



Remediation Strategy Report

Site: 5 Park Row, Cwmavon,
Neath Port Talbot

Prepared For: David & Marie Rees

Issue Date: August 2022

Job No: 16881/RS

REPORT TITLE : **Remediation Strategy Report: Proposed Residential Development, 5 Park Row, Cwmavon, Neath Port Talbot**

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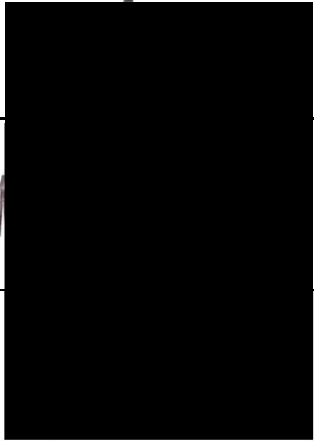
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SECTION 1 Introduction and Proposed Development

1.1 Introduction

David and Marie Rees (the Client) are proposing the residential development of land occupied by 5 Park Row located in Cwmavon.

Terra Firma (Wales) Limited have been commissioned by Go Concept Designs on behalf of the client to prepare a Remediation Strategy report for the site.

Previous investigations and assessments have identified that remediation of contamination is required for the development. This report presents a Remediation Strategy for the site based on these previous investigations and assessments.

1.2 Objectives

The objective of the Remediation Strategy is to detail the remedial steps that are required to render the site fit for its intended use.

In summary, the following remediation requirements have been identified and are covered in detail in this report.

- Installation of capping system in landscape and garden above made ground soils

1.3 Previous Investigations and Assessments

The Remediation Strategy is based on the findings of previous investigations and assessments. This report shall be read in conjunction with the following documents.

TFW Group Ltd Phase 1 Desk Study 15568, September 2021

TFW Group Ltd Soakaway Letter Report 15568, September 2021

TFW Group Ltd Geotechnical and Geoenvironmental Report 16881, November 2021

1.4 Roles and Responsibilities

Table 1.1 Roles and Responsibilities

Role	Organisation
Client	David and Marie Rees
Architect	GO Concept Designs Ltd
Structural and Civil Engineer	Rodgers Leask Engineers
Local Authority	Neath Port Talbot County Borough
Geotechnical & Geoenvironmental Consultant	TFW Group Ltd
Validator	TFW Group Ltd

1.5 Limitations and Exceptions of Investigation

This report has been prepared for the sole internal reliance of the Client and its design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of TFW Group Limited. If an unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill. The report represents the findings and opinions of experienced geo-environmental and geotechnical consultants. TFW Group Limited does not provide legal advice and the advice of lawyers may be required.

It is not within the scope of TFW Group Limited to:

- Provide Method Statements and Risk Assessments for the site remediation, preparation and development.
- Design, assess or install utility service trench fill and pipes for potable water supply beneath the site.

1.6 Quality Assurance

The quality and environmental aspects of the assessment and investigation comply with UKAS Accredited ISO 9001:2015 and ISO 14001:2015 standards.

SECTION 2 Site Characteristics

The following subsection information has been summarised from previous investigation and assessments listed in **Section 1.3**.

2.1 Site Location and Description

The development site is irregular in shape and locates off Park Row, Cwmavon. The site centres on an approximate National Grid Reference of 278110 192670, occupying a plan area of approximately 0.2 Hectares.

The existing dwelling is located in the eastern half of the site and sits upon a plateau which is elevated from Park Row. The western part of the site consists of a large open grassed garden area. A parking area is located on the southern part of this area which is set topographically below the garden and separated by a small retaining wall.

The site is surrounded by residential development. Park Row locates on the site's southern boundary which provides vehicle access to the site.

The site elevation is approximately 71m AOD and remains mostly flat across the majority of the main site plateau. The site falls off to the south with an approximate fall of 2m to the access road of Park Row.

The site location can be seen on **Figure 2.1**

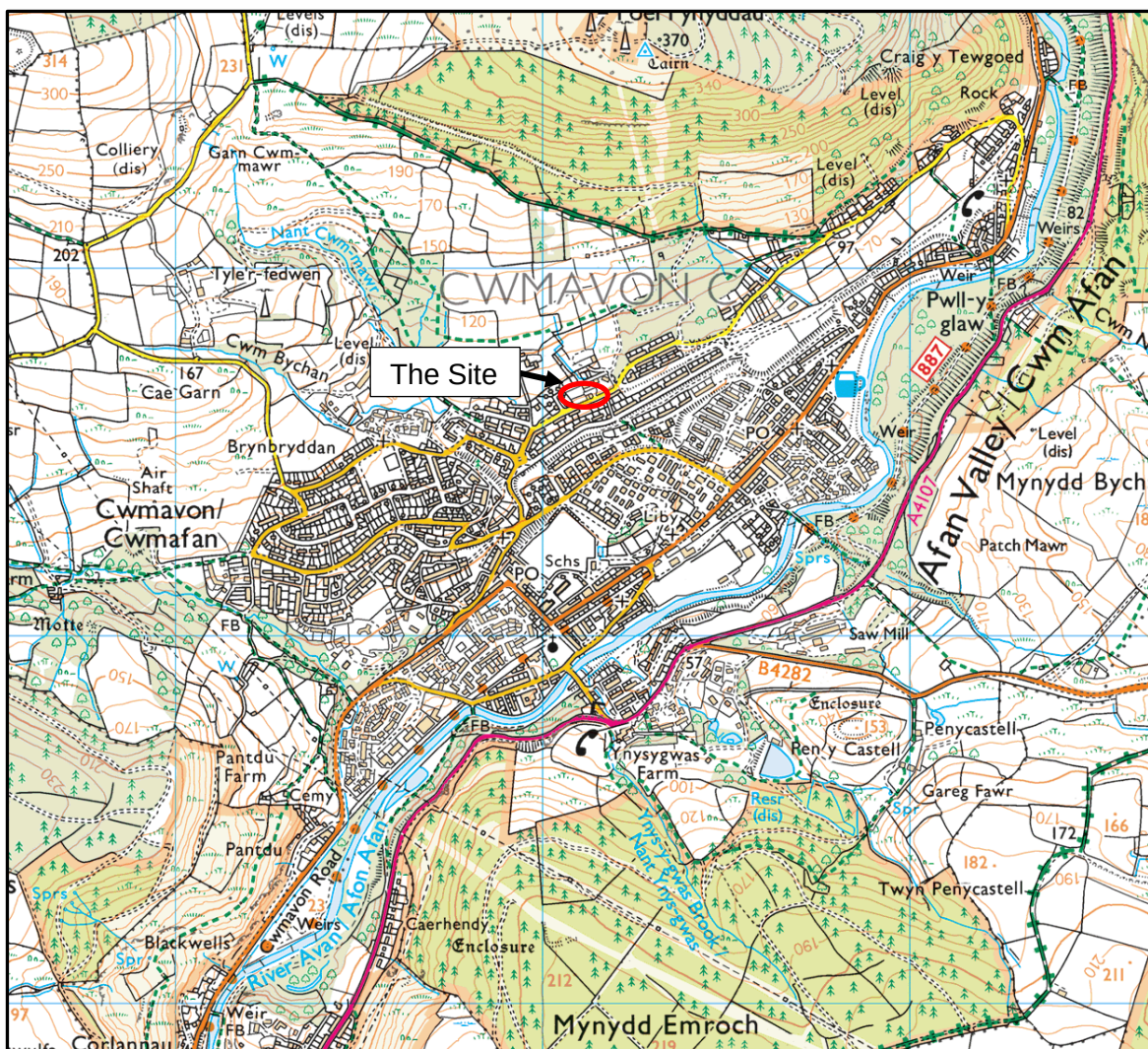


Figure 2.1 Site Location (January 2022)

2.2 Site History Summary

The site was previously occupied by gardens of a row of terraced housing. The housing was demolished in the 1970's. The existing building was constructed in the early 1990's.

2.3 Geology and Ground Conditions

The 1:50,000 scale British Geological Map of the area (Sheet 249) was consulted for geology underlying the site. The site is shown to be underlain the South Wales Middle Coal Measures Formation.

The ground conditions encountered during the site investigation can in general be summarised as shown in **Table 2.1**

Table 2.1 Summary of Ground Conditions (March 2017)

Depth (m)			Thickness (m)	Stratum
0.00	-	0.1/0.2	0.1/0.2	MADE GROUND. Grass over brown organic-rich sandy slightly gravelly CLAY with some roots. Gravel is angular mudstone, sandstone and rare brick.
0.1/0.2	-	1.25/1.5	Absent/1.4	MADE GROUND. Very soft to soft brown slightly sandy slightly gravelly CLAY . Gravel is angular sandstone and occasional concrete. Low cobble content of angular concrete.
1.25/1.5	-	1.9/2.0	Absent/0.65	Soft grey and orangish brown sandy slightly gravelly CLAY . Gravel is angular sandstone.
0.2/2.0		>2.0/>4.0	-	Very stiff grey and orangish brown sandy slightly gravelly CLAY with low cobble content/ very dense brown slightly clayey very gravelly SAND . Gravel is angular sandstone.

2.4 Radon

No radon protective measures are required for new developments on the investigation site.

2.5 Hydrogeology and Hydrology

The nearest surface water feature locates off site 36m to the northwest.

The bedrock deposits beneath the site have an aquifer designation of secondary aquifer – A.

The hydraulic gradient will be at its steepest during periods of heavy rainfall and aquifer recharge.

Groundwater was encountered in WS04 at 2.5m, recorded as a very slow inflow.

2.6 Identified Contamination

2.6.1 Made Ground Soils

Laboratory soil test results highlight exceedances of asbestos (chrysotile), arsenic, lead, naphthalene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)Anthracene when compared to human health guidelines for a residential with plant uptake scenario. Exceedances were located in WS01 (0.5m), WS02 (0.1m), WS03 (0.5m), WS04 (0.1m), WS04 (0.5m).

2.6.2 Ground and Mine Gas

There is a potential risk to the site from ground gas and mine gas from the infilled land and past shallow mining respectively.

SECTION 3 Sources of Contamination Requiring Remediation

The summary of the refined conceptual site model is presented in **Table 3.1** and based on findings of previous investigations and assessments, detailing significant pollutant linkages requiring remediation or mitigation.

Table 3.1 Summary of Significant Pollutant Linkages

Source	Pathway	Receptor
S1 – Made ground	P1 – Direct soil and dust ingestion P2 – Consumption of home grown produce P3 – Dermal contact P4 – Inhalation of dust and vapours P10 – Inhalation of asbestos fibres	R1 – Construction and maintenance workers R2 – Future site users (residents) R3 – Passers-by or neighbouring site users
S2 – Infilled land	P8 – Horizontal and vertical migration of ground gasses and vapours	R2 – Future site users (residents)
S3 – Mine workings	P7 – Artificial contaminant pathway (borehole, grout hole) P8 – Horizontal and vertical migration of ground gasses and vapours	R2 – Future site users (residents)

SECTION 4 Proposed Remedial and Mitigating Measures

4.1 General

Based on the finding of previous investigations and assessments and the identified pollutant linkages the following remedial measures have been devised for the site.

Specific validation requirements for the proposed remedial measures are discussed in the following section.

4.2 Made Ground Soils

4.2.1 Protection of Construction & Maintenance Workers and Passers-by or Neighbouring Site Users

The potential production of soil dust asbestos (chrysotile), arsenic, lead, naphthalene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)Anthracene contaminants during construction works presents a risk to construction and maintenance workers as well as passers-by or adjacent site users through, direct soil and dust ingestion, dermal contact, inhalation of dust and naphthalene.

A selection of mitigating measures are presented below to disrupt the contaminant pathway to the receptor.

- Dust suppression and measures to dampen the material
- Site perimeter screening
- Suitable PPE for site workers

It is therefore essential that the contractor puts in place adequate measures to ensure the safety of all workers.

All utility service channels placed within made ground soils on site should be lined with inert material to sever the link between the source and the receptor.

These measures should be detailed in the contractor's Risk Assessment and Method Statements as well as the contractor's Construction Management Plan.

4.2.2 Protection of Future Site Users (Residents)

Future site users will be potentially at risk from direct soil and dust ingestion, dermal contact and inhalation of dust and vapours from soils containing asbestos (chrysotile), arsenic, lead, naphthalene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)Anthracene contaminants, during excavation of made ground soils while undertaking gardening activities. Future site users are also at risk from the consumption of home grown produce grown within contaminated made ground soils.

Complete removal of the contaminant source would prove to be uneconomical given the low level of risk identified and the volume of affected soils therefore the installation of a capping system is proposed to interrupt the link between the source and receptor.

The capping system should be installed above Made Ground soils only in garden and landscaped areas and comprise 600mm thick capping layer of imported clean inert soils. Beneath areas of the site due to be covered by hard-standing or developed upon, no remedial measures are required.

Validation of the capping system and imported materials will be required.

4.2.3 Protection of Construction Materials (Potable Water Supply Pipes)

Potable water supply pipes are at risk of degradation when in contact with made ground soils containing arsenic, lead, naphthalene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)Anthracene contaminants.

It is recommended that a Potable Water Supplier should complete an assessment in accordance with UK Water Industry Research guidance; Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR Report Ref: 10/WM/03/21. The assessment should determine the selection of Water Supply Pipe material.

4.3 Ground Gas

4.3.1 Protection of Future Site Users (Residents)

Future site users are at risk of asphyxiation from the horizontal migration and accumulation indoors of ground gas. In addition, future site users are at risk from the horizontal migration, indoor accumulation and explosion of gas.

Gas protection measures will be required at the site to effectively sever the link between the source and receptor.

Due to elevated concentration of Naphthalene, it is recommended that a vapour barrier also be installed on all future developments at the site.

Validation of gas protection measures will be required in accordance with CIRIA publication C735:2014.

SECTION 5 Validation of Remedial and Mitigating Measures

The following remedial measures will require verification and inclusion within a Validation Report:

- Capping system (importation of soils and installation)
- Potable water supply pipe (assessment and installation)

5.1 Capping System

Following the importation and placement of 600mm of clean inert material in the soft landscaped and gardens areas of all plots, verification of the capping thickness should be undertaken.

Validation of the capping system will comprise photographic evidence clearly showing the thickness and depth of individual strata. In addition, samples will be obtained at this point for validation testing of imported soils in accordance with **Section 5.1.1**.

The soft landscaped and garden areas of 1 in every 2 plots should be validated as prescribed.

A validation report including a description of the works undertaken, validation photographs and chemical validation test results shall be presented upon completion.

5.1.1 Imported Soil Validation

Importation of soils will be required to provide a capping layer of clean inert material in identified landscaped and garden areas.

All imported soils, aggregate or stone that are not virgin quarry stone should be validated as suitable for use. Imported materials exempt from validation testing should be accompanied by a transfer note. Transfer notes should be retained and submitted for inclusion within the Validation Report upon completion of the works.

The provider should supply a laboratory analysis report to confirm that the soil/aggregate/stone is suitable for use. Depending on the source and available test data, it may be prudent to independently sample and analyse the materials (if practical) prior to being brought to site.

Sampling and analysis of the soil/aggregate/stone once imported will be required in addition to any taken at source.

In accordance with publication 'Requirements for the Chemical testing of Imported Materials for Various End Uses and Validation of Cover Systems' the number of representative samples required for analysis is dependent on the volume of each source soil. For a volume between 20m³ and 250m³ four samples should be taken. For a volume greater than 250m³, 4 samples per 250m³ should be taken. Where quantities exceed 1000m³ The CLO/EHO should be contacted to agree a sampling scheme.

All samples should be analysed for the determinands listed in **Table 5.1**.

Table 5.1 Validation Criteria

Determinand	Units	Guideline Value (Residential)	Source
Inorganic			
Arsenic	mg/kg	37	1
Boron	mg/kg	290	1
Cadmium	mg/kg	11	1
Chromium III	mg/kg	910	1
Chromium VI	mg/kg	6	1
Copper	mg/kg	2400	1
Lead	mg/kg	200	2
Mercury	mg/kg	40	1
Nickel	mg/kg	180	1
Selenium	mg/kg	250	1
Zinc	mg/kg	3700	1
Asbestos	%	Non Detected	-
Organics – Phenol & PAH			
Phenol	mg/kg	120	1
Naphthalene	mg/kg	2.3	4
Acenaphthylene	mg/kg	170	4
Acenaphthene	mg/kg	210	4
Flourene	mg/kg	170	4
Phenanthrene	mg/kg	95	4
Anthracene	mg/kg	2400	4
Fluoranthene	mg/kg	280	4
Pyrene	mg/kg	620	4
Benzo(a)anthracene	mg/kg	7.2	4
Chrysene	mg/kg	15	4
Benzo(b)fluoranthene	mg/kg	2.6	4
Benzo(k)fluoranthene	mg/kg	77	4
Benzo(a)pyrene	mg/kg	2.2	4
Indeno(123cd)pyrene	mg/kg	27	4
Dibenzo(ah)anthracene	mg/kg	0.24	4
Benzo(ghi)perylene	mg/kg	320	4
Organics – TPH			
PH C5 – C6 Aliphatic	mg/kg	42	4
PH C6 – C8 Aliphatic	mg/kg	100	4
PH C8 – C10 Aliphatic	mg/kg	27	4
PH C10 – C12 Aliphatic	mg/kg	130	4
PH C12 – C16 Aliphatic	mg/kg	1100	4
PH C16 – C21 Aliphatic	mg/kg	65000	4
PH C21 – C35 Aliphatic	mg/kg	65000	4
PH C5 – C7 Aromatic	mg/kg	70	4
PH C7 – C8 Aromatic	mg/kg	130	4
PH C8 – C10 Aromatic	mg/kg	34	4
PH C10 – C12 Aromatic	mg/kg	74	4
PH C12 – C16 Aromatic	mg/kg	140	4
PH C16 – C21 Aromatic	mg/kg	260	4
PH C21 – C35 Aromatic	mg/kg	1100	4
1 - LQM/CIEH Suitable For Use Level (S4UL) 2015			
2 - Defra Category 4 Screening Level (Provisional value)			
4 - S4UL threshold based on 1% soil organic matter			

5.2 Potable Water Supply Pipes

Evidence of the water supply pipe installation should be collected by the Client and provided independently. Evidence should comprise photographs of the water pipe supply installation.

5.3 Ground Gas Protection System

Verification of the ground gas protection system design and installation needs to be carried out in accordance with CIRIA publication C735:2014.

Early engagement with a suitably qualified and experienced consultant, preferably during the project design stage, is paramount to achieve this verification process. It will be necessary for a Ground Gas Protection System Verification Plan to be prepared to detail the verification methodology. To satisfactorily Validate the ground gas protection system installation, the 'Verification Plan' methodology is to be followed as prescribed and documented in a Validation Report.

Verification of the gas protection system installation is to be carried out by Terra Firma Wales Ltd, or a similarly experienced, qualified, trained and independent verifier. Documents demonstrating the above shall be included in the Validation Report.

SECTION 6 Working Practices

6.1 Protection of Construction Workers

In order that construction workers are protected during site works across the site the following should be adhered to:

1. Compliance with health and safety regulations
2. Provision of Method Statements and Risk Assessments
3. Compliance with Control of Substances Hazardous to Health (COSHH) Assessment
4. Good level of Personal Protection Equipment (PPE)
5. Good level of hygiene by site workers
6. Dust suppression measures
7. Emergency contingencies should be defined prior to commencement of site works

Further guidance for the safe working on contaminated site is presented in CIRIA Report 132:1996.

6.2 Protection of the Environment

During the remediation and construction periods, there is a risk to the environment and adjacent sites from de-watering, excavations, moving contaminated soil, drainage misconnections, discharges of perched groundwater to local surface waters or the ground, runoff from construction materials and/or exposed ground, wheel washing and oil or chemical spills.

A drainage plan should be devised, identifying manholes to prevent pollutants accidentally reaching surface water sewers. Temporary drainage measures may need to be put in place.

In addition, the following precautions should also be taken.

- All potential chemicals and associated risks and emergency procedures for spills/leaks should be considered in the site risk assessment and the details provided to all site employees.
- Any potential pollutant materials or chemicals/detergents used on site should be adequately stored in suitable containers, with clear labelling.
- Any oil or hazardous substance containers and associated pipe works should be enclosed within a bund.
- Care taken during delivery of materials, with correct supervision and labelling detailing the substance and its quantities.
- All delivery drivers should be informed of procedures and restrictions.
- Any materials on delivery should be covered to ensure there is no spillage.
- Any detergents, paints, chemicals etc should not be allowed to be discharged into surface drains or water courses.
- Washing out and cleaning of concrete/cement plant should be carried out in a contained area with adequate measures to collect all run-off water.
- Security and prevention of vandalism, especially of oil drums/containers.

6.3 Management & Disposal of Soils

During site works excavations of the made ground are anticipated.

All materials excavated should be managed and stored appropriately in a controlled manner to ensure protection of site construction workers and neighbouring site users, and to prevent the transfer of contamination to other areas of the site.

If possible, and if levels allow, and excavated made ground should be retained on site and relocated beneath areas of hardstanding. This would provide the most sustainable approach and avoid landfill and haulage fees, disruption and aggravation of local residents caused by haulage lorries, and would avoid unnecessary CO₂ emissions.

Any movement and transfer of materials on site should be documented in materials management plan, in accordance with 'CL:AIRE Definition of Waste: Development Industry Code of Practice (DoW CoP)'.

Alternatively, excavated made ground may be disposed of at landfill. Prior to disposal classification of the material will need to be completed in accordance with Environment Agency protocol detailed in 'Technical Guidance WM3 – Waste Classification - Guidance on the Classification and Assessment of Waste'.

A contaminated land specialist should supervise and document any earthworks on site.

Waste transfer and disposal must be undertaken by an authorised person. A waste transfer note must accompany each load and records should be maintained for inspection if required

6.4 Groundwater Disposal

Groundwater resulting from dewatering on site does not require offsite disposal and unless it is contaminated can be discharged onto areas of grassland or into sumps and allowed to soak into the ground.

**ANNEX A
Documents**



Geotechnical and Geoenvironmental Report

Site: 5 Park Row, Cwmavon,
Neath Port Talbot

Prepared For: David & Marie Rees

Issue Date: November 2021

Job No: 16881

REPORT TITLE : **Geotechnical and Geoenvironmental Report:
Proposed Residential Development, 5 Park
Row, Cwmavon, Neath Port Talbot**

JOB NUMBER : **16881**

ISSUE DATE : **November 2021**

REPORT REFERENCE : **241121-16881-01**

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	Name	Signature
Prepared	Michael Watkins MESci FGS	
Checked	David Emanuel BSc (Hons), MSc, FGS, Dip.Chem, M Phil, CGeol	
Approved	Gwyn Lake BSc (Hons). PhD, CGeol, FGS	



Executive Summary

Site Location and Proposed Development	David and Marie Rees (the Client) is proposing the residential development of land occupied by 5 Park Row located in Cwmavon.																												
Ground Conditions	<table border="1"> <thead> <tr> <th colspan="3">Depth (m)</th><th>Thickness (m)</th><th>Stratum</th></tr> </thead> <tbody> <tr> <td>0.00</td><td>-</td><td>0.1/0.2</td><td>0.1/0.2</td><td>MADE GROUND. Grass over brown organic-rich sandy slightly gravelly CLAY with some roots. Gravel is angular mudstone, sandstone and rare brick.</td></tr> <tr> <td>0.1/0.2</td><td>-</td><td>1.25/1.5</td><td>Absent/1.4</td><td>MADE GROUND. Very soft to soft brown slightly sandy slightly gravelly CLAY. Gravel is angular sandstone and occasional concrete. Low cobble content of angular concrete.</td></tr> <tr> <td>1.25/1.5</td><td>-</td><td>1.9/2.0</td><td>Absent/0.65</td><td>Soft grey and orangish brown sandy slightly gravelly CLAY. Gravel is angular sandstone.</td></tr> <tr> <td>0.2/2.0</td><td></td><td>>2.0/>4.0</td><td>-</td><td>Very stiff grey and orangish brown sandy slightly gravelly CLAY with low cobble content/ very dense brown slightly clayey very gravelly SAND. Gravel is angular sandstone.</td></tr> </tbody> </table>				Depth (m)			Thickness (m)	Stratum	0.00	-	0.1/0.2	0.1/0.2	MADE GROUND. Grass over brown organic-rich sandy slightly gravelly CLAY with some roots. Gravel is angular mudstone, sandstone and rare brick.	0.1/0.2	-	1.25/1.5	Absent/1.4	MADE GROUND. Very soft to soft brown slightly sandy slightly gravelly CLAY . Gravel is angular sandstone and occasional concrete. Low cobble content of angular concrete.	1.25/1.5	-	1.9/2.0	Absent/0.65	Soft grey and orangish brown sandy slightly gravelly CLAY . Gravel is angular sandstone.	0.2/2.0		>2.0/>4.0	-	Very stiff grey and orangish brown sandy slightly gravelly CLAY with low cobble content/ very dense brown slightly clayey very gravelly SAND . Gravel is angular sandstone.
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Contamination of Concern	Asbestos (chrysotile), Arsenic, Lead, Naphthalene, Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)Anthracene																												
Mitigation Measures	To protect future site users from the identified contamination the site will need to be capped. The capping should consist of the proposed buildings and hard standings. In garden and soft landscaped areas, the capping should consist of 600mm of suitable inert topsoil, and subsoil if desired. The capping soil should be directly underlain by a double no-dig barrier comprising a geo-grid and a geotextile membrane. Alternatively, made ground soils could be removed from site and disposed of at a suitably licenced landfill site. Due to elevated concentration of Naphthalene, it is recommended that a vapour barrier also be installed on all future developments at the site.																												
Ground Gas Risk Assessment	Future development on site should incorporate gas protection measures to mitigate any risks posed from potential ground/mine gas. Gas protection measures suitable to cater for Gas Characteristic situation 2 should be designed and installed on all future development on site.																												
Foundation Solution	It is recommended that reinforced concrete strip or trench fill foundations be used; founded within the stiff to very stiff brown sandy slightly gravelly clay/very dense grey and orangish brown clayey very gravelly sand at an approximate depth of between 0.75m and 2m below the existing ground level. An allowable bearing pressure of 100kN/m² may be used for strips up to 750mm wide. To allow for the sloping nature of the founding strata, the trench fill foundations should be stepped. Due to the potential risk from shallow mine workings (assessed by others) reinforcement will be required and should be designed to span a crown hole of 3.0m with a cantilever effect on corners of 1.5m. It is recommended that the foundation recommendations be reviewed following a full assessment of shallow mining risk. Foundations must sit at least 200mm within the founding horizon. For the given foundation solutions and bearing pressure, maximum total settlements of <25mm should result with differential movements of the superstructure not exceeding 1:750. Floor slabs should be designed as suspended.																												

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Drawings

Drawing 01 Proposed Site Layout

SECTION 1 Introduction and Proposed Development

1.1 Introduction

David and Marie Rees (the Client) is proposing the residential development of land occupied by 5 Park Row located in Cwmavon.

Terra Firma (Wales) Limited have been commissioned by Go Concept Designs on behalf of the Client to undertake a geoenvironmental assessment and geotechnical investigation of the site.

The main objectives of the geoenvironmental assessment programme are:

- Investigate the potential human health and environmental liabilities at the site associated with any contamination
- Provide a summary of the human health and environmental conditions at the site, together with any necessary further intrusive works and / or remediation works to render the site fit for its intended use

The main objectives of the geotechnical site investigation are:

- Investigated the type, strength and bearing characteristics of the shallow superficial and underlying solid geology
- Investigate the risk, if any, from historical shallow underground mining features
- Provide engineering foundation and floor slab recommendations for the proposed development
- Provide infiltration rates and stormwater drainage viability.
- Provide recommendations regarding any other geotechnical aspects pertaining to the development

In order to achieve the above objectives, Terra Firma (Wales) Limited carried out an assessment programme including a site walkover, a review of existing data, followed by a field investigation to collect geotechnical and geoenvironmental data from selected locations.

A copy of the desk study undertaken in September 2021 is presented in **Annex A**.

1.2 Limitations and Exceptions of Investigation

The Client has requested that a Geoenvironmental Site Assessment (GSA) and Geotechnical Investigation (GI) be performed to enable the outlined main objectives.

The GSA and GI were conducted, and this report has been prepared for the sole internal reliance of the Client and their design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. If an unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill. The report represents the findings and opinions of experienced geoenvironmental and geotechnical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may be required.

The subsurface geological profiles, any contamination and other plots are generalised by necessity and have been based on the information found at the locations of the exploratory holes and depths sampled and tested.

It was beyond the scope of this report to assess mining risks.

1.3 Quality Assurance

The quality and environmental aspects of the assessment comply with Terra Firma Wales Ltd business management system which is UKAS Accredited to ISO 9001:2015 and ISO 14001:2015 standards.

SECTION 2 Review of Existing Data

2.1 Physical Setting and Current Site Use

The development site is irregular in shape and locates off Park Row Cwmavon. The site centres on an approximate National Grid Reference of 278110 192670, occupying a plan area of approximately 0.2 Hectares.

The existing dwelling is located in the eastern half of the site and sits upon a plateau which is elevated from Park Row. The western part of the site consists of a large open grassed garden area. A parking area is located on the southern part of this area which is set topographically below the garden and separated by a small retaining wall.

The site is surrounded by residential development. Park Row locates on the sites southern boundary which provides vehicle access to the site.

The site elevation is approximately 71m AOD and remains mostly flat across the majority of the main site plateau. The site falls off to the south with an approximate fall of 2m to the access road of Park Row.

The site location can be seen on **Figure 2.1**

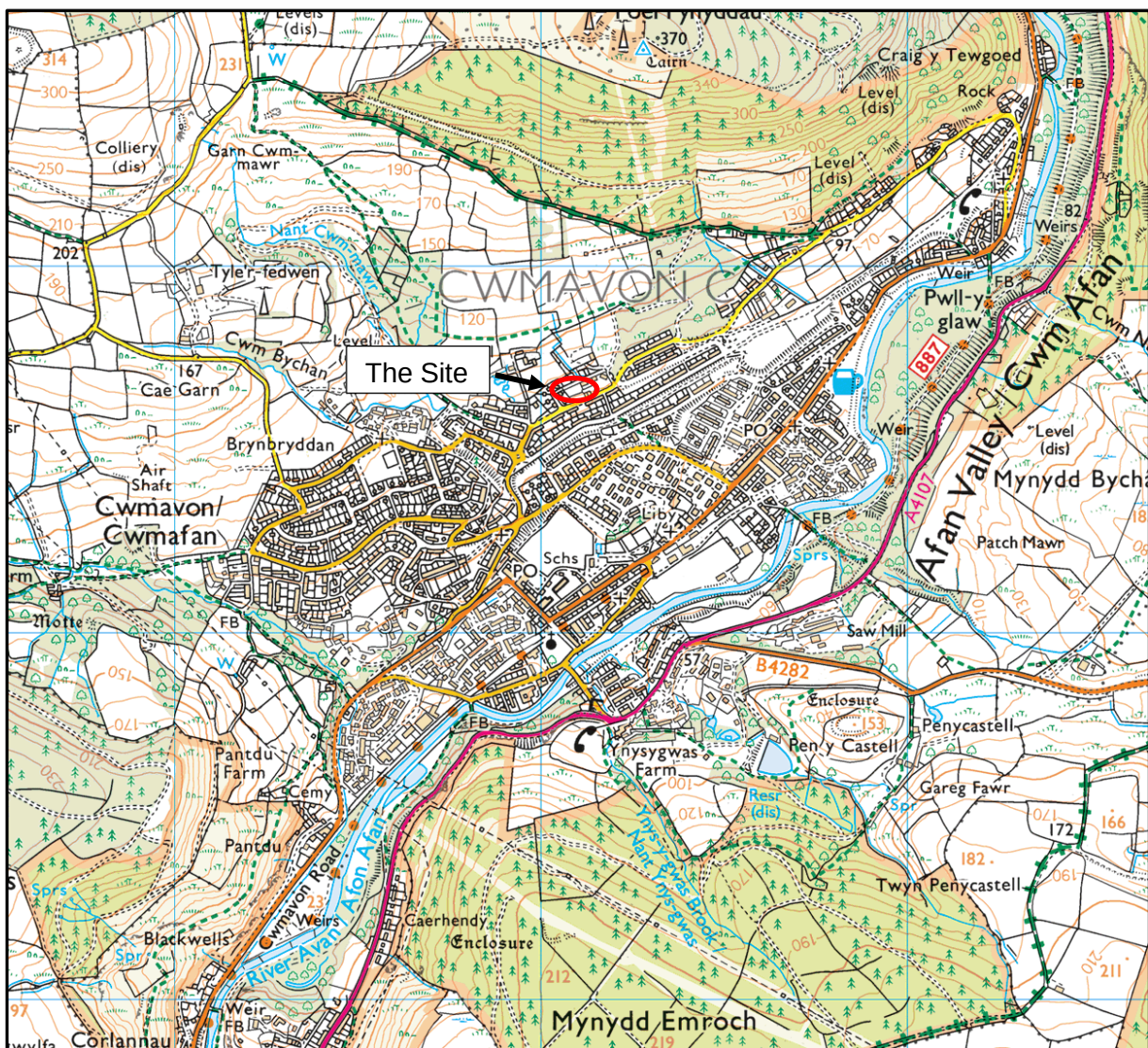


Figure 2.1 Site Location

SECTION 3 David & Marie Rees Field Investigation

3.1 Site Works

A geotechnical and geoenvironmental site investigation comprising 4No. Windowless Sampler Boreholes was undertaken on the 21st October 2021.

The fieldwork was supervised by Terra Firma (Wales) Limited, who logged the exploratory holes to the requirements of BS 5930:2015+A1:2020. The proposed locations of the exploratory holes were determined by Terra Firma (Wales) Ltd in general accordance with BS 10175:2011+A2:2017 in order to assess the findings of the preliminary conceptual site model.

The boreholes referenced WS01 to WS04, were formed using a Terrier 2000 rig. Dynamic sampling techniques were employed from surface to produce a continuous disturbed sample.

Standard penetration tests (SPT) were carried out at regular intervals in general accordance with BS1377: Part 9:1990:3.3. SPT results summarised as N values are presented on the borehole log.

Boreholes were monitored for groundwater ingress as drilling proceeded.

Representative disturbed samples were taken and retained in airtight containers for environmental and geotechnical testing.

The borehole logs are presented in **Annex B**.

Exploratory hole locations are shown on **Drawing 01**.

3.2 Ground Conditions

The ground conditions encountered by the exploratory holes can in general be summarised as shown in **Table 3.1**.

Table 3.1 Summary of Typical Ground Conditions

Depth (m)			Thickness (m)	Stratum
0.00	-	0.1/0.2	0.1/0.2	MADE GROUND. Grass over brown organic-rich sandy slightly gravelly CLAY with some roots. Gravel is angular mudstone, sandstone and rare brick.
0.1/0.2	-	1.25/1.5	Absent/1.4	MADE GROUND. Very soft to soft brown slightly sandy slightly gravelly CLAY . Gravel is angular sandstone and occasional concrete. Low cobble content of angular concrete.
1.25/1.5	-	1.9/2.0	Absent/0.65	Soft grey and orangish brown sandy slightly gravelly CLAY . Gravel is angular sandstone.
0.2/2.0		>2.0/>4.0	-	Very stiff grey and orangish brown sandy slightly gravelly CLAY with low cobble content/ very dense brown slightly clayey very gravelly SAND . Gravel is angular sandstone.

3.3 Groundwater

Groundwater information recorded during the site investigation is summarised in **Table 3.2**.

Table 3.2 Groundwater Summary

Location	Depth (m)	Details
WS04	2.5	Very slow inflow.

3.4 Stability and Obstructions

Boreholes remained stable and vertical during drilling.

3.5 Laboratory Chemical Testing

3.5.1 Sampling Strategy

Soil sampling locations were selected on a non-targeted basis to characterise the contamination status of a defined area. A herringbone sampling pattern was adopted.

Sample locations, depths and suspected/known contamination source targets are summarised in **Table 3.3**:

Table 3.3 Sample Locations, Depths and Targets

Location	Depth (m)	Contamination Targets
WS01	0.5	S1 - Building/demolition waste in made ground
WS02	0.1	S1 - Building/demolition waste in made ground
WS03	0.5	S1 - Building/demolition waste in made ground
WS04	0.1	S1 - Building/demolition waste in made ground
WS04	0.5	S1 - Building/demolition waste in made ground

3.5.2 Soil Laboratory Analysis

During the site investigation works soil samples were taken and despatched to the accredited laboratories of Eurofins Chemtest for laboratory chemical testing. Soil samples were tested for the determinants listed in **Table 3.4**.

Table 3.4 Soil Laboratory Analysis

Metals & Metalloids	In-Organics	Organics	Others
Arsenic	Cyanide	Phenols	pH (acidity)
Cadmium	Sulphate	PAH	Asbestos
Chromium III		Petroleum Hydrocarbons	
Chromium VI			
Copper			
Lead			
Mercury			
Nickel			
Selenium			
Zinc			

The results are discussed in detail in **SECTION 4** and the laboratory test results certificates may be found in **Annex C**.

3.5.3 Laboratory Geotechnical Testing

A schedule of laboratory tests was prepared by Terra Firma Wales Ltd and samples were despatched to the accredited laboratories of GSTL. A summary of the testing carried out is presented in **Table 3.5**.

Table 3.5 Summary of Geotechnical Testing

Geotechnical Test	Standard (BS1377:1990)	No. Tested
Moisture Content	Part 2, Clause 3.2	2
4 Point Liquid and Plastic Limit	Part 2, Clause 4.3 & 5.3	2

The test results are presented in **Annex D** and discussed in **SECTION 7** of this report.

SECTION 4 Evaluation of Geoenvironmental Analytical Results

4.1 Assessment Methodology

Comparison of the analytical results has been made with the 2015 Suitable 4 Use Levels (S4UL) provided by Land Quality Management (LQM) Limited and the Chartered Institute of Environmental Health (CIEH) or provisional Category 4 Screening Levels (pC4SL).

Soil leachate and groundwater analytical results have been compared with available published guidelines in the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 and Drinking Water Directive (98/83/EC).

Sulphate results have been compared to guidelines presented in British Research Establishment (BRE SD1:2015). Sulphate levels need only be considered for buried concrete risk assessment and are not human health related.

Soils subjected to a UK Water Industry Research (UKWIR) suite of testing have been compared with guidelines set out in UKWIR Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites (Ref 10/WM/03/21).

4.2 Soil Test Results

A summary of the chemical test results which include the regulatory soil guideline values used in a residential setting with plant uptake are given in the following tables. The complete results can be found in **Annex C**.

4.2.1 Inorganics & Miscellaneous

Five samples were tested for a standard suite of inorganics, pH and organic matter. The summarised results are in **Table 4.1**.

Table 4.1 Summary of Soil Chemical Test Results – Inorganics & Miscellaneous

Substance	Threshold Value (mg/kg)	Source	Measured Concentrations (mg/kg)		Number of Exceedances
			Minimum	Maximum	
Arsenic	37	LQM/CIEH	8.5	62	2
Cadmium	11	LQM/CIEH	<0.1	2.6	0
Chromium III	910	LQM/CIEH	11	30	0
Chromium VI	6	LQM/CIEH	<0.5	<0.5	0
Copper	2400	LQM/CIEH	27	440	0
Lead	200	pC4SL	16	330	2
Mercury (inorganic)	40	LQM/CIEH	0.06	0.36	0
Nickel	180	LQM/CIEH	17	71	0
Selenium	250	LQM/CIEH	0.35	1.1	0
Zinc	3700	LQM/CIEH	65	890	0
Cyanide	-	-	<0.5	<0.5	-
Boron	290	LQM/CIEH	<0.40	0.81	0
Sulphate (%)	0.24	BRE	<0.01	0.095	0
Organic Matter (%)	-	-	0.60	3.3	-
pH	-	-	7.2	8.4	-
Notes: - No available guideline					

4.2.2 Organics

Five samples were tested for speciated polycyclic aromatic hydrocarbons. The summarised results are in **Table 4.2**.

Table 4.2 Summary of Soil Chemical Test Results – Speciated Polycyclic Aromatic Hydrocarbons

Substance	Threshold Value (mg/kg)	Source	Measured Concentrations (mg/kg)		Number of Exceedances
			Minimum	Maximum	
Naphthalene	2.3	LQM/CIEH	<0.1	6.3	3
Acenaphthylene	170	LQM/CIEH	<0.1	0.41	0
Acenaphthene	210	LQM/CIEH	<0.1	1.0	0
Fluorene	170	LQM/CIEH	<0.1	0.77	0
Phenanthrene	95	LQM/CIEH	<0.1	11	0
Anthracene	2400	LQM/CIEH	<0.1	1.8	0
Fluoranthene	280	LQM/CIEH	<0.1	16	0
Pyrene	620	LQM/CIEH	<0.1	13	0
Benzo(a)anthracene	7.2	LQM/CIEH	<0.1	6.5	0
Chrysene	15	LQM/CIEH	<0.1	12	0
Benzo(b)fluoranthene	2.6	LQM/CIEH	<0.1	11	1
Benzo(k)fluoranthene	77	LQM/CIEH	<0.1	4.5	0
Benzo(a)pyrene	2.2	LQM/CIEH	<0.1	6.5	1
Indeno(123cd)pyrene	27	LQM/CIEH	<0.1	5.3	0
Dibenzo(ah)anthracene	0.24	LQM/CIEH	<0.1	2.0	5
Benzo(ghi)perylene	320	LQM/CIEH	<0.1	4.9	0
Total PAH	-	-	<2.0	100	-
Notes:					
Thresholds based on 1.0% soil organic matter					
- No available guidelines					

Five samples were tested for petroleum hydrocarbon. The summarised results are shown in **Table 4.3**.

Table 4.3 Summary of Soil Chemical Test Results – Petroleum Hydrocarbons

Substance	Threshold Value (mg/kg)	Source	Measured Concentrations (mg/kg)		Number of Exceedances
			Minimum	Maximum	
Aliphatic					
PH C5 – C6 Ali	42	LQM/CIEH	<1.0	<1.0	0
PH C6 – C8 Ali	100	LQM/CIEH	<1.0	<1.0	0
PH C8 – C10 Ali	27	LQM/CIEH	<1.0	<1.0	0
PH C10 – C12 Ali	130	LQM/CIEH	<1.0	<1.0	0
PH C12 – C16 Ali	1100	LQM/CIEH	<1.0	<1.0	0
PH C16 – C21 Ali	65000*	LQM/CIEH	<1.0	<1.0	0
PH C21 – C35 Ali	65000*	LQM/CIEH	<1.0	<1.0	0
PH C35 – C44 Ali	65000	LQM/CIEH	<1.0	<1.0	0
Aromatic					
PH C5 – C7 Arom	70	LQM/CIEH	<1.0	<1.0	0
PH C7 – C8 Arom	130	LQM/CIEH	<1.0	<1.0	0

PH C8 – C10 Arom	34	LQM/CIEH	<1.0	<1.0	0
PH C10 – C12 Arom	74	LQM/CIEH	<1.0	<1.0	0
PH C12 – C16 Arom	140	LQM/CIEH	<1.0	<1.0	0
PH C16 – C21 Arom	260	LQM/CIEH	<1.0	<1.0	0
PH C21 – C35 Arom	1100	LQM/CIEH	<1.0	<1.0	0
PH C35 – C44 Arom	1100	LQM/CIEH	<1.0	<1.0	0

Notes:

PH – Petroleum Hydrocarbon

Ali – Aliphatic

Arom – Aromatic

Thresholds based on 1.0% soil organic matter

* – Ali C16-21 and C21-C35 based on criteria for Ali EC >16-35

Five samples were tested for Phenols. The summarised results are in **Table 4.4**.

Table 4.4 Summary of Soil Chemical Test Results – Phenols

Substance	Threshold Value (mg/kg)	Source	Measured Concentrations (mg/kg)		Number of Exceedances
			Minimum	Maximum	
Phenols	120	LQM/CIEH	<0.1	<0.1	0

Notes:

- No available guideline

4.2.3 Asbestos Testing

All made ground soil samples were scheduled for asbestos screening. Asbestos was detected in 1 No. sample. Samples testing positive for asbestos were further scheduled for gravimetric quantification of ACM and fibres in soil/fibre quantification in soils. The results are summarised in **Table 4.5**.

Table 4.5 Summary of Soil Chemical Test Results – Asbestos Quantification

Sample	Depth (m)	Comment	Result (mass %)
WS01	0.5	No Asbestos Detected	
WS02	0.1	No Asbestos Detected	
WS02	0.5	No Asbestos Detected	
WS03	0.5	Chrysotile Fibres/Clumps	<0.001
WS04	0.1	No Asbestos Detected	
WS04	0.5	No Asbestos Detected	

4.2.4 Leachate Test Results

Substances found to be significantly elevated in soil samples were submitted for leachate testing. Five samples were tested for speciated polyaromatic hydrocarbons. The results are summarised in **Table 4.6**.

Table 4.6 Summary of Leachate Chemical Test Results – Speciated Polyaromatic Hydrocarbons

Substance	Threshold Value (µg/l)	Source	Measured Concentrations (µg/l)		Number of Exceedances
			Minimum	Maximum	
Naphthalene	2	WFD1	<0.01	<0.01	0
Acenaphthylene	-	-	<0.01	<0.01	BLDL
Acenaphthene	-	-	<0.01	<0.01	BLDL
Fluorene	-	-	<0.01	<0.01	BLDL

Phenanthrene	-	-	<0.01	<0.01	BLDL
Anthracene	0.1	WFD1	<0.01	<0.01	0
Fluoranthene	0.0063	WFD1	<0.01	1.2	1
Pyrene	-	-	<0.01	0.31	1 ALDL
Benzo(a)anthracene	-	-	<0.01	<0.01	BLDL
Chrysene	-	-	<0.01	<0.01	BLDL
Benzo(b)fluoranthene	0.017	WFD3	<0.01	<0.01	0
Benzo(k)fluoranthene	0.017	WFD3	<0.01	<0.01	0
Benzo(a)pyrene	0.00017	WFD1	<0.01	<0.01	BLDL
Indeno(123cd)pyrene	-	-	<0.01	<0.01	BLDL
Dibenzo(ah)anthracene	-	-	<0.01	<0.01	BLDL
Benzo(ghi)perylene	0.0082	WFD3	<0.01	<0.01	BLDL

Notes:

WFD1 - Water Framework Directive – Inland Surface Waters (AA)

WFD2 - Water Framework Directive – Freshwater (Long Term Mean)

WFD3 - Water Framework Directive – Inland Surface Waters (MAC)

- No available guideline

ALDL - Above laboratory detection limit

BLDL - Below laboratory detection limit

SECTION 5 Geotechnical Testing Results

Geotechnical testing results are summarised in the following sections and presented in their entirety in **Annex D**.

5.1 Plasticity & Moisture Content Testing

During the investigation two samples of the shallow clay material was taken and submitted for plasticity testing. The test results are summarised in **Table 5.1**.

Table 5.1 Plasticity & Moisture Content Test Results

Location	Depth (m)	Laboratory Principal Soil Type	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Volume Change Potential
WS01	1.4	Clay	21	19	79	15	Low
WS03	2.3	Clay	12	12	79	9.5	Non plastic

In line with the NHBC (Chapter 4.2), the modified plasticity index for each sample was calculated. For design purposes the soils on site should be assumed to have a low volume change potential.

5.2 BRE SD1 Testing

Two samples were subject to BRE SD1 testing for concrete classification. The results are summarised in **Table 5.2**.

Table 5.2 BRE SD1 Testing Summary

Location	Depth (m)	2:1 Water/Soil Extract	Total Potential Sulphate (%)	Oxidisable Sulphate (%)	pH	Design Sulphate Class for Location	ACEC Class for Location
		SO ₄ (mg/l)					
WS01	1.4	14	0.03	0.01	7.6	DS-1	AC-1
WS03	0.5	57	0.42	0.325	7.5	DS-2	AC-2

SECTION 6 Quantitative Risk Assessment

6.1 Contaminants of Concern

Contaminants identified as part of the investigation are summarised in **Table 6.1**, along with an interpretation of the likely contamination source. Where applicable, the contaminant, source relationship is based on the inferences made in the preliminary conceptual site model.

Table 6.1 Contaminants of Concern

Location	Depth	Contaminant	Source
WS01	0.5	Naphthalene Dibenz(a,h)Anthracene	S1 - MADE GROUND. Very soft to soft brown slightly sandy slightly gravelly CLAY. Gravel is angular sandstone and occasional concrete. Low cobble content of angular concrete.
WS02	0.1	Dibenz(a,h)Anthracene	S1 - MADE GROUND. Grass over brown organic-rich sandy slightly gravelly CLAY with some roots. Gravel is angular mudstone, sandstone and rare brick.
WS03	0.5	Asbestos (chrysotile) Arsenic Lead Naphthalene Benzo(b)fluoranthene Benzo(a)pyrene Dibenz(a,h)Anthracene	S1 - Very soft dark brown organic-rich silty sandy slightly gravelly CLAY. Occasional fragments of brick, slag, glass, plastic.
WS04	0.1	Arsenic Lead Naphthalene Dibenz(a,h)Anthracene	S1 - MADE GROUND. Grass over brown organic-rich sandy slightly gravelly CLAY with some roots. Gravel is angular mudstone, sandstone and rare brick.
WS04	0.5	Dibenz(a,h)Anthracene	S1 – MADE GROUND. Soft brown sandy slightly gravelly CLAY. Gravel is angular sandstone.

6.2 Pollutant Linkages

Based on the findings of the intrusive site investigation and identified contaminants, the preliminary conceptual site model has been revised. Significant pollutant linkages are tabulated in the refined conceptual site model **Table 6.2**. Identified pollutant linkages will require detailed risk assessment, appropriate mitigation or remedial measures.

Table 6.2 Refined Conceptual Site Model

Source	Pathway	Receptor
S1 – Made ground	P1 – Direct soil and dust ingestion P2 – Consumption of home grown produce P3 – Dermal contact P4 – Inhalation of dust and vapours	R1 – Construction and maintenance workers R2 – Future site users (residents) R3 – Passers-by or neighbouring site users

	P10 – Inhalation of asbestos fibres	
S2 – Infilled land	P8 – Horizontal and vertical migration of ground gasses and vapours	R2 – Future site users (residents)
S3 – Mine workings	P7 – Artificial contaminant pathway (borehole, grout hole) P8 – Horizontal and vertical migration of ground gasses and vapours	R2 – Future site users (residents)

6.3 Mitigation and Remedial Measures

The following sections summarise the likely mitigation and remedial measures suitable for the identified contamination and proposed development. Detailed methodology to achieve the measures should be prescribed in a Remediation Strategy Report and the results presented in a Validation Report upon completion of the development.

6.3.1 Human Health

6.3.1.1 Contaminated Soils

The advice of an asbestos specialist will be required and as a minimum the following precautions should be employed:

- Dust suppression and measures to dampen the material
- Suitable PPE for site workers
- Air monitoring on the site boundary
- Personal air monitors (for a time to determine actual personnel / fibre interaction)

In addition to the above it is best practise to clean down plant and change air filters on any plant used in the works with asbestos contaminated material.

To protect future site users from the identified contamination the site will need to be capped. The capping should consist of the proposed buildings and hard standings. In garden and soft landscaped areas, the capping should consist of 600mm of suitable inert topsoil, and subsoil if desired. The capping soil should be directly underlain by a double no-dig barrier comprising a geo-grid and a geotextile membrane. Alternatively, made ground soils could be removed from site and disposed of at a suitably licenced landfill site.

As good practice, construction workers should adhere to good site management, COSHH, good standards of hygiene and appropriate health & safety on site, with personal protection equipment (PPE) and dust suppression where appropriate.

All imported soils should be validated as clean and suitable for use in accordance with 'Requirements for the Chemical Testing of Imported Soils for Various End Uses and Validation Cover Systems'.

For proposed new supply water pipes, the UK Water Industry Research publication 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (Report 10/WM/03/21)' should be consulted.

In accordance with EC Regulation 1272/2008 and Environment Agency Guidance WM3 soils destined for off-site disposal should be classified on the basis of their hazard phrases prior to disposal. Soils are classified as a mirror entry waste and should be classified on the basis of their specific chemical properties.

If during earthworks ground conditions are encountered that are markedly different to those found during the investigation, then the ground should be subject to additional sampling and testing and any necessary remedial measures designed and implemented before continuing with the works.

6.3.1.2 Ground Gas

As recommended in Section 3.6 of Terra Firma's Desk Study (**Annex A**) future development on site should incorporate gas protection measures to mitigate any risks posed from potential ground/mine gas. Gas protection measures suitable to cater for Gas Characteristic situation 2 should be designed and installed on all future development on site.

Due to elevated concentration of Naphthalene, it is recommended that a vapour barrier also be installed on all future developments at the site.

The ground gas protection system should be designed, verified, installed and validated in accordance with the British Standard 8485:2015+A1:2019 and CIRIA guidance C735:2014.

With respect to volatile organic compounds (Naphthalene) encountered at the site, ground gas protection elements should be selected based on guidelines presented in CIRIA C748:2014. In addition, NHBC guidance may also need to be adopted depending on the requirements of the proposed development guarantor.

It is recommended that a specialist consultant is retained to prepare a risk assessed ground gas protection system Verification Plan for the proposed development. The Verification Plan will detail the required protection measures based on the perceived risk associated with the complexity of design, experience of the installer, size of the site and gas characteristic situation. The Verification Plan also details the step-by-step process and requirements to allow for the completion of a Validation Report. Terra Firma (Wales) Ltd offer Verification and Validation services.

Validation of installed ground gas protection systems by an independent third party will be required upon completion of the development. Validation may only be achieved if processes prescribed in the Verification Plan are undertaken.

6.3.2 Aquatic Environment

Several PAH contaminants were recorded above soil laboratory guidelines. Leachate testing confirmed that one sample also contained two contaminants (fluoranthene, and pyrene) above either its target concentration or laboratory detection limits. However, based upon the preliminary conceptual site model that recorded no significant risks to controlled waters, the contaminant concentrations recorded by the chemical testing, the high clay content of the shallow soils, the lack of any evidence of olfactory or visual 'gross' contamination, the distance to the closest surface water body, and the lack of any direct pathways to a surface water body; it is considered that the risk to controlled waters is insignificant.

Site specific mitigation and remedial measures are therefore not required with respect to the aquatic environment.

During the construction period, there is a risk to the environment/adjacent sites from de-watering, digging foundations, moving contaminated soil, drainage misconnections, discharges to local surface waters or the ground, runoff from construction materials and/or exposed ground, wheel washings and oil or chemical spills.

The risk is considered to be negligible as any adverse effects will be easily preventable by due diligence to good construction practise and housekeeping in preventing surface runoff and the spillage of materials.

The basic measures that should be taken are as follows:

- Prepare a drainage plan and mark the manholes to prevent pollutants accidentally reaching the surface water sewers;
- Carry out any activities that could cause pollution in a designated, bunded area, away from rivers or boreholes. Where possible it should drain to the foul sewer;
- Use settlement ponds to remove silty water;
- Store all oils and chemicals in a fully bunded area to prevent leaks or spills;
- Get advice on whether you need an environmental permit and apply in good time

SECTION 7 Engineering Recommendations

7.1 Preparation of Site

Areas of vegetation including all roots should be stripped and removed from beneath the proposed development site.

Allowances should be made for any temporary/permanent support works to any existing adjacent structure necessary as a result of the proposed works.

Contingencies should be made for the protection/diversion of any underground/overhead services present beneath/above the site brought about as a result of the proposed works.

Any reduced levels should be brought up to the required levels with suitable inert mainly granular materials. Department of Transport (DTP) type 2 sub-base or similar should be used and compacted in layers to the requirements of the Specification for Highway Works.

Allowances should also be made for the excavation of any soft spots/areas and their replacement with well compacted imported granular materials.

In accordance with EC Regulation 1272/2008 and Environment Agency Guidance WM3 soils and other materials destined for off-site disposal should be classified on the basis of their hazard phrases prior to disposal. Soils are classified as a mirror entry waste and should be classified on the basis of their specific chemical properties. Terra Firma (Wales) Ltd offer this service if required.

7.2 Foundation and Floor Slab Solution

It is recommended that reinforced concrete strip or trench fill foundations be used; founded within the stiff to very stiff brown sandy slightly gravelly clay/very dense grey and orangish brown clayey very gravelly sand at an approximate depth of between 0.75m and 2m below the existing ground level. An allowable bearing pressure of 100kN/m² may be used for strips up to 750mm wide.

To allow for the sloping nature of the founding strata, the trench fill foundations should be stepped.

Due to the potential risk from shallow mine workings (assessed by others) reinforcement will be required and should be designed to span a crown hole of 3.0m with a cantilever effect on corners of 1.5m. It is recommended that the foundation recommendations be reviewed following a full assessment of shallow mining risk.

Foundations must sit at least 200mm within the founding horizon.

For the given foundation solutions and bearing pressure, maximum total settlements of <25mm should result with differential movements of the superstructure not exceeding 1:750.

Floor slabs should be designed as suspended.

If trees are to be incorporated within the proposed development, foundations will need to be taken deeper within influencing distance of the tree root systems. The National House Building Council (NHBC) Chapter 4.2 gives guidelines as to the appropriate type of floor slab and void based on the type of tree, distance of the foundation from the tree and the plasticity index of the in-situ materials.

During the investigation two samples of the in-situ clay were taken and submitted for plasticity testing. In line with the NHBC (Chapter 4.2), the modified plasticity index for each sample was

calculated. For design purposes the superficial cohesive deposits should be assumed to have a low volume change potential.

Foundations should be taken down to a minimum depth of 750mm below finished levels when founding in low volume change potential soils.

Allowances should be made for the removal of any 'soft spots' and their replacement with well-compacted granular materials. Department of Transport (DoT) Type 2 materials or similar could be used and should be compacted in layers to the specification for Highway Works.

All foundation formations should be inspected by a suitably qualified Engineer before being concreted.

7.3 Excavations and Formations

Most of the shallow excavations will be possible with normal soil excavating machinery.

Shallow perched water and groundwater flows were not encountered during the investigation. Any water inflows together with rainwater infiltration should be dealt with by conventional pumping techniques. However, it should be noted that during times of heavy rainfall a higher water table will be encountered.

The sides of any excavations deeper than 1.20m, or shallower if unstable, should be supported by planking and strutting or other proprietary means.

The sub-formations/formations are likely to be susceptible to loosening, softening and deterioration by exposure to weather (rain, frost and drying conditions), the action of water (flood water or removal of groundwater) and site traffic.

Formations should never be left unprotected and continuously exposed to rain causing degradation, or left exposed/uncovered overnight, unless permitted by a qualified engineer.

Construction plant and other vehicular traffic should not be operated on unprotected formations.

As a minimum the formation/excavation surfaces must be protected by blinding concrete immediately after exposure.

Allowances should be made for the removal of soft spots/areas and their replacement with well compacted granular materials.

Allowances should also be made for special precautions to prevent formation deterioration in addition to the above.

7.4 Protection of Buried Concrete

When the results are compared with Table C2 of BRE Digest 1:2005, it indicates that buried concrete should generally conform to DS-2 Class AC-2.

7.5 Access Roads and Car Parking Areas

For car parking and road areas, formations within the in-situ natural soils a CBR value of 2% may be used for design purposes.

Allowances should be made for the removal of any 'soft spots/areas' and their replacement with well-compacted granular materials as previously described.

Please note that the Local Council / Highways Authority may require in-situ CBR testing to be undertaken before a road is adopted. In-situ CBR Testing should be performed following earthworks to verify the performance of the engineered fill.

7.6 Retaining Walls

Due to the sloping nature of the site, retaining walls may be required. The existing steepness of any embankments should not be increased. Any cuts should be undertaken in small sections and in such a way so as not to induce any instability to the ground.

Effective shear parameters for retaining wall design are presented in **Table 7.1**.

Table 7.1 Effective Shear Stress Parameters

Stratum Description	Bulk Unit Weight (γ) kN/m ³	Effective Cohesion (c') kN/m ²	Effective Angle of Shearing Resistance (ϕ') degrees
Soft to firm cohesive soils	18	0	18 – 24
Firm to stiff cohesive soils	18	0	24 – 28
Loose granular soils	18	0	22
Medium dense granular soils	18	0	25-30

The parameters are based on experience in similar ground conditions.

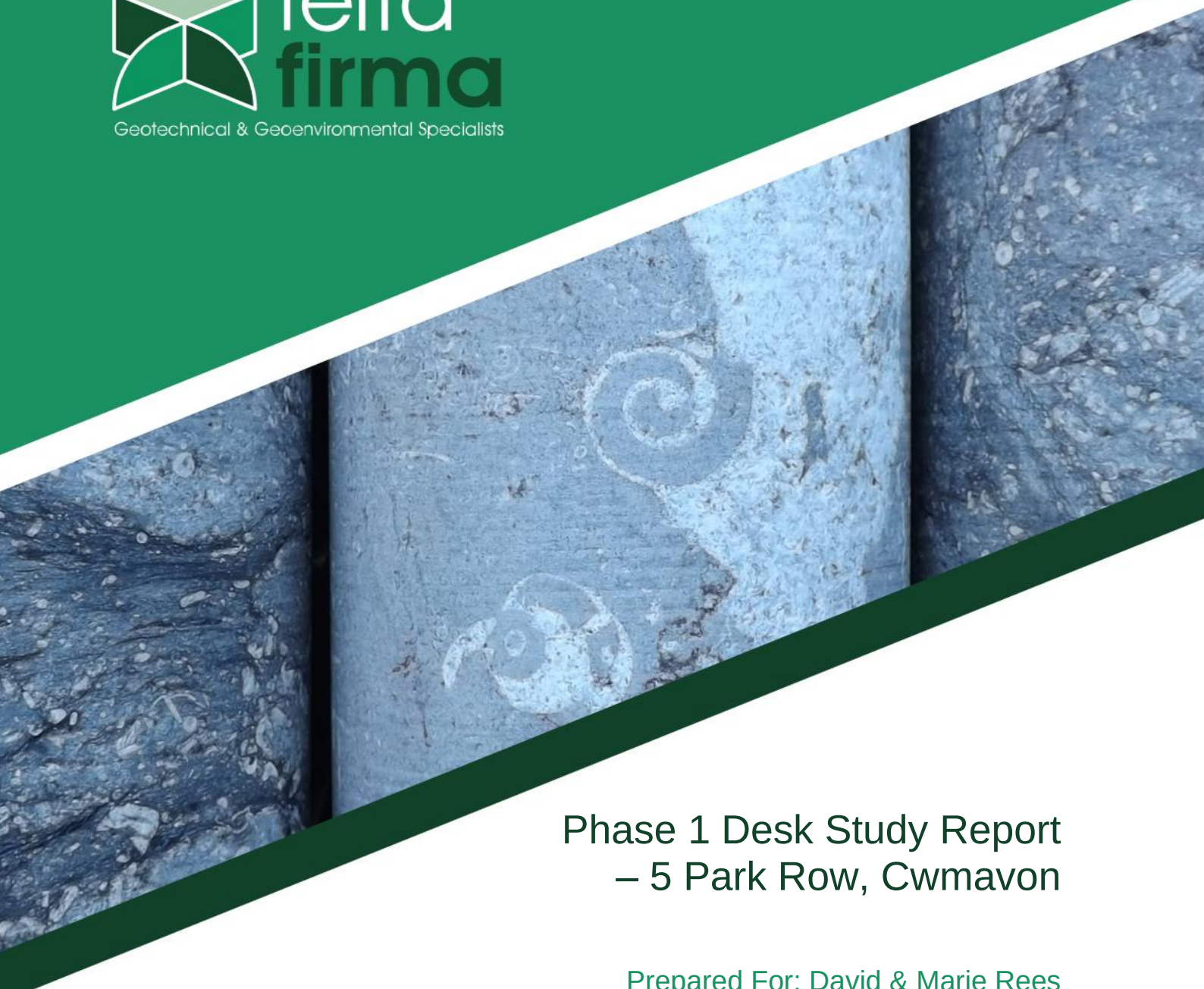
The materials to be in-filled behind the retaining wall should be placed at or close to its optimum moisture content/maximum dry density and compacted in layers as per the requirements of the Specification for Highway Works. During the earthworks suitable in-situ testing should be carried out to ensure that the compaction process is achieving the required maximum dry density to achieve at least 95% compaction.

The acceptability of the filling works should be verified by appropriate on site testing. A certification report should also be prepared on the earthworks by a suitably qualified Geotechnical Engineer.

Appropriate drainage should be incorporated in the design to prevent the build-up of hydrostatic pressure.

Appropriate cutting and benching of the existing slope should be conducted prior to the replacement of any imported fill to minimise the risk of any slip surfaces forming on the interface between the existing imported materials.

**ANNEX A
Desk Study**



Phase 1 Desk Study Report – 5 Park Row, Cwmavon

Prepared For: David & Marie Rees

Issue Date: September 2021

Job No: 15568

REPORT TITLE : **Phase 1 Desk Study Report: Proposed Residential Development, 5 Park Row, Cwmavon**

REPORT STATUS : **Final**

JOB NUMBER : **15568**

DATE : **September 2021**

REPORT REFERENCE : **02092021-15568-1**

Document Revision Record

Issue Number	Date	Revision Details
1	02/09/2021	First Issue

	Name	Signature
Prepared	Mathew Lake MEng FGS Tech IOSH	
Checked	David Emanuel BSc (Hons), MSc, FGS, Dip.Chem, M Phil, CGeol	
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Executive Summary

Site Location and Proposed Development	David and Marie Rees (the Client) is proposing the residential development of land occupied by 5 Park Row located in Cwmavon. The development site is irregular in shape and locates off Park Row Cwmavon. The site centres on an approximate National Grid Reference of 278110 192670, occupying a plan area of approximately 0.2 Hectares.
Site History	The site was previously occupied by gardens of a row of terraced housing. The housing was demolished in the 1970's. The existing building was constructed in the early 1990's.
Geology	The site is underlain by rocks of the South Wales Middle Coal Measures Formation. No superficial deposits are shown to overly the solid geology. Made ground is known to be present on site from recent percolation testing.
Radon	No radon protection measures are required for new development on site.
Preliminary Human Health and Environmental Risks	The desk study has identified several potential sources of contamination that require further consideration. Made ground has been proven on site containing building waste. It is likely that this has been tipped following demolition of the original Park Row dwellings. The made ground soils may contain elevated levels of metals or PAH determinants along with asbestos containing materials or asbestos fibres. Chemical analysis of the soils should be undertaken to further assess the risk and pollutant linkage. The site is underlain by coal measures strata which contain many shallow coal seams along with known coal workings. It is understood that some of the workings beneath the site have been stabilised by drilling and grouting methods. It is unclear as to whether the previous investigation boreholes have been suitably grouted in order to prevent them acting as preferential gas migration pathways directly from the shallow coal seams/workings. Given the age of the investigations, this is unlikely. The existing property has not experienced any issues regarding mine gas, so the risk is considered low. However, future development on site should incorporate gas protection measures to mitigate any risks posed from potential ground/mine gas. Gas protection measures suitable to cater for Gas Characteristic situation 2 should be designed and installed on all future development on site.
Recommended Further Works	It is recommended that an intrusive investigation is undertaken to inspect the ground conditions and to take soil samples for laboratory chemical analysis. It is perceived that dynamically sampled boreholes will be suitable to investigate the site.

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ANNEX C Risk Assessment Definitions

SECTION 1 Introduction and Proposed Development

1.1 Introduction

David and Marie Rees (the Client) is proposing the residential development of land occupied by 5 Park Row located in Cwmavon.

Terra Firma (Wales) Limited have been commissioned by Concept Designs on behalf of the Client to undertake a phase 1 desk study for the site.

The main objectives of the assessment programme are to:

- Provide information on past and current uses of the site and surrounding area
- Provide information on the nature of any hazards and physical constraints, for example buried structures/obstructions
- Provide information on the likely ground conditions beneath the site, including soil types, groundwater and if made ground is likely to be present
- Identify the likely potential environmental liabilities at the site associated with any soil and groundwater contamination from past site uses
- Identify if gas emissions either from the site or surrounding areas is likely to be present
- Produce an initial site conceptual model of the site, to detail the nature and extent of potential contamination, its source, potential pathways and likely receptors (pollutant linkage)
- Prepare a human health and environmental risk assessment for the site
- Provide data to assist in the design of an intrusive site investigation and give early indications of possible remediation requirements

In order to achieve the above objectives, Terra Firma (Wales) Limited carried out an assessment programme including a site walkover and a review of existing data.

1.2 Limitations and Exceptions of Investigation

The Client has requested that a Phase 1 Desk Study (DS) be undertaken to enable the outlined main objectives.

The DS was conducted, and this report has been prepared for the sole internal reliance of the Client and their design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. If an unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill. The report represents the findings and opinions of experienced geoenvironmental and geotechnical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may be required.

It was beyond the scope of this report to assess geotechnical or mining risks.

1.3 Quality Assurance

The quality and environmental aspects of the assessment and investigation comply with UKAS Accredited ISO 9001:2015 and ISO 14001:2015 standards.

SECTION 2 Review of Existing Data

2.1 Physical Setting and Current Site Use

The development site is irregular in shape and locates off Park Row Cwmavon. The site centres on an approximate National Grid Reference of 278110 192670, occupying a plan area of approximately 0.2 Hectares.

The existing dwelling is located in the eastern half of the site and sits upon a plateau which is elevated from Park Row. The western part of the site consists of a large open grassed garden area. A parking area is located on the southern part of this area which is set topographically below the garden and separated by a small retaining wall.

The site is surrounded by residential development. Park Row locates on the sites southern boundary which provides vehicle access to the site.

The site elevation is approximately 71m AOD and remains mostly flat across the majority of the main site plateau. The site falls off to the south with an approximate fall of 2m to the access road of Park Row.

The site location can be seen on **Figure 2.1**.

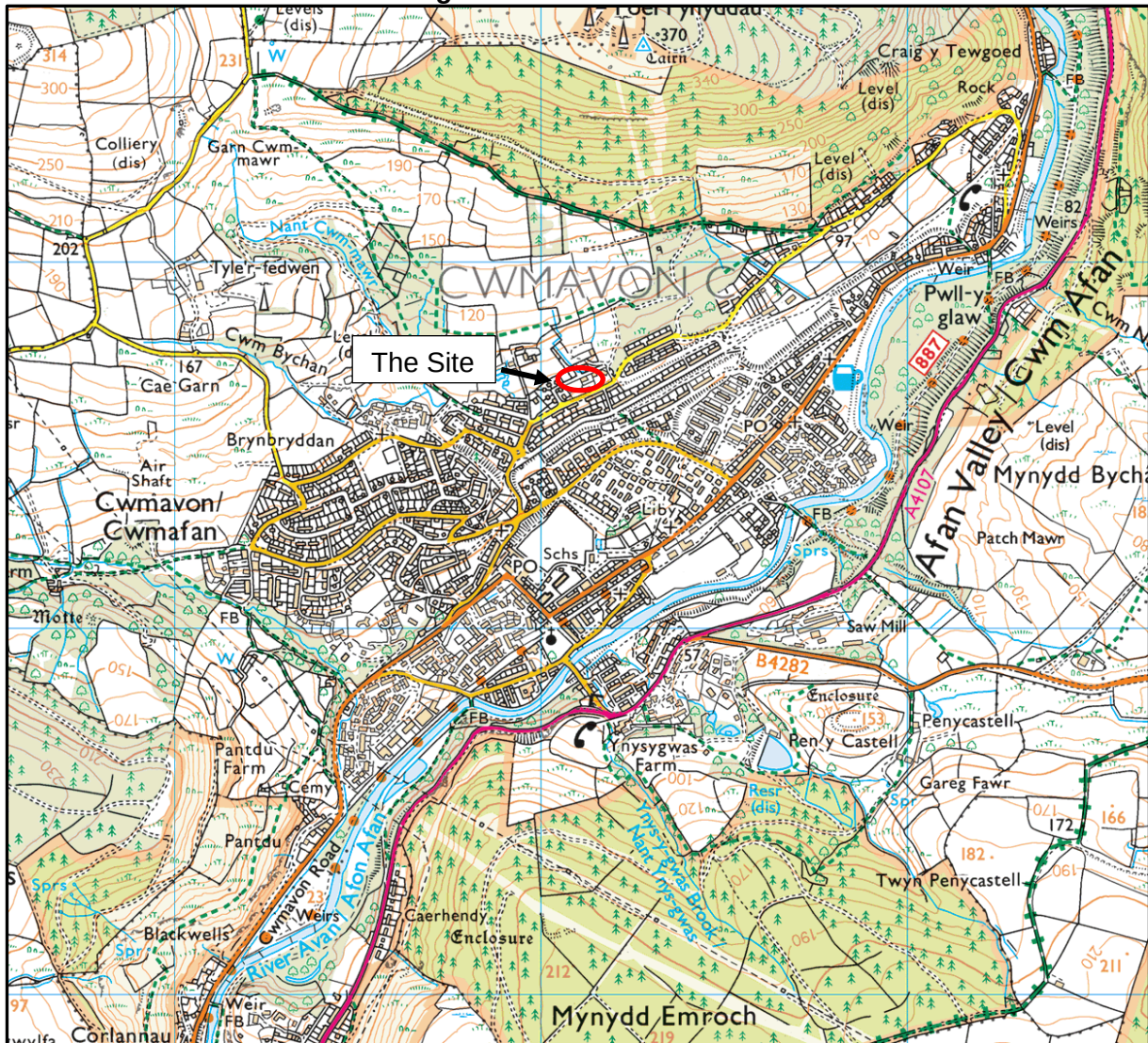


Figure 2.1 Site Location

2.2 Site History

Historical maps of the site have been obtained in an Envirocheck Report, provided by Landmark Information Group. The history plans are supplied in **Annex A** of this report, and the most relevant editions are summarised in **Table 2.1**. Distances, where quoted are approximate, and any changes in-between map editions may not be recorded.

Table 2.1 Historical Development from Map Information

Map Edition & Scale	Key Features on Site	Key Features off Site
1878 1:2,500	The site locates across the gardens of a row of terraced properties labelled Park Row.	A row of terraced houses are shown 20m south of the site labelled Park Row. An Engine House is shown immediately south of Park Row. Finery Coal Slant is shown 180m east of the site. Several old coal levels are shown 220m north of the site. A Copper Works is shown 150m east of the site. Multiple tramways are shown passing and connecting the copper works to the surrounding area. A Chemical works is also shown 130m south of the site. Meadow pit is shown 220m south east of the site. The majority of the area surrounding the copper and chemical works and pit is shown as spoil. This is likely derived from the local coal mining and industrial process in the area.
1899 1:2,500	No change.	The Chemical Works has been replaced by a Steel Works.
1919 1:2,500	No change.	No significant changes.
1936 1:2,500	Several small outbuildings are shown along the northern edge of the site.	Allotment gardens are now shown immediately north of the site.
1949 Arial photo	No noticeable change.	The steel and copper works have been dismantled and the land appears to be in the process of redevelopment.
1965 1:2,500	No change.	Residential development has started to take place to the south in the area of the former steel works.
1975 1:2,500	The site is now shown to be unoccupied. Park Row has been demolished.	The residential development to the south has extended significantly and now covers the entire area of the former steel and copper works. The area to the north east is labelled as a disused tip.
1994	The existing property is now shown on the site.	Park Row is now shown.
2006 1:10,000	The site remains unchanged.	The surrounding area remains unchanged.
2021 1:10,000	No change.	A dwelling is now shown immediately east of the site.

2.3 Geological Setting

2.3.1 Geology

The BGS geology viewer was consulted for geology underlying the site. The site is shown to be underlain by coal measures rock. No superficial soils are shown to overly the solid geology. Detailed stratigraphical information is provided in **Table 2.2**.

Table 2.2 Detailed Stratigraphical Information

Period	Formation
Carboniferous	South Wales Middle Coal Measures Formation - Grey, (productive) coal-bearing mudstones/siltstones, with seatearths and minor sandstones.

A small veneer of made ground is expected on site giving the past site activity.

2.3.2 BGS Borehole Information

The BGS hold several borehole records on the site, though the records are confidential and not available to the public.

There are also several borehole records available for the tip shown to the north east of the site. The boreholes record colliery waste consisting of shale with boulders to depths around 12-13m which overlies boulder clay. No suggestion of organic material is noted in the borehole logs.

2.3.3 Radon

The Envirocheck Report (**Annex A**) details that no radon protective measures are required for new developments on the investigation site.

2.3.4 Mining

A CON29M Coal Report was procured from the Coal Authority. The report is presented in **Annex B**. The report is summarised below:

The property is in a surface area that could be affected by underground mining in 4 seams of coal at 30m to 220m depth, and last worked in 1900. In addition the property is in an area where the Coal Authority believes there is coal at or close to the surface. This coal may have been worked at some time in the past.

Several intrusive mining investigations have been undertaken across the site and the immediate surrounding area which have confirmed the presence of numerous coal seams beneath the site at shallow depth. The investigations have also identified open voids beneath the site associated with past coal and ironstone mining.

It is known that part of the plot 5 area has been subject to drilling and grouting measures in an attempt to stabilise the mine workings beneath the site.

2.4 Environmental Setting

The following sections have been compiled using the Landmark Information Group Envirocheck datasheet and maps which can be found in **Annex A**.

2.4.1 Hydrogeology

The bedrock deposits beneath the site have an aquifer designation of Secondary Aquifer – A

Deeper groundwater flow within the underlying bedrock will be controlled by the strata dip and any fractures or bedding planes within the rock units.

The hydraulic gradient will be at its steepest during periods of heavy rainfall and aquifer recharge.

The site does not locate within a groundwater source protection zone.

The nearest groundwater abstraction point is located 1186m south west of the site, operated by Ms Powell & Mr Spackman for use in water bottling.

2.4.2 Hydrology

The nearest surface water feature locates off site 36m to the north west.

The topography of the local area slopes down towards to the south. Surface water is likely to drain in this direction.

2.4.3 Flooding

The site is not at risk from extreme flooding from rivers or sea.

2.4.4 Waste

Recorded landfill sites within 250m of the site are summaries in **Table 2.3**.

Table 2.3 Landfill Sites Summary

Landfill Name	Distance/ Direction from site	Operation Dates	Deposited Wastes
Disused Tip off Heol Tabor	47m north east	Not supplied	Not supplied though BGS borehole records confirm the tip received colliery waste comprising shale

There are no licensed waste management facilities or waste transfer sites within 250m of the site.

2.4.5 Pollution

No pollution incidents are recorded to have occurred within 250m radius of the site.

2.4.6 Sensitive Land Use

The site is not located within a sensitive land use area.

2.4.7 Measured Urban Soil Chemistry

The BGS do not hold any urban soil chemistry data for the site or surrounding area.

2.4.8 Industrial Land Use

There are no trade directory entries recorded within proximity of the site.

2.4.9 Infilled Land

Potentially infilled land features within 250m of the site are summarised in **Table 2.4**.

Table 2.4 Potentially Infilled Land

Feature	Distance/Direction from site
Unknown Filled Ground – Historical maps show the area to have received colliery waste	79m north east
Unknown Filled Ground - Historical maps show the area to have received colliery waste	83m east
Unknown Filled Ground - Historical maps show the area to have received colliery/ steelworks waste	90m south east

2.5 Historical Site Investigation Data

Terra Firma recently undertook a percolation test on site. The ground conditions encountered comprised made ground to 1.9m which was underlain by a firm sandy gravelly clay. The made ground soils comprised a loose black sandy gravel with brick and metal inclusions.

SECTION 3 Preliminary Human Health and Environmental Risk Assessment

3.1 General

The preliminary human health and environmental risk assessment is a qualitative evaluation of unacceptable risks to human health or the environment from potential 'contaminated land', based on reviewed information in preceding sections of this report.

For 'contaminated land' to exist as defined in Part 2A of the Environmental Protection Act (EPA) 1990, a Pollutant Linkage needs to be identified. Pollutant linkages are defined by having a valid 'source – pathway – receptor' as established in the preliminary conceptual site model.

For our definitions of pollution linkage and how we define risk please refer to **Annex B** which includes our classifications of consequence and probability, and risk assessment matrix.

3.2 Potential Sources of Contamination

Potential or known sources of contamination associated the sites current and historical land use are summarised in **Table 3.1**.

Table 3.1 Contamination Sources

ID	Source	Contaminant
S1	Building/demolition waste in made ground	Metals, PAH, asbestos
S2	Infilled land	Methane, Co2
S3	Mine workings	Methane, Co2

No other significant potential on-site or off-site sources of contamination have been identified during the desk study.

3.2.1 Omitted Potential Sources

One potential source of contamination highlighted in this Phase 1 Desk Study have been excluded from further risk assessment. These are listed in **Table 3.2**.

Table 3.2 Omitted Contamination Sources

Source	Reasoning
Steel, Chemical and Copper Works	All sources were located downgradient of the site and it is extremely unlikely that contamination arising from these sources would migrate upwards toward the site
Railway land	Again, all railway land was located downgradient of the site.

3.3 Potential Pollution Pathways

Potential contaminant pathways associated with a **residential with home grown produce land use** are as follows.

- P1 – Direct soil and dust ingestion
- P2 – Consumption of home grown produce
- P3 – Dermal contact
- P4 – Inhalation of dust and vapours
- P5 – Vertical migration of leachates (unsaturated zone)
- P6 – Horizontal and vertical migration of contaminants (saturated zone)
- P7 – Artificial contaminant pathway (borehole, grout hole)
- P8 – Horizontal and vertical migration of ground gasses and vapours

P9 – Direct contact with construction materials

P10 – Inhalation of asbestos fibres

3.4 Potential Receptors

There are human and hydrological receptors to any contamination that may be present on site. Potential receptors include.

R1 – Construction and maintenance workers

R2 – Future site users (residents)

R3 – Passers-by or neighbouring site users

R4 – Groundwater (aquifer)

R5 – Construction materials (concrete/potable water pipes)

3.5 Preliminary Conceptual Site Model

The preliminary conceptual site model establishes potential pollutant linkages between contaminants (source), pathways and receptors, realised during the preparation of the desk study report. Where a potential pollutant linkage is identified an assessment of risk is subsequently undertaken. The preliminary conceptual site model is tabulated in **Table 3.3**.

Outcomes of the preliminary conceptual site model are used as a basis for the design and implementation of the site investigation, whereby areas of potential contamination can be targeted as well as investigating the wider site.

Findings of the site investigation can in turn be used to develop and refine the conceptual site model.

3.6 Conclusions

The desk study has identified several potential sources of contamination that require further consideration.

Made ground has been proven on site containing building waste. It is likely that this has been tipped following demolition of the original Park Row dwellings. The made ground soils may contain elevated levels of metals or PAH determinants along with asbestos containing materials or asbestos fibres. Chemical analysis of the soils should be undertaken to further assess the risk and pollutant linkage.

The site is underlain by coal measures strata which contain many shallow coal seams along with known coal workings. It is understood that some of the workings beneath the site have been stabilised by drilling and grouting methods.

It is unclear as to whether the previous investigation boreholes have been suitably grouted in order to prevent them acting as preferential gas migration pathways directly from the shallow coal seams/workings. Given the age of the investigations, this is unlikely.

The existing property has not experienced any issues regarding mine gas, so the risk is considered low. However, future development on site should incorporate gas protection measures to mitigate any risks posed from potential ground/mine gas. Gas protection measures suitable to cater for Gas Characteristic situation 2 should be designed and installed on all future development on site.

Table 3.3 Preliminary Conceptual Site Model

Source	Pathway	Receptor	Preliminary Risk Assessment		
			Consequence	Probability	Risk
Human Health					
S1 - Building/demolition waste in made ground	P1 – Direct soil and dust ingestion P2 – Consumption of home grown produce P3 – Dermal contact P4 – Inhalation of dust and vapours P10 – Inhalation of asbestos fibres	R1 - Construction and maintenance workers	Medium	Low Likelihood	Low Risk - COSHH assessment and good level of PPE/ hygiene by site workers/ staff; dust suppression measures if required. Suitably designed site investigation recommended
		R3 - Passers-by or neighbouring site users	Medium	Unlikely	Low Risk - Dust suppression measures if required.
		R2 - Future site users (residents)	Medium	Likely	Medium Risk – made ground comprising building/demolition waste is know to be located on site which is a credible known source of contamination
S2 – Infilled land S3 – Mine Workings	P7 – Artificial contaminant pathway (borehole, grout hole) P8 - Horizontal and vertical migration of ground gasses and vapours	R2 - Future site users (residents)	Medium	Low Likelihood	Low Risk – Only small areas of workings encountered beneath the site in historic investigations. Large areas of infilled land are not likely to contain organic waste capable of generating ground gasses
S1 - Building/demolition waste in made ground	P9 - Direct Contact	R5 - Construction materials (water pipes and concrete)	Mild	Low Likelihood	Low Risk
Aquatic Environment					
S1 - Building/demolition waste in made ground	P5 - Vertical migration of leachates (unsaturated zone) P6 - Horizontal and vertical migration of contaminants (saturated zone)	Groundwater (aquifer) R4	Mild	Low Likelihood	Low Risk – Low permeability soils will prevent migration of contaminants

SECTION 4 Recommended Site Investigation

4.1 General

An intrusive site investigation designed and justified in accordance with guidance provided in BS10175:2011+A2:2017 should be undertaken to achieve the following objectives:

- Identify the potential environmental liabilities at the site associated with the known made ground from past site uses, to substantiate and enhance the conceptual site model, for a residential with home grown produce scenario.
- Provide a summary of the environmental conditions at the site, together with any necessary remediation works to render the site fit for its intended use.

4.2 Intrusive Investigation

It is recommended that an intrusive investigation is undertaken to inspect the ground conditions and to take soil samples for laboratory chemical analysis. It is perceived that dynamically sampled boreholes will be suitable to investigate the site.

4.3 Soil Sampling Strategy

Soil sampling locations should be selected on a non-targeted basis to characterise the contamination status of the site.

4.4 Recommended Soil Chemical Analysis

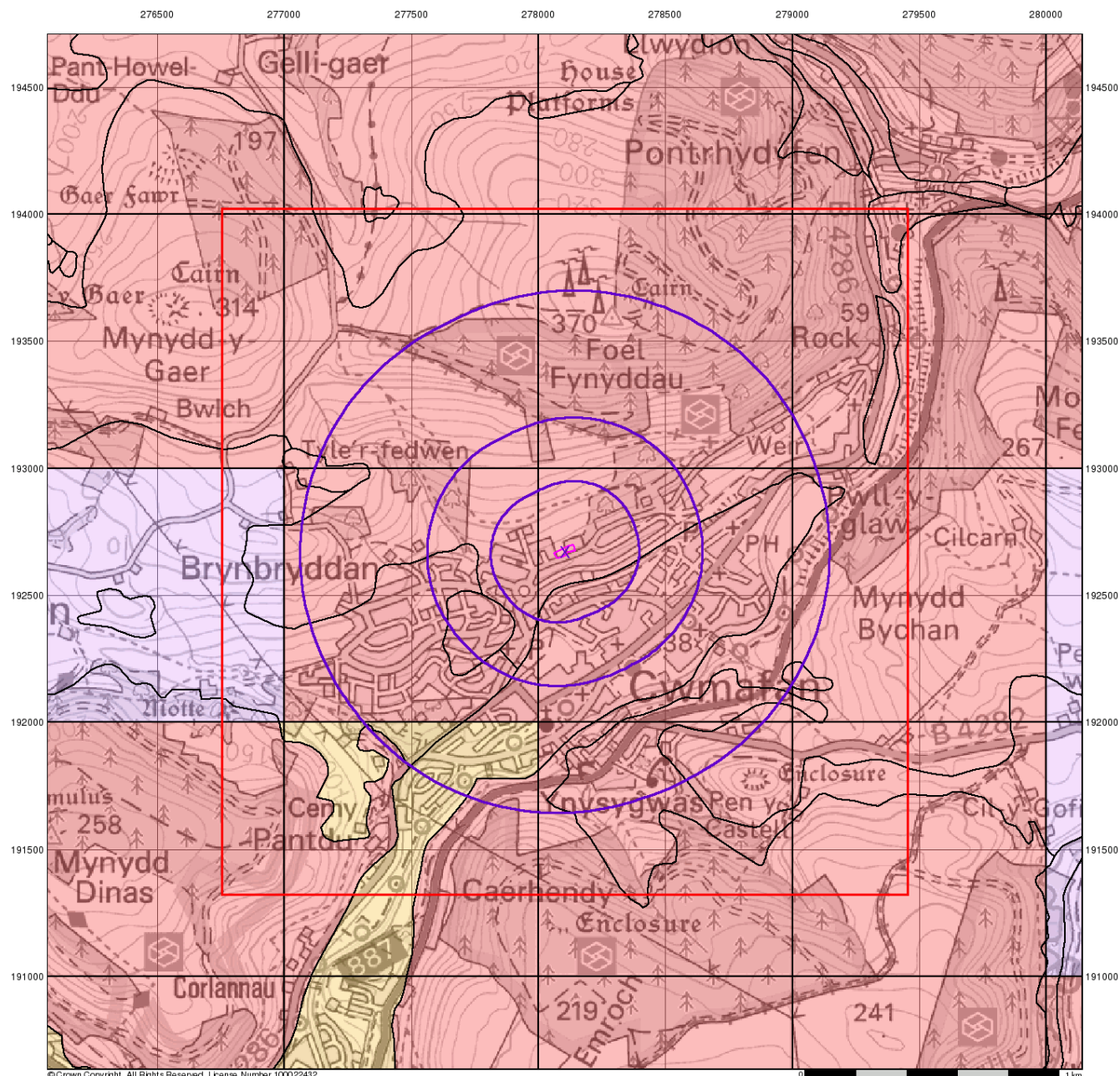
It is recommended that soil samples be taken of the made ground and underlying natural materials and tested at an accredited laboratory for the determinants listed in **Table 4.1**.

Table 4.1 Soil Laboratory Analysis

Metals & Metalloids	In-Organics	Organics	Others
Arsenic	Cyanide	Phenols	pH (acidity)
Cadmium	Sulphate	PAH	Asbestos
Chromium III		Petroleum Hydrocarbons	
Chromium VI			
Copper			
Lead			
Mercury			
Nickel			
Selenium			
Zinc			

Soil samples exhibiting elevated levels of metal and metalloid determinants should be further schedule for leachate testing of the offending substance.

**ANNEX A
Envirocheck Report**



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Groundwater Vulnerability

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Bedrock Aquifers

- High Vulnerability, Principal Aquifer
- High Vulnerability, Secondary Aquifer
- Medium Vulnerability, Principal Aquifer
- Medium Vulnerability, Secondary Aquifer
- Low Vulnerability, Principal Aquifer
- Low Vulnerability, Secondary Aquifer

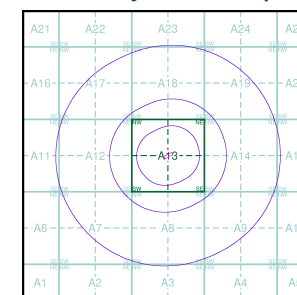
Superficial Aquifers

- High Vulnerability, Principal Aquifer
- High Vulnerability, Secondary Aquifer
- Medium Vulnerability, Principal Aquifer
- Medium Vulnerability, Secondary Aquifer
- Low Vulnerability, Principal Aquifer
- Low Vulnerability, Secondary Aquifer

Unproductive Aquifer

Soluble Rock

Site Sensitivity Context Map - Slice A



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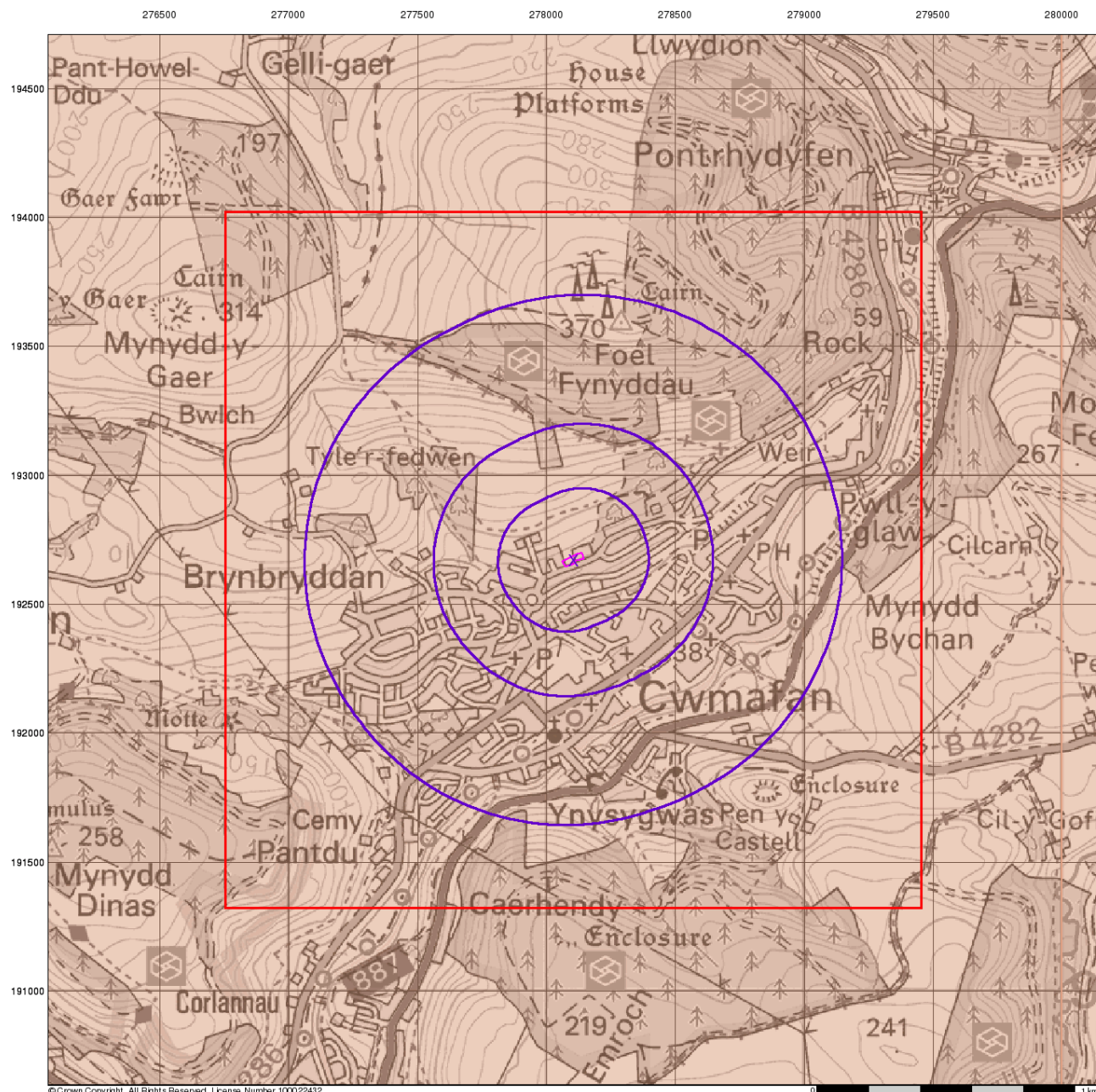
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 Customer Ref: 15568
 National Grid Reference: 278110, 192670
 Slice: A
 Site Area (Ha): 0.2
 Search Buffer (m): 1000

Site Details

5, Park Row, Cwmavon, PORT TALBOT, SA12 9PW

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0 1 km



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Bedrock Aquifer Designation

General

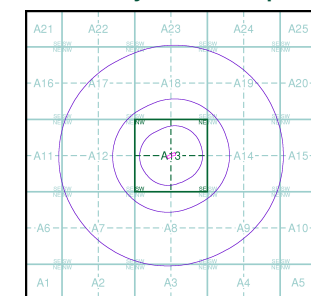
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A



Order Details

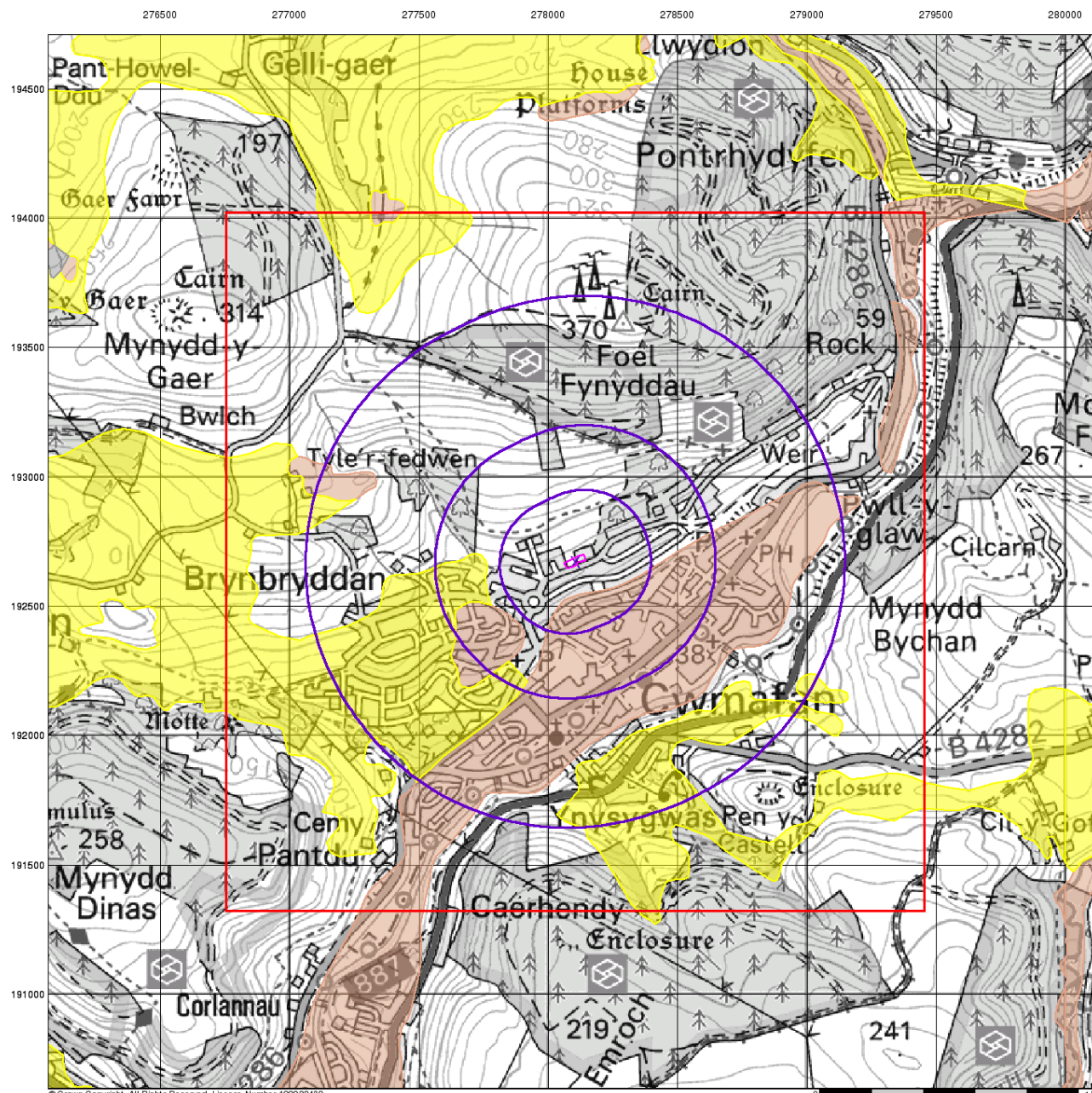
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Superficial Aquifer Designation

General

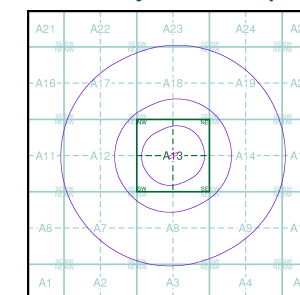
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A



Order Details

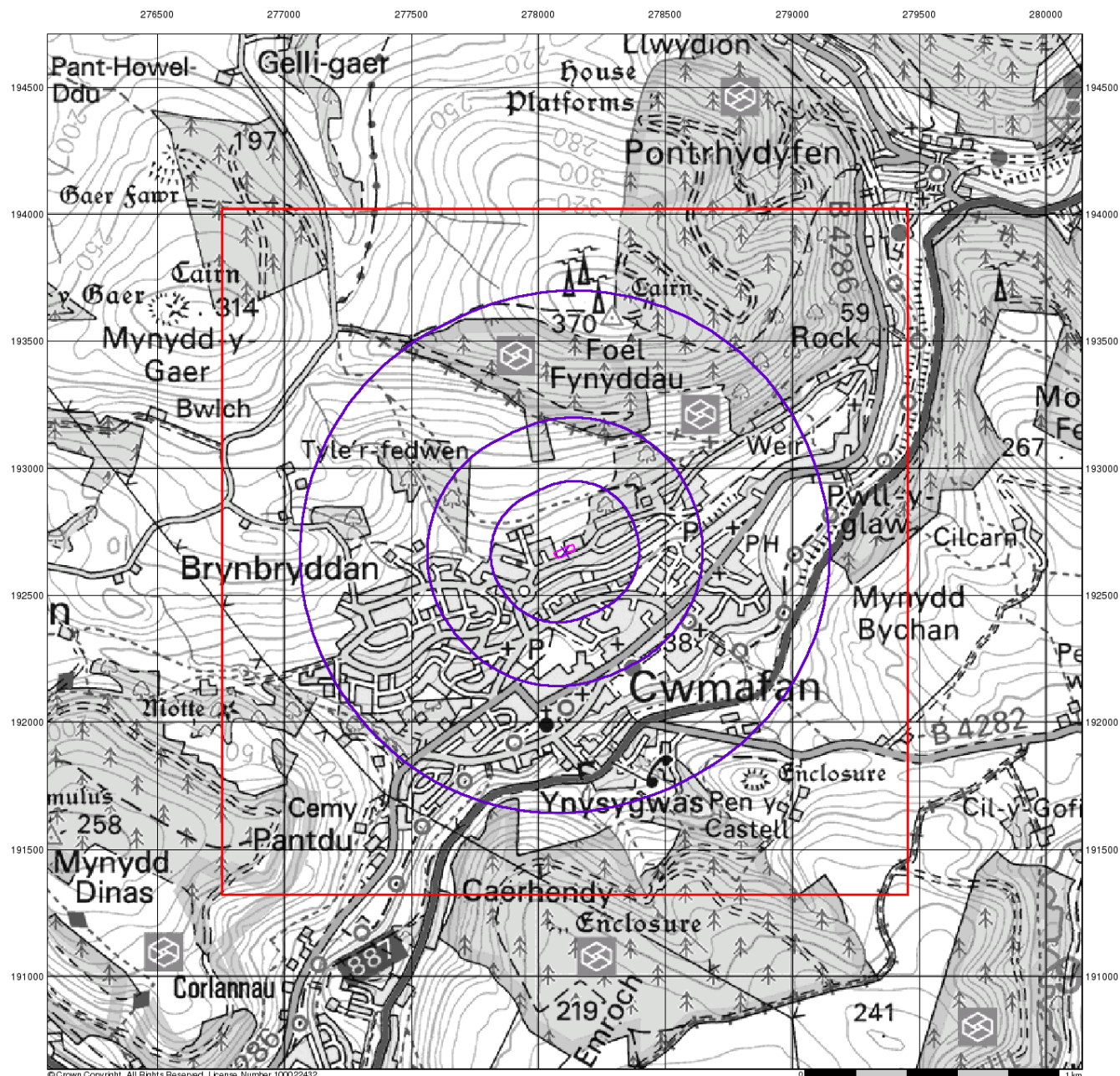
Order Number: 284338045_1_1
 Customer Ref: 15568
 National Grid Reference: 278110, 192670
 Slice: A
 Site Area (Ha): 0.2
 Search Buffer (m): 1000

Site Details

5, Park Row, Cwmavon, PORT TALBOT, SA12 9PW



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Source Protection Zones

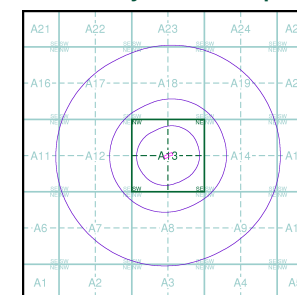
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)

Site Sensitivity Context Map - Slice A



Order Details

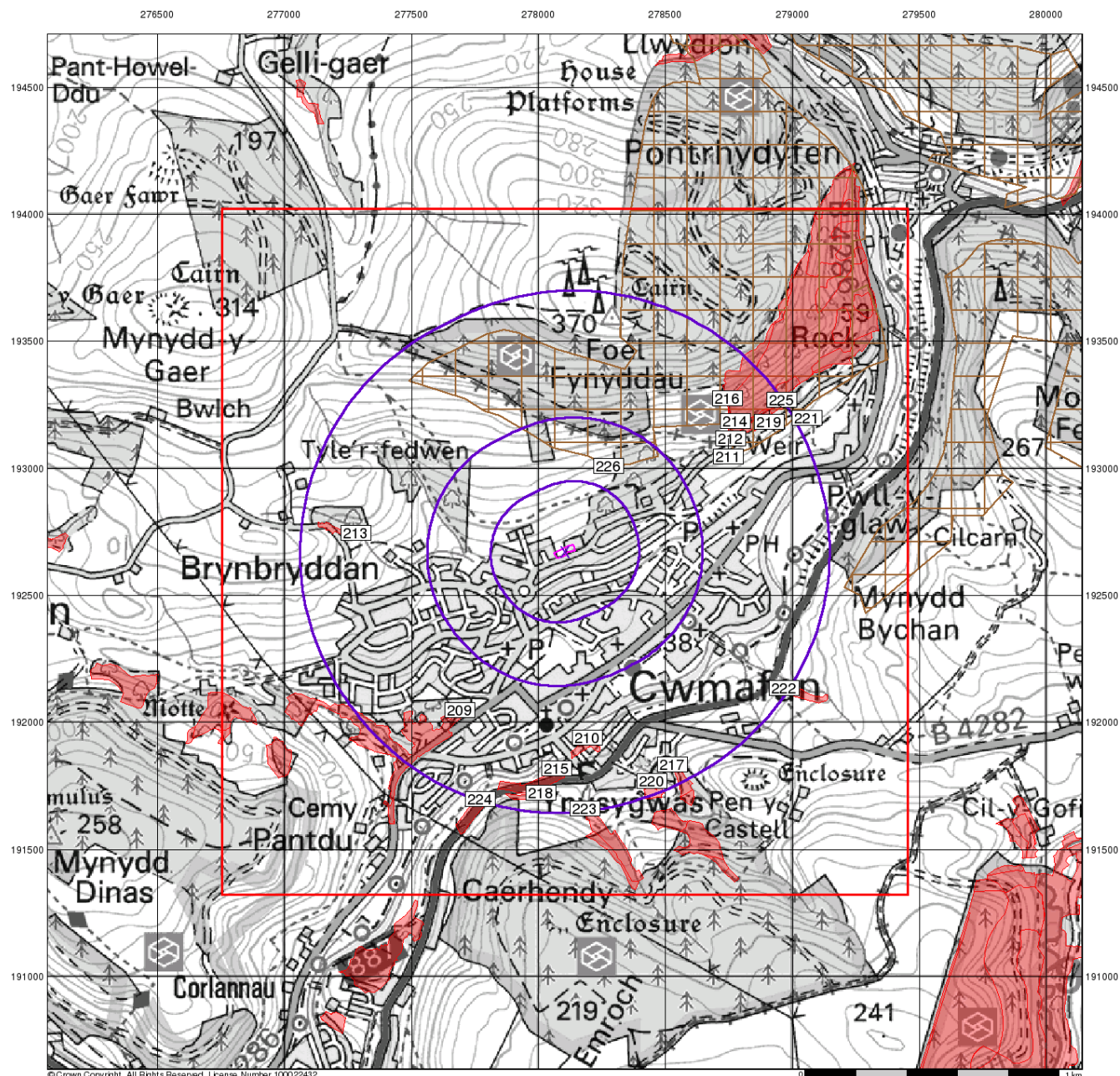
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Sensitive Land Uses

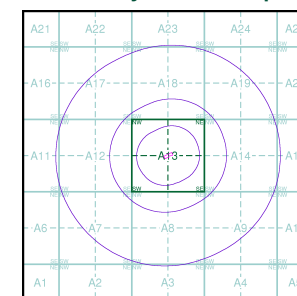
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Sensitive Land Uses

- Ancient Woodland
- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
- Forest Park
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area
- World Heritage Sites

Site Sensitivity Context Map - Slice A



Order Details

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