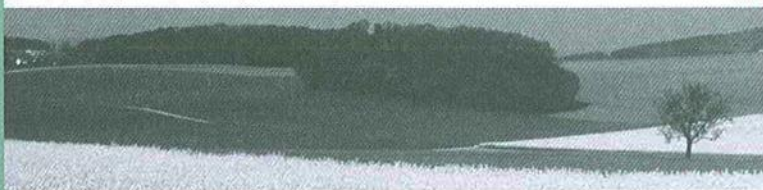


Remediation Strategy:
Proposed Residential Development
Former Clyne Primary School, Clyne

PREPARED FOR:
Mr Jim Slater

September 2020

Job No: 14242-2

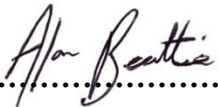


REPORT TITLE : **Remediation Strategy:** Proposed Residential Development, Former Clyne Primary School, Clyne

REPORT STATUS : **Final**

JOB NUMBER : **14242-2**

DATE : **September 2020**

PREPARED BY : 
.....
Mr Alan Beattie

REVIEWED BY : 
.....
Mr David Emanuel

APPROVED BY : 
.....
Dr Gwyn C Lake

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SECTION 1 Introduction and Proposed Development

1.1 Introduction

Mr Jim Slater is proposing the development of the former Clyne Primary School site in Clyne. The development comprises approximately 29 units (semi-detached and detached houses) with associated access road, car parking areas, garden and hard and soft landscaped areas.

Terra Firma (Wales) Limited have been commissioned by Mr Jim Slater to prepare a remediation strategy 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.

- Removal of contamination during site strip
- Installation of capping system across the site

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.

- Terra Firma (Wales) Ltd - Geotechnical and Geo-environmental Site Investigation Report, No. 14242 (August 2017)

1.4 Roles and Responsibilities

Table 1.1 Roles and Responsibilities	
Organisation	Names
The Client	Mr Jim Slater
Project Manager/ Principal Contractor	Unknown
Architect	Unknown
Local Authority	Neath Port Talbot Council
Geotechnical & Geo-environmental Consultant	Terra Firma Wales Ltd
Validator	Not assigned

1.5 Limitations and Exceptions

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 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, install and validate the pipes for potable water supply beneath the site.

SECTION 2 Site Characteristics

2.1 Site Location and Description

The former Clyne Primary School site locates to the south of the B4434 in Clyne and is centred on an approximate National Grid Reference of 281040, 201170. It occupies an approximate plan area of 0.84 hectares or 8,400m². The location of the site is presented below.

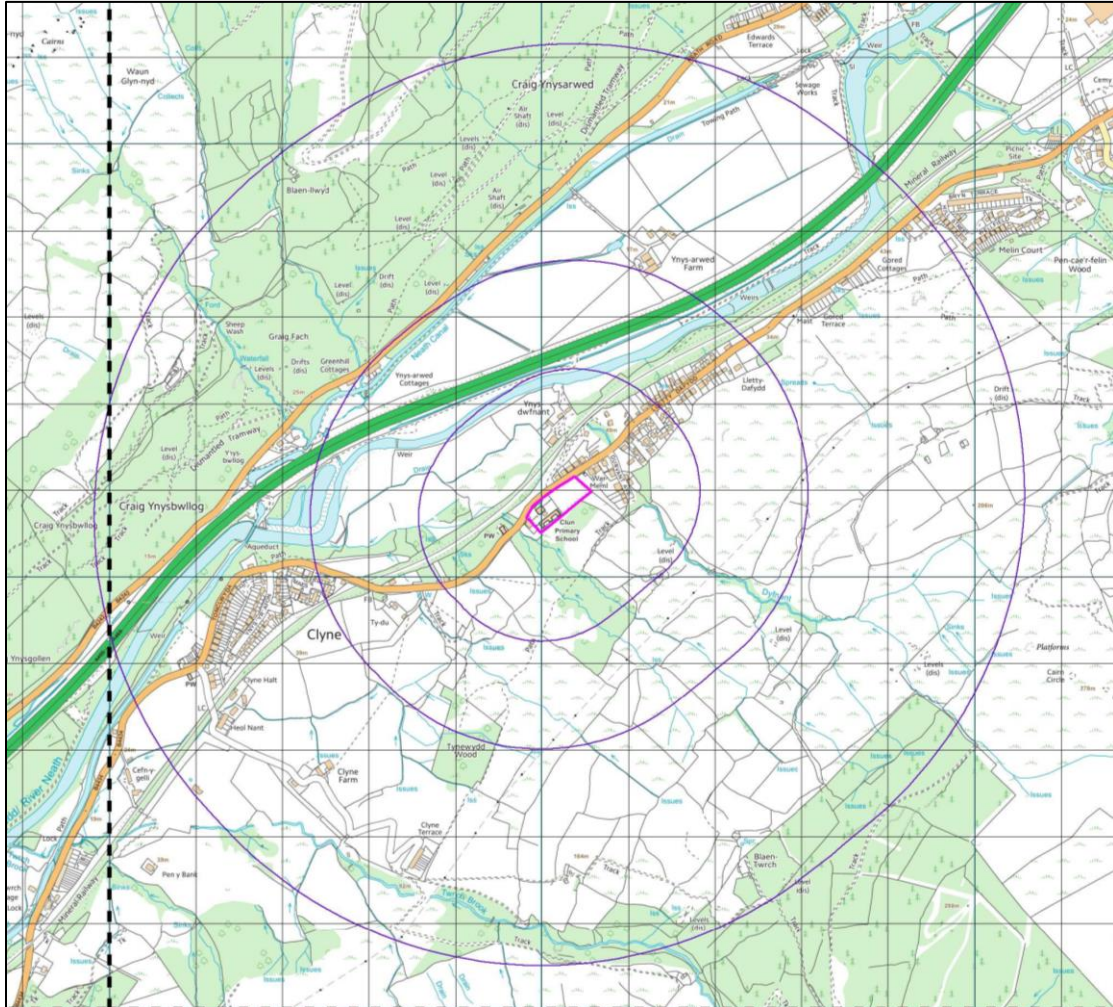


Figure 2.1: Site Location (NTS)

The boundaries of the development area are defined by the B4434 to the north-west, a fence to the north east and south east and the property boundary of Vernon House to the south west.

The site is raised above the B4434, it appears that a program of cutting on the southern side of the site and filling on the northern side has been undertaken to form a level area. The majority of the site where the main building and playing field is a level plateau. In the south of the site towards the road are lower tiers around the smaller school building. A series of ramps and steps connect these areas.

The surrounding area is dominated by field land and areas of woods with a small residential area to the north east.

Current site layout is presented at the rear of the report in **Drawing 01**.

2.2 Site History

The 1881 historic map shows the site to fall across an area of field and woodland. The southern end of the site is then occupied by a school building in the 1899 edition and by the 1918 edition a much large building with smaller structures has been added. In the 60s the northern area of the site is modified to create a level plateau. The site then remains relatively unchanged to the present day.

2.3 Geology & Ground Conditions

The site is seen to be underlain by rocks of the South Wales Upper Coal Measures Formation which are Carboniferous in age. The formation comprises “grey (productive) coal-bearing mudstones/siltstones with seatearths and minor grey, quartz-rich sandstones, coals and ironstones”.

The bedrock geology is seen to be overlain by superficial deposits in the form of glacial sand and gravel. The historic maps have shown the site to be occupied by a school and a cut and fill exercise may have taken place on the site. Made ground may therefore be present on the site.

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
GL	-	0.10/1.50	0.10/1.50	MADE GROUND: Tarmac / medium dense, grey slightly clayey ashy GRAVEL / loose, dark grey, ashy sandy GRAVEL with slag / very soft, dark grey brown, gravelly CLAY with brick and small ashy patches / medium dense, black, very gravelly ashy SAND
0.10/1.50	-	>1.00/2.70	-	Soft to firm, firm and firm to stiff, orange and grey, grey brown, gravelly CLAY with common cobbles. / medium dense, grey, clayey gravelly SAND / dense, brown mottled grey, clayey sandy GRAVEL / firm, grey, slightly sandy slightly gravelly CLAY

2.4 Groundwater

There are no groundwater source protection zones within 1km of the site.

There is one groundwater abstraction point within 500m of the site. The abstraction point is located 490m to the north-west of the site. The abstraction point is a stream at Greenhill Cottages, Abergarwed.

No ground water was encountered during the excavation of the trial pits.

2.5 Hydrogeology & Hydrology

The dominant surface water feature in the area is the River Neath which locates 230m to the north-west of the site. The nearest surface water feature is the small stream which locates 21m to the south west of the site. This stream converges with the River Neath approximately 500m to the west of the site. To north east of the site is the Dyfnant at a distance of 80m and this converges with the River Neath 230m north of the site.

A level plateau has been formed for the existing development on the site. The surrounding area falls to the north-west and surface and shallow groundwater beneath the site is likely to flow in a north westerly direction. Given the nature of the surrounding area surface water is likely to infiltrate through the open land with a minor amount collected by surface water drainage systems.

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 beneath the site has 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. These are generally aquifers formerly classified as minor aquifers".

The superficial deposits are also classed as 'Secondary A'.

2.6 Contamination Observation

2.6.1 Contaminants of Concern: Soil

The chemical analysis has found the substances in the **Table 2.2** below to be above their guideline values.

Table 2.2 Summary of Contaminants of Concern				
Substance	Location	Depth (m)	Guideline (mg/kg)	Result (mg/kg)
Arsenic	WS11	0.30	37	44
	TP3	0.25		83
	TP5	0.30		57
Dibenzo(ah)Anthracene	WS11	0.30	0.24	0.40

All other substances tested for were found to be present at concentrations below their respective human health threshold levels.

2.6.2 Contaminants of Concern: Leachates

Leachate testing has been undertaken on the above contaminants of concern. The leachate has identified that the arsenic is below the leachate guideline. There is no guideline value for dibenzo(ah)anthracene however leachate testing has found that concentrations are below laboratory detection limits.

It is therefore considered that there is no risk to the aquatic environment from the contaminants of concern.

2.6.3 Ground Gasses

There is a thin veneer of made ground and the risk of ground gas is therefore considered to be negligible.

No viable source of landfill gas has been identified and there is a negligible risk.

No volatile contamination has been identified on the site.

No radon protection measures are required for the development.

SECTION 3 Sources of Contamination Requiring Remediation

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

Table 3.1 Summary of Significant Pollutant Linkages		
Contamination Source	Pathway	Receptor
Arsenic and Dibenzo(ah)anthracene	Dermal contact, Ingestion, or Inhalation of Soil/Soil dust, ingestion of homegrown produce	Construction workers
		Adjacent Site Users
		Site End Users Resident and Visitors

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.

The approved remediation scheme must be fully undertaken in accordance with its terms prior to the occupation of any part of the development unless otherwise agreed in writing by the Local Planning Authority. The Local Planning Authority must be given two weeks written notification of commencement of the remediation scheme works.

Within 6 months of the completion of the measures identified in the approved remediation scheme, a verification report that demonstrates the effectiveness of the remediation carried out must be submitted to and approved in writing by the Local Planning Authority.

In the event that contamination is found at any time when carrying out the approved development that was not previously identified it must be reported in writing within 2 days to the Local Planning Authority, all associated works must stop, and no further development shall take place unless otherwise agreed in writing until a scheme to deal with the contamination found has been approved. An investigation and risk assessment must be undertaken and where remediation is necessary a remediation scheme and verification plan must be prepared and submitted to and approved in writing by the Local Planning Authority. Following completion of measures identified in the approved remediation scheme a verification report must be submitted to and approved in writing by the Local Planning Authority. The timescale for the above actions shall be agreed with the LPA within 2 weeks of the discovery of any unsuspected contamination.

4.2 Contaminants in Soils

4.2.1 Protection of Construction Workers & Adjacent Site Users

The potential production of soil dust containing contaminants during construction works presents a risk to construction workers and adjacent site user through inhalation and ingestion pathways.

Standard PPE equipment such as gloves and goggles will be effective in mitigating most risks.

Dust suppression by dampening down of soils is likely to prove the most effective method of control.

Similarly, appropriate measures should be taken for any materials being transported off site to prevent dust migration, ensuring cover of materials within the lorries and provision of wheel wash facilities if necessary.

Advice on the most appropriate PPE and other protection necessary protection measures should be sought from a specialist. This should include any decontamination facilities, if required, although these are likely to be provided by the remedial contractor.

Emergency contingencies should be defined prior to commencement of site works.

COSHH Assessment will also be required as part of the health and safety assessment.

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 Site End Users

Site end users will be potentially at risk from dermal contact, inhalation and ingestion of soil/soil dust containing contaminants. Additionally they are at risk from ingestion of home grown produce and potable water.

To protect site end users from the identified contamination the site will need to be capped. The capping system should comprise of the proposed buildings and roads. Under hard standings such as driveways, paths and patios 600mm of inert suitable granular material should be used. In garden and soft landscaped areas 600mm of suitable inert topsoil/subsoil material should be used. The capping layer under hard standings and in garden and landscaped area should be placed over a geotextile no dig barrier to prevent the mixing of soils.

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

4.3 Protection of Aquatic Environment

There are not considered to be any risks to the aquatic environment from site soils.

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. 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 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
- Installation of geofabric

5.1 Capping System

Following the importation of 600mm of clean inert material, verification of the capping thickness should be undertaken. Verification should be carried out within the garden areas.

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

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 may be required, to provide a capping layer of clean inert material in identified in garden and soft landscaped 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 substances 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	130	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
Fluorene	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 C35 – C44 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
PH C35 C44 Aromatic	mg/kg	1100	4
Notes 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			

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 residents caused by haulage lorries and would avoid unnecessary CO₂ emissions.

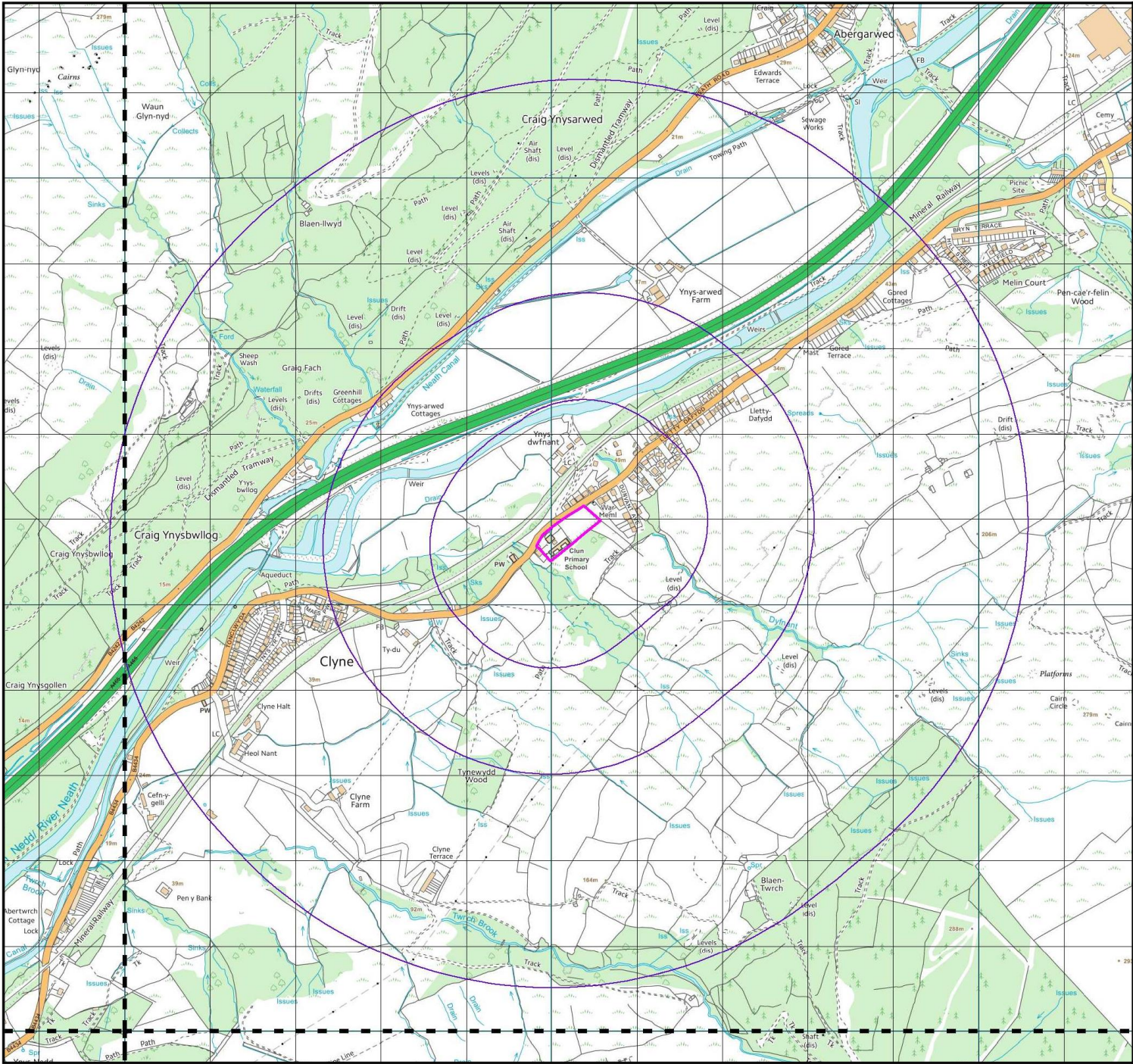
Any movement and transfer of materials on site should be documented in materials management plan, in accordance with 'CL:AIRE Definition of Waste: Development Industry Code of Practice (DoW CoP)'.

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'.

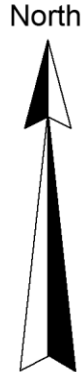
A contaminated land specialist should supervise and document any earthworks on site.

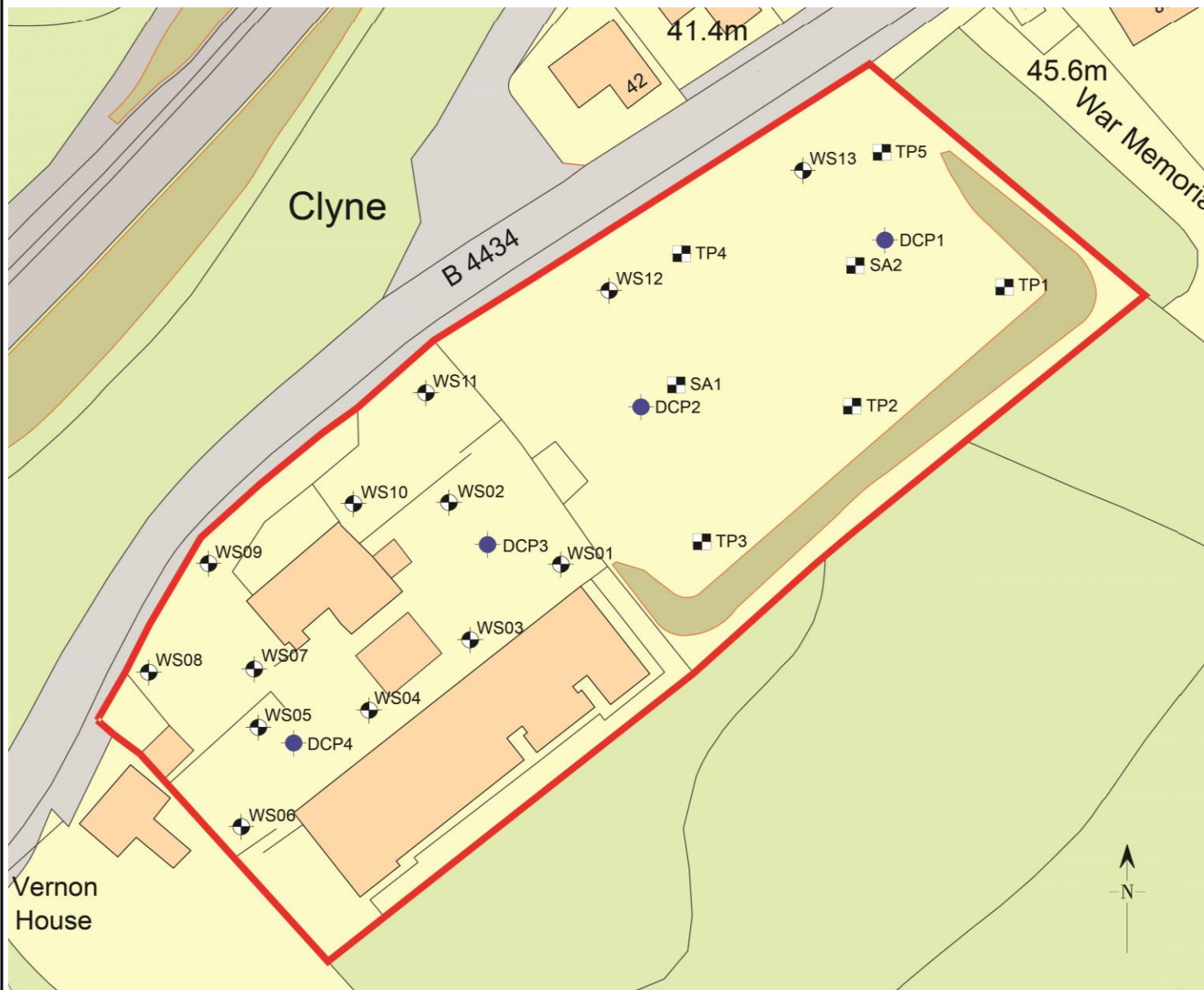
Waste transfer and disposal must be undertaken by an authorised person. A waste transfer note must accompany each load and records should be maintained for inspection if required

DRAWINGS



Job Number:	14242
Job Title:	Clyne Primary School
Drawing Title:	Site Location
Drawing Number:	01
Scale:	Not To Scale





Job Number:

14242

Job Title:

Clyne Primary School

Drawing Title:

Current Site Layout

Drawing Number:

02

Scale:

Not To Scale

Legend:



Approximate position of
windowless sampling borehole



Approximate position of machine
excavated trial pit



Approximate position of dynamic
cone penetrometer test



Terra Firma (Wales) Ltd.

Consulting Geo-Technical & Geo-Environmental Engineers
Site Investigation Contractors

5 Deryn Court, Wharfedale Road,
Pentwyn, Cardiff CF23 7HB
Tel: 029 2073 5354 Fax: 029 2073 5433
Email: info@terrafirmawales.co.uk
www.terrafirmawales.co.uk