



Hydrogeological Impact Appraisal of
Temporary Dewatering Activities
The Airfields, Plot B

Reference: 16-866
Date: 18 October 2023



HYDROGEOLOGICAL IMPACT APPRAISAL

The Airfields, Plot B
Land at Welsh Road
Northern Gateway
Deeside

Prepared for:

Marshalls Constructions West Yorkshire Ltd

Report Ref: 16-886-R2-1

Date Issued: 18 October 2023

The Airfields, Plot B, Deeside

Hydrogeological Impact Appraisal of Temporary Dewatering Activities

October 2023

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1. INTRODUCTION

1.1. BACKGROUND

E3P has been commissioned by Marshalls Construction to undertake a desk-based Hydrogeological Investigation Appraisal of temporary dewatering works that will be required to facilitate the construction of foundation and drainage infrastructure.

Due to the requirement for dewatering, Marshalls Construction West Yorkshire (Marshalls) has applied for a Water Resources Licence (transfer) A 'transfer licence' that authorises Marshalls to abstract groundwater from one supply and transfer it to another source of supply without any intervening use, over a period of 28 days or more.

The requirement for this appraisal is based on comments from Natural Resources Wales (NRW) as presented in their letter reference PAN-023289 dated 9 October 2023.

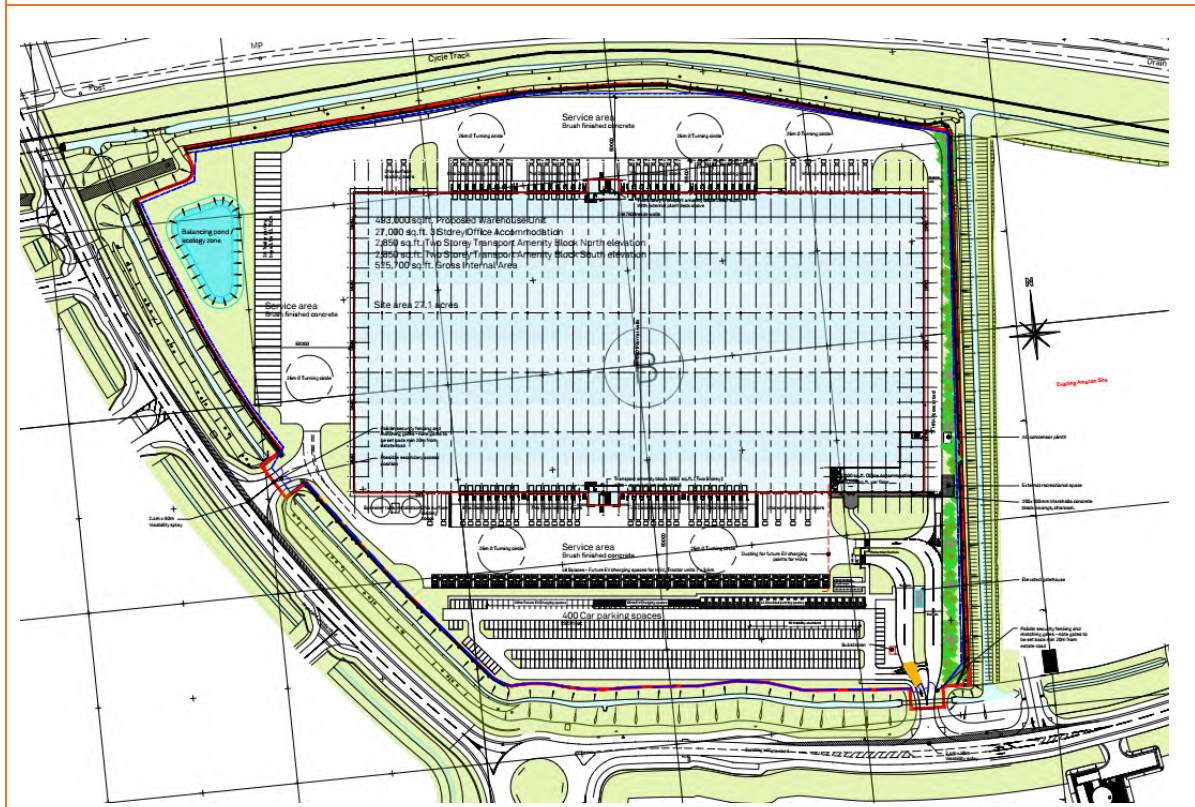
This hydrogeological impact appraisal follows the general principles outlined within the Environment Agency guidance document Hydrogeological impact appraisal for dewatering abstractions (reference SC040020/SR1).

1.2. PROPOSED DEVELOPMENT

Marshalls is looking to commence a commercial development project at Plot B, The Airfields, Northern Gateway, Deeside, Flintshire, CH5 2RD. Planning consent RES/000385/22 covers the construction of a 'Proposed storage and distribution unit with ancillary offices, associated accesses, car parking, service yards, security gatehouse, electricity substation, pump house and landscaping.

A proposed development scheme for the site is presented in Figure 1.1 (below) and Appendix III.

FIGURE 1.1 PROPOSED DEVELOPMENT PLAN



1.3. OBJECTIVES

The objectives of the assessment are as follows:

- ✚ Review available geological, hydrogeological and hydrological data for the site;
- ✚ Assess the implications of any potential risk to groundwater and/or surface water associated with possible changes in levels, flows and water quality; and
- ✚ Provide a Hydrogeological Impact Appraisal (HIA) report relating to the dewatering temporary activities, in particular referencing the 14 steps outlined in EA guidance.

1.4. HIA GUIDANCE AND SCOPE OF WORKS

This HIA will address the steps as outlined within EA guidance and where relevant will:

- ✚ Establish the regional water resource status.
- ✚ Identify all potential water features that are susceptible to flow impacts.
- ✚ Apportion the likely flow impacts to the water features.
- ✚ Allow for the mitigating effects of any discharges, to arrive at net flow impacts.
- ✚ Assess the significance of the net flow impacts.
- ✚ Define the search area for drawdown impacts.
- ✚ Identify all features in the search area that could be impacted by drawdown.
- ✚ For all these features, predict the likely drawdown impacts
- ✚ Allow for the effects of measures taken to mitigate the drawdown impacts.
- ✚ Assess the significance of the net drawdown impacts.
- ✚ Assess the water quality impacts.
- ✚ Develop a conceptual model for the abstraction and the surrounding area.
- ✚ If necessary, redesign the mitigation measures to minimise the impacts.
- ✚ Develop a monitoring strategy

1.5. DATA SOURCES

This report refers to the following data sources:

- ✚ JGP - Desk Study Report - Reference 4671-JPG-XX-XX-RP-G-0644-S2-P01;
- ✚ JPG - Geoenvironmental Ground Investigation – Reference 4671-JPG-XX-XX-PR-G-0645-S2-P01;
- ✚ JPG – Factual Report on Groundwater Monitoring Investigation - Reference 4671-JPG-XX-XX-RP-G-0660-S2-P01;



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- ✚ MCWY Drawing Ground Water Comments Nr.1 14-03-2023;
- ✚ MCWY Drawing Ground Water Comments Nr.2 14-03-2023;
- ✚ MCWY Drawing Ground Water Comments Nr.3 14-03-2023;
- ✚ Dewatering Services Ltd Method Statement Risk Assessment Reference 233205 dated 23-06-23
- ✚ JPG drawing 4671-JPG-PB-ZZ-DR-D-1400-S4-P04 dated 06-02-23
- ✚ NRW Interactive Map Viewer
- ✚ NRW Flood and Coastal Erosion Risk Map
- ✚ BGS Solid Geology map Sheet Map 108 –Flint, 1:50,000 Scale; and
- ✚ BGS Online viewers–Geology Maps and Borehole Records.
- ✚ MAGIC Map Application

1.6. LIMITATIONS

The limitations of this report are presented in Appendix I.

1.7. CONFIDENTIALITY

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



2. HYDROGEOLOGICAL IMPACT APPRAISAL

2.1. REGIONAL WATER RESOURCES STATUS

2.1.1. GEOLOGY AND HYDROGEOLOGY

The British Geological Survey (BGS) map for the site, (Sheet 108 Flint) indicates the site is underlain by the geological sequence presented in Table 4.1.

TABLE 4.1 SUMMARY OF UNDERLYING GEOLOGY

GEOLOGICAL UNIT	CLASSIFICATION	DESCRIPTION	AQUIFER CLASSIFICATION
Drift	Tidal Flat Deposits	Clay, Silt and Sand	Secondary Aquifer - Undifferentiated
Solid	East – Kinnerton Sandstone Formation	Sandstone	Principal Aquifer
	West – Pennine Middle Coal Measures	Mudstone, Siltstone and Sandstone	Secondary A Aquife

An excerpt from the BGS Solid Map (Sheet 108) is presented in Figure 2.1 below.

FIGURE 2.1 EXCERPT BGS DRIFT GEOLOGICAL MAP

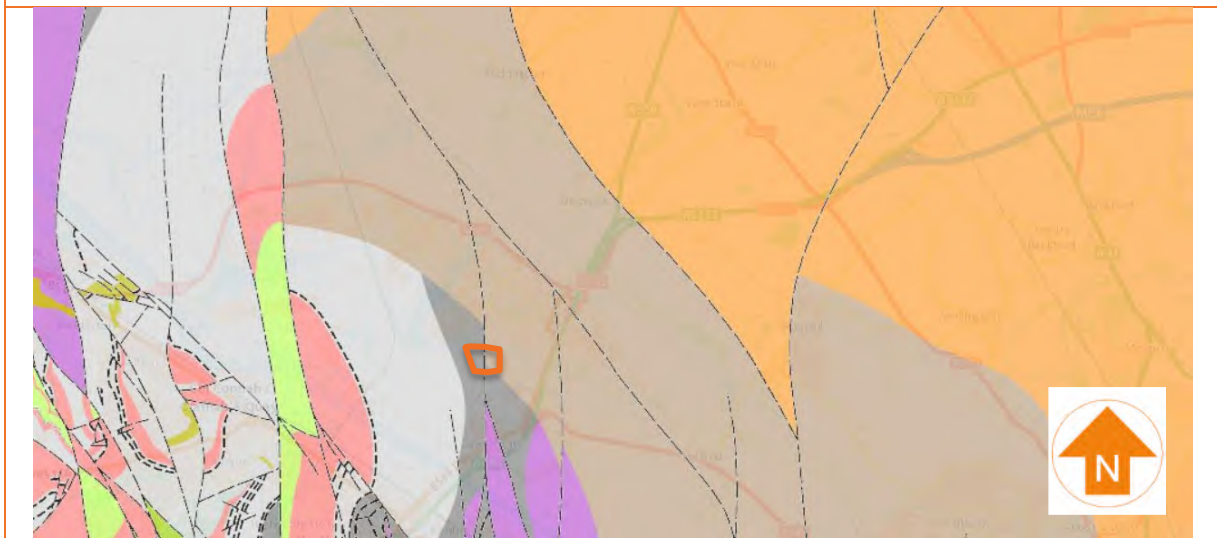


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FIGURE 2.2 EXCERPT BGS SOLID GEOLOGICAL MAP

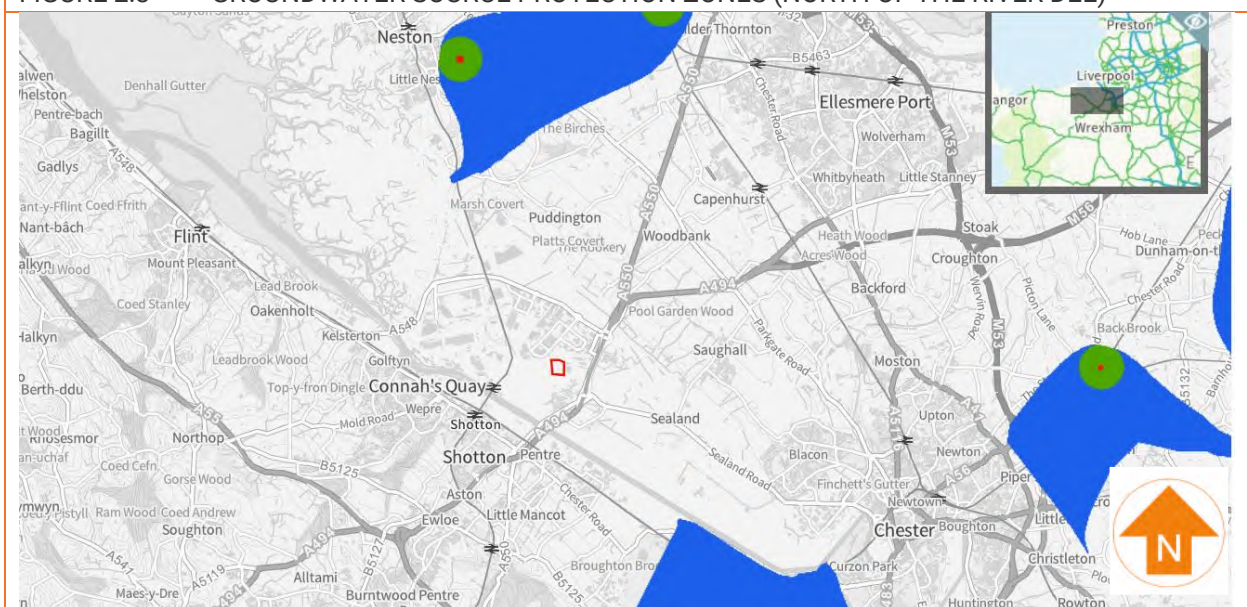


The site does not lie within 500 m of a Natural Resources Wales Groundwater Source Protection Zone (SPZ) or Environment Agency Source Protection Zone. There are no active potable water abstraction licences within 2 km of the site.

Figure 2.3 shows the EA source protection zones within the hydrogeological region of the site. The EA zones are considered to be within the same groundwater catchment as they are located north of the River Dee, as is the subject site. Any zones within the NRW area are not likely to be within the same groundwater catchment area, with the closest SPZ being 19 km from the subject site.

There are four recorded active groundwater abstraction licenses within 2 km of the site. Three of these records relate to licences held for the abstraction of groundwater for 'process water' (these are located 1387 m northeast, 1664 m north and 1806 m northeast of the site). The other record relates to a licence held for the abstraction of groundwater for 'pollution remediation', this is located 1476 m north of the site.

FIGURE 2.3 GROUNDWATER SOURCE PROTECTION ZONES (NORTH OF THE RIVER DEE)



2.2. SITE WATER RESOURCE STATUS

JPG has completed a phase of ground investigation at the site, which comprised trial pits, cable percussion boreholes and Cone Penetrometer Tests. The maximum depth of these investigations was 15.0 m bgl which is significantly in excess of the engineering and dewatering works now being appraised and is therefore considered to be acceptable.

The JPG site investigation findings are summarised below:

2.2.1. MADE GROUND

Made Ground topsoil was encountered to depths of between 0.10 m bgl and 0.30 m bgl. The Made Ground topsoil typically comprised dark brown silty sand with rootlets, plastic was noted in TP206. Also, in TP206 a thin band (0.10 m to 0.35 m) of grey sandy gravel of limestone was encountered.

A variable horizon of dark brown clayey fine to coarse sand topsoil, with frequent rootlets, was encountered across the site between 100-300 mm in thickness.

No visual and olfactory evidence of potential hydrocarbon contamination (i.e. sheens or odours) was encountered during the site investigation.

Chemical testing of soil samples did not record any significantly elevated concentrations when compared with commercial screening values. Additionally, a selected sample of Made Ground was tested on a leachate basis and this did not record any elevated concentrations when compared with controlled water screening levels.

2.2.2. DRIFT DEPOSITS

Natural Tidal Flat Deposits were found to underlie the reworked topsoil and made ground at all exploratory locations. The underlying natural deposits consisted of granular light greyish brown medium dense to dense sand, with frequently disseminated shell fragments. The granular strata were encountered to a maximum depth of 14.45 m bgl.

2.3. SOLID STRATA

Bedrock was not recorded during the JPG ground investigation and E3P has completed a review of available BGS borehole records to try and determine a likely depth to rockhead.

The closest record (SJ36NW4) is located ca. 600 m to the west and extends to a depth of ca. 180 m bgl. Although some distance from the site, it is within the same drift unit (Tidal Flat Deposits) as the subject site. This record indicates that drift strata are to a depth of 51.79 m bgl, and comprise upper horizons of Tidal Flat Deposits with a lower horizon of Boulder Clay (Glacial Till).

2.3.1. FAULTS

There is a fault which runs north to south through the centre of the site. The fault only affects the solid strata. The fault may have some control over regional groundwater flow in so much as this may provide a barrier to groundwater flows between the more permeable Kinnerton Sandstone Formation and less permeable Coal Measures strata. There may be some degree of breccia along the fault line that may provide some perpendicular flow but this is not likely to be dominant



2.3.2. GROUNDWATER

JPG has completed a detailed assessment of groundwater levels at the subject site in order to determine if groundwater is under tidal influence. This was completed due to the site's proximity to the tidal River Dee.

The JPG works comprised the monitoring of four boreholes at 30-minute intervals for 26 days. The data readings from the waterloggers were uploaded into the Solinst Levellogger software (Version 4.6.2), the data was compensated with the barologger data readings and monitored water depth recorded during the ground investigation. The findings are summarised below:

- ☞ The groundwater levels in WS201 varied between 3.383 m AOD (1.29m bgl) and 3.486m AOD (1.19 m bgl), with an average of 3.431 m bgl (1.25 m bgl).
- ☞ The groundwater levels in WS202 varied between 3.371 m AOD (1.3 1m bgl) and 3.496 m AOD (1.18 m bgl), with an average of 3.437m bgl (1.24 m bgl).
- ☞ The groundwater levels in WS203 varied between 3.203m AOD (1.47 m bgl) and 3.32 1m AOD (1.36m bgl), with an average of 3.255m AOD (1.42 m bgl).
- ☞ The groundwater levels in WS204 varied between 3.325 m AOD (1.35 m bgl) and 3.461 m AOD (1.22 m bgl), with an average of 3.384m AOD (1.29 m bgl).
- ☞ Based on all of the recorded levels, groundwater ranges between 3.203 m AOD (1.47 m bgl) and 3.496 m AOD (1.18 m bgl).

JPG then correlated the groundwater monitoring results with tidal flow results as measured at Connah's Quay and concluded that there was no tidal influence at the subject site.

Based on a review of the desk-based information and site investigation data, E3P considers shallow groundwater likely to be separate from deeper groundwater within underlying aquifers. Shallow groundwater within the drift is likely to follow the local topographical gradient and flow south towards adjacent watercourses, particularly in the River Dee. Groundwater flow from drift strata will likely provide some baseflow to watercourses but given the small scale of the site relative to the reach of the watercourses, the contribution from the subject site alone is likely to be limited.

2.4. HYDROLOGY

A review of topographic information indicates that non-designated swales/watercourses are located within 10 m of the northern, eastern and southern boundaries of the site. These swales/watercourses will form part of the proposed development and will be used for the discharge of stormwater flows from the completed development with appropriate pollution control and stormwater attenuation.

The swales/watercourse eventually discharge into Shotwick Brook, which in turn converges with the River Dee.

As indicated above, there are three principal watercourses within the surrounding area and these are detailed below:

- ☞ The River Dee is located 1070 m to the southwest at its closest point. The River Dee is classified as Main River by NRW.
- ☞ Shotwick Brook is located approximately 350 m to the west of the subject site. Shotwick Brook is also classified as Main River by NRW.
- ☞ Garden City Drain West is located approximately 260m to the southeast of the subject site.



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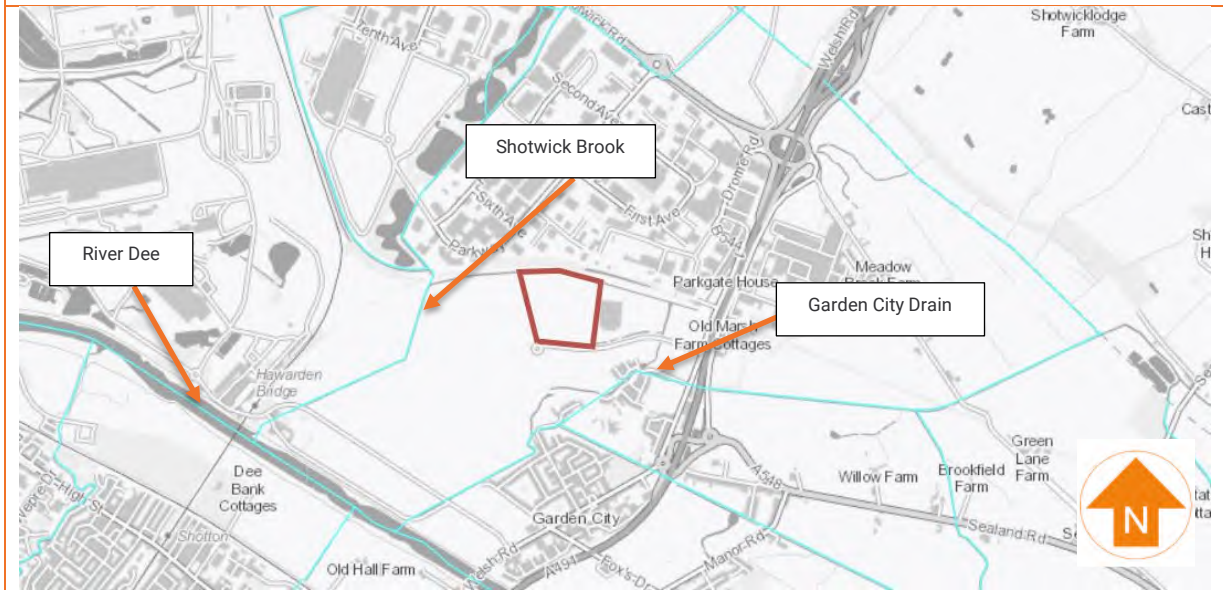
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Garden City Drain is also classified as a Main River by NRW.

These watercourses are shown in Figure 2.4.

FIGURE 2.4 NRW MAIN RIVER MAP



There is one recorded active discharge consent to surface water within 500 m of the site. This is located 250 m to the south of the site and relates to 'Trade Discharges-Site Drainage' to the River Dee.

There are no recorded active surface water abstractions within 2 km of the site. There are no records of active pollutant releases to surface water (red list) within 500 m of the site.

There are no records of pollutant releases to the public sewer within 500 m of the site. The annual risk of flooding from the rivers and the sea (RoFRaS) is low (less than 1 in 100, but greater than or equal to 1 in 1000).



3. CONCEPTUAL HYDROGEOLOGICAL MODEL

3.1. INTRODUCTION

When considering the conceptual hydrogeological model it is necessary to put the site's environmental setting within the context of the proposed construction and dewatering.

The water features that are considered susceptible to flow impacts are:

- ✿ Secondary undifferentiated aquifer - Tidal Flat Deposits.
- ✿ Base flow to Shotwick Brook and Garden City Drain.

The generic construction and dewatering works are discussed below.

Detailed design drawings showing all the construction activities are available from the contractor.

Construction Works

Construction of the proposed commercial unit requires the entire site to be raised by approximately 1.00 m above existing site levels. The construction of the main building will then require a series of excavations for the formation of different sizes of foundation pads and the formation of manhole chambers associated with the drainage.

Marshalls has completed an assessment of the likely depths of these excavations from the finished floor level against the average depths of groundwater in the drift as assessed by JPG. These assessments are presented within drawings:

- ✿ MCWY Drawing Ground Water Comments Nr.1 14-03-2023;
- ✿ MCWY Drawing Ground Water Comments Nr.2 14-03-2023;
- ✿ MCWY Drawing Ground Water Comments Nr.3 14-03-2023;

These assessments indicate that excavations will vary from approximately 804 mm **above** groundwater to 664 mm **below** groundwater. However, it should be noted that groundwater levels can vary significantly depending on the season with the site recorded as being in an area at high risk of groundwater flooding as shown in Figure 3.1.

Given the variability of groundwater and likely seasonal fluctuation, it is not possible to calculate the total volume of water to be abstracted as there will not be a requirement to pump water consistently through the excavation works.

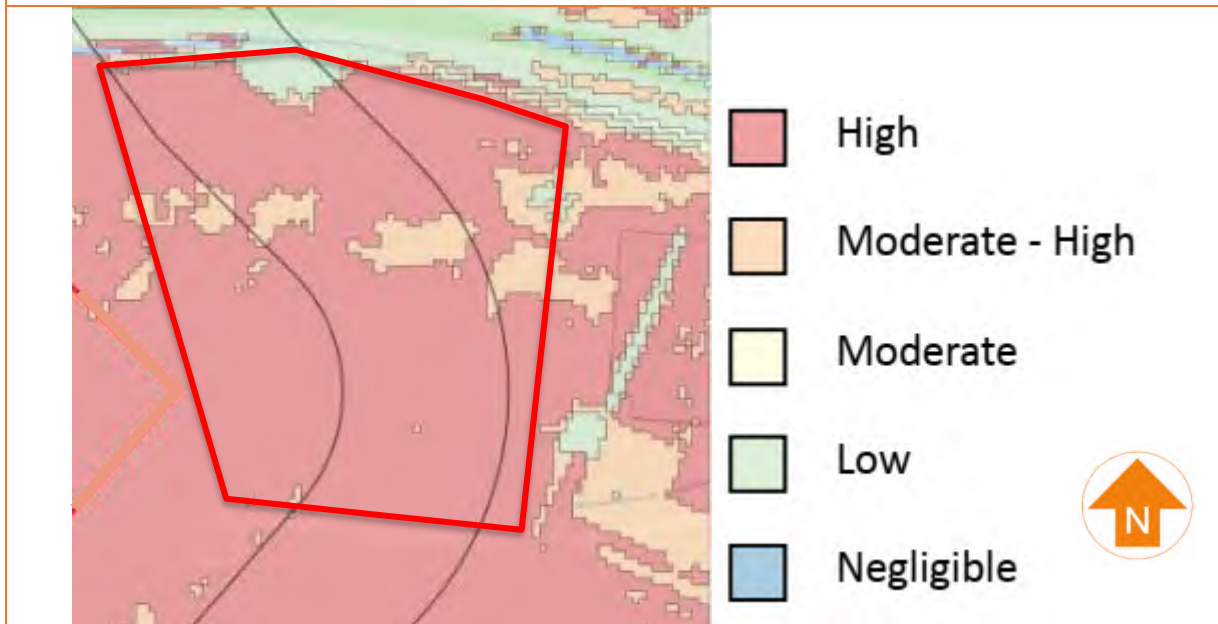


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FIGURE 2.4 GROUNDWATER FLOODING MAP



To successfully ensure that the foundation pads, floor slab and manholes can be engineered, it is envisaged that local dewatering ahead of excavation will be required where excavations are sub-groundwater table.

Detailed method statements have not yet been provided but Risk Assessment Method Statements from Dewatering Services Ltd indicate that up to 6 m deep wells will be drilled around the excavation area by water jetting. Only clean water will be used for this process. The void will be backfilled with piezometric tubing that is fitted with a geotextile membrane to ensure that silt is not abstracted with the water.

The pump connected to the wells will be operated at all times by a representative of Dewatering Services Ltd to ensure that the excavation remains dry and that water is not over-abstracted so that this does not cause instability within adjacent areas of the development.

Assessment of Drawdown Impacts

Abstracting groundwater will create a temporary cone of depression and based on the assessment of depths to groundwater and depths of excavation it is determined that groundwater will need to be lowered by approximately 1–2 m below the existing groundwater level at the work area. The effects of low-level pumping will not create cones of depression that extend beyond the site boundary.

Drawdown from localised pumping is also not considered likely to affect flow as the Tidal Flats aquifer has a significant thickness allowing flows beneath the influence of the drawdown. Furthermore, the aquifer covers an extensive geographic area (as can be seen in Figure 2.1) allowing flows to continue laterally around the works area.

Once construction works are completed the pumps will be switched off and groundwater levels will return to their previous level, and as such there will not be any significant long-term net drawdown impacts.

Assessment of Flow Path Impact

Abstracted water will be pumped to one of four temporary settlement lagoons on site and these will be further pumped via a silt mitigation system to the adjacent swale/watercourses. These activities have been agreed upon with the NRW and will be subject to an environmental permit, and a Construction



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Surface Water Management Plan will be prepared to detail all aspects of managing discharges during the construction phase.

The location of the temporary lagoons and outline programme of engineering works are presented in JPG drawing 4671-JPG-PB-ZZ-DR-D-1400-S4-P04 dated 06-02-23.

Given that the underlying saturated drift aquifer is likely to be in the region of 50 m thick, a temporary localised reduction in hydraulic head of ca. 1.0 m is not likely to significantly affect groundwater flows or baseflow to local watercourses. Notwithstanding, given that all water abstracted from the site will be directed to the existing surface water system no loss in surface water flow is anticipated in the short term, with longer-term levels returning to normal following work completion.

Assessment of Water Quality Impacts

The abstracted groundwater will comprise only clean water from natural strata, although silt has been considered within the proposal for managing construction water as outlined below.

Silt will be mitigated through three stages:

1. The abstraction wells will be constructed with geotextile membranes to prevent silt ingress at the point of abstraction;
2. Water will be held in one of four settlement lagoons;
3. Water from the settlement lagoons will be pumped via silt mitigation to the adjacent swales/watercourses. This aspect will be subject to a detailed Construction Surface Water Management Plan.

A Conceptual Site Model drawing is presented as Figure 3.1.



4. SUMMARY AND CONCLUSIONS

Marshalls are undertaking a redevelopment of Plot B, the Airfields, Deeside. As part of the redevelopment, it will be necessary to undertake engineering works to form the proposed commercial unit foundations, floor slab and drainage network.

These engineering works include the requirement to form varying depth excavations across the whole site and it has been shown through site investigation that there is a shallow and variable groundwater level across the site which is likely to be intercepted during the engineering works.

Forming excavations for subsequent engineering works will necessitate the absence of groundwater and as such a plan has been developed that will include the installation of point wells to lower the water table to facilitate short-term engineering works.

The flow and drawdown effects associated with the works will be limited and temporary when considered on a local and regional scale with groundwater levels returned to existing once the works are completed.

E3P has completed a Hydrogeological Impact Appraisal and the findings are summarised below:

HIA STEPS	CONCLUSION
Establish the regional water resource status.	<ul style="list-style-type: none">▪ The drift strata are classified as a secondary undifferentiated aquifer.▪ The solid strata comprise a secondary A aquifer in the west and a principal aquifer in the east.▪ The site is not within a groundwater source protection and there are no potable groundwater abstractions within 1 km of the site.▪ There are three Main Rivers that are located in proximity to the site: Shotwick Brook, Garden City Drain and River Dee.
Identify all potential water features that are susceptible to flow impacts.	<ul style="list-style-type: none">▪ The underlying secondary undifferentiated aquifer.▪ Shotwick Brook.▪ Garden City Drain.▪ The River Dee is a significant watercourse that is under tidal influence. This is not considered to be susceptible to flow impacts.
Apportion the likely flow impacts to the water features.	<ul style="list-style-type: none">▪ Localised short-term pumping is unlikely to significantly impact flows within the secondary undifferentiated aquifer as this feature has a saturated thickness of ca.50m and covers a wide geographical area.▪ All water that is abstracted will be directly returned to adjacent watercourses ensuring that there is no net loss allowing for any minor, temporary reduction in base flow to Shotwick Brook or Garden City Drain.
Allow for the mitigating effects of any discharges, to arrive at net flow impacts.	<ul style="list-style-type: none">▪ There are not considered to be any effects therefore additional mitigation of net flow impacts is not considered necessary.



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HIA STEPS	CONCLUSION
Define the search area for drawdown impacts.	<ul style="list-style-type: none">▪ Pumping will be from the shallow aquifer only and only on a localised and temporary basis. Significant drawdown is not anticipated to be a factor in the interception of regional groundwater flows or changing the current hydrogeological regime.▪ Once the works are completed groundwater will return to its natural level.
Identify all features in the search area that could be impacted by drawdown. For all these features, predict the likely drawdown impacts	<ul style="list-style-type: none">▪ None identified.
Allow for the effects of measures taken to mitigate the drawdown impacts.	<ul style="list-style-type: none">▪ None identified.
Assess the significance of the net drawdown impacts.	<ul style="list-style-type: none">▪ None identified.
Assess the water quality impacts.	<ul style="list-style-type: none">▪ All water abstracted will be subject to treatment to remove silt in accordance with an agreed Construction Surface Water Management Plan (CSWMP). Discharge rates to watercourses will be to agreed permitted limited).
Develop a conceptual model for the abstraction and the surrounding area.	<ul style="list-style-type: none">▪ A CSM has been prepared.
If necessary, redesign the mitigation measures to minimise the impacts.	<ul style="list-style-type: none">▪ None Identified.
Develop a monitoring strategy	<ul style="list-style-type: none">▪ CSWP will detail what management steps are required concerning the discharge of any water from the site.

END OF REPORT



APPENDIX I LIMITATIONS

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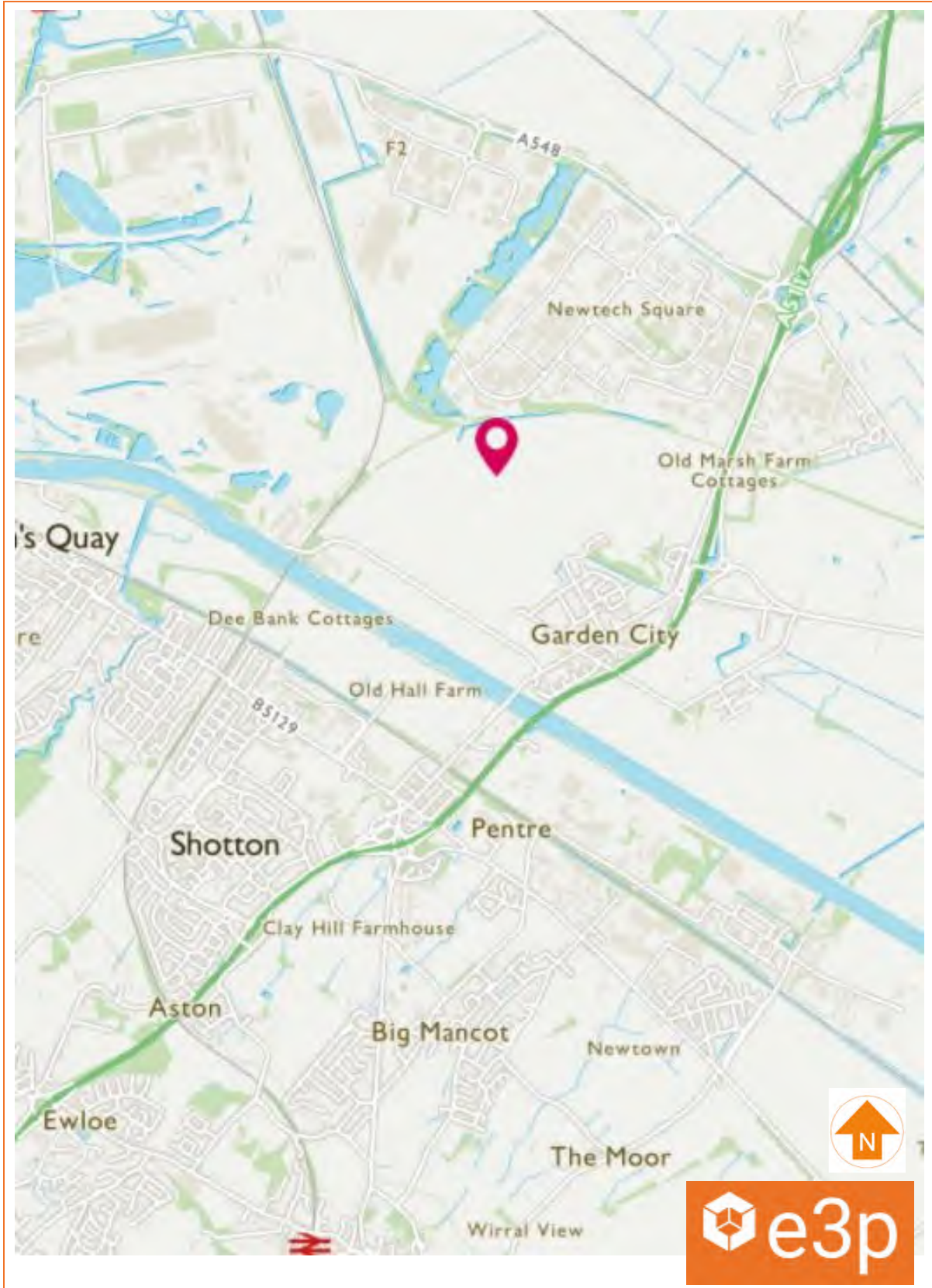
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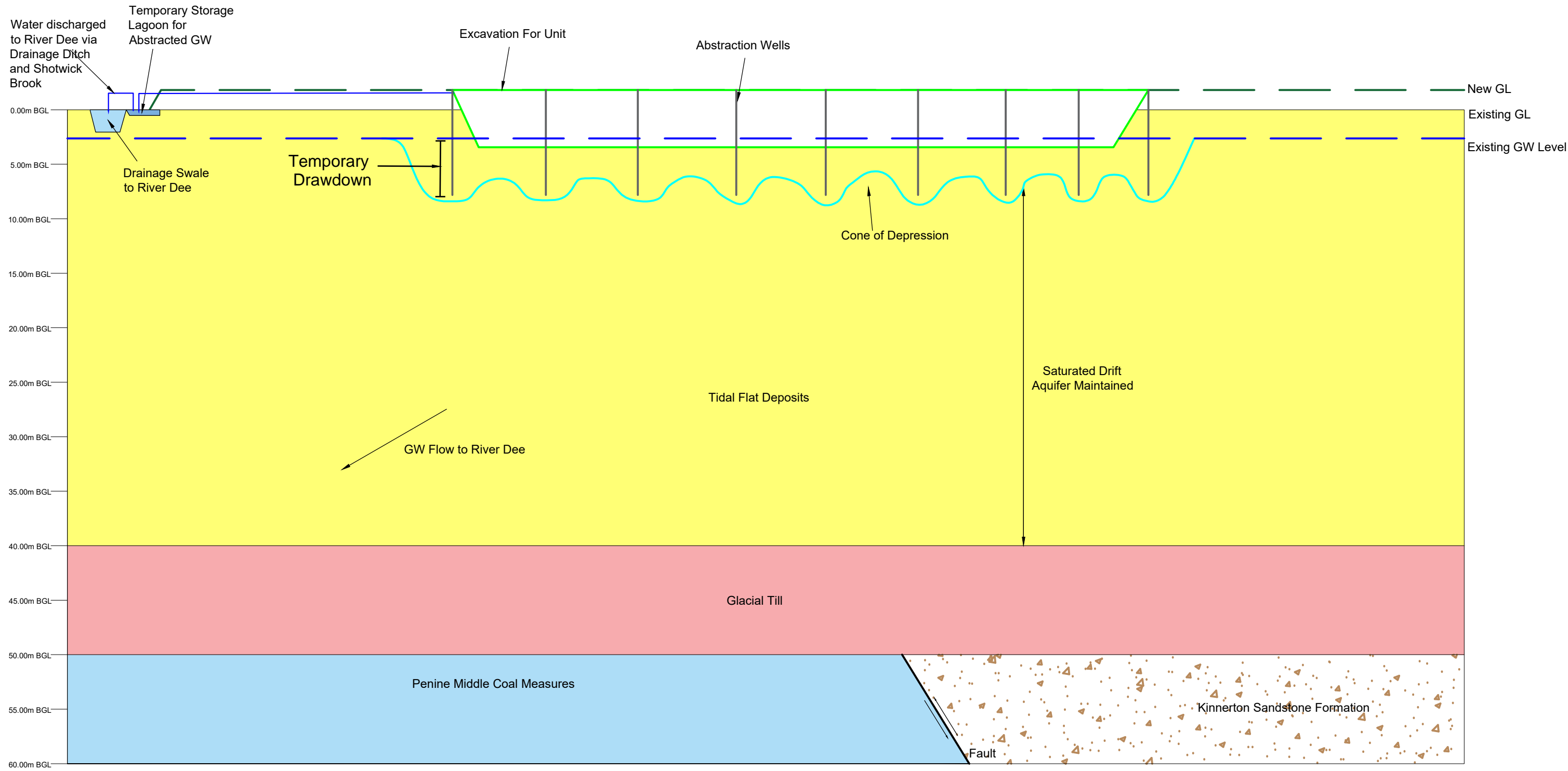
1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.3.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily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



APPENDIX II SUPPORTING INFORMATION

DRAWING 16-886-001 – SITE LOCATION PLAN





Geology Key

	Tidal Flat Deposits
	Glacial Till
	Pennine Middle Coal measures
	Kinnerton Sandstone Formation

Notes:

P1	REVD	19.10.2023	OW	AE	AE
P1	REVC	19.10.2023	EB	AE	AE
P1	REVB	18.10.2023	EB	AE	AE
P1	REVA	17.10.2023	EB	AE	AE
Phase	Issue	Date	Drawn	Checked	PM

Client:
Marshall

Job No:
16-886

Drawing No:
010

Date:
19.10.2023

Scale:
NTS@ A3



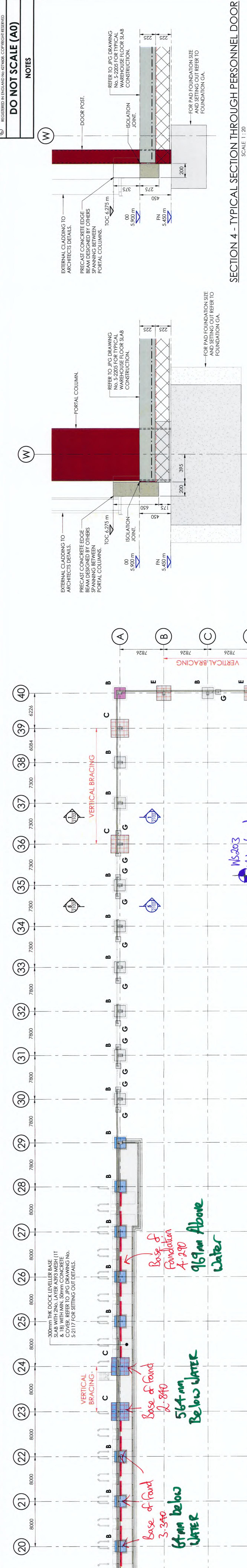
Environmental Engineering Partnership Ltd
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Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

P1	REVD	19.10.2023	OW	AE	AE
P1	REVC	19.10.2023	EB	AE	AE
P1	REVB	18.10.2023	EB	AE	AE
P1	REVA	17.10.2023	EB	AE	AE
Phase	Issue	Date	Drawn	Checked	PM

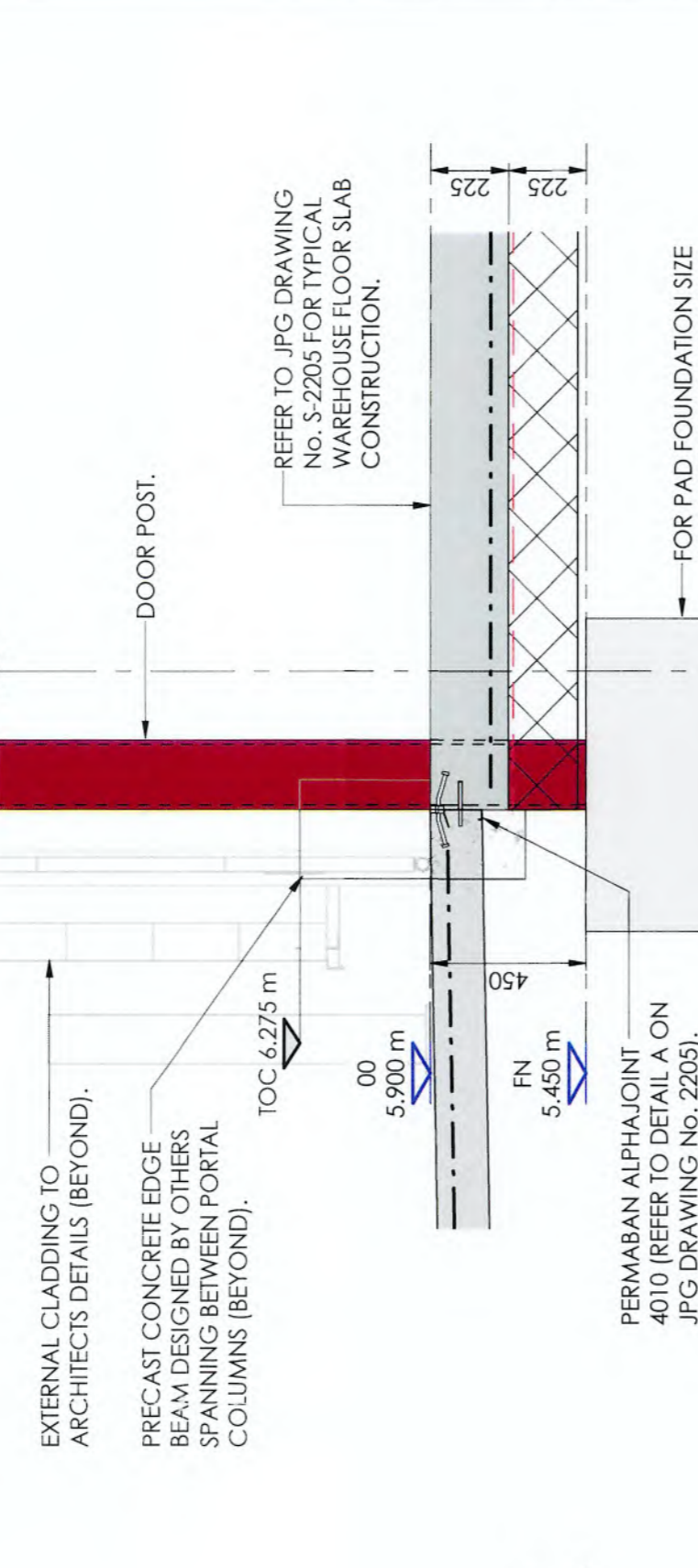
Job Title:
Plot B - Airfields, Deeside

Drawing Title:
Hydrogeological Appraisal
Conceptual Site Model

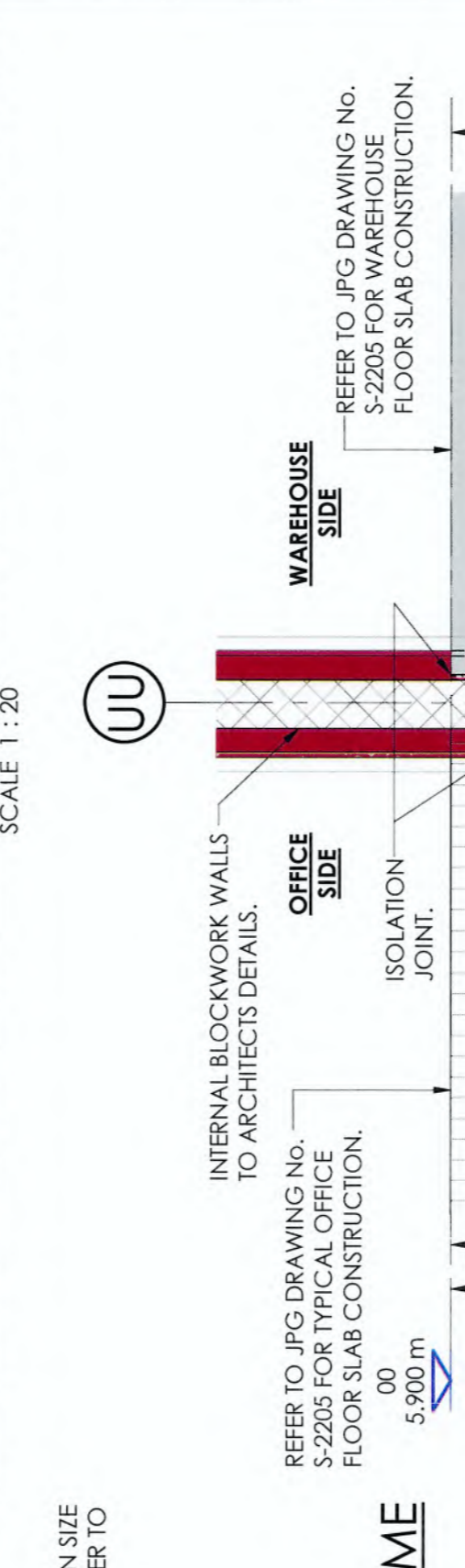
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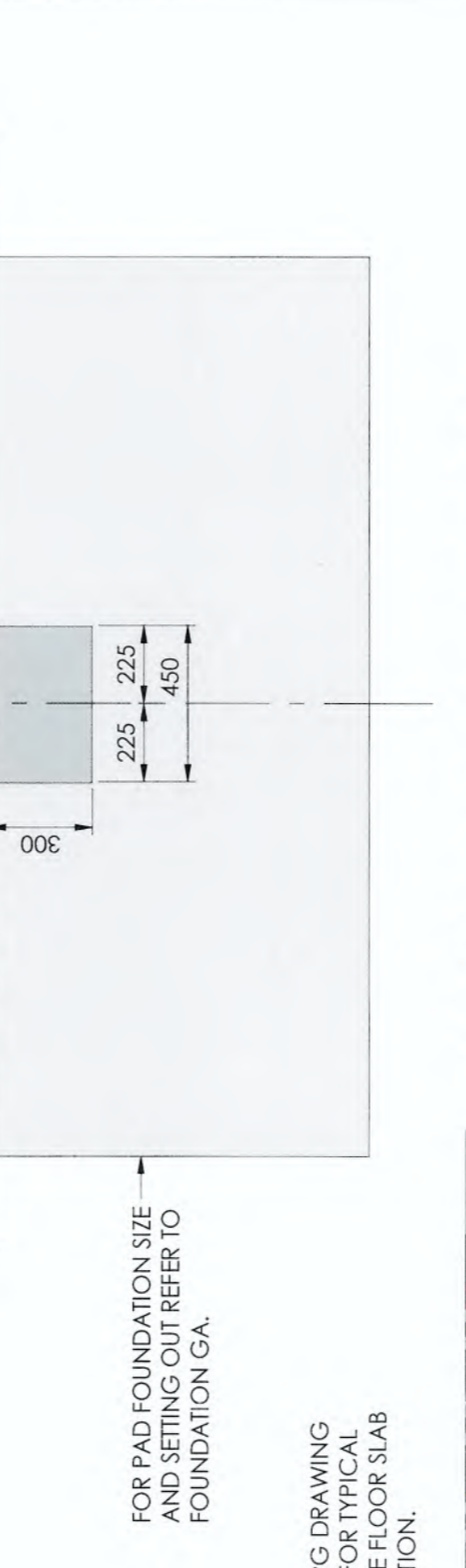
SECTION 1 - TYPICAL SECTION BETWEEN PERIMETER PORTAL FRAME
 SCALE 1:20



SECTION 2 - TYPICAL SECTION BETWEEN PERIMETER GABLE FRAME
 SCALE 1:20



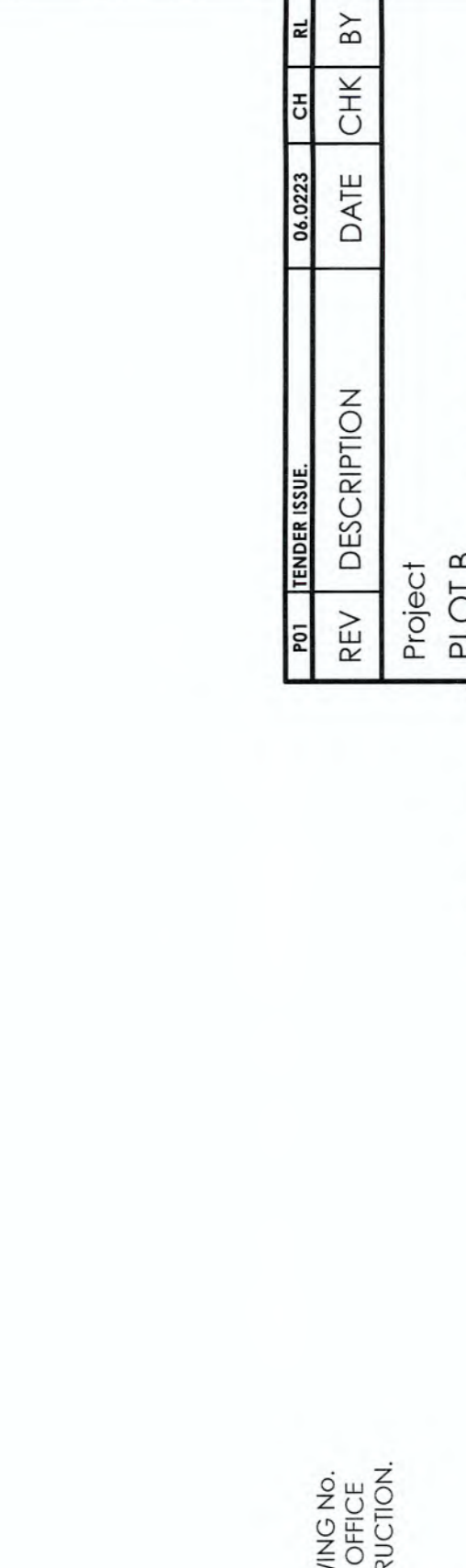
SECTION 3 - TYPICAL INTERNAL COLUMN
 SCALE 1:20



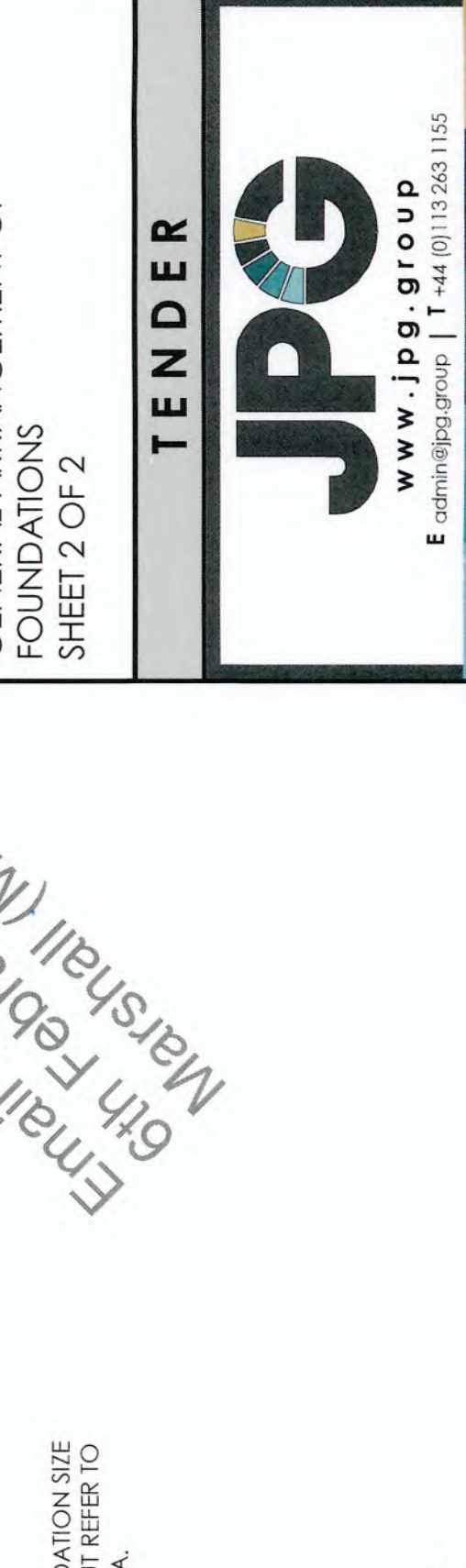
SECTION 4 - TYPICAL SECTION THROUGH PERSONNEL DOOR
 SCALE 1:20



SECTION 5 - TYPICAL SECTION THROUGH LEVEL ACCESS DOORS
 SCALE 1:20



SECTION 6 - TYPICAL SECTION THROUGH OFFICE FLOOR
 SCALE 1:20



SECTION 7 - TYPICAL SECTION BETWEEN WAREHOUSE AND OFFICE FLOOR
 SCALE 1:20



DO NOT SCALE (A1)

NOTES

- FOUNDATION NOTES**
- ALL CONCRETE (inc. BLINDING AND MASS FILL) TO BE GRADE C28/35 USING 20mm AGGREGATE.
Min. CEMENT CONTENT = 340 kg/m³
Max. WATER/CEMENT RATIO = 0.5
CEMENT TYPE = CAM 1
MIX CLASS = CLASS DC-2
 - CONCRETE COVER TO REINFORCEMENT TO BE 50mm (SEE NOTE 3).
 - WHERE FOUNDATIONS ARE CAST DIRECTLY AGAINST THE SIDE OF AN EXCAVATION, COVER TO REINFORCEMENT TO BE INCREASED TO 75mm.
 - ALL BOLT TUBES TO BE REMOVED AFTER THE INITIAL SET OF CONCRETE. BOLTS ARE TO BE FREE TO MOVE 75mm AT TOP OF NUTS. THREADS TO HAVE ADEQUATE PROTECTION AND BE FREE RUNNING.
 - BOLT BOXES/STEELWORK BASE PLATES TO BE GROUTED UP ON COMPLETION OF LINE AND LEVELLING USING NON SHRINK GROUT.
 - ALL STRUCTURAL STEELWORK TO BE PROVIDED WITH A Min. 100mm CONCRETE SURROUND OR 100 MASONRY PLUS 50mm CONCRETE CASING BELOW GROUND LEVEL TO SUIT ARCHITECTS DETAILS.
 - BLOCKS BELOW GROUND TO BE 10.5 N/m³ (SOLID) AND BE CLASSED AS SUITABLE FOR USE BELOW GROUND, AND BE RESISTANT TO CLASS 2 CONDITIONS. NO BLOCK IS TO EXCEED A WEIGHT OF 20kg. REFER TO RELEVANT HSE DOCUMENTATION FOR GUIDANCE.
 - MORTAR TO BLOCKS BELOW GROUND TO BE 1:3 (CEM 1 : SAND).
 - FOUNDATION BEARINGS**
ALL FOUNDATION BEARINGS SHALL BE SMOOTH AND LEVEL, FREE FROM IRREGULARITY (i.e. BUCKET MARKS), WHERE PRACTICAL FOUNDATION BEARINGS SHALL BE FINISHED OFF BY HAND, OR OTHERWISE BY SMOOTH BUCKET.
 - FOUNDATION TOP SURFACE**
TOPS OF ALL FOUNDATIONS ARE TO BE TROWELLED LEVEL AND SPRAY CURED WITH 'SIKA PROSEAL W' CURING AGENT TO BE APPLIED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
 - FOUNDATION CONSTRUCTION JOINTS**
ALL CONSTRUCTION JOINTS (STOP ENDS) SHALL BE SCABBLED BACK TO CLEAN FACE FREE OF SURFACE LATENCE AND SHALL BE WETTED IMMEDIATELY PRIOR TO PLACING CONCRETE.

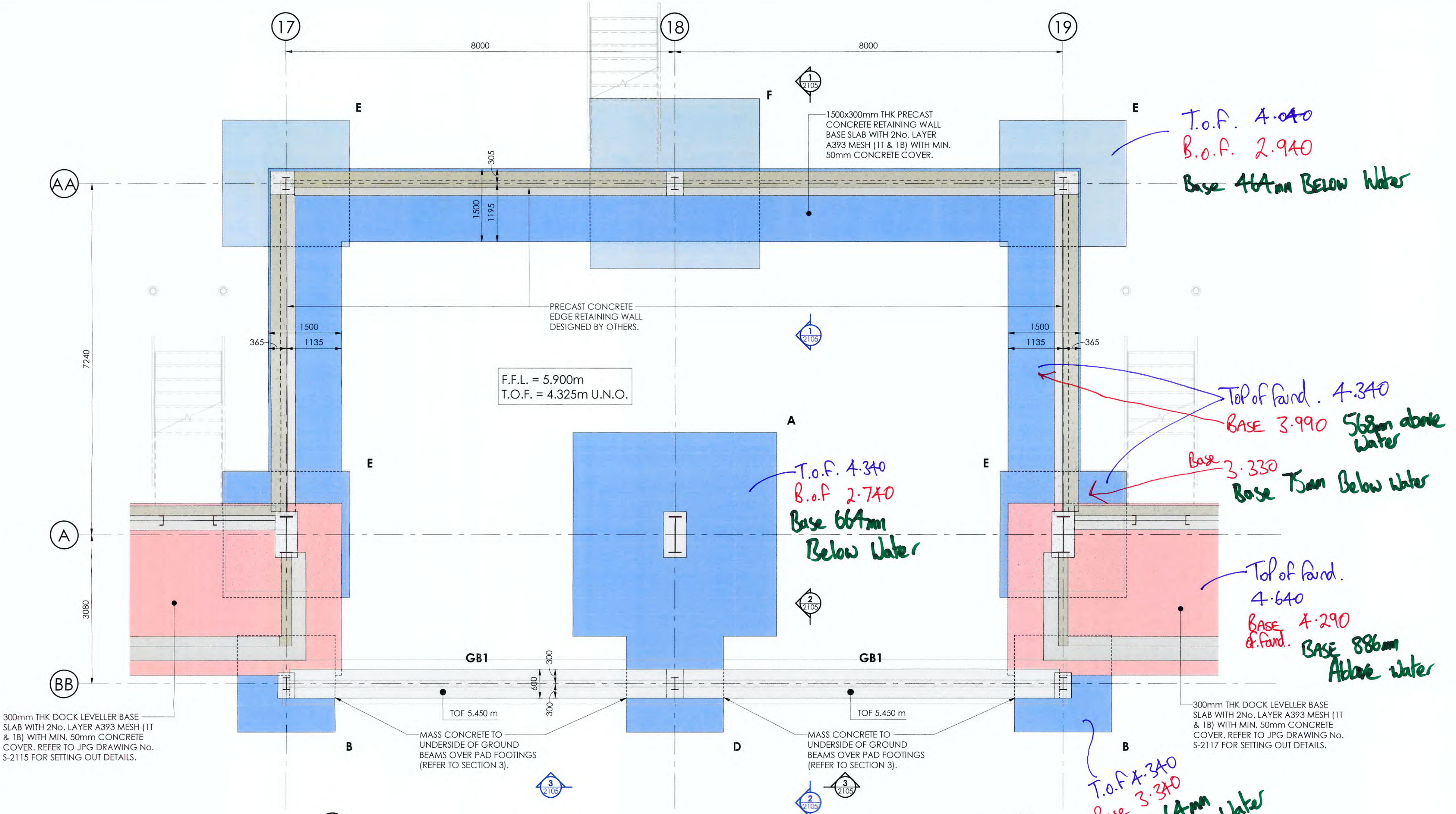
NOTE:
SETTING OUT, DIMENSIONS AND LEVELS TO BE CONFIRMED BY THE ARCHITECTS.

NOTE:
ALL FOUNDATION SIZES SUBJECT TO FINAL LOADS TBC BY THE STEELWORK SUB-CONTRACTOR.

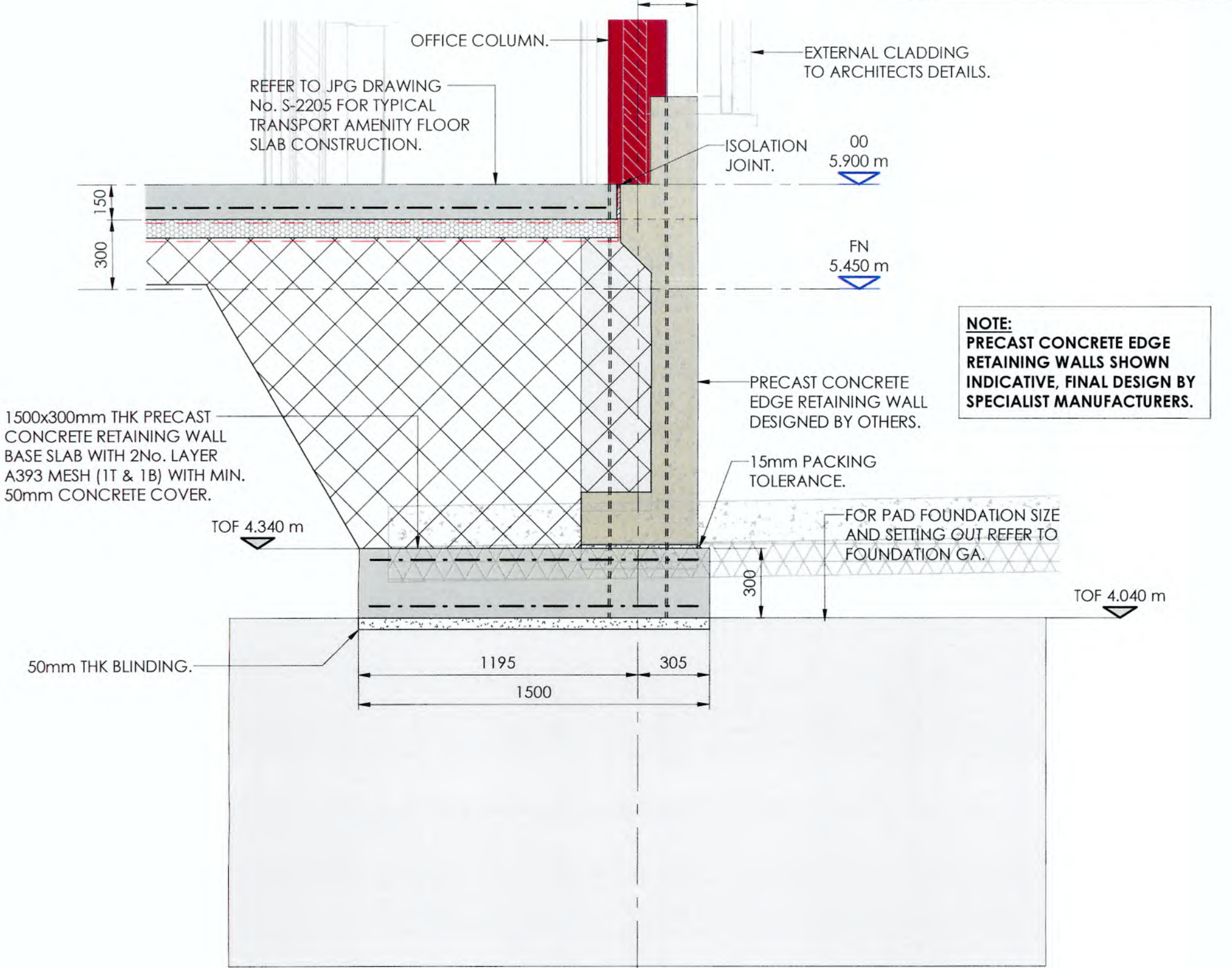
NOTE:
ALL FOUNDATIONS TO BE CENTRAL TO COLUMN LOCATION U.N.O. FOR SETTING OUT OF COLUMNS REFER TO JPG DRAWING No. S-2301.

FOUNDATION TOF LEGEND:

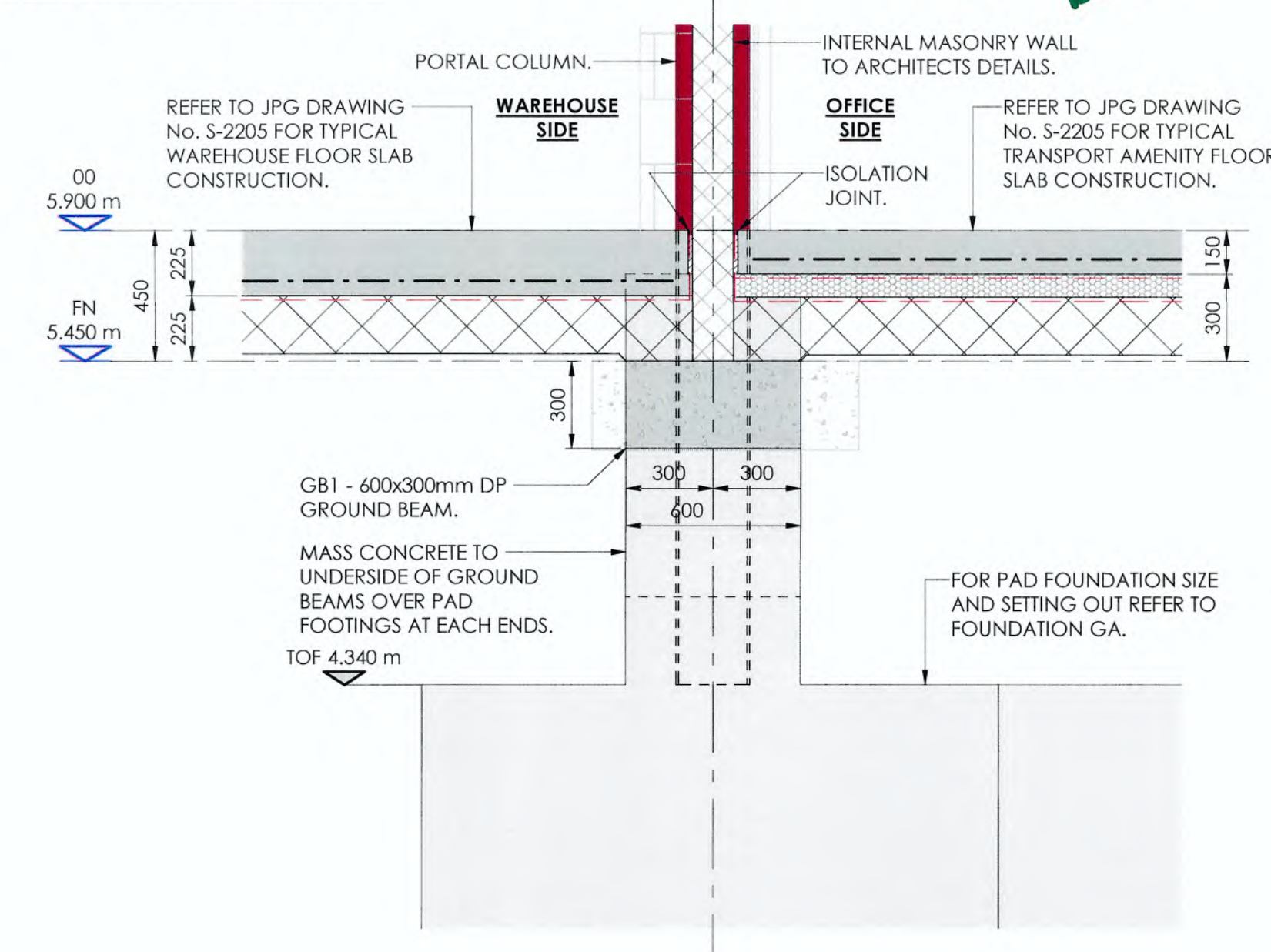
- TOP OF FOUNDATION = F.F.L. - 450mm
 - TOP OF FOUNDATION = F.F.L. - 450mm
 - TOP OF FOUNDATION = F.F.L. - 375mm
 - TOP OF FOUNDATION = F.F.L. - 675mm
 - TOP OF FOUNDATION = F.F.L. - 900mm
 - TOP OF FOUNDATION = F.F.L. - 1325mm
 - TOP OF FOUNDATION = F.F.L. - 1260mm
 - TOP OF FOUNDATION = F.F.L. - 1560mm
 - TOP OF FOUNDATION = F.F.L. - 1760mm
 - TOP OF FOUNDATION = F.F.L. - 1860mm
- ALL PAD FOOTINGS AND GROUND BEAMS TO BE -450mm FROM F.F.L. U.N.O.



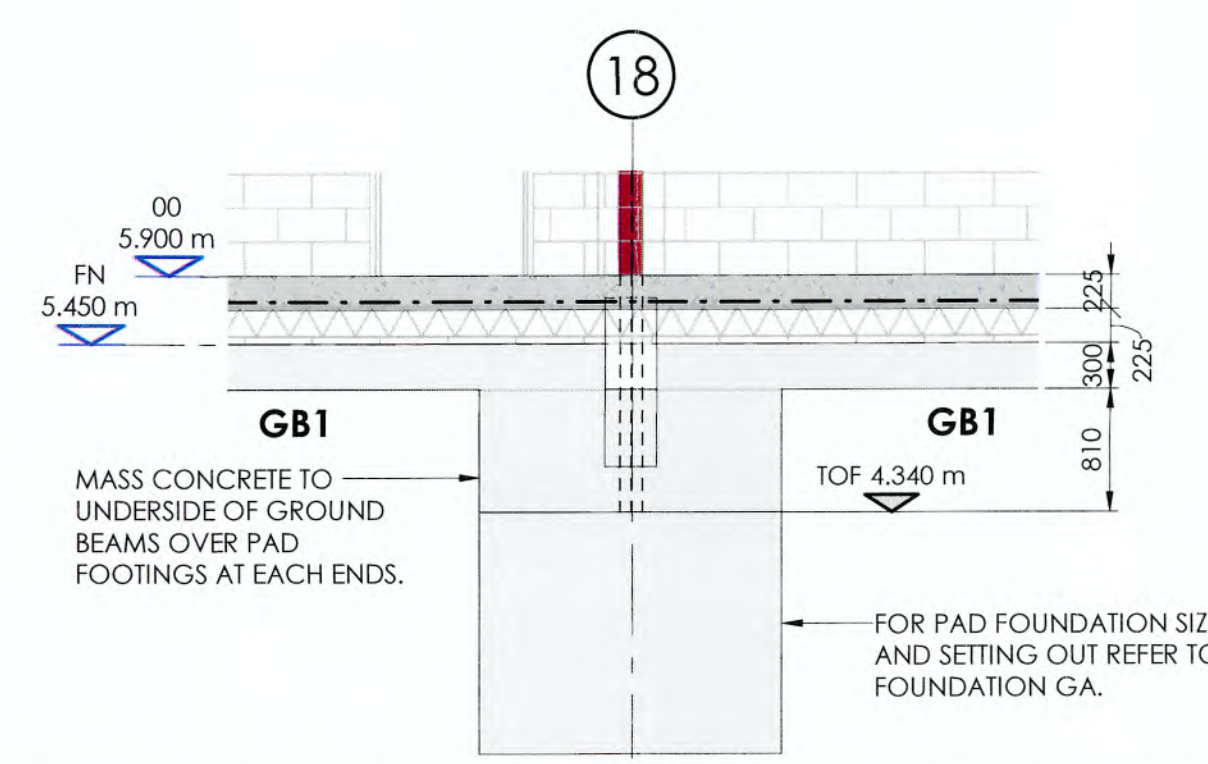
NORTH TRANSPORT AMENITY FOUNDATION LAYOUT
SCALE 1 : 50



SECTION 1 - TYPICAL PERIMETER SECTION
SCALE 1 : 20



SECTION 2 - TYPICAL SECTION BETWEEN WAREHOUSE AND TRANSPORT OFFICE
SCALE 1 : 20



SECTION 3 - TYPICAL GROUND BEAM STEP DETAIL
SCALE 1 : 50

SCHEDULE - PAD FOUNDATIONS

REF.	LENGTH	WIDTH	DEPTH	No.	VOLUME
A	4200	4200	1600	86	28.22 m ³
B	2000	2000	1000	85	4.00 m ³
C	3200	3200	1500	15	15.36 m ³
D	2000	2000	1600	2	6.40 m ³
E	2600	2600	1100	28	7.44 m ³
F	3500	3500	1500	8	18.38 m ³
G	900	900	500	39	0.41 m ³
H	2650	2950	300	1	2.34 m ³
J	1400	600	300	2	0.25 m ³

SCHEDULE - GROUND BEAM

REF.	H (mm)	W (mm)	REINFORCEMENT
GB 1	300	600	
GB 2	300	450	

REV	DESCRIPTION	DATE	CHK	BY
P01	TENDER ISSUE	06.02.23	CH	RL

Project
PLOT B
THE AIRFIELDS, DEESIDE
New Ground Water Comment
14/3/23

Drawing Title
GENERAL ARRANGEMENT OF FOUNDATIONS TO TRANSPORT OFFICE NORTH

TENDER

JPG
www.jpg.group
E admin@jpg.group | T +44 (0)113 263 1155

4671-JPG-PB-FN-DR-S-2105 | S4 | P01

Email Received
6th February 2023
Marshall (MCWY) Ltd



THE INSTITUTE OF GEOLOGICAL SCIENCES
RECORD OF SHAFT, BOREHOLE OR SECTION

NAME OF SECTION SEALAND EXPLORATION COMPANY No 2 BOREHOLE	REGISTRATION NUMBER SJ 36 NW 4
Exact site - at an angle of the road to the south of Sealand Bank Farm (formerly Cripps an old Series Map), Skilton.	NATIONAL GRID REFERENCE SJ 366 6973
Information taken from First Memoir 1890, Supplement, p. 4.	SURFACE OR STARTING LEVEL 199.98m A.O.D.
	1:50 000 MAP CONFIDENTIALITY 105

LITHOLOGICAL CLASSIFICATION REF.	DESCRIPTION OF STRATA	THICKNESS STRATA (m)	REDUCED LEVEL (m A.O.D.)	DEPTH (m)	SCALE
	Shale	0.24	199.74	0.24	
	Shale with sandstone	1.82	197.92	1.82	
	Shale with sandstone	0.52	197.40	1.34	
	Shale	1.18	196.22	2.52	
	Shale with sandstone	1.09	195.13	3.61	
	Red sandstone	1.43	193.70	5.04	
	Shale	6.25	190.45	11.29	
	Shale with sandstone	6.70	183.75	17.99	
	Shale with sandstone and fossils in lower part	2.25	181.50	20.24	
	Shale with sandstone	3.75	177.75	24.00	
	Shale with sandstone	1.85	175.90	25.85	
	Red sandstone	2.01	173.89	27.86	
	Shale	0.15	173.74	28.01	
	Shale with sandstone	1.32	172.42	29.33	
	Shale with sandstone	0.95	171.47	30.28	
	Shale with sandstone	1.51	170.96	31.79	
	Shale with sandstone	0.80	170.16	32.59	
	Shale with sandstone	0.10	169.96	32.69	
	Shale with sandstone	5.13	164.83	37.82	
	Shale with sandstone	1.24	163.59	39.06	
	Shale with sandstone	0.85	162.74	39.91	
	Shale with sandstone	2.55	160.19	42.46	
	Shale with sandstone	5.25	154.94	47.71	
	Shale with sandstone	23.63	131.31	71.34	
	Shale with sandstone and fossils	1.23	129.08	72.57	
	Shale	0.11	128.97	72.68	
	Shale with sandstone	0.81	128.16	73.49	
	Shale	0.74	127.42	74.23	
	Shale with sandstone	11.36	116.06	85.59	
	Coal	1.37	114.69	86.96	
	Coal	2.51	112.18	89.47	
	Coal	0.74	111.44	90.21	
	Shale	3.90	107.54	94.11	
	Coal	1.30	106.24	95.41	
	Shale	0.37	105.87	95.78	



3186 6973 11
SJ 36 NW 408
RECORD OF WELL (SHAFT OR BORE)

At Sealand Exploration Company No. 2 Bore N.S. 408
Town or Village Shotton County Flint O.S. 105E
Six-inch quarter sheet 105E
Grid Ref. 105E 4.

Exact site At an angle of the seabank 700 yds. N.W. of Sealand Bank Farm (Griffin's or series map) (A rough sketch-map or a tracing from a map is very desirable)

Level of ground surface above sea-level (O.D.) c. 20 ft. If well starts below ground surface, state how far _____ ft.
Shaft _____ ft., diameter _____ ft. Bore 590 ft. Diameter of bore: at top _____ ins.; at bottom _____ ins.

Details of permanent lining tubes (internal diameters preferred) (mineral bore)

Water struck at depths of (feet) _____

Rest-level of water ^{below} top of well _____ feet. Suction at _____ feet. Yield on _____ hours' test
_{above} _____ 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 1891

Information from Flint Memoir 1890. Supplement. page 4.

GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	m.	THICKNESS		DEPTH	
			Feet.	Inches.	Feet.	Inches.
Estuarine	Sea sand	5.24	50	-	50	- 15.24
	Sand and gravel	1.07	3	6	53	6 11.31
	Blue clay	0.30	1	-	54	6 16.61
	Boulder clay with cobbles	1.57	5	2	59	8 18.19
	Stiff brown boulder clay	11.89	39	-	70	8 29.98
Glacial	Sand	0.91	3	-	101	8 30.89
	Boulder clay with cobbles	1.07	3	6	105	2 29.96
	Red sand	1.63	5	4	110	6 30.59
	Boulder clay	6.25	20	6	116	3 37.03
	Fine red sand and gravel	2.90	9	6	140	6 34.93
	Stiff brown boulder clay, with cobbles in lower part	3.11	10	3	148	4 41.22
	Sand and gravel	1.45	4	9	158	7 45.44
	Stiff brown boulder clay	2.01	6	7	163	4 46.89
	Red sandstone	17.30	56	9	169	11 48.84
	Fireclay and shale	0.43	1	5	226	8 66.19
Coal	0.15	1	5	228	1 66.62	
Sandstone	1.37	4	6	228	7 66.78	
Coal	1.18	5	6	233	1 68.5	
Shale and fireclay	0.30	1	-	238	7 69.82	
Coal	0.05	2	-	239	7 70.13	
Sandstone-band	0.10	2	-	239	9 70.8	
Coal	0.10	4	-	240	1 70.28	
Stone-band	0.05	2	-	240	3 70.33	
Coal	0.61	2	-	242	3 70.94	
Fireclay and shale	5.13	16	10	242	1 76.07	
Coal	0.05	2	-	259	3 76.12	
Fireclay and sandy shale	17.88	58	8	259	11 76.01	
Limestone (?)	0.01	2	-	317	11 74.4	
Shale and fireclay	7.49	24	7	319	6 76.11	
Middle Coal Measures	Dark grey limestone (?)	0.23	9	-	344	6 76.11

(Contd...)

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)
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(P11815) W1.29057/0.369 10,000 9/39
A. & B.W. Ltd. Gp. 686



(*11932) W6.30370/0370 10,000 9/39 A.& E.W.Ltd. Cp.685

SJ 36 NW 4
6" Quarter Sheet

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

Country:

GEOLOGICAL CLASSIFICATION	DESCRIPTION	THICKNESS			DEPTH			
		m.			m.			
					105.24	105.24	345	3
	Fireclay and shale	3.58	11	9	105.92	105.92	357	-
	Cannel coal	0.46	1	6	106.37	106.37	358	6
	Fireclay and sandy shale	23.67	77	-	129.84	129.84	435	6
	Shale with ironstone and fireclay	1.37	4	6	131.22	131.22	440	-
	Coal	0.91	3	-	132.13	132.13	443	-
	Shale and fireclay	11.61	54	6	143.74	143.74	497	6
	Coal	6.91	3	-	149.66	149.66	500	6
	Shale and fireclay	12.34	40	6	162.00	162.00	541	-
	Coal	1.37	4	6	163.37	163.37	545	6
	Shale	0.46	1	6	163.83	163.83	547	-
	Coal	0.41	1	4	164.24	164.24	548	4
	Shale	0.38	1	3	164.62	164.62	549	7
	Coal	0.99	3	3	165.61	165.61	552	10
	Shale	9.86	32	4	175.47	175.47	585	2
	Coal	1.30	4	3	176.77	176.77	589	5
	Fireclay	0.33	1	1	177.10	177.10	590	6

Metrication now corrected SJE 17/11/93



9-L.TIF SJ36/9
RECORD OF WELL (SHAFT OR BORE)
 At Sealand Exploration Company No. 2 Bore
 Town or Village Shotton County Flint Six-inch quarter sheet 105E
 Exact site At an angle of the seabank 700 yds. N.W. of Sealand Bank Farm (Griffith's or Osceles map). (A rough sketch-map or a tracing from a map is very desirable)
 Level of ground surface above sea-level (O.D.) c. 20 ft. If well starts below ground surface, state how far _____ ft.
 Shaft _____ ft., diameter _____ ft. Bore 590 1/2 ft. Diameter of bore: at top _____ ins.; at bottom _____ ins.
 Details of permanent lining tubes (internal diameters preferred) (mineral bore).
 Water struck at depths of (feet) _____
 Rest-level of water below top of well _____ feet. Suction at _____ feet. Yield on _____ hours' 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 1891
 Information from Flint Memoir 1890. Supplement. page 4.

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS		DEPTH	
		Feet.	Inches.	Feet.	Inches.
Estuarine	Sea sand	50	-	50	-
	Sand and gravel	3	6	53	6
Glacial	Blue clay	1	-	54	6
	Boulder clay with cobbles	5	2	59	8
	Stiff brown boulder clay	30	-	98	8
	Sand	3	-	101	8
	Boulder clay with cobbles	3	6	105	2
	Red sand	5	4	110	6
	Boulder clay	20	-	131	-
	Fine red sand and gravel	9	6	140	6
	Stiff brown boulder clay, with cobbles in lower part	7	10	148	4
	Sand and gravel	10	3	158	7
	Stiff brown boulder clay	4	9	163	4
	Red sandstone	6	7	169	11
	Fireclay and shale	56	9	226	8
	Coal	1	5	228	1
	Sandstone		6	228	7
	Coal	4	6	233	1
	Shale and fireclay	5	6	238	7
	Coal	1	-	239	7
	Sandstone-band		2	239	9
	Coal		4	240	1
	Stone-band		2	240	3
	Coal	2	-	242	3
	Fireclay and shale	16	10	259	1
	Coal		2	259	3
	Fireclay and sandy shale	58	8	317	11
	Limestone (?)	2	-	319	11
	Shale and fireclay	24	7	344	6
Middle Coal Measures	Dark grey limestone (?)		9	345	3

(Contd...)

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. 29051/0.369 10,000 9/39
A. & E.W. Ltd. Gp. 686



(*11028) W1.80870/0370 10,000 9/39 A.& E.V.Lad. Gp.648

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

9-2.TIF

2

County

SJ3614

6" Quarter Sheet

GEOLOGICAL CLASSIFICATION	DESCRIPTION	THICKNESS		DEPTH	
				345	3
	Fireclay and shale	11	9	357	-
	Cannel coal	1	6	358	6
	Fireclay and sandy shale	77	-	435	6
	Shale with ironstone and fireclay	4	6	440	-
	Coal	3	-	443	-
	Shale and fireclay	54	6	497	6
	Coal	3	-	500	6
	Shale and fireclay	40	6	541	-
	Coal	4	6	545	6
	Shale	1	6	547	-
	Coal } ? NINE FT	1	4	548	4
	Shale } or Upper Letchcroft	1	3	549	7
	Coal } ?	3	3	552	10
	Shale } ?	32	4	585	2
	Coal } ? Yard	4	3	589	5
	Fireclay	1	1	590	6