



Remediation Strategy Report

Site: Pant Celydd, Margam

Prepared For: CJ Construction Wales Ltd

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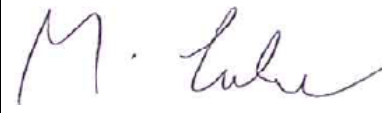
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SECTION 1 Introduction and Proposed Development

1.1 Introduction

CJ Construction Wales Ltd (the Client) is proposing the development of residential housing at Pant Celydd, Margam.

Terra Firma (Wales) Limited have been commissioned by 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
- Installation of suitable potable water pipes

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 relevant documents.

- Terra Firma Wales Ltd, July 2021, Geotechnical and Geoenvironmental Report, Reference 280721-16306-2.

1.4 Roles and Responsibilities

Table 1.1 Roles and Responsibilities

Role	Organisation
Client	CJ Construction Wales Ltd
Local Authority	Neath and Port Talbot County Borough Council
Geotechnical & Geoenvironmental Consultant	Terra Firma Wales Ltd
Validator	Terra Firma Wales 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 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 geo-environmental and geotechnical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may be required.

It is not within the scope of Terra Firma (Wales) 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.

2.1 Site Location and Description

The site is located off Toronto Avenue, in the Margam area of Port Talbot, and is centred on a National Grid Reference of 278150 187960. The site covers an area of 0.48 hectares.

The site lies to the immediate north of houses fronting onto Toronto Avenue, and to the immediate west of Pant Celydd. Houses lie on the opposite side of Pant Celydd. To the immediate west of the site and separated by a wall is Groeswen Playing Fields. To the north of the site is a footpath, beyond which are houses.

The site is covered by trees, brambles, bushes and long grass. A path passes through the site from the north northwest to south southeast, however due to the overgrown nature of the site, this is no longer evident or usable. The site is generally flat throughout and lies at approximately 8m above Ordnance Datum.

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

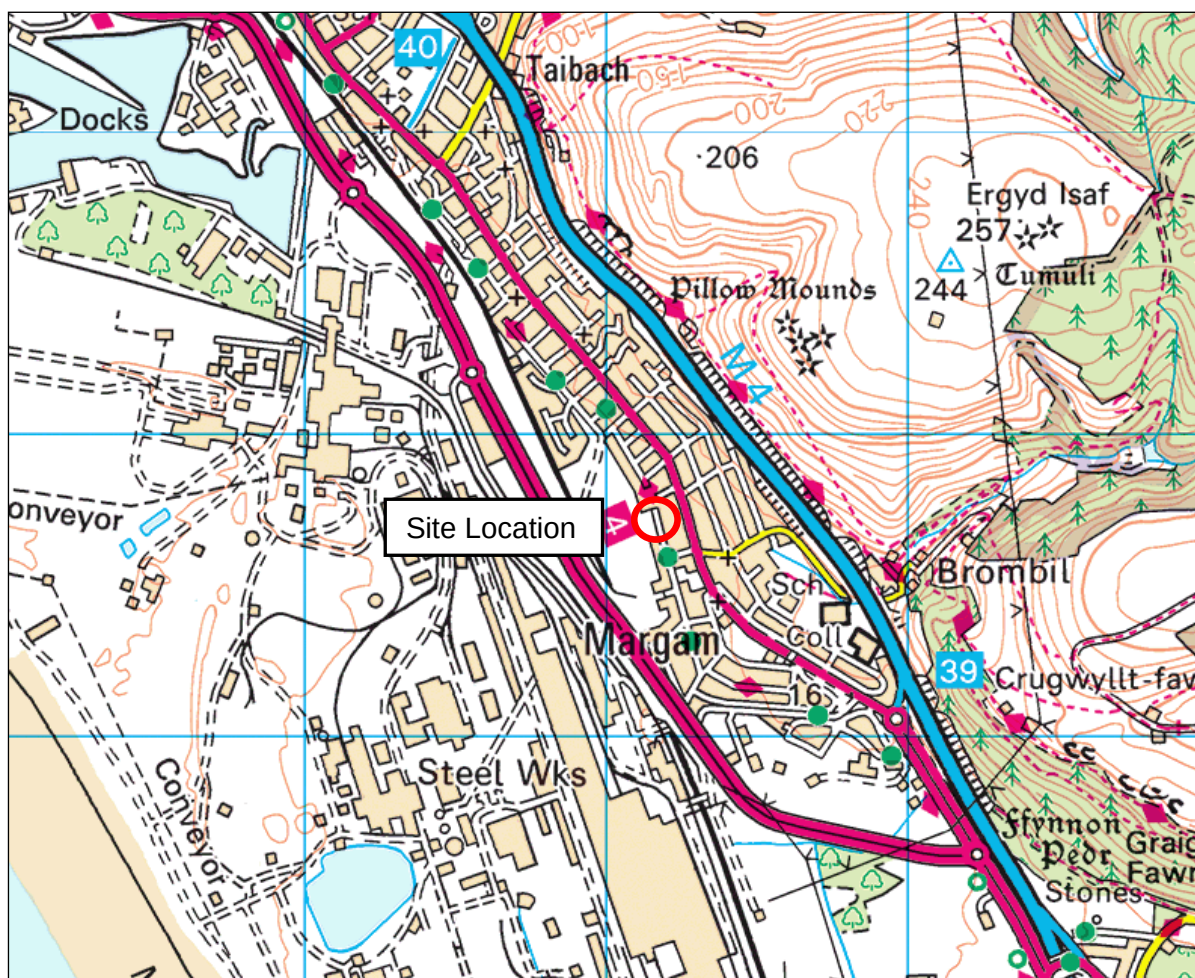


Figure 2.1 Site Location

2.2 Site History Summary

The desk study has shown the site to have been unoccupied throughout the years researched, however, BGS boreholes at the site suggest a significant quantity of Made Ground has been

placed at the site. There is also some evidence of disturbance of the soil at the north of the site.

2.3 Geology and Ground Conditions

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

The site sits upon the boundary between Tidal Flat Deposits (clay, silt and sand) at the west and Glaciofluvial Ice Contact Deposits (sand & gravel) at the east.

Made Ground overlies the superficial deposits.

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

Depth (m)			Thickness (m)	Stratum
0.00	-	1.70/2.40	1.70/2.40	MADE GROUND: Vegetation over dark brown organic-rich clayey gravelly SAND . / Medium dense to very dense brown gravelly silty SAND/SAND & GRAVEL . / soft to firm sandy gravelly CLAY .
1.70/2.40	-	1.80/2.50	0.10	PEAT/BURIED TOPSOIL
1.80/2.50	-	3.30/6.50	1.40/4.20	Soft to firm locally stiff blueish grey mottled brown/reddish brown/black slightly sandy locally slightly gravelly silty CLAY
3.30/6.50	-	6.90/8.60	2.10/4.40	Stiff to very stiff locally firm brown slightly sandy slightly gravelly to sandy gravelly CLAY with cobbles. Locally with dense brown gravelly SAND bands (up to 1.10m thick).
6.90/8.60	-	>10.00	-	Dense to very dense brown gravelly SAND with cobbles.

2.4 Radon

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

2.5 Hydrogeology and Hydrology

Superficial deposits beneath the site have an aquifer designation of secondary aquifer – A and Undifferentiated strata.

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

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

The nearest groundwater abstraction point is located 299m west of the site, operated by Costain Limited for dust suppression.

2.6 Identified Contamination

2.6.1 Made Ground Soils

Laboratory soil test results highlight exceedances of lead, arsenic and non-volatile Polyaromatic Hydrocarbon Species when compared to human health guidelines for a residential with plant uptake scenario. Exceedances were located within the made ground.

2.6.2 Ground Gasses

No sources of ground gas have been identified during the investigation. Mine gas has been discounted as a potential source of gas given the significant depth to the shallowest coal seam/mine workings beneath the site. This assessment is consistent with the risk assessment approach in Wilson. S et al 2021 (unpublished), CL:AIRE Technical Note on risk assessment for mine gas emissions V6.

2.6.3 Groundwater

A significant risk to the Aquatic Environment has not been identified.

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 investigations and assessments, detailing significant pollutant linkages requiring remediation or mitigation.

Table 3.1 Summary of Significant Pollutant Linkages

Source	Pathway	Receptor
Made ground – S1	P1 – Direct soil and dust ingestion P2 – Consumption of home grown produce P3 – Dermal contact P4 – Inhalation of dust and vapours P7 – Artificial contaminant pathway (pile, excavation) P8 – Surface run-off P9 – Plant uptake P11 – Direct contact with construction materials	R1 – Construction and maintenance workers R2 – Future site users (residents) R3 – Passers-by or neighbouring site users

SECTION 4 Proposed Remedial and Mitigating Measures

4.1 General

Based on the finding of the 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 containing 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 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
- 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.

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 lead, arsenic and non-volatile PAH 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 potentially at risk of degradation when in contact with certain organic contaminants identified made ground soils containing.

In accordance with 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)' the Client is proposing to use of PE-AL-PE Barrier pipe in lieu of undertaking a full UKWIR assessment. Reference should be made to the above publication for exact product specification.

Validation of the Barrier Pipe installation 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 (importation of soils and installation)
- Potable water supply pipe (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. Imported soils should be accompanied by an appropriate permit/exemption/declaration to legitimise the import.

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 determinants listed in **Table 5.1**.

Table 5.1 Validation Criteria

Determinant	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
Cyanide	mg/kg	8	3
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)			
3 - Environment Agency CLEA v1.06 Derived Value (Now withdrawn)			
4 - S4UL threshold based on 1% soil organic matter			

5.2 Potable Water Supply Pipes

Evidence of the water supply pipe installation should be retained for inclusion in the Validation Report.

Photographic evidence of the installation shall be provided by the **groundworker** for inclusion 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

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.

The contractor(s) must also strictly adhere to the Pollution Prevention Guidelines for Working at Construction and Demolition Sites (PPG6). This publication gives both advice and guidelines which should be followed with regards to the planning and preparation of site works, site drainage, delivery and storage of construction materials, the management of waste, good housekeeping in particular to prevent runoff of silt and other fines into nearby water courses, refuelling, concrete and what to do in the event of an emergency.

Within the documentation prepared by the contractor(s), the following information should be provided, but not limited to:

- Project Description
- Key participants/contractor(s)
- Technical procedures
- Phasing of works and approximate timescales
- Site plans to scale
- Details of consents or license needed
- Health and Safety, COSHH Assessment, Method Statements and Risk Assessments
- Emergency contingencies

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



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