



RIDGE

**HATFIELD JLR
FLOOD RISK ASSESSMENT &
DRAINAGE STRATEGY REPORT**

OCTOBER 2024

HATFIELD JLR FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY REPORT

Prepared for

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1. EXECUTIVE SUMMARY

This report details the Flood Risk and Drainage Strategy for the Hatfield Jaguar Land Rover scheme. The proposed scheme is to replace the existing greenfield area with a new Jaguar Land Rover dealership. The proposed development will comprise of a showroom, offices, servicing, MOT workshop, associated car parking and storage areas. **Table 1** below provides a summary of the Flood Risk and Drainage / SuDS Strategy for the scheme.

Table 1 – Drainage / SuDS Summary

Item	Brief Description
Flood Zone	Fluvial Flood Zone 1 (Low Risk). At low risk of flooding from all other sources. See Figure 2.
Overland Flow	The indicative surface water flood map shows the existing site is very low risk of surface water flooding. There are no existing surface water flow routes through the site that need to be maintained.
Groundwater Flooding	The SFRA map suggests the site is not susceptible to groundwater flooding. The online BGS borehole logs indicates no groundwater strikes were encountered. The proposals for the site do not include any basement or underground structures that would be susceptible to the risk of groundwater.
Artificial Drainage	There are no other bodies of water, such as ponds, reservoirs or other artificial sources, in proximity to the site. The flood risk from external sources is therefore negligible.
Infrastructure Failure	Following development, the onsite drainage systems will be design appropriately and in accordance with best practice and planning policy.
Flood Risk Assessment	An assessment of flood risk has been undertaken at the site. Based on the assessment of sources above, the site is considered to be at low risk of flooding from all sources.
Geology	A full site investigation is yet to be carried out at the site. According to British Geological Survey (BGS) information the site is underlain by Devensian Till, over mudstone (bedrock). BGS borehole logs also indicate mudstone as the underlying ground condition, this information is attached within Appendix B. Online data source 'Landis Soilscales' mapping tool shows ground conditions at the site to be "Slowly permeable seasonally wet slightly acid loamy and clayey soils" with impeded drainage.
Infiltration Rate	BGS borehole logs also indicate mudstone as the underlying ground condition. Therefore, infiltration has been discounted.
Nearest Watercourses	No watercourses are located within close proximity to the site and no existing connections to nearby watercourses to which connection would be possible.

Item	Brief Description
Nearest Adopted Sewers	Existing public Surface Water and Foul Water sewers are located north of site within Coppice Lane – see Appendix B for the S104 Drainage Plan.
Surface Water Outfall and SuDS Hierarchal Approach	Based on the above: Infiltration - discounted based on the cohesive nature of the underlying ground condition. Soakaways are unlikely to be potentially viable SUDs technique. Watercourse – No nearby watercourse, therefore this approach is not feasible. Surface Water Sewer – This is the most feasible option due to the public sewers located within Coppice Lane. Combined Water Sewer – this option has been discounted due to the surface water connection proposed.
Existing SW Discharge Rate	Site is classed as Greenfield and Brownfield. This site is part of a wider catchment area in which the greenfield runoff rates have been calculated - see Appendix C. As specified in the approved FRA & Drainage Strategy '3516 rev 1' dated April 2017, the maximum runoff rate for the wider catchment area is 45.7l/s. See Section 7.1 for details
Proposed SW Discharge Rate	As noted above the proposed development is part of a wider catchment area in which each site, the proposed maximum runoff rate had been approved in the FRA & Drainage Strategy '3516 rev 1' dated April 2017. Therefore, in accordance with the approved FRA stated above, the proposed development (Sites 4 and 5) will be limited to a maximum runoff of 25.1 l/s. At the time of writing this report, we were awaiting a response from UU on the pre development enquiry relating to existing and proposed discharge rates.
Allowance for Climate Change	Lower Mersey Management Catchment, Upper End Allowance, 2070's 3.3% AEP – 40% 1% AEP 45% To be applied to the modelled drainage calculations
Proposed Attenuation Method and Volume	Permeable Paving, Geocellular Storage Tank and oversized pipes Proposed development – 1100 m³ to contain the 100year + 45% event.

Item	Brief Description
SuDS features	Water Quantity - Geocellular Storage Tanks, oversized pipes. Water Quality – Permeable Paving, Petrol Interceptor, Gullies and Silt traps. Amenity – Rain Garden
Maintenance Responsibility	Management Company / Site Owner
Foul Drainage Outfall	Based on the above, foul water from the Proposed development will discharge into the foul water public sewer located within Coppice Lane.

There is a reduction in surface water flood risk from the development site to the surrounding district due to the reduction of existing storm water flow rates. Therefore, the development does not increase the risk of flooding to the other adjacent properties and roads. Out of chamber or gully flooding for the events in excess of the 100-year plus 45% climate change event may occur within the development site and is classed as exceedance flows. Flood water from this event will be contained within the development site and directed away from the buildings to the external hard and soft landscaped areas.

2. INTRODUCTION

- 2.1 Ridge & Partners LLP have been appointed by Hatfield Garages Ltd to prepare this Flood Risk Assessment (FRA) and Drainage Strategy Report to support the full planning application for the erection of a new Jaguar Land Rover dealership. The proposed development will comprise of a showroom, offices, servicing, MOT workshop, associated car parking and storage areas. The assessment has been undertaken in line with the new 'National Planning Policy Framework' (NPPF), plus the accompanying 'Flood Risk and Coastal Change' chapter of the National Planning Practice Guidance.
- 2.2 This report has been commissioned by Hatfield Garages Ltd and is specific to their interests in the development proposals as described by the Architectural plan in **Appendix A**.
- 2.3 The report has been commissioned to identify any drainage-related issues associated with the proposed development and which are subsequently addressed within this report.
- Identify available data relating to flood risk at the site.
 - Determine whether the site is at risk from flooding from all sources, including from breach or overtopping of any existing flood defences, surface water flooding and/or groundwater flooding.
 - Consider the flood risk from all other sources.
 - Determine the current surface water drainage regime and assess any potential increase in surface water runoff as a result of the proposed development.
 - Discuss Sustainable Drainage Systems (SuDS) as an option for reducing surface water flood risk.
 - Devise an appropriate outline surface water drainage strategy (including calculation where appropriate) to deal with any potential increase in surface water runoff and include for climate change.
 - Devise an appropriate outline foul water drainage strategy.
 - Consider the recommendations of the Knowsley Metropolitan Borough Council Strategic Flood Risk Assessment (SFRA).
 - Assess mitigation measures & off-site impacts and define any residual risks.

3. PLANNING POLICY AND CONSULTATION

3.1. Planning Policy Framework

- 3.1.1. The flood maps provided by the Environment Agency (EA) locate the site within Flood Zone 1, i.e. land defined as having an annual probability of fluvial flooding of less than 1 in 1000 in any year (<0.1%). As a requirement of the NPPF (2021) and accompanying National Planning Practice Guidance (NPPG), the proposed development has to satisfy the requirements of the Sequential Test and where applicable the Exception Test.
- 3.1.2. Sequential Test:
Under the NPPF (2021), Zone 1 is defined as low probability flood risk. The proposal is for a new showroom, which in line with Table 2 is classified as 'Less Vulnerable'.
- 3.1.3. Placing both these criteria into Table 3 (Flood Risk Vulnerability and Flood Zone 'Compatibility'), Less Vulnerable development in Flood Zone 1 determines that 'Development is Appropriate'.
- 3.1.4. Exception Test:
As the Sequential Test is passed, the Exception Test is not required.

3.2. Knowsley Metropolitan Borough Council – Strategic Flood Risk Assessment

- 3.2.1. SFRA's assess the risk associated with all types of flooding and provide the information required to identify the amount of development permitted in an area; how drainage systems in the area should function and also how risks in vulnerable areas can be reduced and/or mitigated. The NPPF states that Regional Planning Bodies (RPB's) or Local Planning Authorities (LPA's) should prepare SFRA's in consultation with the EA.
- 3.2.2. In 2012 Knowsley Metropolitan Borough Council (KMBC) instructed Capita Symonds to prepare a Strategic Flood Risk Assessment for the area in accordance with the new NPPF criteria. The purpose of the SFRA is to assess and map all known sources of flood risk including fluvial, surface water, sewer, groundwater and all impounded water bodies, taking into account future climate change predictions.
- 3.2.3. A summary of the main elements from the SFRA is detailed below. The full report can be found on the Knowsley Council website.
- Proposed Development is within a Flood Zone 1.
 - No incidents of sewer flooding.
 - No Surface Water / historic flooding incidents.
 - No Groundwater flooding incidents.
 - Site is located within a Critical Drainage Area (CDA).
 - Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100 year storm event, considering climate change.
 - Development should be designed so that there is no flooding to the development in a 1 in 30 year event and so that there is no property flooding in a 1 in 100 year plus climate change event.

4. THE SITE

4.1. Site Details

4.1.1. The site details are summarised in Table 2 below:

Table 2: Site Referencing Information

Item	Brief Description
Site name	Hatfield JLR
Site address and location	Land off Coppice Lane, Tarbock Green, Liverpool, L35 6AG
Planning Authority	Knowsley MBC
Lead Local Flood Authority	Knowsley MBC
Drainage Statutory Undertaker	United Utilities
Site Area	Site area is 2.45ha
Approximate Grid Reference	OS: 345911, 389291
General Locality	The site is located approximately 2km south of Huyton Town Centre and 11.5km east of Liverpool City Centre.

4.2. Site Description

- 4.2.1. The existing site and surrounding boundary conditions is shown **Figure 1**. The redline boundary denotes the application boundary.
- 4.2.2. The site area is approximately 2.45 Hectares and currently consists of greenfield land with some hardstanding areas located at the eastern site boundary. The site is classed as both greenfield and brownfield.
- 4.2.3. The development site is bounded by Tarbock Roundabout to the east, the M62 motorway to the south and Coppice Lane (classified as an adopted highway) located north of the site.

Figure 1: Aerial Photograph of Existing Site (Microsoft Maxar, 2024)



4.3. Proposed Development

- 4.3.1. As discussed in the earlier sections, the proposed scheme is to replace the existing greenfield area with a new Jaguar Land Rover dealership. The proposed development will comprise of a showroom, offices, servicing, MOT workshop, associated car parking and storage areas.
- 4.3.2. Access into the proposed development will be from Coppice Lane.
- 4.3.3. The current outline Architectural Master Plan in **Appendix A** provides an indication of the proposals of the site.

5. DEFINITION OF FLOOD HAZARD

5.1. Sources of information

- 5.1.1. The NPPF (2021) requires the developer to consider the impact of runoff generated by the proposed development onto the downstream catchment, and to assess the risk of runoff from the surrounding district impacting on the development footprint. Further, the report is to consider flood risk from all other sources. The following section defines the flood risk receptors and anticipated flood risk. Section 5 then discusses in further detail the probability of flooding and the likely impacts.

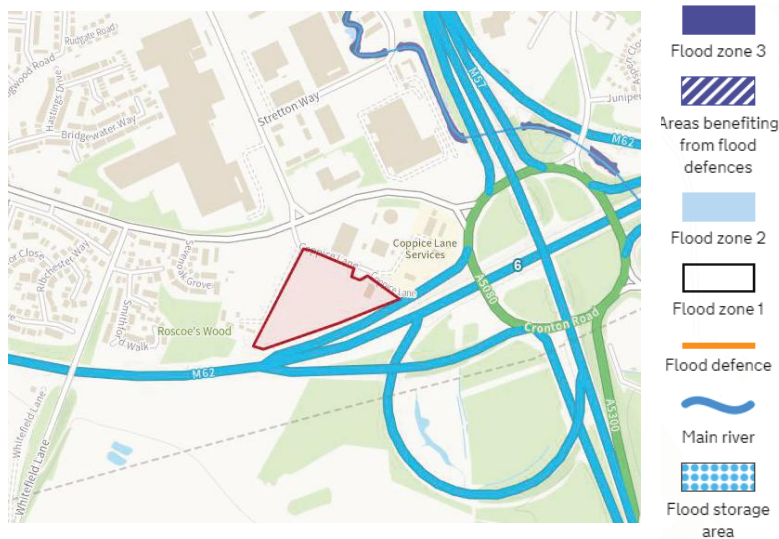
Table 2: Sources of information used in the identification of flood risk

Source of Information	Details
Environment Agency Flood Map	Indicative Flood Maps
United Utilities	Sewer Records
Historic Maps	From various websites
Knowsley MBC SFRA	Report & Various Maps from the SFRA

5.2. Flooding from Rivers (Fluvial)

- 5.2.1. Chapel Brook approximately 130m to the north, Ochre Brook some 400m to the south and Netherley Brook some 1.1km to the west. There are also other small unnamed tributaries within 1km of the site. All of these Brooks and tributaries flow generally in a southerly direction until they outfall into the River Mersey some 6.5km south of the site.
- 5.2.2. Figure 2 below locates the site on the Environment Agency's indicative floodplain map. It is clear from this that the red line boundary of the development sits outside of a fluvial generator of flood water from any identified water body or river. It is considered therefore that the overall site lays outside of the active 100-year and extreme event floodplains, thus lying within 'Flood Zone 1 Classification' in accordance with NPPF Guidance, i.e. probability of annual fluvial flooding significantly less than 1 in 1000 in any one year (<0.1%). The risk from fluvial flood water is diminished to acceptable levels, removing the requirement for further investigation and assessment of the fluvial flood regime.

Figure 2 – The EA's Flood Zone Map



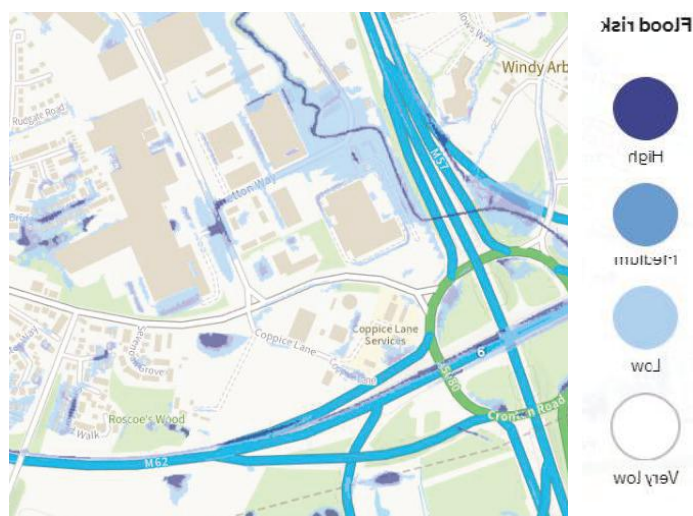
5.3. Flooding From Land (Overland Flow)

- 5.3.1. Any surface water runoff from the surrounding area is captured by the existing drainage infrastructure, both private and adopted and conveyed away from the site.

The indicative surface water flood map shows the existing site is very low risk of surface water flooding as illustrated in **Figure 3**. There are no existing surface water flow routes through the site that need to be maintained.

- 5.3.2. The proposed Surface Water Drainage Strategy is to be designed so that no surface water flooding / overland flow occurs up to the 1:30 year event. Exceedance flows beyond the 1:30 year up to the 1:100 year + climate change events are permitted to flood the surrounding hardstanding areas. However, these flows shall be kept away from the buildings and surrounding areas. As such, by incorporating appropriate mitigation measures and designing the drainage strategy to current best practice guidance to ensure that any surface water flooding is controlled, the risk of flooding from overland flow is considered to be low.

Figure 3 – The EA's Indicative Surface Water Flood map



5.4. Flooding from Sewers

- 5.4.1. Existing public Surface Water and Foul Water sewers are located north of site within Coppice Lane. See **Appendix B** for the S104 Drainage Plan.
- 5.4.2. Failures in areas of this nature are usually notified to the asset owner within a short period of time of the failure occurring and remedial work is usually implemented soon thereafter to prevent subsequent highway damage and inconvenience to road users.
- 5.4.3. It is anticipated that the SW private sewer network have been designed to accommodate a minimum of 1:30 year event. Beyond this projection, there may be a small degree of peripheral 'Exceedance' flooding within the areas above the sewers. However, this is expected to be localised and restricted to the location of specific manhole covers located outside the development footprint.
- 5.4.4. The existing private drains on site will be abandoned / demolished to facilitate the proposed development and ensure that the required UU easements are adhered to Design & Construction Guidance (DCG), BS EN 752: 2008 and Building Regulations Part H guidance.
- 5.4.5. As such the risk of flooding at the site is regarded as low.

5.5. Flooding from Groundwater

- 5.5.1. The SFRA map suggests the site is not susceptible to groundwater flooding.
- 5.5.2. The online BGS borehole logs indicates no groundwater strikes were encountered.
- 5.5.3. The proposals for the site do not include any basement or underground structures that would be susceptible to the risk of groundwater.

5.6. Flooding from Artificial Sources

- 5.6.1. There are no other bodies of water, such as ponds, reservoirs or other artificial sources, in proximity to the site. The flood risk from external sources is therefore negligible.

6. ASSESSMENT OF FLOOD RISK ON UNIT 1 DEVELOPMENT SITE (PROBABILITY)

6.1. Summary

- 6.1.1. Section 5 has defined the anticipated flood risks from all sources. Table 3 below considers each of the sources and defines in tabular format the Probability of Flood Risk associated to each and the likely impacts to the proposed development. Below is a table summary of the flood risks associated with the Unit 1 development site.

Table 3 – Flood Risk Summary

Source	Flood Risk	Likely Impacts	Remarks
Tidal	Low	Low	Site not tidally influenced.
Fluvial (Watercourse)	Low	Low	Site located in Flood Zone 1 (low risk).
Overland Flow	Low	Low	EA mapping shows site is at low risk. There are no flow routes through the site that need to be maintained.
Sewers	Low	Low	Public sewers located north of the site have been designed to accommodate flows up to the 1 in 100 year storm event. Also the proposed development infrastructure is to attenuate up to the 1 in 100 year + 45 Climate Change.
Groundwater	Low	Low	No groundwater strikes indicated on the BGS boreholes logs. Also, the proposed plans do not indicate any basement / underground structures.
Artificial Sources	Low	Low	No Artificial Sources in close proximity

7. OUTLINE DRAINAGE STRATEGY

7.1. Existing Surface Water Runoff

- 7.1.1. The existing site is approximately 2.45 ha in area and is classified as both greenfield and brownfield.
- 7.1.2. To calculate the pre-development the pre-development greenfield runoff rates have been calculated using the Infodrainage ICP SUDS calculation, which is a rationalisation and scaling of the IH 124 method of greenfield run off calculation.
- 7.1.3. As part of the site is brownfield, existing drainage rate has also been assessed using the modified rational method and a rainfall intensity of 35mm/hr.

$$Q = CIA$$

$$Q = 2.78 \times 35 \times 0.45 = 44 \text{ l/s}$$

- 7.1.4. The runoff rates from the existing site are summarised in **Table 4** and the results are attached in the **Appendix C**.

Table 4: Pre-development Brownfield Runoff Rates

	Impermeable Area (m ²)	Existing Runoff Rate (l/s)		
		1 in 1 Year	1 in 30 Year	1 in 100 Year
Greenfield	20000	10.6	20.6	25.3
Brownfield	4500	44		
Total	24500	54.6	64.6	69.3

7.2. Geology

According to British Geological Survey (BGS) information the site is underlain by Devensian, Glaciofluvial Sheet Deposits over Wilmslow Sandstone Formation (bedrock).

- 7.2.1. A full site investigation is yet to be carried out at the site.
- 7.2.2. According to British Geological Survey (BGS) information the site is underlain by Devensian Till, over mudstone (bedrock). Also the BGS borehole logs indicate mudstone as the underlying ground condition, this information is attached within **Appendix B**.
- 7.2.3. Online data source 'Landis Soilscales' mapping tool shows ground conditions at the site to be "Slowly permeable seasonally wet slightly acid loamy and clayey soils" with impeded drainage.

- 7.2.4. As such, infiltration is unlikely to be feasible at the site. However, it is recommended a full site investigation (soakaway testing works) are undertaken to confirm if infiltrating SuDS are feasible for this site.

7.3. Hydrology

- 7.3.1. Chapel Brook approximately 130m to the north, Ochre Brook some 400m to the south and Netherley Brook some 1.1km to the west. There are also other small unnamed tributaries within 1km of the site. All of these Brooks and tributaries flow generally in a southerly direction until they outfall into the River Mersey some 6.5km south of the site
- 7.3.2. Therefore, no watercourses are located within close proximity to the site and with no existing connections to any nearby watercourse, this approach is not feasible.

7.4. Existing Drainage

- 7.4.1. Existing public Surface Water and Foul Water sewers are located north of site within Coppice Lane. See **Appendix B** for the S104 Drainage Plan.
- 7.4.2. The existing drainage within Coppice Lane serves the wider catchment area as noted in the above sections. Each area / site has its own flow control and attenuation based on the plan area of the site. Each sites SW flows are then after discharged at a restricted rate towards the public surface water network in Coppice Lane, which in turn outfalls to a United Utilities Pumping Station where it will be pumped to the surface water sewer to the north in Stretton Way.

7.5. Sustainable Drainage Systems

- 7.5.1. SuDS Objectives
- Sustainable drainage developed in line with the ideals of sustainable development is collectively referred to as Sustainable Drainage Systems (SuDS). At a particular site, these systems are designed both to manage the environmental risks resulting from the urban runoff and to contribute wherever possible to environmental enhancement. SuDS objectives are therefore to minimise the impacts from the development on the quantity and quality of the runoff and maximise amenity and biodiversity opportunities (CIRIA C753, 2015).
- 7.5.2. SuDS's Design Themes
- A strong design theme is essential if the maximum aesthetic benefits are to be gained from the SuDS approach. At a more local scale the SuDS should link with the individuals plot structure, planting, public open space requirements and amenity areas, gaining multiple benefits from a limited area of land.
- 7.5.3. The SuDS Management Train
- The 'Management Train Approach' should be central to the surface water drainage strategy of the proposed site. The main objective is treatment and control of runoff as near to the source as possible protecting downstream habitats and further enhancing the amenity value of the site. This concept uses a hierarchy of drainage techniques to incrementally reduce pollution, flow rates and volumes of storm water discharge from the site, and is as follows:

1. **Prevention** – The use of good site design and housekeeping measures to prevent runoff and pollution and includes the use of rainwater reuse / harvesting.
2. **Source Controls** – Control of runoff at source or as close to source as possible (e.g. soakaways, green roofs, pervious pavements).
3. **Site Control** – Management of water in a local area and can include below ground storage / attenuation, detention basins, large infiltration devices.
4. **Regional Control** – Management of water from a site or various sites and can include wetlands and balancing ponds.

7.5.4. SuDS Site Constraints

SuDS techniques are suitable for all sites; therefore, an assessment of the existing site is required so that SuDS limitations can be determined.

- Land Use Characteristics: The size and type of the development plot allows a range of source control and site control SuDS devices to be considered are to be below and above ground.
- Site Characteristics: Underlying ground conditions means soakaways are not viable for use on the site.
- Catchment Characteristics: The site is currently classed as Brownfield and Greenfield.
- Environmental and Amenity Performance: The inclusion of SuDS within the overall development is a key driver in providing both amenity and habitat creation. Safety to all future occupiers is paramount and so best practice guidance will be incorporated so that these devices blend into the surrounding without the need for significant safety precautions. Maintenance plans will be prepared for all SuDS devices that are included.

7.5.5. SuDS Methods

Tables 5 and 6, below, provide an assessment of various above and below ground SuDS methods that can provide water quality treatment and management of flows to reduce runoff rates and volumes and whether they can be suitably incorporated at this development site. The purpose of this assessment is to set out options to be considered at the planning stage with consideration to time constraints, viability and lifetime maintenance of the development.

Table 5: Surface SuDS Methods

Method	Comment	Suitability for Development
Green Roofs	Can be used on suitable low-rise buildings to provide retention, attenuation and treatment of rainwater. Promotes evaporation and local biodiversity.	<u>Not Suitable</u> Architectural proposals for the development and maintenance issues deem this unsuitable.
Water Butts	Plastic tanks placed at the base of rainwater down pipes to collect rainwater runoff from the roof areas.	<u>Not Suitable</u> Architectural proposals for the development and maintenance issues deem this unsuitable.

Rainwater Harvesting	Rainwater harvesting reduces the total runoff volume from the developed site and reduces treated water consumption.	<u>Not Suitable:</u> Additional costs of installation would have severe effect on viability of development.
Infiltration Options	Reduces total run off volume from the development.	<u>Not Suitable:</u> Ground conditions indicates clay soils, and therefore is deemed this is unsuitable for infiltration.
Permeable Surfacing (Infiltration)	- Reduces total run off volume from the development. - Can be used to enhance water quality.	<u>Not Suitable:</u> Ground conditions indicates clay soils with shallow groundwater, therefore, this is unsuitable for infiltration.
Permeable Surfacing (Standard)	- Can be used to enhance quality of runoff water. - Sub-base provides 'source' storage and reduces the volume of storage downstream. - The storage can be created with selection of the stone fill or use of plastic box stems. - Impermeable membrane at base of construction to prevent impact on pavement stability.	<u>Suitable:</u> The use of permeable paving has been proposed for the new car parking and paved areas.
Swales, basins and ponds	- Provide areas for above ground surface runoff storage. - Swales also improve water quality through filtration.	<u>Not Suitable:</u> - Space constraints on site do not permit large above ground areas for surface water storage. - No scope to reduce development area due to site viability.
Rain Gardens	- Reduced surface water pollution to the receiving water bodies. - Reduction in flooding from intense rainfalls. - Increased biodiversity.	<u>Suitable:</u> The use of this shallow above ground SuDS methods is deemed suitable for some pavement areas.

Table 6: Sub-Surface SuDS Methods

Method	Comment	Suitability for Development
Geocellular Storage	- Suitable for sites with insufficient space for basins etc. - Suitable for sites where topography prevents the use of open basins etc.	<u>Suitable:</u> The use of geocellular attenuation may be possible to retain excess storm water.

	Can be very effective infiltration devices subject to ground conditions.	
Large Diameter Pipes, Culverts or Tanks	- Suitable for sites with insufficient space for basins etc. - Provide a volume of below ground storage with a high void ratio and good man entry provision to allow for future maintenance and cleaning. - Generally suitable for adoption by the statutory water company.	<u>Suitable:</u> The use of oversized pipes may be possible to retain excess storm water.

7.5.6. SuDS Hierarchal Approach

Based on the SuDS assessment in Tables 5 and 6, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in greater detail below:

Table 7: SuDS Hierarchal Approach

Method	Suitability	Suitability for Development
Infiltration to Ground	No	Underlying ground conditions deems this approach unsuitable. See section 7.2.
Connection to Watercourse	No	Due to the topography and proximity of this watercourses, this approach would not be feasible. See section 7.3.
Connection to Surface Water Sewer	<u>Yes</u>	There is a public surface water sewer north of the site within Coppice Lane (see S104 plan in Appendix B). Therefore, connection to a public surface water sewer is most suitable.
Connection to Combined Sewer	No	Discounted due to the above method chosen.

7.5.7. SuDS Design Philosophy

The SuDS assessment and hierarchal approach discussed in **Tables 5, 6 and 7** above has defined the overall SuDS strategy. Thus, the SuDS philosophy for the development site is the promotion of Prevention, Source Control and Site Control techniques with discharge rates to be restricted to the approved FRA stated above (sites 4 and 5 run off rates), to reduce the risk of both site and downstream flooding.

The following design philosophy is proposed:

- Surface water treatment using the 'Management Train' approach to remove and isolate contamination at all SuDS facilities prior to conveyance to the ground.
- Site control in the form of rain garden, permeable paving, geocellular storage and oversized pipes.
- Aim to limit where possible the impermeable fraction of development.

7.6. Surface Water Drainage Strategy

7.6.1. This section should be read in conjunction with the 'Proposed Drainage Strategy' available in **Appendix D**.

7.6.2. A drainage strategy has been undertaken for the site to demonstrate that surface water runoff can be effectively managed within the site, without increasing the risk of flooding to the site or elsewhere.

As outlined previously in section 7.1, surface water for the proposed development is to be discharged into the public surface water sewer within Coppice Lane. The proposed runoff rates for the proposed developable are shown in **Table 8**.

Table 8: Post-Development Runoff Rates

	1 Year (l/s)	30 Year + 40% CC (l/s)	100 year + 45% CC (l/s)
Proposed Development	25.1		

7.6.3. As noted above the proposed development is part of a wider catchment area in which each site, the proposed maximum runoff rate had been approved in the FRA & Drainage Strategy '3516 rev 1' dated April 2017.

7.6.4. Therefore, in accordance with the approved FRA stated above, the proposed development (Sites 4 and 5) will be limited to a maximum run off **25.1 l/s**.

7.6.5. At the time of writing this report, we were awaiting a response from UU on the pre development enquiry relating to existing and proposed discharge rates.

7.6.6. An infrastructure-based SW Drainage Strategy is considered feasible for the development, with run off from the hardstanding areas (highways, car park and roof) directed to the new below ground infrastructure. To achieve the post-development runoff rate (**Table 8**), flow control devices are to be situated at the downstream end of the surface water networks.

7.6.7. The proposed drainage layout for the new development will be designed in accordance with Design & Construction Guidance (DCG), BS EN 752: 2008 and Building Regulations Part H guidance, i.e. up to the 30-year storm return period criterion (including the 40% increase to account for climate change) and tested for the 1 in 100 year return period including a 45% increase to account for climate change to confirm that there is no flood risk to the buildings.

7.6.8. Flooding can occur on a local scale beyond the 30-year criterion due to runoff exceeding the capacity of the minor system during extreme events and it can only be addressed on a site-specific basis. Design & Construction Guidance states that developments should be protected against flooding from extreme events (1 in 30 year) and that flood pathways are identified when the drainage system is exceeded.

7.6.9. In the case of this development, exceedance flows will be all those over and above the 30-year design criterion set by Design & Construction Guidance. Using storage within the external areas would be achievable and would direct flood water away from the proposed buildings, with flows directed back into the surface water drainage network as water levels in the drainage network

receded. The exceedance flows and volumes can be calculated for the new development drainage layout. In the case of this development and due to the fall across the site, consideration will be given to make sure all water is controlled so that it does not impact on any adjoining properties.

- 7.6.10. Any future drainage calculations carried out as part of a site-wide drainage strategy or for the development layouts themselves must include the appropriate increase in rainfall to satisfy the future Climate Change allowances.

7.7. Pollution Control

- 7.7.1. There are to be multiple levels of treatment incorporated into the development, including trapped gullies, silt traps and swales / bio retention system. These provide filtration at various points in the system to improve water quality.
- 7.7.2. To improve the water quality from the proposed development the proposed drainage strategy has incorporated SuDS features that are line with the Simplified Index Approach (Ciria 753). The pollution hazard for the proposed scheme is very low, as it the land use is residential (roof only), see the extract below from CIRIA 753 SuDS Manual.

Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

- 7.7.3. To mitigate the Total Suspended Solids (TSS) from site, the drainage strategy incorporates series of catchpits manholes and trapped gullies. These measures collect the sediment and debris that gets carried along the SW system and reduces the possibility of blockages occurring.
- 7.7.4. Metals from the proposed roof will be very to non-existent due to the roof finish will be a paint finish with no metal cladding being exposed.
- 7.7.5. The mitigation measure for hydrocarbon pollution, the drainage strategy demonstrates that the Rain Garden areas within the grassed verges, petrol interceptor and Permeable Paving will help alleviate these pollution hazards.

7.8. Foul Water Strategy

- 7.8.1. The outline foul water drainage strategy is to connect to the existing public foul water sewer within Coppice Lane. The pre development enquiry response from United Utilities will determine this proposal.

8. MANAGEMENT MEASURES, OFF SITE IMPACTS AND RESIDUAL RISK

8.1. Flood Risk Management Measures

- 8.1.1. The report has found the site to be at high to low risk of flooding from various sources.
- 8.1.2. The surface water drainage strategy will restrict runoff from the Proposed development to maximum 25.1l/s (as per the approved SHD FRA dated April 2017 Rev 1), prior to discharge into the UU surface water sewer. Attenuation has been proposed in the form of oversize pipes, permeable paving and a geocellular storage tank. The new surface water networks will be designed in line with current British Standard and Design & Construction Guidance up to the 100-year storm return period including an allowance for climate change.
- 8.1.3. The use of SuDS in the form of Source Control and Site Control measures, with controlled (restricted) outflow, will help to minimise the flood risk impact to the surrounding sewer network.
- 8.1.4. There will be a site management health and safety document prepared in respect of the final development. This will include the required maintenance regime for the on-site drains and drainage facilities such as the channels, gullies, pipes, manholes and all SuDS facilities.
- 8.1.5. Should any flooding occur from the new sewers and drains it will be directed away from the buildings to the external areas.

8.2. Off Site Impacts

- 8.2.1. Up to and including the 100-year plus increase in rainfall allowance due to climate change (CC) event, the report has justified that there is no risk of flooding.
- 8.2.2. Surface water runoff does not increase from the pre-development regime and utilises SuDS solutions to satisfy the site constraints, the proposed development will therefore not increase flood risk onto its locality.

8.3. Residual Risk

- 8.3.1. With careful design of the drainage elements as described above there will be no residual flood-related risks that will remain after the development has been completed.

9. APPENDICES

- Appendix A – Architectural Site Layout
- Appendix B – Existing Site Information
- Appendix C – Existing Site Run Off Calculations
- Appendix D – Ridge Design Drawings
- Appendix E – Outline Surface Water Attenuation Calculations

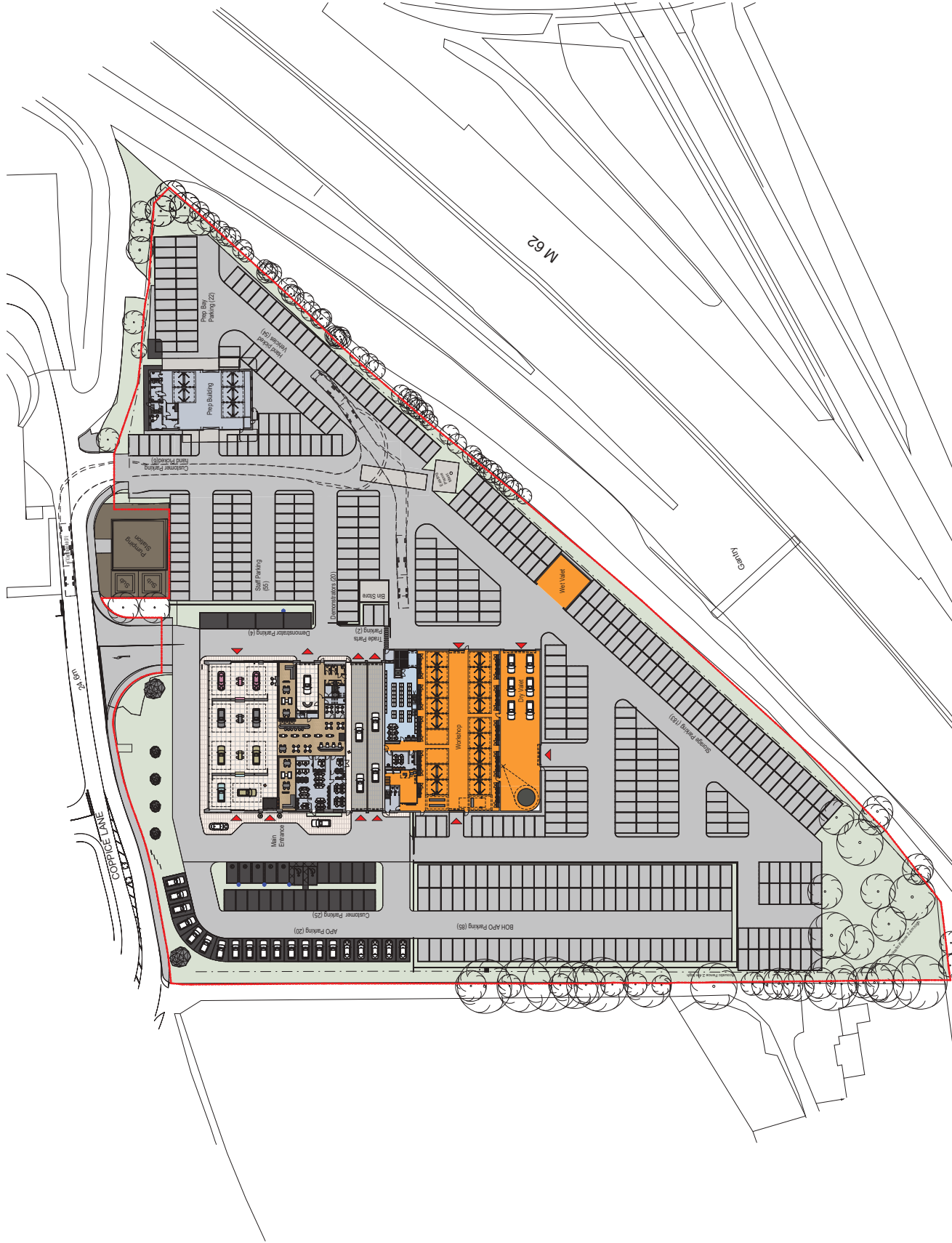
APPENDIX A – ARCHITECTURAL SITE LAYOUT

4527.01 m²

01 LEVEL	BOH Spaces	3,87.33 m ²
01 LEVEL	Offices	2,92.62 m ²
01 LEVEL	Prep Building first floor	62.26 m ²

Grand total 1 422.22 m²
4 565.93 m²

Parking Type	Total
APD Parking	165
APD Parking - Curbed	20
BOH Parking	211
Customer Parking	18
Customer Parking - Accessible	2
Customer Parking - Charging	5
Demonstrator - BOH Parking	20
Hand Picked Customer Parking	6
Hand Picked Vehicle Parking	54
Pro Bay Parking	22
Staff Parking	55
Tenite Pads Parking	2
	500



11	Presentation hall extended	JR	-	06/09/24
10	Layout amended to Client's comments	AP	-	30/03/24
9	Reduced scope of works adopted	JR	-	20/03/24

No.	Description	Prep	CRK	Date
	Do not scale this drawing All given dimensions are in millimeters As object to be modified, discrepancies in figured dimensions Contractors must check all dimensions from site			© Taylor Design 2018

Project	Hatfield JLR Knowsley
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Proposed Site Plan

Job No. 6329_01	Drawing No. 101	Revision 11
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STATUS:	Sketch		
Auth:	JR	Date:	March 2024

TAYLORDESIGN
architects

APPENDIX B – EXISTING SITE INFORMATION



Note:

The survey is plotted on a plane Local
Grid. Orientation to National Grid.
All levels relate to Ordnance Datum,
achieved using the
OS National GPS Network.
Survey Control Markers established for
mapping purposes only and should not be
used for construction without the written
approval of Survey Operations Ltd.
Levels in parenthesis indicate top of walls.
Utility survey added to topographical survey
JOB number 16109.
All drainage information must be verified
with local authority records before use.

SURVEY STATIONS			
Name	Easting	Northing	Height
M01	345788.03	393179.97	25.36
M02	345788.03	393179.97	25.36
M03	345804.51	393201.45	25.45
M04	346009.64	393207.94	24.45
M05	346030.93	393233.90	25.66
M06	346136.19	393447.52	25.82
M07	346076.67	393452.80	25.57
M08	346036.79	393461.54	25.49



Form P.70
(Series 610)

SECTION OF **ROSCOE No2 BOREHOLE (Urtonen Co. Lincs.)**

PURPOSE

EXACT SITE N.G.Co-ordinates:-

E 345 836

N 389 234

LEVEL AT WHICH ^{strat}bore _{drift} COMMENCED RELATIVE TO O.D. 77.41 Feet

DATE OF SINKING OR BORING COMMENCED 12 September 1977
Completed 2 November 1977

SINKER OR BORER National Coal Board, Western Area

6-inch Map

B/H
Regd.No

(County Sheet and Qtr.)

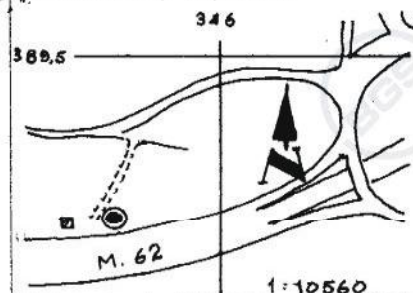
514

SJ 48 NE

(Nat.Grid,Sheet and Qtr.)

31

Each tracing from a map or
sketch map if possible



GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS		DEPTH	
		FEET	IN.	FEET	IN.
	Drift	9	4	9	4
	Cores badly fragmented to 22'6"				
	Siltstone, coarse, laminated. Grey to dark grey. Abundant comminuted plant debris. DIP 24°		11	10	3
	Mudstone, grey, laminated with occ listric inclined planes. Abundant plant fragments occ. coalified	2	9	13	0
	Sandstone/Mudstone interlaminated. Plant debris abundant occ Cordaites		8	13	8
	Mudstone, quartz laminae. comminuted plant debris	1	11	15	7
	Mudstone/Sandstone, slurry bedded. Ironstone nodules at 15'9". Abundant coalified plants	1	1	16	8
	Mudstone, grey, laminated, occ. plant debris with bands of abundant plant debris. Ironstone band 1" @ 20'; ironstone nodules with pyrite @ 22'3"				
	Mud loss (520 gallons) at 21'6"				
	Quartz laminae from 22'6"				
	DIP 28°. Soft and friable from 23'9"	7	6	24	2
	Sandstone, fine grain, light brown abundant plant debris		11	25	1
	Sandstone, white, turbulent bedding		6	25	7
	Mudstone, grey, abundant plant debris broken core	1	3	26	10
	Sandstone, laminated to 27'1", then wispy laminae, strong	1	2	28	0
	Mudstone, grey, laminated, abundant plant debris. Very fine quartz laminae increasing in basal 2"	1	11	29	10
	Fragmented core, consisting of mudstone, grey, fine quartz laminae	2	2	32	0
	Sandstone, coarse		6	32	6
	Mudstone, grey, laminated. Occ. plant debris. Bands with quartz laminae. Layers of abundant plant debris. Light brown				



FORM P 71 T
SERIES 680

Section of ... DE N 2 BOREHOLE

6-INCH MAP	B/H
	514
48 NE	31

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS		DEPTH	
		ft or ft*	m or in*	ft or ft*	m or in*
				87	3
	Mudstone, silty, gray. Plant debris				
	Conglomeratic with small green				
	pellets to 29'0" then large pebbles				
	to 89'3"	2	4	89	7
	Sandstone, gray, strong, 2" mudflake cong-				
	lomerate to 100'9". Abundant black				
	hair like fossils to 98'6".				
	Laminated below	15	5	105	0
	Mud loss (390 gallons) between 86'5				
	and 104'4"				
	Sandstone, striped with black micaceous				
	laminae		8	105	8
	Sandstone, fine grain. Massive. High angle				
	slip with fragmentary cores from				
	104' to 105'10"	1	7	107	3
	COAL DIP 25°		2	107	5
		1	11	109	4
	Sandstone, strong, wispy				
	Sandstone, coarse grain, occ. coalified				
	plants. Laminated from 112'6"	4	11	114	3
	Sandstone, medium grain. Very wispy laminae				
	Occ. carbonised patches. Laminated				
	from 118'6" to 119'3"	10	9	125	0
	Mudstone, gray, lam. 28". Abundant plant				
	debris DIP 28". High angle listric				
	slip 126'11" to 127'5". Erosive	3	0	128	
	base				
	Sandstone, gray, white. Mud flakes 131'9				
	to 132'	7	0	135	0
	Sandstone, gray, strong, laminated.				
	Micaceous	3	3	138	3
	Sandstone, gray, strong, massive. Occ.				
	small carbon patches. High angle				
	slip 139'10" - 140'5". More				
	laminata below 141'9"	1	5	142	8
	Sandstone, striped		6	144	2
	Sandstone, flaser bedded		3	146	5
	Mudstone, dark gray. Laminated, speckled				
	with plant debris. High angle				
	slips from 149'4" to 151'11"	5	6	151	11
	Mudstone, gray, strong. Well preserved				
	plants - Alethopteris. Broken				
	cores between 153' and 153'3"	3	1	155	0
	Probable Fault gouge		11	155	11
	Mudstone, dark gray. High angle slips to				
	157'5". Plant debris. Brownish				
	infilled with plant burrows	2	4	158	
	Mudstone, silty, bl. var. core to 159'4"				
	and between 159'10" and 160'4"				
	Abundant small slips throughout	2	1	160	4
	Mudstone, dark gray. Strong. Occ. plant				
	debris. DIP 33°. Quartz laminae				
	from 161'6" increasing in plants	2	3	162	7
	Sandstone/Mudstone, interlaminated		8	163	3
	Sandstone, fine grain, speckled with plant				
	debris. DIP 42°. High angle listric				
	slips, broken cores from 164'	2	2	165	5
	3				



FORM P 71 T
SERIES 600

Section of ROSLOE No 2 BOREHOLE

1:50,000 MAP	B/H
	514
SJ 48 NE	31

*Delete as appropriate

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS		DEPTH	
		m or ft*	m or in*	m or ft*	m or in*
	patches and small brown mud lenses. High angle slip mineralised from 32' to 37'0"	3	4	35	11
	Sandstone, strong white, wispy laminae		4	36	2
	Mudstone, smooth, grey, laminated, occ. plant debris. DIP 30° @ 38'	1	10	38	
	Mudstone, weak and friable	1	0	39	
	Sandstone/Mudstone, very finely interlaminated. Abundant plant debris	1	0	40	0
	Mudstone, grey, laminated, smooth. Abundant plant debris. Mica specks	2	5	42	5
	Sandstone, fine grain, laminated. Plants		6	42	11
	Mudstone, grey, laminated. Abundant plant debris. High angle slip to 44'				
	Small faults at 46'6" to 47'. Mud with breccia at 50'		1	50	0
	Mudstone, dark grey, laminated. Occ. plant debris. Sandy bands, quartz laminae from 51'	2	0	52	0
	Mudstone, dark grey, weak and friable. Quartz laminae. Abundant plants		9	52	9
	Sandstone, slurry bedded to 53'4", then containing streaks, lenses and ironstone nodules		9	53	6
	Mudstone, dark grey, 7'2"		7	54	
	Sandstone, strong, wispy coal laminae	1	3	55	
	Mudstone,		11	56	
	Sandstone, abundant coalified stems		10	57	1
	Sandstone, coarse grain, pale yellow with slight petroleum smell, occ. coalified plants. Coal laminae from 58'2"	1	3	58	4
	Mudstone, coarse grain, white. Slightly micaceous. Massive to 64'9" then laminated to 66'2". High angle slip 68'5" to 69'2". Mud loss (260 gallons) at 71'	3	0	71	4
	Sandstone, fine grain, grey, strong	1	2	72	6
	Sandstone, coarse grain, white. Occ. coal wisps	3	0	75	6
	Mudstone, grey, silty, laminated. Isolated patches of plant debris. DIP 30°		5	75	11
	Mudstone, grey, weak and flakey		6	76	
	Sandstone, grey, coarse, massive to 78'5" then laminated. Coal films and lenses from 79'1" Mud loss (260 gallons) at 79'10"	4	3	80	
	Sandstone, fine grain, creamy, wispy laminae	1	8	82	4
	Mudstone, grey, weak and friable. Structureless. Occ. plant debris.				
	Ironstone nodules at 83'6; listric surfaces. Strong from 84'10"				
	DIP 30°. Quartz wisps from 86'6"		7	86	11
	Sandstone, wispy		4	87	3



FORM P 71 T
SERIES 580

Section of ...12' ...2 BOREHOLE

0-1 INCH MAP	B/W
	514
48 NE	31

* Delete as appropriate

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS		DEPTH	
		ft or in*	ft or in*	ft or in*	ft or in*
	Siltstone, fine grain, dark grey. Speckled with carbonised plant debris, occ. larger stems		10	165	5
	Mudstone silty, grey. Calamites and Cordaites Strong. DIP 30°	1	1	166	
	Siltstone, dark grey. Strong. Occ. specks of plant debris. Coarsens below 169'4". High angle listric slip 170'5"-171'3"	4	10	167	
	Mudstone, fragments to 173'			172	2
	Mudstone silty dark grey badly broken by listric surfaces. Quartz laminae from 176', abundant listric slips, badly fragmented to 180'4" then pulverised	8	11	181	1
	Mudstone, grey, abundant listric slips		4	182	5
	Mudstone silty, grey/green. Abundant plant debris, occ. roots. Structureless, isolated ironstone nodules	1	4	183	9
	Mudstone silty, grey/green. Structureless. High angle slip 184'6" - 185'3". No plants	2	6	186	3
	Mudstone, grey. Poorly laminated DIP 34°. Small fault 187'0". High angle slip 190'1" - 192'0". Occ. faint imprints of calamites stems. Ironstone nodules at 193'7". Becomes darker and laminated with speckled plant debris from 194', occ. calamites, ironstone nodules at 196'. Broken by slips 196'8" - 197'3". High angle listric slip 201'5"-201'8". Calamites abundant from 201'8". Quartz laminae, DIP 35°. Small fault 204'4", no calamites below but speckled plant debris	1	9	205	0
	Sandstone, fine grain, laminated. Interbedded with grey mudstone. Sandstone occ. wispy, finely micaceous. Occ. layers of plant debris. High angle slip 209'3" - 210'. Coal 1" at 210'2", slurry bedded below. Faulted base	5	10	210	10
	Fault breccia		8	211	6
	Mudstone, dark grey. Abundant listric surfaces. Fault zone at 212'	1	6	213	
	Mudstone, dark grey. Sphaerosideritic to 213'11" to 213'11" to 214'2". Isolated faint plant impressions. Listric planes cease at 215'10". No mud loss from 212'. DIP 22° at 217'. Broken down 218'4" - 218'10". Calamites stems from 219'3". Small fault from 220'	7	4	220	4

Probable London
Delf & Crombouke
Seams Coal

FORM P 71 T
SERIES 680

Section of ROSCOE No. 2 BOREHOLE

1 INCH MAP	S/N
	514
SJ 48 NE	31

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS		DEPTH	
		For ft*	For in*	For ft*	For in*
				220	4
	Mudstone, dark grey, con. specks of plant debris, sole stems. Small fault @ 221' fragmentary to base	3	0	221	
	Seatearth, abundant, tectonic listric surfaces	1	1	224	5
	Sandstone, coarse, weak	1	9	226	2
	Siltstone, dark grey, fine grain, laminated. Fragmentary from 227'	2	0	228	2
	Mudstone, grey. Abundant high angle listric slip planes. Ironstone nodules at 229'9 and 230'6. Sandy beds 3" to 231'4 and 2" to 232'7, plant debris below	4	10	233	0
	Siltstone, fine grain, plant debris, calamites, occ. quartz laminae increasing from 235'3				
	Mineralised slip, fragmentary core 237' to 237'9. DIP 15° @ 238'	6	0	239	0
	Sand/Silt, complex interlaminated, micaceous, carbon laminae	2	0	241	0
	Sandstone, complex laminations, white striped dark grey grain, micaceous, dark grey bedded from 244'. High angle slip 245'-246'	5	7	246	7
	Mudstone, silty, dark grey, plants and stems. DIP 25° at 248'. Slip at 249'. Layer of ironstone nodules at 250'. Slip at 251'. Abundant plants to 252'. Badly broken core from 252'2. DIP 30°	6	1	252	8
	Siltstone, fine grain, dark grey, speckled with mica. Shell fragments. LINGULID at 254'. plant debris fucoids	2	10	255	6
	Mudstone, dark grey, laminated. Abundant plant debris. Fucoids at 256'6. Fault with thin gouge at 257' broken core with abundant listric slips to 259'3	2	6	258	0
	Mudstone, canneloid, dark grey, laminated. Fish debris	1	3	259	3
	Seatearth, strong, roots abundant. Listric surfaces		9	260	
	Seatearth, slightly silty, abundant roots, slip planes	1	1	261	1
	Seatearth, muddy		5	261	6
	Seatearth, silty. Strong, roots. Becoming laminated with occ. quartz laminae from 261'10		11	262	5
	Siltstone, grey, laminated, strong. Plant debris abundant in top 6" then occ. specks	1	4	263	9
	Siltstone, slurry bedded		2	263	11
	Siltstone, quartz laminae		4	264	3
	Mudstone, laminated. Abundant plant debris, occ. carbonised, DIP 22°	1	1	265	4



FORM P 71 T
SERIES 680

Section of ROSCOE No 2 BOREHOLE

CH MAP	B/H
	514
SJ 48 NE	31

*Delete as appropriate

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS		DEPTH	
		ft or in*	m or in*	ft or in*	m or in*
				265	4
	Sandstone, white, sub-silt with bands of dark silt. Abundant plant debris. High angle slips from 265' with badly broken core	2	0	267	4
	Faulted ground up material	1	1	268	5
	Mudstone, gray strong		2	268	7
	Sandstone, very fine grain, finely laminated wispy to 269'6 then complex Broken with high angle slips from 270'11. Contorted laminae contemporaneous faulting to 272'4		9	270	4
	Fault, fragmented core, silty fragments and gouge	2	8	275	0
	Sand/Silt, striped, carbon laminae DIP 45°	1	0	276	0
	Mudstone, dark gray, Ironstone patches broken by listric slips	1	2	277	2
	Fault gouge		8	277	10
	Mudstone, dark gray fragments		10	278	8
	Mudstone, dark gray, laminated		1	278	9
	COAL, some pyrite, DIP 27°	1	6	280	3
	Seatearth, weak		6	280	
	Mudstone Seatearth, strong, laminated roots	1	4	282	1
	Siltstone Seatearth, laminated, roots and plants		10	282	11
	Siltstone, fine grain. Plant debris abundant. Quartz laminae from 285'10 Calamites and stems. Strong	1	1	287	3
	Sandstone, light gray, fine grain, Complex laminated with carbon laminae	1	7	288	10
	Sandstone, strong, white, wispy laminae	1	9	290	7
	Mudstone, light gray, strong, Quartz bands. Occ. plants	1	1	291	8
	Sandstone, slurry bedded		4	292	0
	Sandstone/Mudstone, interlaminated	1	0	293	0
	Mudstone, interlaminated with fine laminae of quartz. Occ. plant debris DIP 25°. Quartz content increases from 296' highly inclined joint from 296' to 297'3	4	3	297	3
	Sand/Silt interlaminated, striped. Fine grain, micaceous	3	3	300	
	Sand/Silt complex interlaminated. Fine grain, micaceous	3	1	303	7
	Siltstone, dark gray, laminated. DIP 24° Abundant quartz laminae in bands	2	7	306	2
	Sand/Silt, complex interlaminated	3	6	309	8
	Siltstone, gray, laminated, fine grain Occ. quartz laminae	1	1	310	9
	Mudstone, gray strong. DIP 27°. No fossils		10	316	7
	Ground up material, Probable Fault gouge		8	317	3
	6				

Possible
St Helens Yard
Seam



FORM P 71 T
SERIES 580

Section of ROSCOE No 2 BOREHOLE

ON MAP	S/N
	514
48 NE	31

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	*Delete as appropriate			
		THICKNESS		DEPTH	
		ft or m	ft or m	ft or m	ft or m
	Mudstone, gray, lam. smooth DIP 20°			317	3
	occ. plant debris		11	318	2
	Seatearth, gray, laminar, roots & listric surfaces. listric slip planes from 320'6	2	9	320	1
	Faulting, fragmentary core		5	321	4
	Sandstone, strong slurry bedded to 322'4				
	Small fault passes through then turbulent laminated, striped	2	3	323	7
	Mudstone, silty, dark gray. Laminated DIP 15°. High angle slip 324'7- 325'3, then broken by slips to 326'4	6	2	329	9
	Mudstone, thinly laminated	1	7	330	4
	Seatearth, very weak		5	331	9
	Mudstone, laminate DIP 30°		5	332	2
	COAL, considerable pyrite	3	1	333	3
	Dirt, soft in top 3" (4" missing B.P.B.)		10	336	1
	COAL, core	2	10	338	11
	Dirt, black, soft		1	339	0
	COAL, core DIP 29°		4	339	1
	Seatearth, mudstone, compact with listric surfaces, abundant roots	1	5	340	5
	Seatearth, very weak and swollen	1	10	342	2
	Seatearth/ mudstone, weak	1	3	343	0
	Mudstone, gray, laminated. Weakly compacted occ. plants mainly comminuted isolated stems. Ironstone nodules at 345'3"	3	2	347	0
	Mudstone, silty. High angle slips, bands of sandstone slurry bedded from 348'6	2	7	349	7
	Sandstone, white, fine grain. Slurry bed- ded to 349'11 then finely laminated abundant plant debris		8	351	3
	Mudstone silty, gray. Fractured core strong and coarsening from 352'4	1	11	353	2
	Siltstone, fine grain, gray, strong, occ. plant debris, DIP 27°. Quartz laminae 356'6-356'9. Calamitas and Neuropteris. Slip 362'2-362'10	10	1	363	2
	Mudstone, silty, gray abundant plant debris, DIP 2°	1	9	365	0
	Siltstone, gray laminate, abundant plant debris	1	5	366	5
	Silt/Sand, laminate		7	367	0
	Sandstone, complex laminated	1	4	368	4
	Siltstone with sand laminae, Striped. High angle slip 368'6-369'4	1	0	369	4
	Sand/Silt laminated, Finely disseminated plant debris. Silt content increas- ing		5	370	9
	Siltstone, gray laminate, plant debris Strong, fining down	1	10	372	7
	Mudstone silty, gray occ. quartz whisps isolated				
	7				

Ince Six Feet Seam
(Spore analysis
report YRL.9122)



FORM P 71 T
SERIES 580

Section of ROSCOE No. 2 BOREHOLE

1:50,000 MAP	B/H
	514
SJ 48 NE	31

*Delete as appropriate

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS		DEPTH	
		ft or ft*	m or m*	ft or ft*	m or m*
	isolated plants DIP 20°	3	10	372	7
	Siltstone, gray, laminae Strong, plants	5	4	376	2
	Mudstone, gray, plant debris, Occ. Ironst-			381	9
	one nodules DIP 5° at 383'				
	Quartz laminae from 383'	3	3	385	2
	Mudstone, dark gray, laminated, Occ. plant				
	debris, isolated nodules DIP 13°	3	8	388	8
	Siltstone, fine grain, gray, Strong		4	389	0
	Sand/Silt, interlaminated, some distortion	1	6	390	6
	Siltstone, gray, strong, Occ. isolated				
	plant debris, DIP 14°	1	3	391	9
	Sand, interlaminated		3	392	0
	Mudstone, gray, laminated, strong, Quartz				
	laminae from 393'		8	393	8
	Mudstone, fine grain, gray, Complex				
	laminations, Conglomerate with few				
	large pebbles 395'5 to base	2	3	395	11
	Mudstone, gray, isolated plant debris,				
	increasing below 397'. High angle				
	slip from 397'6	2	3	398	2
	Mudstone, with fine abundant quartz				
	laminae and whist Easy partings,				
	Plant debris: DIP 7°	1	3	399	5
	Cavity, Mud loss to 403'		7	400	
	Clay gouge material		7	400	7
	Mudstone, gray, abundant plant debris				
	DIP 25°	1	4	401	11
	Cavity		6	402	5
	Clay gouge and peices of mudstone core				
	with plant debris, Mud loss to				
	403', 400 gallons of water mad				
	at 2 g.p.m. at 403'3"		7	405	0
	Fragmentary core and clay gouge, coaly				
	2" to 407'1"		9	410	9
	Fragmentary core,				
	Siltstone, dark gray, plant debris				
	DIP 28°	1	0	411	9
	Ground up material		9	412	6
	Siltstone, fragmentary	1	4	413	10
	Ground up material	3	2	417	0
	Siltstone, abundant plant debris, oco,				
	coalified	1	1	418	1
	Ground up material		7	418	5
	COAL, very dirty, pyrite on partings				
	pyrite films		10	419	6
	Mudstone, silty, gray, Plant debris	1	1	420	7
	Ground up coaly debris		4	420	11
	COAL, ffragments		8	421	7
	Ground up debris	1	3	422	10
	COAL dirty, core		8	423	6
	COAL, fragments		4	423	10
	Seearth, soft, listric, bedded		6	424	4
	COAL, dirty, pyrite films, core, DIP 2°		1	425	5
	Seearth, very weak, swollen, High an,				
	slip 427'8-428'8	4	7	430	0

Probable Higher
& Lower Florida
Seams Old Workings

FORM P 71 T
Series 680

Section ofROSCOE No. 2 BOREHOLE

REGION MAP	B/H
	514
SJ 48 NE	31

*Delete as appropriate

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS		DEPTH	
		ft or in*	ft or in*	ft or in*	ft or in*
				430	0
	Seatearth, broken	1	1	431	1
	Ground up material		11	432	0
	Sandstone, ferruginous, mineralised joints	1	9	433	
	Seatearth, mudstone, listric surfaces.				
	Roots, becoming bedded below 435'6"				
	DIP 20°. Faulted base	3	10	437	7
	Seatearth, mudstone, roots, listric surfaces. Ironstone pellets				
	Coarsening below 440'	4	0	441	7
	Sandstone, fine grain, light grey, stems		4	441	11
	Siltstone, slurry bedded		4	442	3
	Sandstone, wispy laminae		10	443	1
	Siltstone, laminated, plant debris abundant, stems and speckled		11	444	0
	Fault				
	Mudstone, grey, abundant plant debris		6	444	6
	Ground up muddy material		6	445	0
	Seatearth, weak		9	445	9
	Mudstone, ironstone nodules. Plant debris		10	446	7
	DIP 15°				
	Mudstone, fragments with high angle slips	1	0	447	7
	Sandstone, fine grain, grey, strong, mainly white & tan slurry bedded	3	7	451	2
	Siltstone, grey, occ. plant debris		11	452	
	Sandstone, complex laminated	1	11	454	0
	Siltstone, occ. plant debris		11	454	11
	Sand/Silt, slurry bedded		10	455	9
	Sandstone, fragments	1	1	456	10
	High angle slip				
	Siltstone, dark grey, plant debris		7	457	5
	High angle slip				
	Sand/Silt, slurry bedded		7	458	0
	Siltstone, grey, strong. Plant debris				
	Ironstone nodules and pellets				
	Fining below 459'	1	10	459	10
	Mudstone, grey, strong. Occ. plant debris		6	460	4
	DIP 25°				
	Siltstone, fine grain, grey. Plant debris				
	with Alethopteris. Strengthening				
	with abundant quartz whips from				
	461'1". Ironstone nodules				
	from 462' fining down and passing to	2	8	463	0
	Mudstone, grey, abundant plant debris		10	463	
	Mudstone, grey, weak. Abundant plant debris				
	occ. carbonised	1	2	465	0
	FAULT core affected by abundant High angle				
	listric planes	1	3	466	3
	Mudstone, dark grey, laminated DIP 27°				
	Abundant plant debris, coalified				
	Sigillaria. Becoming seatearth texture below 467'6"	2	4	468	7

FORM P 71 T
SERIES 880

Section of REGION No 2 BOREHOLE

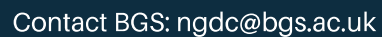
MCN MAP	B/H
	514
S.T +8 NR	31

*Delete as appropriate

[illegible]

Aqua Geological Service
Stoke-on-Trent







FORM P 70
SERIES 680

Section of **ROSCOE** N° **1** **DR HOLE** (Cranton Colliery)

Purpose

Exact Site National Grid Co-ordinates

E. 345 906 m;

N. 389 217 m;

Level at which bore commenced relative to O.D. 7.1 m or ft

Date of sinking or boring Commenced 24th November 1977

Completed 5th December 1977

Sinker or borer National Coal Board, Western Area

CONFIDENTIAL

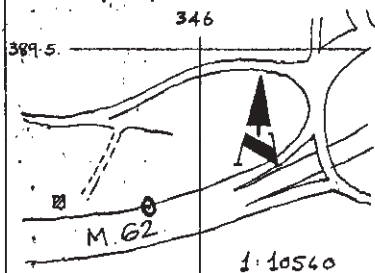
INCH MAP
(Count, Sheet and Qtr.)

515

32 W. NR
(Nat. Grid, Sheet & Qtr.)

32

Attach tracing from a map or sketch map if possible



GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	*Delete as appropriate			
		THICKNESS		DEPTH	
		ft	in	ft	in
Base of Drift	Soil and clay	9		9	9
	Gravel, uncemented	9		10	6
	Gravel, deep red, clayey material			13	6
	Mudstone, purple with grey and yellow stains. Heavy with no structure		9	14	3
	Mudstone, as above; fragmented	8	10	23	1
	Mudstone, grey mottled purple, bedded. DIP 25°. Small lense of sooty COAL 1" thick at 27'. Predominantly grey below 28'6"	6	11	30	0
	FAULT		6	30	6
	Sandstone, fine grain, grey occasional plants. Turbule bedding. Badly broken core v. High Angle Slips at 33 feet. Grey mottled deep purple below	3	6	34	0
	Sandstone, fragments	1	0	35	0
	Seatearth, grey. Fragmentary core from 36 feet	3	4	38	4
Bed hole conditions; drilling continued by Rock Bit					
Log compiled by Geophysical Log and Rock Bit Chippings:					
				38	4
	Siltstone, grey	3	0	41	4
	Mudstone, grey	5	5	46	9
	Mudstone, very high gamma peak	8	5	55	2
	Mudstone, grey. Probable sand laminae	28	10	84	0
	Siltstone,	2	7	86	7
	Mudstone, High gamma at top	4	3	90	10
	Mudstone becoming increasingly silty downwards	14	10	105	8
	Mudstone, with high gamma peak at base	6	7	112	3
	Sandstone, grey. Poss. 1" COAL at 128 feet	21	11	134	2
	Mudstone, light grey	8	10	143	0
	Sandstone, light grey, possibly occasional ferruginous patches	44	0	187	0
	Sandstone, with siltstone bands	15	2	202	2
	Mudstone, possibly with silty laminae and some ironstone bands. Reddens below 230 feet	25	5	237	7
	COAL	1			
	Gravel	1	4		
	Superior Coal			241	5
	Mudstone, grey, sandy laminae	25	7	288	0
	Mudstone silty	16	5	304	5



FORM P 71
SERIES 680

Section of ROSOE FOREHOLE

6-INCH MAP	B/H
SJ48NE 32	

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS		DEPTH	
		ft or in*	in or ft*	ft or in*	in or ft*
	Inferior Coal	1	4	304	5
	Mudstone, silty grey	17	1	305	9
	Inferior Coal	1	11	324	9
	Siltstone/Mudstone, grey	28	4	353	1
	COAL	1	3	354	4
	Siltstone/Mudstone, grey with some red fragments	20	0	374	4
	Sandstone, grey and reddened	4	3	378	7
	Mudstone, silty	37	10	416	5
	COAL	2	11	419	4
	Mudstone, silty at top	5	10	425	2
	Mudstone, siltstone	8	3	433	5
	Siltstone	6	10	440	3
	Mudstone	14	7	454	10
	COAL	1	2		
	Dirt		8		
	COAL	2	0		
	Coal inferior	2	3	460	11
	Dirt		8		
	Dirt		10		
	COAL		9	466	2
	Coal and dirt, (probably carbonaceous seatearth)	3	8	469	10
	Geophysical Log Stops				
	Siltstone fine grained with red sandstone fragments	20	2	490	0
	Mudstone dark grey with some reddish colour	30	0	520	0
	COAL	10	0	530	0
	TOTAL DEPTH - 531ft 6ins				
	Filled to surface with cement-1.25 tons				



SECTION OF ROSEBURY 3 BOREHOLE

6-inch Map

B/H

SJ 48 NE 32

515

32

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	DEPTH	
		FEET	IN.
	Examination of chippings from rock bit section. Percentages estimated. -----000-----		
	Sandstone, fine grained, light grey; occ. deep purple fragments	40	0
	Mudstone, light grey 90%; Sandstone 30%	50	0
	Mudstone, light grey	60	0
	Mudstone/silty, grey	70	0
	Mudstone/silty, grey	80	0
	Mudstone/silty, grey; a few sandstone chips	90	0
	Mudstone/silty, light grey	100	0
	Siltstone, fine grain, grey	110	0
	Mudstone, grey 60%; sandstone white 40%	120	0
	Mudstone, 50%; Sandstone, 50%	130	0
	Mudstone, light grey, occ carbon pieces; a few sandstone fragments	140	0
	Sandstone, white 50%; Sandstone fawn 40%; mudstone 10%	150	0
	Sandstone, 70%; Mudstone 30%	160	0
	Mudstone, light grey 60%; sandstone 40%	170	0
	Sandstone, grey, Ironstone 80%; sandstone 20%	180	0
	Sandstone, grey; occ. ironstone flecks	190	0
	Mudstone grey with COAL flecks and iron- stone 80%; Sandstone 20%	200	0
	COAL, a little sandstone	210	0
	Siltstone, grey, some ironstone and occ. carbon fragments	220	0
	Sandstone/Siltstone, 40/50 some reddish fragments	230	0
	Siltstone dark with a little sandstone white; Some pyrite	240	0
	Siltstone 70%; Sandstone 30%	250	0
	Siltstone 70%; Sandstone 30%	260	0
	Siltstone light grey	270	0
	Siltstone light grey	280	0
	Mudstone/silty 90%; Sandstone 10%	290	0
	Sandstone grey 20%; Mudstone 30%; Reddened siltstone 50%	300	0
	COAL	305	0
	Mudstone light grey 95%; COAL 5%	310	0
	Mudstone dark grey	320	0
	COAL	326	0
	Clay and Seatearth	330	0
	Mudstone grey 60%; Sandstone reddish with occ. white 40%	340	0
	Mudstone light grey 80%; Sandstone pale pink with white 20%	350	0
	COAL	353	6
	MUDstone light grey 85%; Sandstone white and brick red 15%	360	0
	ditto	370	0
	Mudstone, silty, light grey	380	0
	Siltstone, grey 80%; Sandstone 20%	390	0
	Siltstone grey 80%; Sandstone Red 15% sandstone white 5%	400	0
	Siltstone grey 80%; Fine red sandstone 20%	410	0
	COAL	417	0
	COAL with a little dirt	420	0
	Mudstone/Seatearth grey with 5% red Sst	430	0
	Mudstone grey with a few fragments of red fine grain Sandstone	440	0
	Mudstone grey	450	0
	COAL	454	0
	COAL	460	0
	COAL	463	0



SECTION OF ROSCE No 3 BOREHOLE

8-Inch Map

B/H

SJ 48 NE 32

GEOLOGICAL CLASSIFICATION	NATURE OF STRATA	THICKNESS		DEPTH	
		FEET	IN.	FEET	IN.
	Mudstone grey with a little coal and red fine grained sandstone			470	0
	Siltstone fine grained, grey, 80%; Fine sandstone red 20%			480	0
	ditto			490	0
	Mudstone dark grey with a little white sandstone and red fine sandstone			500	0
	Mudstone/Seatearth			510	0
	Mudstone silty 80%; Fine sandstone 15%; White sandstone 5%			520	0
COAL				521	0
COAL				530	0
TOTAL DEPTH 531 Ft 6Ins					
162m					