m. ..... ft.; Plain ..... m. ..... ft.; Slotted ..... m. ..... ft.; Top ..... m. ..... ft. above* below surface

Length ..... m. ..... ft.; Diam. ..... m. ..... ft.; Plain ..... m. ..... ft.; Slotted ..... m. ..... ft.; Top ..... m. ..... ft. above* below surface

Details of well screen

DETAILS OF REST WATER LEVELS DURING CONSTRUCTION

Water struck at depths of ..... below well top

Rest level of water ..... m. ..... ft. above* below O.D.* well top when bore ..... m. ..... ft. deep. Date

Rest level of water ..... m. ..... ft. above* below O.D.* well top when bore ..... m. ..... ft. deep. Date

Rest level of water on completion of bore ..... m. ..... ft. above* below O.D.* well top when bore ..... m. ..... ft. deep. Date

Method of drilling

Brief details of well development e.g. acid treatment etc.

* delete as applicable

(46452-1) 1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

DETAILS OF PUMPING TEST

Water level depressed from ..... m. / ..... ft. above* / below well top to ..... m. / ..... ft. below well top, pumping at ..... $m^3/s.$ / ..... galls/hr.

Water level depressed from ..... m. / ..... ft. above* / below well top to ..... m. / ..... ft. below well top, pumping at ..... $m^3/s.$ / ..... galls/hr.

Water level depressed from ..... m. / ..... ft. above* / below well top to ..... m. / ..... ft. below well top, pumping at ..... $m^3/s.$ / ..... galls/hr.

Suction at ..... ft. below well top. Capacity of pump ..... . Test from ..../..../19.... to ..../..../19 ....

DETAILS OF PERMANENT PUMPING EQUIPMENT

Make and/or type ..... Motive Power .....

Capacity ..... galls/hr. Suction at ..... m. / ..... ft. below well top.

Amount pumped ..... m^3/day* / galls/day. Pumping for ..... hrs./day.

Estimated consumption ..... m^3/week* / galls/week ..... m^3/year* / galls/year

3. WELL DATA

WELL USE. Abstraction ☐, Recharge ☐, Observation ☐, Disused ☐, Filled-in ☐

WATER USE. Public Supply ☐, Industrial ☐, Irrigation ☐, Agriculture ☐ Domestic ☐, Unused ☐, Misc. ☐

WATER LEVEL OBSERVATIONS

	Rest Water Level	Pumping Water Level	Depression	Rate of Pumping	Date
①	..... m. / ..... ft. O.D.	..... m. / ..... ft. O.D.	..... m. / ..... ft.	..... $m^3/s.$ / ..... galls/hr.	.....
②	..... m. / ..... ft. O.D.	..... m. / ..... ft. O.D.	..... m. / ..... ft.	..... $m^3/s.$ / ..... galls/hr.	.....
③	..... m. / ..... ft. O.D.	..... m. / ..... ft. O.D.	..... m. / ..... ft.	..... $m^3/s.$ / ..... galls/hr.	.....
④	..... m. / ..... ft. O.D.	..... m. / ..... ft. O.D.	..... m. / ..... ft.	..... $m^3/s.$ / ..... galls/hr.	.....

GEOPHYSICAL DATA AVAILABLE

Resistivity ☐ Conductivity ☐ Temperature ☐ Any other logs .....

PARTIAL ANALYSIS DETAILS in milligrams per litre

Date	TDS	Tot H	Carb H	Non-Carb H	Alk	SO4	Cl	E.C.

Site marked on: 1 inch (print) ..... , 1 inch (master) ..... , 2½ inch ..... (use symbol and give data)

DR DLn 46452/1(2)/360 2,500 11/66 TXL

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

WATER RESOURCES BOARD

WELL RECORD

SHEET 2

W.R.B. REF NO. 9) 66/5

R.A. LICENCE No.

4. HYDROGEOLOGY

Topography AT WELL SITE

Local depression ☐, Flat surface ☐, Hill top ☐, Hillside ☐, Valley bottom ☐, Terrace ☐

MAJOR AQUIFER ..... Lithology .....

Depth to top of aquifer ..... m. / ..... ft. Thickness penetrated ..... m. / ..... ft.

Top of aquifer ..... m. / ..... ft. AOD* / BOD Total thickness of aquifer ..... m. / ..... ft.

Coefficient of storage ..... Transmissibility ..... m²/day* / galls/day/ft.

MINOR AQUIFER (a) ..... Lithology .....

Depth to top of aquifer ..... m. / ..... ft. Thickness penetrated ..... m. / ..... ft.

Top of aquifer ..... m. / ..... ft. AOD* / BOD Total thickness of aquifer ..... m. / ..... ft.

Coefficient of storage ..... Transmissibility ..... m²/day* / galls/day/ft.

MINOR AQUIFER (b) ..... Lithology .....

Depth to top of aquifer ..... m. / ..... ft. Thickness penetrated ..... m. / ..... ft.

Top of aquifer ..... m. / ..... ft. AOD* / BOD Total thickness of aquifer ..... m. / ..... ft.

ADDITIONAL NOTES:

* delete as applicable

(46452-2)1

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732469 : BGS Reference: SJ66NE8
EPSG: 27700 : 365777,368794

5. STRATA

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS FEET	THICKNESS IN.	DEPTH FEET	DEPTH IN.	DEPTH METRES
	Sand,					
	Gravel			303	—	
	boulder Clay					

DR DLn 46452/2(2)/360 2,500 11/66 TXL

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

BGS ID: 732590 : BGS Reference: SJ66NE128
British National Grid (27700) : 366613,369824

SJ 66 NE/125 - 128

SJ66NE 125

ICI RM 72

SJ66NE

1: 2000

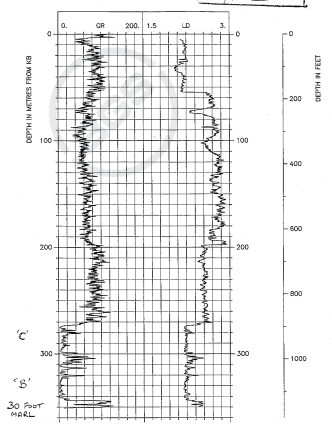
364 34772
Grid East 369100 North 368693
Latitude 53 12 50.81
Longitude −2 27 45.99

Datum KB 38.07 maOD

NGDC ACCESSION NUMBER 14995

RECEIVED N.GD.C. DATE: 18.7.96 SIG:

W of Key St fault



SJ66NE 126

ICI RM 72A

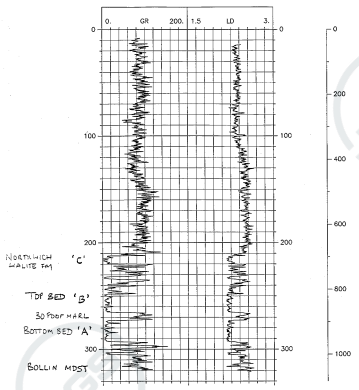
SJ66NE

1: 2000

359 04 34 62
Grid East 368976 North 368655
Latitude 53 12 49.55
Longitude −2 27 52.66

Datum KB 37.90 maOD

West



SJ66NE 127

ICI RM 75

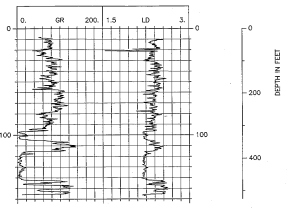
SJ66NE

1: 2000

26.6 39.252
Grid East 366650 North 369813
Latitude 53 13 26.52
Longitude −2 29 58.50

Datum KB 31.80 maOD

Chester sheet



SJ66NE 128

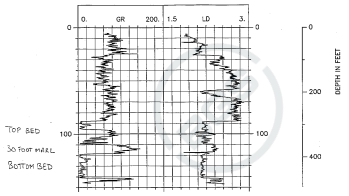
ICI RM 75A

SJ66NE

1: 2000

Grid East 366613 North 369824
Latitude 53 13 26.87
Longitude −2 30 0.49

Datum KB 30.97 maOD



LPLOTH V1.05 Date : 29-NOV-93

Contact BGS: ngdc@bgs.ac.uk

British Geological Survey

SJ67SE/191-193

SJ67SE/191

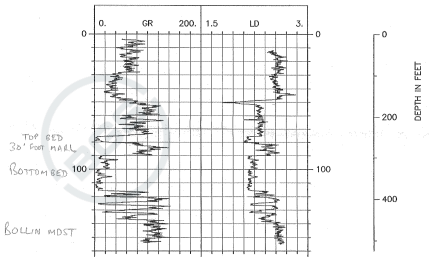
ICI RM 73

SJ67SE 1

1: 2000

Grid East 368420 North 370198
Latitude 53 13 39.37
Longitude −2 28 23.18

Datum KB 24.34 maOD



SJ67SE/192

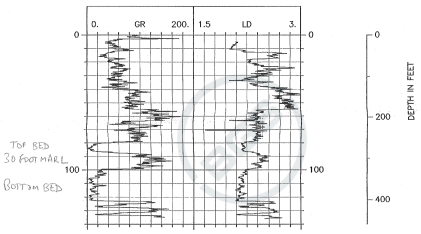
ICI RM 74

SJ67SE 2

1: 2000

Grid East 367398 North 370192
Latitude 53 13 38.95
Longitude −2 29 18.30

Datum KB 19.07 maOD



SJ67SE/193

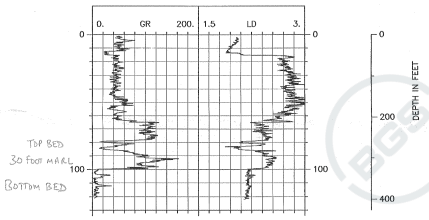
ICI RM 74A

SJ67SE 3

1: 2000

Grid East 367384 North 370210
Latitude 53 13 39.53
Longitude −2 29 19.06

Datum KB 18.87 maOD



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