



Remediation Strategy Report

Site: Land off Tabernacle Terrace, Cwmafan

Prepared For: Edwards Properties South Wales

Issue Date: December 2024

Job No: 14611

REPORT TITLE : **Geotechnical and Geoenvironmental Report:
Proposed Residential Development, Land off
Tabernacle Terrace, Cwmafan, Port Talbot**

JOB NUMBER : **14611**

DATE : **December 2024**

REPORT REFERENCE : **14611-CA-RS-3**

Document Revision Record

Issue	Date	Revision Details
1	July 2019	Draft
2	July 2019	Second revision
3	2 nd December 2024	Update of document post issue of 14611-CA-GGR-5, Geotechnical and geoenvironmental report

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TABLE OF CONTENTS

SECTION 1 Introduction and Proposed Development	1
1.1 Introduction	1
1.2 Objectives	1
1.3 Previous Investigations and Assessments	1
1.4 Roles and Responsibilities	1
1.5 Limitations and Exceptions of Investigation	1
1.6 Quality Assurance	2
1.7 Author Competency	2
SECTION 2 Site Characteristics	3
2.1 Site Location and Description	3
2.2 Site History Summary	4
2.3 Ground Conditions	4
2.4 Radon	4
2.5 Mining	4
2.6 Hydrogeology and Hydrology	4
2.7 Identified Contamination	5
2.7.1 Made Ground Soils S1, S2	5
SECTION 3 Sources of Contamination Requiring Remediation	6
SECTION 4 Proposed Remedial and Mitigating Measures	7
4.1 General	7
4.2 Made Ground Soils S1, S2	7
4.2.1 Protection of Construction & Maintenance Workers	7
4.2.2 Protection of Future Site Users (Residents)	7
SECTION 5 Validation of Remedial and Mitigating Measures	8
5.1 Capping System Installation	8
5.1.1 Imported Soil Validation	8
SECTION 6 General Working Practices	10
6.1 Protection of Construction Workers	10
6.2 Protection of the Environment	10
6.3 Importation of Materials	10
6.4 Management & Disposal of Soils	11
6.5 Groundwater Disposal	11

Tables

Table 1.1 Roles and Responsibilities	1
Table 2.1 Summary of Ground Conditions	4
Table 2.2 Summary of Typical Ground Conditions Encountered by Rotary Boreholes	4
Table 2.3 Made Ground Contamination Summary	5
Table 3.1 Summary of Significant Pollutant Linkages	6
Table 5.1 Validation Criteria	8

Figures

Figure 2.1 Site Location	3
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Annexes

Drawings

Drawing 01 Current Site Layout

Drawing 02 Proposed Site Layout

SECTION 1 Introduction and Proposed Development

1.1 Introduction

Edwards Properties South Wales (the Client) are proposing the development of residential housing at Tabernacle Terrace, Cwmafan, Port Talbot.

TFW Group Ltd (Terra Firma) has been commissioned by the Client to prepare a Remediation Strategy report for the construction phase.

Previous investigations and assessments have identified that remediation of contamination is required for the development. This report presents a Remediation Strategy for Phase 1 during the construction phase based on these previous investigations and assessments.

Any changes from the approved methodologies detailed in this report must be agreed with the Local Authority prior to undertaking such works.

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 all landscape and garden areas

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 - Geotechnical and Geoenvironmental Report, 14611-CA-GGR-5

1.4 Roles and Responsibilities

Table 1.1 Roles and Responsibilities

Role	Organisation
Client	Edwards Properties South Wales
Local Authority	Neath Port Talbot Council
Geotechnical & Geoenvironmental Consultant/ Verification Consultant	Terra Firma (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 Ltd. 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. TFW Group Ltd does not provide legal advice and the advice of lawyers may be required.

It is not within the scope of Terra Firma to:

- Prepare Method Statements and Risk Assessments for the site remediation, preparation and development.

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.

1.7 Author Competency

Mr Rhys-Williams has extensive experience in brownfield land investigation, risk assessment and site remediation gained while working for various geotechnical and geoenvironmental contractors and consultants since 2014.

Mr Rhys-Williams holds a bachelor honours degree in Geology obtained from the University of Bristol in 2010 and is a fellow of the Geological Society of London, maintaining regular industry related continuous professional development.

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 triangular in shape and centres on an approximate National Grid Reference of 277890, 192180, occupying a plan area of approximately 0.17 Hectares. The site is confined within a parcel of land bound to the northwest by Tabernacle Terrace, residential housing to the southeast and mature woodland to the northeast adjacent to the playing field.

The site is shown in **Figure 2.1**.

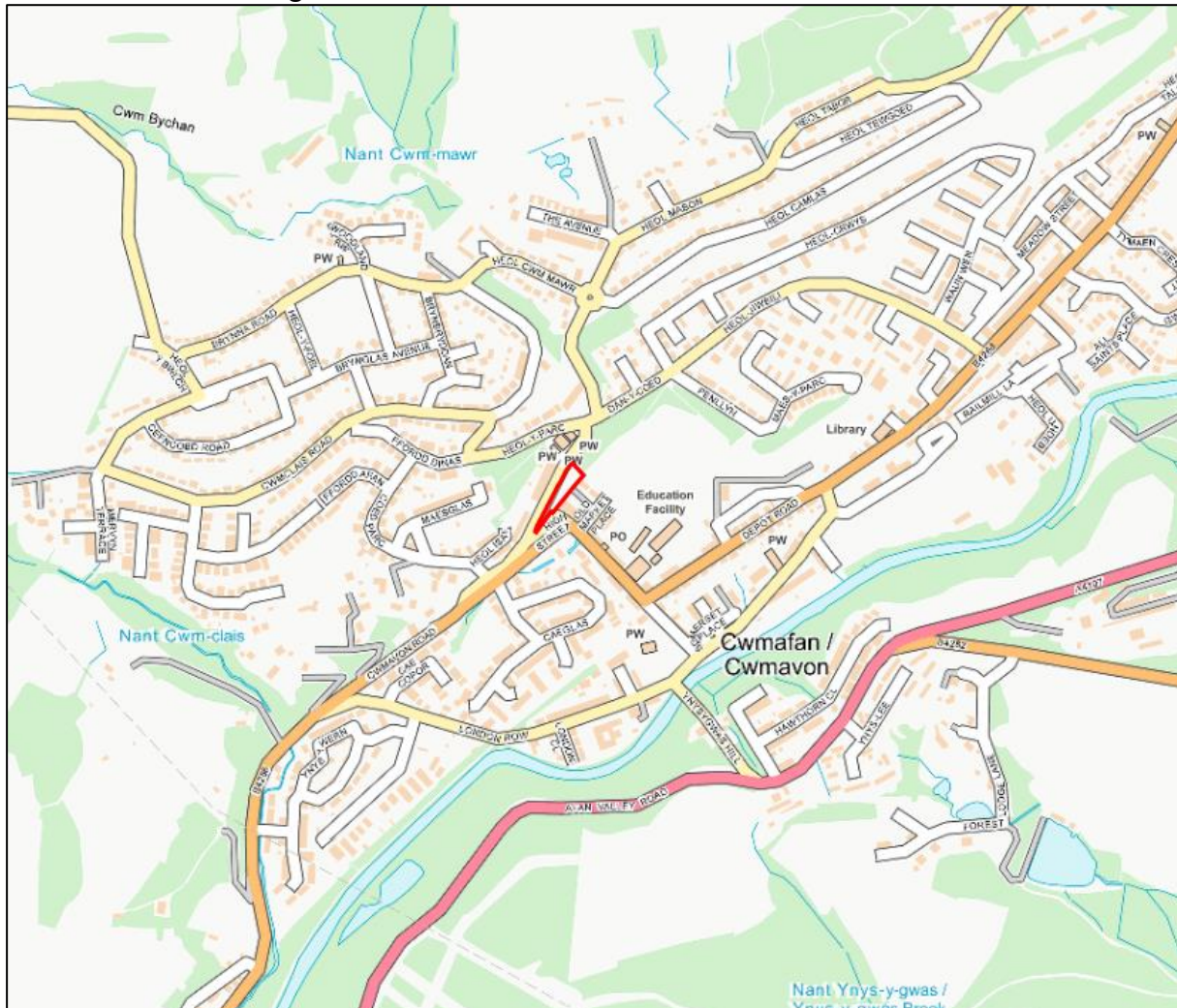


Figure 2.1 Site Location

The western boundary of the site is marked by Tabernacle Terrace. The eastern boundary is marked by a retaining wall in the north beyond which is a lane and in the south by a road. The northern boundary is marked by some steps.

The site and surrounding area falls in elevation to the east. The western side of the site falls steeply to the level plateau which forms the eastern side of the site. The site is then retained above the land and houses to the east.

Current and proposed site layouts are presented in **Drawing 01** and **Drawing 02** respectively.

2.2 Site History Summary

The earliest map edition c.1877 shows the site to be occupied by a terrace of structures across the centre of the site. An additional structure is added to the site in the late 1910's. The site is then cleared and by the 1964 edition shows that all structures have been removed. A square structure is then constructed towards the northeast of the site and is shown on the 1978 edition. This is subsequently removed by the 2006 edition and the site is then unoccupied to the most recent edition.

2.3 Ground Conditions

The ground conditions encountered by the exploratory holes can in general be summarised as shown in **Table 2.1**.

Table 2.1 Summary of Ground Conditions

Depth (m)			Thickness (m)	Stratum
0.00	-	0.90/1.50	0.90/1.50	Variable MADE GROUND
0.90/1.50	-	>2.10/2.30	-	Variable NATURAL STRATA comprising firm to stiff, grey green and brown, slightly gravelly CLAY with occasional cobble / (Medium dense), grey brown, clayey SAND and GRAVEL / Medium dense, grey silty SAND / Stiff, light grey, laminated slightly sandy silty CLAY / Soft to firm, grey brown, silty sandy CLAY / Very soft, orange brown and grey, sandy slightly gravelly CLAY /

Deeper ground conditions encountered by the rotary boreholes can in general be summarised as shown in **Table 2.2**.

Table 2.2 Summary of Typical Ground Conditions Encountered by Rotary Boreholes

Depth (m)			Thickness (m)	Stratum
0.00	-	1.20/2.00	1.20/2.00	FILL
1.20/2.00	-	7.50/9.50	6.30/7.50	Gravelly CLAY
7.50/9.50	-	16.50/22.60	7.00/14.00	MUDSTONE and SANDSTONE
16.50/22.60	-	17.50/23.60	1.00	COAL (not in BH01)
17.50/23.60	-	20.30/25.10	1.50/2.80	MUDSTONE and SANDSTONE
20.30/25.10	-	21.00/25.80	0.70	COAL (not in BH01)
21.00/25.80	-	>37.00/40.00	Unknown	MUDSTONE and SANDSTONE

Notes: Driller's descriptions of strata encountered

2.4 Radon

Radon protective measures are not required for new developments on the investigation site.

2.5 Mining

It was concluded that there is a negligible risk to the proposed development from past unrecorded underground mining.

2.6 Hydrogeology and Hydrology

The nearest recorded groundwater abstraction point is located 733m to the southwest of the site.

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

Groundwater was typically encountered between 0.80m and 1.20m in the trial pits and between 6.00m and 10.00m in the rotary boreholes.

The nearest surface water feature locates 50m to the south. This feature comprises a river within the Afan catchment area.

The topography of the site generally slopes steeply towards the southeast, therefore the likely flow of surface and shallow groundwater would also be in this direction.

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 bedrock and superficial deposits beneath the site have an aquifer designation of 'Secondary A'. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. Locally the superficial aquifer designation is recorded as unproductive.

2.7 Identified Contamination

2.7.1 Made Ground Soils S1, S2

Previous risk assessments have identified potential pollutant linkages attributed to the presence of organic and metal contaminants in soils. Please refer to this previous report for exploratory hole locations, laboratory testing certificates, risk assessment criteria and definitions. **Table 2.3** summarises contaminants identified in made ground soils.

Table 2.3 Made Ground Contamination Summary

Location and Depth	Contaminant	Source
TP01 0.50m	Lead, PAH	S1 S2
TP02 0.40m	PAH	
TP03 0.30m	1-1,Dichloroethane	
TP04 at 0.80m	PAH, 2-Methyl-4,6-Dinitrophenol	
TP06 at 0.60m	Arsenic, PAH	
TP07 at 0.40m	Lead	
TP08 at 0.20m	Lead, PAH, EPH >C16-C21	

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
Contaminated Soils S1 S2	Direct soil and dust ingestion P1 Dermal contact P3 Inhalation of dust and vapours P4	Construction and maintenance workers R1
		Future site users (residents) R2

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 S1, S2

4.2.1 Protection of Construction & Maintenance Workers

The potential production of soil dust containing the identified contaminants during construction works presents a risk to construction and maintenance workers through direct soil and dust ingestion, dermal contact, inhalation of dust and vapours.

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

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

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

These protection measures are required to be detailed in the Developer's Risk Assessment and Method Statements as well as their 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 the identified contaminants, during excavation of made ground soils while undertaking gardening activities.

Neither in-situ treatment of the contaminated soils, nor complete removal of the contaminant source would prove to be economical given the low level of risk identified and the volume of affected soils, therefore, the installation of a capping system utilising natural site-won topsoils is proposed to interrupt the link between the source and receptor.

It is the developer preferred solution to hard landscaped the site with a permanent cover and provide raised planters to improve the visual aesthetics. The proposed capping is detailed in **Drawing 02**.

It will therefore be necessary to place a covenant on the properties to stipulate that the hard capping could not be penetrated or removed for the duration of the development's existence.

Validation of the capping system and any imported materials (if applicable) will be required.

SECTION 5 Validation of Remedial and Mitigating Measures

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

- Capping system (installation)

Any deviation from the agreed validation measures will require approval from the Local Authority EHO/CLO prior to undertaking such works.

5.1 Capping System Installation

Given the nature of the developers preferred capping system it will not be possible to undertake hand dug pits to confirm the thickness of the capping, however, this is not critical to the function of the capping. It is recommended that detailed photographs which show the emplacement of the capping are taken throughout the project and while the hard standings are placed.

In the garden areas this should clearly show the installation of the geofabric above the in-situ soils, the aggregate and brick paving.

A validation report including a description of the works undertaken, validation photographs shall be presented upon completion. If imported soils are required for the raised planters, depending on the source and volume, chemical testing may be required as detailed in

5.1.1 Imported Soil Validation

Importation of soils may be required, to fill the raised planters planned in the garden areas of the properties.

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 obtained soil samples must be analysed for the determinands listed in **Table 5.1**, and results compared to the validation pass thresholds listed within.

Table 5.1 Validation Criteria

Determinand	Units	Validation Pass Thresholds	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

SECTION 6 General Working Practices

6.1 Protection of Construction Workers

In order that construction workers are protected during site works across the site the following will need to 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 must be defined prior to commencement of site works

A wealth of further guidance and legislation relating to safe working on brownfield construction sites is available or sign-posted at hse.gov.uk.

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 must 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 must also be taken.

- All potential chemicals and associated risks and emergency procedures for spills/leaks must 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 must be adequately stored in suitable containers, with clear labelling.
- Any oil or hazardous substance containers and associated pipe works must 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 must be informed of procedures and restrictions.
- Any materials on delivery must be covered to ensure there is no spillage.
- Any detergents, paints, chemicals etc must not be allowed to be discharged into surface drains or water courses.
- Washing out and cleaning of concrete/cement plant must 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 Importation of Materials

All imported soils, aggregate or stone that are not otherwise exempt must be validated as suitable for use in accordance with Welsh Land Contamination Working Group. May 2013. Requirements for the Chemical testing of Imported Materials for Various End Uses and Validation of Cover Systems, V1.

6.4 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'.

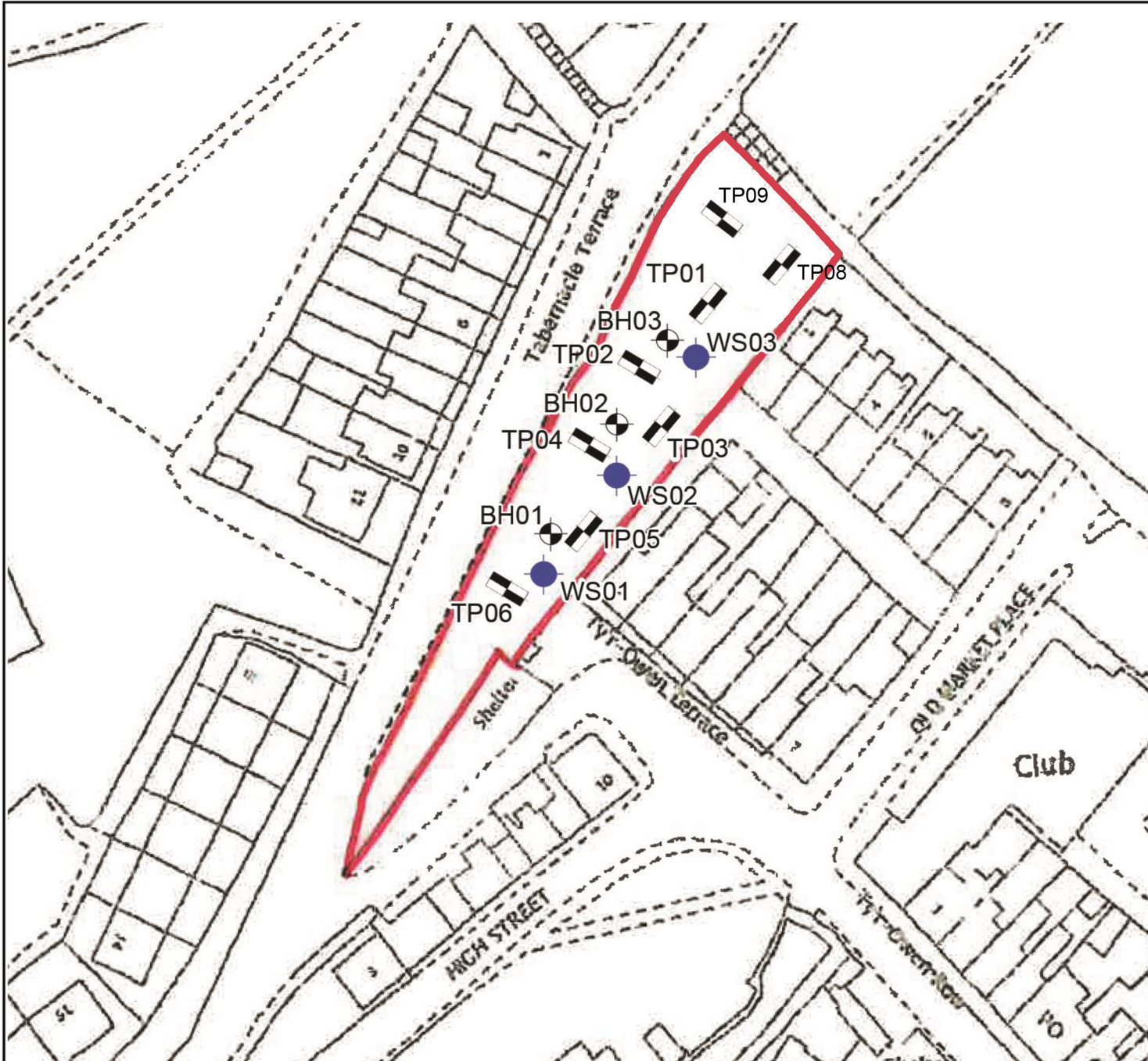
A contaminated land specialist should supervise and document any earthworks on site.

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.

6.5 Groundwater Disposal

Within localised pockets of perched groundwater, any contaminated water shall be removed and treated to remove suspended sediment and excessive concentrations of hydrocarbons. Any free phase product encountered, which is considered unlikely, shall be removed using an oil water separator and subject to agreement with Welsh Water discharged to foul sewer. Wastewater may need to be passed through a carbon filter prior to discharge to foul sewer. Any groundwater pumping, also considered unlikely, will be undertaken in accordance with the Water Resources Act under an abstraction permit if required.

DRAWINGS



Job Number:

14611

Job Title:

Tabernacle Terrace, Cwmafan

Drawing Title:

Current Site Layout

Drawing Number:

01

Scale:

Not To Scale

Legend:



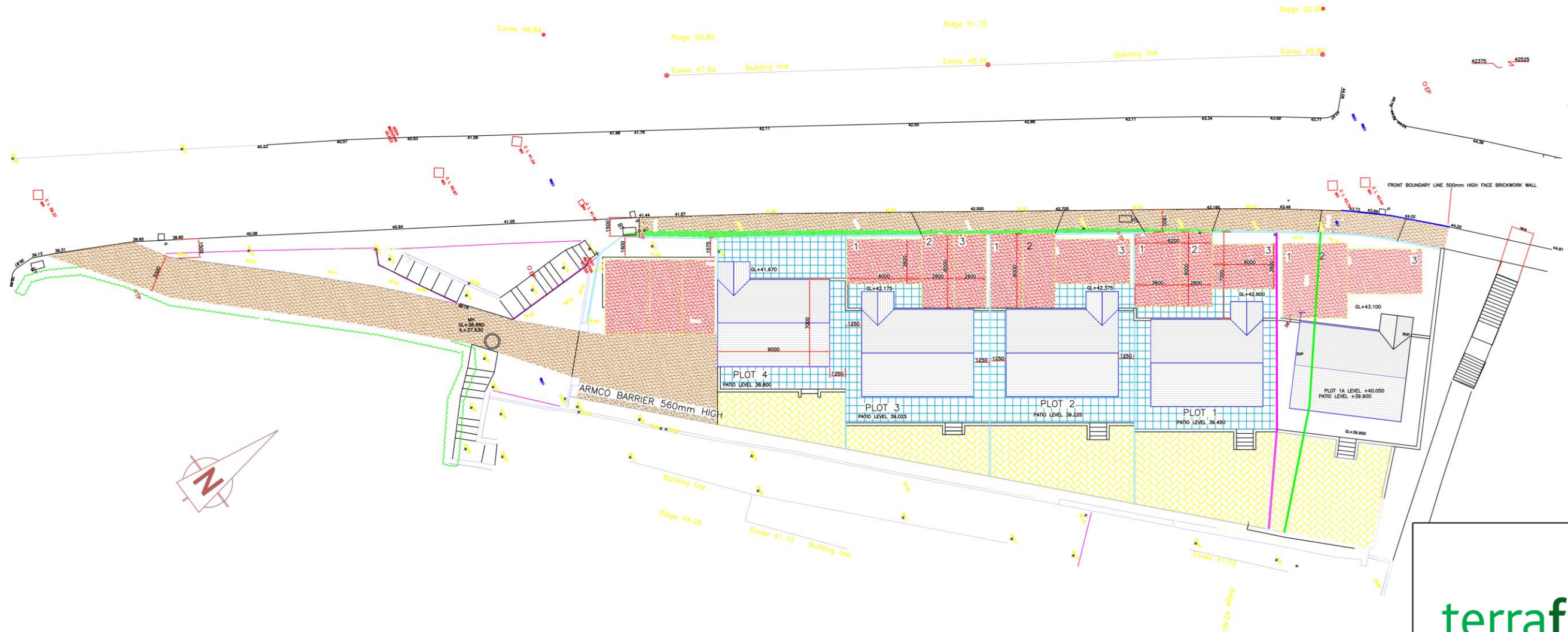
Approximate position of machine excavated trial pit



Approximate position of mini percussive borehole



Approximate position of rotary percussive borehole



Job Number:

14611

Job Title:

Tabernacle Terrace

Drawing Title:

Site Layout

Drawing Number:

02

Scale:

Not To Scale

Legend:



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