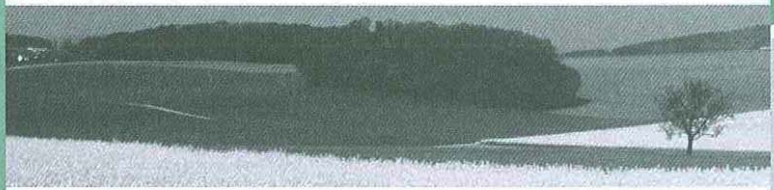


GEO-ENVIRONMENTAL REPORT:
Proposed Inert Waste Transfer Station
Ty-Newydd Farm,
Groesfaen

PREPARED FOR:
Tom Prichard Contracting Ltd.

May 2016

Job No: 13685




REPORT TITLE : **Geo-environmental**
Report: Proposed Inert Waste Transfer
Station, Ty-Newydd Farm, Groesfaen

REPORT STATUS : **Final**

JOB NUMBER : **13685**

DATE : **May 2016**

PREPARED BY : 
.....
Mr James Rhys-Williams

REVIEWED BY : 
.....
Mr Alan Beattie

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

Executive Summary

Site Location and Proposed Development	<p>The development site centres on an approximate National Grid Reference of 306000 181280, occupying a plan area of approximately 3.15 Hectares. The site is currently located within a brown field site.</p> <p>The boundary to the north of the site is defined by a river beyond which situates an industrial estate and Ty-Newydd Woods. The areas to the east, west and southwest of the site are agricultural fields. Located to the southeast of the site is a disused water filled quarry. Access to the site is from the A4119 to the south.</p> <p>Tom Prichard Contracting Ltd is proposing to re-use the site as an inert waste transfer station.</p>
Site History	<p>Historically the site has been occupied since 1986 by a landfill site which accepted inert and industrial waste. Since 1995 the site has been used as a waste transfer station. Prior to 1986 the site was recorded as open field land.</p>
Geology	<p>The 1:10,560 scale geological map of the area (Sheet ST 08 SE) was consulted for geology underlying the site. The site is shown to be underlain by Limestone which is Carboniferous in age. The BGS online geological map shows the site to be underlain by various formations of limestone with interbedded mudstone and dolomites.</p> <p>Superficial deposits of Alluvium and Head Deposits are recorded towards the north of the site.</p> <p>Made ground comprising refuse materials is expected at the site.</p>
Ground Conditions	<p>The ground conditions encountered beneath the site can be summarised as MADE GROUND comprising (loose to dense?) concrete, brick and sandstone GRAVEL OR Very soft to very stiff CLAY. With variable quantities of secondary and tertiary minor constituents of clay, silt, sand and gravel. Cobbles and boulders are frequently observed.</p>
Radon	<p>Full radon protection is required for all new development on the site.</p>
Laboratory Chemical Testing	<p>All substances tested for were found to be present at concentrations below their respective human health threshold levels when compared to industrial guidelines with the exception of asbestos, which was found to be present in made ground in two locations, TP03 at 1.0 – 1.1m depth and TP07 at 1.7 – 1.8m depth (below the height of the top of the stockpile)</p>
Remedial Measures	<p>Human health will be protected by placement of the new concrete slab proposed to cover the entire site.</p> <p>The aquatic environment is not considered to be at risk.</p>

TABLE OF CONTENTS

SECTION 1 Introduction and Proposed Development

- 1.1 Introduction
- 1.2 Limitations and Exceptions of Investigation

SECTION 2 Review of Existing Data

- 2.1 Physical Setting and Current Site Use
- 2.2 Site History
- 2.3 Geological Setting
 - 2.3.1 Geology
 - 2.3.2 Radon
- 2.4 Environmental Setting
 - 2.4.1 Hydrogeology and Hydrology
 - 2.4.2 Groundwater
 - 2.4.3 Flooding
 - 2.4.4 Waste
 - 2.4.5 Pollution
 - 2.4.6 Sensitive Land Use
 - 2.4.7 Urban Soil Chemistry
 - 2.4.8 BGS Recorded Mineral Sites

SECTION 3 Preliminary Human Health and Environmental Risk Assessment

- 3.1 General
- 3.2 Preliminary Site Conceptual Model
- 3.3 Potential Sources of Contamination and Gas
- 3.4 Potential Receptors and Pollution Pathways
- 3.5 Preliminary Human Health and Environmental Risk Assessment
- 3.6 Preliminary Illustrative Site Conceptual Model

SECTION 4 Field Investigation

- 4.1 Site Works
- 4.2 Ground Conditions
- 4.3 Water Strikes
- 4.4 Stability and Obstructions
- 4.5 Laboratory Chemical Testing
 - 4.5.1 Quality Assurance
 - 4.5.2 Sampling Regime
 - 4.5.3 Soil Laboratory Analysis

SECTION 5 Evaluation of Soil Analytical Results

- 5.1 Soil Assessment Methodology
- 5.2 Soil Test Results

TABLE OF CONTENTS (Continued)**Section 6 Quantitative Risk Assessment**

- 6.1 Contaminants of Concern
 - 6.1.1 Contaminants of Concern in Soil
 - 6.1.2 Leachable Contaminants of Concern
- 6.2 Potential Receptors and Pathways
 - 6.2.1 Human Receptors
 - 6.2.2 Aquatic Environment
- 6.3 Mitigation and Remedial Measures
 - 6.3.1 Human Health
 - 6.3.2 Aquatic Environment
- 6.4 Refined Illustrative Site Conceptual Model

Tables

- Table 3.1 Preliminary Qualitative Human Health and Environmental Risk Assessment
- Table 4.1 Summary of Ground Conditions
- Table 4.2 Sample Locations and Depths
- Table 5.1 Summary of Soil Chemical Test Results - Standard Suite
- Table 5.2 Summary of Soil Chemical Test Results - PAH
- Table 5.3 Summary of Soil Chemical Test Results - Petroleum Hydrocarbons

Figures

- Figure 3.1 Preliminary Site Conceptual Model

Annexes

- Annex A Envirocheck Report
- Annex B Risk Assessment Definitions
- Annex C Trial Pit Logs
- Annex D Laboratory Soil Chemical Test Results

Drawings

- Drawing 01 Existing Site Plan
- Drawing 02 Proposed Site plan

SECTION 1 Introduction and Proposed Development

1.1 Introduction

Tom Prichard Contracting Ltd is proposing an inert waste transfer station at Groesfaen.

Planabuild Limited is the Planning Consultants for the proposed site.

Terra Firma (Wales) Limited has been commissioned by Planabuild Limited on behalf of Tom Prichard Contracting Ltd to undertake a geo-environmental assessment of the site.

The main objectives of the geo-environmental assessment programme were to:

- Investigate the potential environmental liabilities at the site associated with any soil contamination
- Provide a summary of the 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
- Determine the type of the shallow made ground, superficial and underlying natural geology

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

1.2 Limitations and Exceptions of Investigation

Tom Prichard Contracting Ltd has requested that a Geo-environmental Site Assessment (GSA) be performed in order to determine if contamination is present beneath the site.

The GSA was conducted and this report has been prepared for the sole internal reliance of Tom Prichard Consulting Ltd and its design 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.

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.

SECTION 2 Review of Existing Data

2.1 Physical Setting and Current Site Use

The development site centres on an approximate National Grid Reference of 306000 181280, occupying a plan area of approximately 3.15 Hectares. It is currently located within a brown field site.

The boundary to the north of the site is defined by a river beyond which situates an industrial estate and Ty-Newydd Woods. The areas to the east, west and southwest of the site are agricultural fields. Located to the southeast of the site is a disused water filled quarry. Access to the site is from the A4119 to the south.

The general site level is approximately 55m AOD but slopes upwards to approximately 80m AOD along the access track to the south.

The existing site plan and proposed site plan can be seen on **Drawing 01** and **Drawing 02** respectively.

2.2 Site History

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

1885

The earliest edition historic map shows the site to be situated within open field land. The boundary to the north of the site is defined by a river and the Mwyndy Branch of the Great Western Railway. Located to the north of the railway resides the Mwyndy Iron Ore Works and numerous related quarries and shafts. Surrounding the remainder of the site is generally open field land. Located to the west off the current access track to the south locates a limekiln. A road is present to the south of the current access track.

1877

A quarry is located to the east off the current access track to the south of the site. The site remains unchanged.

1900

A new quarry has been developed to the southeast of the site, whereas the previously mentioned quarry in 1877 is now abandoned. The railway to the north of the site has been renamed as the Brofiscin Branch. Mwyndy Iron Ore Work is now disused. The site remains unchanged.

1919

By 1919 a quarry now crosses the site towards the north of the current access track. The quarry previously described to the southeast of the site is now detailed as disused.

1941

The railway to the north of the site has now been dismantled. The site remains largely unchanged.

1964

The site remains unchanged.

2.2 Site History (Continued)

1991

The 1991 edition shows the east of the site to have situated upon it two large ponds and a spoil heap.

1993

A spoil heap still resides towards the east of the site.

1999

Located on the site towards the east is now situated a refuse tip.

2000

Historical aerial photography shows the site to be entirely affected by earthworks.

2006

This edition shows the site to be designated as a refuse tip.

2016

This edition shows the site to be unused and undeveloped.

2.3 Geological Setting

2.3.1 Geology

The 1:10,560 scale geological map of the area (Sheet ST 08 SE) was consulted for geology underlying the site. The site is shown to be underlain by Limestone which is Carboniferous in age. The BGS online geological map shows the site to be underlain by various formations of limestone with interbedded mudstone and dolomites.

Superficial deposits of Alluvium and Head Deposits are recorded towards the north of the site

Made ground comprising refuse materials is expected at the site.

The bedrock is recorded dipping 30° to the north in the local area.

The underlying geology is prone to dissolution.

2.3.2 Radon

The Envirocheck datasheet (**Annex A**) detail that the site is in a higher probability radon area, as between 10 and 30% of homes are above the action level.

Full radon protective measures are necessary in the construction of new buildings on site.

2.4 Environmental Setting

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

2.4.1 Hydrogeology and Hydrology

The Envirocheck Report records the nearest surface water feature to locate 5m to the north. This feature comprises an unnamed stream. Two drains are located outside of the site boundary to the west and east and flow northerly towards the previously mentioned primary river.

The topography of the site and surrounding area slopes very shallowly downwards towards the northwest 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 beneath the site has an aquifer designation of 'Principal Aquifer'. These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

The superficial deposits where present are designated as a 'Secondary A' or 'Secondary Undifferentiated' aquifer. 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

2.4.2 Groundwater

The nearest recorded groundwater abstraction point is located 418m to the northwest of the site.

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

2.4.3 Flooding

The BGS groundwater flooding susceptibility map records the site to situate within an area of limited potential for groundwater flooding to occur.

The Envirocheck Report states the northwest corner of the site locates within an area affected by flooding from rivers or sea without defences (Zone 3). Additionally the same area of the site is recorded to be within an area affected by a high 1 in 30 years surface water flood event.

2.4.4 Waste

An historic landfill site has been confirmed to operate on the site during the period 1986-1995. However, details of a closure date have not been provided. The landfill site remains on ordinance survey maps until circa 2006. It is recorded that the landfill site received inert and industrial waste.

Records also indicate that a licensed waste management facility has operated on the site since 1995. The current licence status for the site is 'modified'. The facility previously dealt with the transfer of construction, demolition and dredging waste materials but is now categorised as a non-biodegradable waste transfer station.

2.4.5 Pollution

There have been no recorded pollution incidents to controlled waters or substantial pollution incidents within a radius of 250m of the site.

2.4.6 Sensitive Land Use

The Envirocheck Report details the site does not locate within a sensitive land use area.

2.4.7 Urban Soil Chemistry

The BGS have published anticipated soil concentrations for a number of common contaminants, i.e. arsenic, cadmium, chromium, lead and nickel. All of the given determinants have anticipated concentrations on the site that are below the recognised trigger levels for a residential with plant uptake scenario.

2.4.8 BGS Recorded Mineral Sites

The nearest recorded historical mineral site was located 16m to the south of the site and described as an opencast operation mining limestone. Nine additional opencast limestone or dolomite mines have operated within 250m of the site boundary. All mining operations have now ceased within this area.

SECTION 3 Preliminary Human Health and Environmental Risk Assessment

3.1 General

The contaminated land regime is set out in Part IIA of the Environmental Protection Act (EPA) 1990 and was introduced on the 1st April 2000 in England and 1st July 2001 in Wales. A similar regime was introduced in Scotland on 14th July 2000. Part IIA was introduced to achieve two aims:

- (1) The identification of contaminated land
- (2) The remediation of contaminated land that poses an unacceptable risk to human health and/or the environment

Under Part IIA the statutory definition of 'contaminated land' is: any land which appears to the local authority in whose area it is situated, to be in such a condition, by reason of substances in, on, or under the land, that:

- (a) Significant harm is being caused or there is a significant possibility of such harm being caused; or
- (b) Pollution of controlled waters is being, or is likely to be, caused."

For land to be classified as 'Contaminated Land' there must be a 'pollutant linkage'.

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 Preliminary Site Conceptual Model

The preceding sections enable a preliminary conceptual model of the site to be drawn up, to illustrate the likely ground conditions beneath the site together with a preliminary assessment of the nature of any underlying aquifers and groundwater movement. The preliminary site conceptual model is used as a model for the design and implementation of the site investigation, whereby areas of potential contamination can be targeted as well as investigating the site as a whole.

3.3 Potential Sources of Contamination and Gas

The potential contamination beneath the site, whether in the matrix of soil or groundwater is related to the sites past use. The site has been occupied since 1986 by a landfill site which accepted inert and industrial waste. Since 1995 the site has been used as a waste transfer station. Prior to 1986 the site was recorded as open field land.

Made ground and related landfill gasses are anticipated to be present on site. Given the time period over which this landfill site operated it is possible that asbestos containing materials are also present on the site

3.4 Potential Receptors and Pollution Pathways

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

Ground workers will be excavating in soils and will be exposed via dermal contact with soils and dust, ingestion of soil dust and inhalation of soil dust.

3.4 Potential Receptors and Pollution Pathways (Continued)

Future site users (staff and visitors) will potentially be at risk from contaminated soils through the same pathways.

Neighbouring site users and passers-by may potentially be exposed to soil dust.

If contamination is identified it may be leachable, enabling it to mobilise through perched groundwater within site soils and impact on deeper groundwater or surface water.

A Preliminary Human Health and Environmental Risk Assessment summarises the above and is detailed in the **Table 3.1** below and on the following pages.

3.5 Preliminary Human Health and Environmental Risk Assessment

Table 3.1 Preliminary Qualitative Human Health and Environmental Risk Assessment			
Potential Source	Potential Pathway	Potential Target	Preliminary Risk Assessment
Human Health			
Site Soil	Dermal contact with soil, ingestion of soil/soil dust, inhalation of soil dust. Asbestos fibre inhalation.	Ground workers	Medium Risk COSHH assessment and good level of PPE/ hygiene by site workers/ staff; dust suppression measures if required.
Site Soil	Dermal contact with soil dust ingestion of soil dust, soil dust inhalation of soil dust. Asbestos fibre inhalation.	Passers by/Neighbouring site users	Medium Risk During construction No Risk Upon construction - Site to be surfaced with hardstanding
Site Soil	Dermal contact with soil, ingestion of soil/soil dust, inhalation of soil dust. Asbestos fibre inhalation.	Site End Users – Staff and visitors.	Low Risk Upon construction - Site to be surfaced with hardstanding
Radon Gas from underlying bedrock	Migration into indoor air	Site End Users – Staff and visitors	No Risk No buildings and therefore confined spaces will be built on the site where harmful gas may potentially accumulate.
Landfill gas	Migration through superficial deposits and bedrock and accumulation indoors	Site End Users – Staff and visitors	No Risk The site locates on a historic landfill site. However, only inert/industrial waste materials were recorded at the site. No buildings and therefore confined spaces will be built on the site where harmful gas may potentially accumulate.
Ground gas	Direct from any made ground/buried organic matter on site and accumulation indoors	Site End Users – Staff and visitors	No Risk No buildings and therefore confined spaces will be built on the site where harmful gas may potentially accumulate.
Vapours	Migration into indoor air	Site End Users – Staff and visitors	No Risk No buildings and therefore confined spaces will be built on the site where harmful gas may potentially accumulate.
Site Soils	Permeation of drinking water pipes	Site End Users – Staff and visitors	No Risk Drinking water pipes not expected to be installed at the site.

3.5 Preliminary Human Health and Environmental Risk Assessment (Continued)

Table 3.1 Preliminary Qualitative Human Health and Environmental Risk Assessment (Continued)			
Aquatic Environment			
Site Soils	Surface runoff and leaching of contamination into the perched groundwater	Perched groundwater beneath the site	Medium Risk Contamination including asbestos may be present on site.
Site Soils	Groundwater transport	Primary river to north of site	Medium Risk Contamination including asbestos may be present on site.
Site Soils	Groundwater transport	Underlying bedrock: Principle Aquifer	Medium Risk Contamination including asbestos may be present on site.

3.6 Preliminary Illustrative Site Conceptual Model

The following illustration represents a theorised cross section through the site. The drawing is generalised and not to scale.

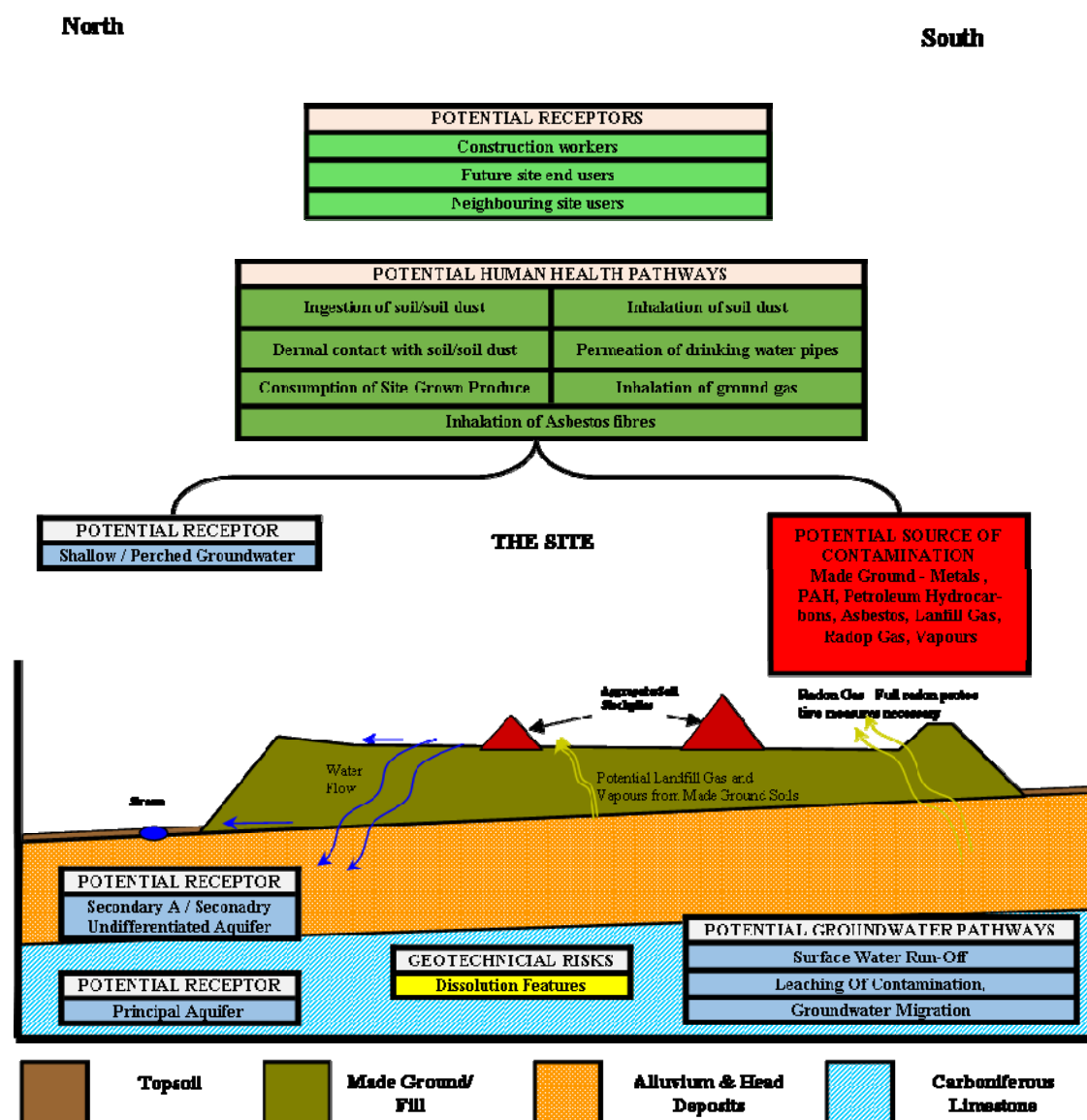


Figure 3.1 Preliminary Site Conceptual Model

SECTION 4 Field Investigation

4.1 Site Works

A geo-environmental site investigation comprising nine machine excavated trial pits was undertaken on the 10th May 2016.

The fieldworks were supervised by Terra Firma (Wales) Limited, who logged the exploratory holes to the requirements of BS5930:2015.

The trial pits, referenced TP01-TP09 (**Annex C**) were formed by a 13 tonne tracked mechanical excavator with a 1.20m wide bucket. The proposed locations of the exploratory holes were determined by Terra Firma (Wales) Limited.

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

On completion all trial pits were backfilled with arisings compacted in suitable layers by the excavator bucket.

The exploratory hole locations are shown on **Drawing 01**.

4.2 Ground Conditions

The ground conditions encountered are summarised below in **Table 4.1**.

Table 4.1 Summary of Ground Conditions			
Depth From (m)	Depth To (m)	Thickness (m)	Stratum
0.0	>0.9/>3.0	>0.9/>3.0	Variable MADE GROUND comprising (loose to dense?) concrete, brick and sandstone GRAVEL OR Very soft to very stiff CLAY . With variable quantities of secondary and tertiary minor constituents of clay, silt, sand and gravel. Cobbles and boulders frequently observed.
1.30	>1.70	>0.40	TP09 ONLY. Very stiff light brown and light grey sandy SILT . Sand is fine. (ALLUVIUM)

Trial pit TP09 was the only exploratory hole to encounter natural ground conditions at a depth of 1.30m.

TP07 was located upon a stockpile (Stockpile 9)

4.3 Water Strikes

Groundwater seepages were encountered in trial pit TP06, TP08 and TP09 at depths of 0.70m, 0.70m and 1.00m respectively.

4.4 Stability and Obstructions

Trial pits TP06 and TP07 experienced pit wall spalling. Concrete boulder obstructions were encountered in trial pit TP08. Apart from TP08 trial pit walls were seen to cut cleanly.

4.5 Laboratory Chemical Testing

4.5.1 Quality Assurance

During the intrusive investigation, eight small disturbed soil samples were collected.

Care was taken to ensure that sampling quality assurance occurred during site works. This included the following measures:

- Soil samples were collected by hand with nitrile gloves.
- Clean gloves were used for each sample.
- Soil samples were stored at a temperature below 4 degrees.
- No head space was left in sample containers.
- Appropriate sample containers were used.
- Samples were submitted for laboratory testing within holding times.

4.5.2 Sampling Regime

The sampling regime was conducted in accordance with BS5930:2015 in order to satisfy the following criteria:

- Investigate suspected sources of contamination
- Investigate type and concentration of contamination
- Ensure good representation of the site
- Provide data to advise on remedial measures if necessary

The sample locations and depths are illustrated in the following table:

Table 4.2 Sample Locations and Depths		
Sample	Depth (m)	MCERTS Sample Description
TP01	0.4 – 0.5	Dark brown gravelly sandy CLAY
TP02	1.7 – 1.8	Dark brown gravelly sandy CLAY
TP03	1.0 – 1.1	Dark brown gravelly sandy CLAY
TP04	2.8 – 2.9	Dark brown gravelly sandy CLAY
TP05	2.5 – 2.6	Dark brown gravelly sandy CLAY
TP06	1.1 – 1.2	Dark brown gravelly sandy CLAY
TP07	1.7 – 1.8	Dark brown gravelly sandy CLAY
TP09	0.5 – 0.6	Dark brown gravelly sandy CLAY

4.5.3 Soil Laboratory Analysis

During the site works a number of soil samples were taken and despatched to the laboratories of Derwentside Environmental Testing Services (DETS) for laboratory chemical testing;

Metals and Metalloids

Lead
Arsenic
Mercury
Cadmium
Chromium III
Chromium VI
Copper
Nickel
Zinc
Selenium

In-Organics

Cyanide
Sulphate

Others

pH (acidity)
Asbestos

Organic Chemicals

Phenol
Polycyclic Aromatic Hydrocarbons (PAH)
Petroleum Hydrocarbons

The results are discussed in detail in **Section 5** and the laboratory test results certificates may be found in **Annex D**.

SECTION 5 Evaluation of Soil Analytical Results

5.1 Soil Assessment Methodology

Comparison of the analytical results has been made with Soil Guideline Values (SGVs) for an industrial scenario, sourced from The Environment Agency Contaminated Land Exposure Assessment (CLEA). Where SGV values are not available reference has been made to the 2015 industrial Suitable 4 Use Levels (S4ULs) provided by Land Quality Management Limited and the Chartered Institute of Environmental Health (CIEH) or Category 4 Screening Levels (C4SLs).

Sulphate results have been compared to British Research Establishment (BRE) guidelines as sulphate levels need only be considered for buried concrete risk assessment only, not human health related.

5.2 Soil Test Results

A summary of the chemical test results which include the regulatory soil guideline values used in the Tier 1 assessment are given in **Tables 5.1 to Table 5.3**. The full results are presented in **Annex D**.

Table 5.1 Summary of Soil Chemical Test Results - Standard Suite					
Substance	SGV/GAC (mg/kg)	Source	Measured Concentrations of Tested Substances (mg/kg)		Number of Exceedences
			Minimum	Maximum	
Arsenic	640	CLEA	4.8	12	0
Cadmium	230	CLEA	0.4	0.9	0
Chromium III	8600	LQM/CIEH	12	23	0
Chromium VI	33	LQM/CIEH	<1.0	<1.0	0
Copper	68000	LQM/CIEH	15	31	0
Lead	2330	C4SL	26	94	0
Mercury	3600	CLEA	<0.05	0.1	0
Nickel	980	LQM/CIEH	9.8	24	0
Selenium	13000	CLEA	0.8	2.7	0
Zinc	730000	LQM/CIEH	61	170	0
Cyanide	480	CLEA	<0.1	0.3	0
Phenols	3200	CLEA	<0.3	0.7	0
Sulphate	2400	BRE	800	3500	2
Organic Matter	-	-	2.2	4.9	-
pH	-	-	8.1	10	-
Total PAH	-	-	0.44	19	See Table 5.2

5.2 Soil Test Results (Continued)

All samples were tested for speciated PAH testing.

Table 5.2 Summary of Soil Chemical Test Results - Speciated Polyaromatic Hydrocarbons					
Substance	GAC (mg/kg)	Source	Measured Concentrations of Tested Substances (mg/kg)		Number of Exceedences
			Minimum	Maximum	
Naphthalene	190	LQM/CIEH	<0.03	0.08	0
Acenaphthylene	83000	LQM/CIEH	<0.03	0.05	0
Acenaphthene	84000	LQM/CIEH	<0.03	0.31	0
Fluorene	63000	LQM/CIEH	<0.03	0.32	0
Phenanthrene	22000	LQM/CIEH	0.06	1.2	0
Anthracene	520000	LQM/CIEH	<0.03	0.32	0
Fluoranthene	23000	LQM/CIEH	0.11	3.4	0
Pyrene	54000	LQM/CIEH	<0.03	2.8	0
Benzo(a)anthracene	170	LQM/CIEH	0.08	1.7	0
Chrysene	350	LQM/CIEH	0.05	1.8	0
Benzo(b)fluoranthene	44	LQM/CIEH	0.06	2.5	0
Benzo(k)fluoranthene	1200	LQM/CIEH	<0.03	0.68	0
Benzo(a)pyrene	35	LQM/CIEH	0.04	1.6	0
Indeno(123cd)pyrene	510	LQM/CIEH	<0.03	0.87	0
Dibenzo(ah)anthracene	3.6	LQM/CIEH	<0.03	0.36	0
Benzo(ghi)perylene	3900	LQM/CIEH	<0.03	0.98	0
Total PAH	-	-	0.44	19	-

Notes:

- Thresholds based on 1.0% SOM

All samples were tested for asbestos.

Table 5.3 Summary of Soil Chemical Test Results - Asbestos		
Sample Location	Sample Depth (m)	Laboratory Test Results
TP01	0.4 – 0.5	No Asbestos Detected
TP02	1.7 – 1.8	No Asbestos Detected
TP03	1.0 – 1.1	Bundle of chrysotile fibres present
TP04	2.8 – 2.9	No Asbestos Detected
TP05	2.5 – 2.6	No Asbestos Detected
TP06	1.1 – 1.2	No Asbestos Detected
TP07	1.7 – 1.8	Small bundels of chrysotile present
TP09	0.5 – 0.6	No Asbestos Detected

5.2 Soil Test Results (Continued)

The results of the petroleum hydrocarbons tests are given in the table below.

Table 5.4 Summary of Soil Chemical Test Results Petroleum Hydrocarbons					
Substance	GAC (mg/kg)	Source	Measured Concentrations of Tested Substances (mg/kg)		Number of Exceedences
			Minimum	Maximum	
<u>PH- Aliphatic</u>					
>C5-C6	3200	CIEH	<0.01	<0.01	0
>C6-C8	7800	CIEH	<0.01	<0.01	0
>C8-C10	2000	CIEH	<0.01	<0.01	0
>C10-C12	9700	CIEH	<1.5	<1.5	0
>C12-C16	59000	CIEH	<1.2	3.8	0
>C16-C21^	1600000	CIEH	<1.5	7.1	0
>C21-C40^	1600000	CIEH	<3.4	85	0
<u>PH- Aromatic</u>					
>C5-C7	26000	CIEH	<0.01	<0.01	0
>C7-C8	56000	CIEH	<0.01	<0.01	0
>C8-C10	3500	CIEH	<0.01	0.11	0
>C10-C12	16000	CIEH	<0.9	<0.9	0
>C12-C16	36000	CIEH	<0.5	5.2	0
>C16-C21	28000	CIEH	<0.6	24	0
>C21-C35	28000	CIEH	<1.4	310	0

Notes:

- ^ Threshold for >C16 - C35
- ** GAC quoted in table based on soil organic matter content of 1%.

SECTION 6 Quantitative Risk Assessment

6.1 Contaminants of Concern

6.1.1 Contaminants of Concern in Soil

All substances tested for were found to be present at concentrations below their respective human health threshold levels or below the laboratory detection limit with the exception of sulphate and asbestos.

The sulphate levels only require consideration when assessing the correct class of concrete for construction and is therefore not considered a contaminant of concern in terms of human health or the environment.

A bundle of chrysotile asbestos were identified in a sample of made ground taken in TP03 at a depth of 1.0 – 1.1m. This horizon of particular made ground extends from 0.7m depth to 1.7m depth.

Bundles of chrysotile fibres were also found in made ground taken from TP07 at a depth of 1.7 – 1.8m depth. This trial pit was excavated atop a spoil mound and the particular made ground type was present at a depth of 1.6m beneath the top of the mound.

6.1.2 Leachable Contaminants of Concern

None of the substances tested for in site soils is considered to present a risk through leaching.

6.2 Potential Receptors and Pathways

6.2.1 Human Receptors

Site construction workers and future employees of the waste transfer station are potentially at risk from inhalation of asbestos fibres.

6.2.2 Aquatic Environment

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

6.3 Human Health

The asbestos present in made ground in TP3 will not be disturbed during site works and future site use, and will remain buried. Therefore it will not present a risk to human health.

During the development stockpiled materials are to be removed or distributed across the site.

Given the known current and proposed site levels it is likely that the made ground containing asbestos found in Stockpile 9 will actually remain in-situ, following spread of the overlying 1.6m of made ground. It would in this instance remain buried.

If future levels are such then the asbestos impacted made ground in the stockpile may be spread themselves provided that they lie below the proposed concrete surface slab. The slab will act as a physical barrier between the made ground and human receptors.

6.3 Human Health (Continued)

As good practise, 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.

Measures should be made to ensure that the handling and movement of asbestos soils is managed and controlled appropriately to prevent contamination of other soils and areas of the site and to protect site workers.

If during development works any other unexpected ground conditions or evidence of contamination is found, inspection by a geo-environmental engineer should be made, and any required testing or investigation carried out prior to continuation of works.

Any materials to be removed from site should be taken to an appropriately licensed landfill facility. In accordance with EC Regulation 1272/2008 and Environment Agency Guidance WM2 (v. 2.3/2011) soils and other materials destined for off-site disposal should be classified on the basis of their hazard phrases prior to disposal.

6.4 Aquatic Environment

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

Any soils containing asbestos are/will be buried and the area capped with a concrete slab. In addition, the slab will prevent direct rainfall infiltration into site soils.

During the construction period, there is a risk to the environment/adjacent sites from de-watering, moving contaminated soil, digging of drainage channels, discharges to local surface waters or the ground, runoff from stockpiled 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,
- Carry out any activities that could cause pollution in a designated, bunded area, away from rivers or boreholes.
- 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

ANNEX A
Envirocheck Report

ANNEX B
Risk Assessment Definitions

Risk Assessment Definitions

Environmental risk assessment evaluates the risk to receptors via an analysis of the 'source-pathway-receptor' linkage.

- (1) A **CONTAMINANT** (hazard) - a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters
- (2) A **RECEPTOR** (target) - something which could be adversely affected by a contaminant
- (3) A **PATHWAY** - a route or means which either allows the contaminant to cause significant harm to that receptor, or that there is a significant possibility of such harm being caused to the receptor, or that pollution of controlled waters is being or likely to be caused.

The term 'Risk' is widely used in different contexts and situations, but a prescriptive definition is given by the Guidelines for Environmental Risk Assessment and Management (DEFRA *et al*, 2000):

'Risk is a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence'.

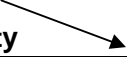
A 'Hazard' is defined as *'a property or situation that in particular circumstances could lead to harm'.*

The classification of consequences and probability and determining the risk category are defined in the following sections.

Table 1 Classification of Consequence	
Classification	Definition
Severe	<ul style="list-style-type: none">• Short term (acute) risk to human health likely to result in significant harm• Short term risk to controlled waters• Catastrophic damage to buildings/structures• Short term risk to an ecosystem or organism within the particular ecosystem
Medium	<ul style="list-style-type: none">• Chronic damage to human health (long term risk)• Pollution of a sensitive water resource• A significant change in an ecosystem or organism within the ecosystem
Mild	<ul style="list-style-type: none">• Pollution of non-sensitive water resources• Significant damage to buildings/structures
Negligible	<ul style="list-style-type: none">• Harm (not necessarily significant) which may result in financial loss• Non permanent health effects to humans (easily prevented by PPE for example)• Easily repairable effects of structural (building) damage

Table 2 Classification of Probability	
Classification	Definition
High	<ul style="list-style-type: none"> • There is a complete pollution linkage and an event appears very likely to occur in the short term and is inevitable in the long term. • Evidence of harm to the receptor
Medium	<ul style="list-style-type: none"> • There is a complete pollution linkage which means that it is probable that an event will occur • The event is not inevitable but possible in short term and likely in the long term
Low	<ul style="list-style-type: none"> • There is a complete pollution linkage and circumstances are possible under which an event could occur • It is not certain that an event will occur in the long term, and it is less likely to occur in the short term
Negligible	<ul style="list-style-type: none"> • There is a complete pollution linkage but circumstances are such that it is improbable that an event would occur even in the long term

By comparing the consequences of a risk and the probability of the risk of a pollution linkage, the likely risk category can be determined as shown in **Table 3** below.

Table 3 Risk Assessment Matrix					
Increasing acceptability 		Consequence			
		Severe	Medium	Mild	Negligible
Probability	High	High	High	Medium / Low	Near zero
	Medium	High	Medium	Low	Near zero
	Low	High / medium	Medium / Low	Low	Near zero
	Negligible	High / medium / Low	Medium / Low	Low	Near zero

High Risk

There is a high probability that severe harm could risk a receptor, or there is evidence that a receptor is being harmed. The risk if realised is likely to result in liability, and urgent investigation or remediation will be required.

Medium Risk

It is probable that harm will arise to a receptor. However it is relatively unlikely that such harm would be severe, or if harm does occur the harm is likely to be relatively mild. Investigation will be required to determine the liability, and some remedial works may be required in the long term.

Low Risk

It is possible that harm may arise to a receptor, but it is likely that the harm would be mild.

Near Zero Risk

There is a very low risk of harm to the receptor. In the event of harm being realised the harm is

ANNEX C
Trial Pit Logs



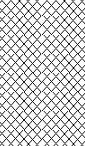
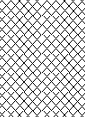
Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Trial Pit No:
TP01
Sheet 1 of 1

Project Name: Ty-Newydd Farm	Project No: 13685	Co-ords: - Level:	Date: 10/05/2016
------------------------------	-------------------	----------------------	------------------

Location: Groesfaen	Dimensions: 2.50 Depth 0.90	Scale: 1:25 Logged: JRW
Client: Tom Prichard Contracting Ltd	1.30	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.40 - 0.50	ES		0.50			(Loose?) dark greyish brown clayey sandy angular to rounded fine to coarse brick, mudstone, sandstone and concrete GRAVEL with a low cobble content. (MADE GROUND)	
				0.90			Stiff dark greyish brown slightly gravelly sandy silty CLAY with a low cobble content. Gravel is angular to rounded fine to coarse brick, sandstone and concrete. (MADE GROUND)	
							End of Pit at 0.900m	1
								2
								3
								4
								5

Stability: Trial pit remained stable and vertical.

Remarks: Groundwater not encountered. Trial pit backfilled with materials arising.



Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Trial Pit No:
TP02
Sheet 1 of 1

Project Name: Ty-Newydd Farm	Project No: 13685	Co-ords: - Level:	Date: 10/05/2016
------------------------------	-------------------	----------------------	------------------

Location: Groesfaen	Dimensions: 2.40 Depth 2.10	Scale: 1:25 Logged: JRW
Client: Tom Prichard Contracting Ltd		

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			Grass over very soft dark brown slightly sandy organic silty CLAY. (MADE GROUND)	
				0.70			Very stiff brown and dark grey slightly gravelly sandy CLAY with rare fragments of plastic. Gravel is angular and subangular fine to coarse sandstone, siltstone, brick and concrete. (MADE GROUND)	
							Firm dark brownish grey sandy gravelly CLAY with a low cobble and boulder content. Gravel is angular to rounded fine to coarse concrete, brick, sandstone and siltstone. (MADE GROUND)	1
	1.70 - 1.80	ES						
				2.10			End of Pit at 2.100m	2
								3
								4
								5

Stability: Trial pit remained stable and vertical.

Remarks: Groundwater not encountered. Trial pit backfilled with materials arising.



Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Trial Pit No:
TP03
Sheet 1 of 1

Project Name: Ty-Newydd Farm				Project No: 13685		Co-ords: - Level:		Date: 10/05/2016		
Location: Groesfaen						Dimensions: 2.10			Scale: 1:25	
Client: Tom Prichard Contracting Ltd						Depth 2.10			Logged: JRW	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
	1.00 - 1.10	ES		0.70			(Loose?) dark brown clayey sandy angular to rounded fine to coarse sandstone, brick, concrete and rare ceramic GRAVEL with a low cobble content. (MADE GROUND)			
				1.70			(Loose?) dark greyish brown sandy very clayey angular to rounded fine to coarse brick, concrete, sandstone, clinker and rare slag GRAVEL with a low cobble and boulder content and with rare fragment of metal and plastic. (MADE GROUND)			
				2.10			(Dense?) dark greyish brown slightly clayey sandy angular to rounded fine to coarse concrete, brick, slag and sandstone GRAVEL with a low cobble and boulder content. (MADE GROUND)			
				End of Pit at 2.100m						
Stability: Trial pit remained stable and vertical.										
Remarks: Groundwater not encountered. Trial pit backfilled with materials arising.										



Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Trial Pit No:

TP05

Sheet 1 of 1

Project Name: Ty-Newydd Farm	Project No: 13685	Co-ords: - Level:	Date: 10/05/2016
------------------------------	-------------------	----------------------	------------------

Location: Groesfaen	Dimensions: 2.70 Depth 2.80	Scale: 1:25 Logged: JRW
Client: Tom Prichard Contracting Ltd	1.40	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	2.50 - 2.60	ES		2.30			(Dense?) dark greyish brown locally dark reddish brown silty sandy angular to rounded fine to coarse sandstone, concrete, brick and tarmacadam GRAVEL with a medium cobble and boulder content. (MADE GROUND)
				2.80			Soft locally firm dark grey and black sandy gravelly CLAY. Gravel is angular to rounded fine to coarse brick, sandstone, concrete and mudstone. (MADE GROUND)
							End of Pit at 2.800m

Stability: Trial pit remained stable and vertical.

Remarks: Groundwater not encountered. Trial pit backfilled with materials arising.



Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Trial Pit No:

TP06

Sheet 1 of 1

Project Name: Ty-Newydd Farm

Project No:
13685

Co-ords: -
Level:

Date:
10/05/2016


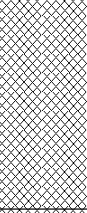
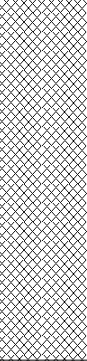
Location: Groesfaen

Dimensions:
2.40
Depth 1.60
1.90

Scale:
1:25

Logged:
JRW

Client: Tom Prichard Contracting Ltd

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	1.10 - 1.20	ES		0.70			(Loose?) dark brown clayey sandy angular to rounded fine to coarse brick, sandstone, concrete and rare ceramic GRAVEL with a low cobble content. (MADE GROUND)	
							(Medium dense?) dark greyish brown slightly clayey sandy angular to subrounded fine to coarse brick, concrete, sandstone and tarmacadam GRAVEL with a medium cobble and boulder content. (MADE GROUND)	1
				1.90			End of Pit at 1.900m	2
								3
								4
								5

Stability: Trial pit walls spalled 0.00-0.60m.

Remarks: Groundwater seepage encountered at 0.70m. Trial pit backfilled with materials arising.



Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Trial Pit No:

TP07

Sheet 1 of 1

Project Name: Ty-Newydd Farm

Project No:
13685

Co-ords: -
Level:

Date:
10/05/2016

Location: Groesfaen

Dimensions:

2.40

Depth

1.40

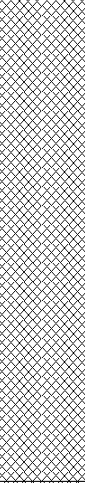
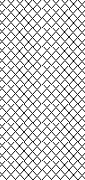
2.20

Scale:

1:25

Logged:
JRW

Client: Tom Prichard Contracting Ltd

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	1.70 - 1.80	ES		1.60			Very soft dark reddish brown slightly sandy slightly gravelly CLAY. Gravel is subrounded and rounded fine to coarse sandstone and mudstone. (MADE GROUND)	1
				2.20			(Medium dense?) dark greyish brown sandy very clayey angular to rounded fine to coarse concrete, brick, sandstone and tarmacadam GRAVEL with a low cobble content. (MADE GROUND)	2
							End of Pit at 2.200m	3
								4
								5

Stability: Trial pit walls spalled 0.00-2.20m.

Remarks: Groundwater not encountered. Trial pit backfilled with materials arising.



Tel: 02920 735354
info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

Terra Firma (Wales) Limited
5 Deryn Court, Wharfedale Road
Pentwyn, Cardiff
CF23 7HA

Trial Pit No:

TP08

Sheet 1 of 1

Project Name: Ty-Newydd Farm

Project No:
13685

Co-ords: -
Level:

Date:
10/05/2016

Location: Groesfaen

Dimensions: 2.90

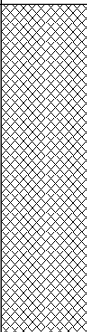
Depth
1.10

3.00

Scale:
1:25

Logged:
JRW

Client: Tom Prichard Contracting Ltd

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼				1.10			(Medium dense?) dark greyish brown angular to subrounded concrete BOULDERS and COBBLES with some sandy angular to rounded fine to coarse concrete, sandstone and brick gravel. (MADE GROUND)
							End of Pit at 1.100m

Stability: Trial pit unstable due to concrete boulder obstructions.

Remarks: Groundwater seepage encountered at 0.70m. Trial pit terminated at 1.10m due to concrete boulder obstruction. Trial pit backfilled with materials arising.

Project Name: Ty-Newydd Farm	Project No: 13685	Co-ords: - Level:	Date: 10/05/2016
------------------------------	-------------------	----------------------	------------------

Location: Groesfaen	Dimensions: 2.50 Depth 1.70	Scale: 1:25 Logged: JRW
Client: Tom Prichard Contracting Ltd		

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.50 - 0.60	ES					Stiff dark brownish grey and black sandy gravelly CLAY with a low cobble and boulder content. Gravel is angular to rounded fine to coarse sandstone, brick and concrete. (MADE GROUND)	1
				1.30			Very stiff light brown and light grey sandy SILT. Sand is fine.	
				1.70			End of Pit at 1.700m	2
								3
								4
								5

Stability: Trial pit remained stable and vertical.

Remarks: Groundwater seepage encountered at 1.00m. Trial pit backfilled with materials arising.

Annex D
Laboratory Soil Chemical Test Results



Certificate of Analysis

Certificate Number 16-66137

18-May-16

Client Terra Firma (Wales) Ltd
5 Deryn Court
Wharfdale Road
Pentwyn
Cardiff
CF23 7HB

Our Reference 16-66137

Client Reference 13658

Order No (not supplied)

Contract Title Ty-Newydd Farm

Description 8 Soil samples.

Date Received 12-May-16

Date Started 12-May-16

Date Completed 18-May-16

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read 'Rob Brown'.

Rob Brown
Business Manager



Summary of Chemical Analysis

Matrix Descriptions

Our Ref 16-66137

Client Ref 13658

Contract Title Ty-Newydd Farm

Sample ID	Depth	Lab No	Completed	Matrix Description
TP01	0.40-0.50	986389	18/05/2016	Dark brown, gravelly, sandy CLAY
TP02	1.70-1.80	986390	18/05/2016	Dark brown, gravelly, sandy CLAY
TP03	1.00-1.10	986391	18/05/2016	Dark brown, gravelly, sandy CLAY
TP04	2.80-2.90	986392	18/05/2016	Dark brown, gravelly, sandy CLAY
TP05	2.50-2.60	986393	18/05/2016	Dark brown, gravelly, sandy CLAY
TP06	1.10-1.20	986394	18/05/2016	Dark brown, gravelly, sandy CLAY
TP07	1.70-1.80	986395	18/05/2016	Dark brown, gravelly, sandy CLAY
TP09	0.50-0.60	986396	18/05/2016	Dark brown, gravelly, sandy CLAY

Summary of Chemical Analysis

Soil Samples

Our Ref 16-66137
 Client Ref 13658
 Contract Title Ty-Newydd Farm

Lab No	986389	986390	986391	986392	986393	986394
Sample ID	TP01	TP02	TP03	TP04	TP05	TP06
Depth	0.40-0.50	1.70-1.80	1.00-1.10	2.80-2.90	2.50-2.60	1.10-1.20
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	10/05/16	10/05/16	10/05/16	10/05/16	10/05/16	10/05/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	7.1	12	4.8	6.0	5.9	7.6
Cadmium	DETSC 2301#	0.1	mg/kg	0.6	0.5	0.3	0.5	0.4	0.4
Chromium	DETSC 2301#	0.15	mg/kg	21	23	21	12	21	18
Chromium III	DETSC 2301*	0.15	mg/kg	21	23	21	12	21	18
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	19	31	15	18	16	24
Lead	DETSC 2301#	0.3	mg/kg	46	56	36	37	26	29
Mercury	DETSC 2325#	0.05	mg/kg	0.10	0.10	0.12	< 0.05	< 0.05	0.06
Nickel	DETSC 2301#	1	mg/kg	17	24	9.8	14	14	13
Selenium	DETSC 2301#	0.5	mg/kg	1.4	2.7	0.8	1.1	1.2	2.2
Zinc	DETSC 2301#	1	mg/kg	89	170	56	76	69	61
Inorganics									
pH	DETSC 2008#			8.8	8.1	10.0	8.7	9.1	9.2
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.1	0.3	0.2	< 0.1	0.2	0.2
Organic matter	DETSC 2002#	0.1	%	4.4	3.9	4.1	2.6	2.2	4.9
Sulphate as SO ₄ , Total	DETSC 2321#	0.01	%	0.12	0.08	0.29	0.10	0.35	0.14
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	3.8	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	7.1	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	46	< 3.4	85	< 3.4	< 3.4	11
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	46	< 10	96	< 10	< 10	11
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	0.11	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	0.5	< 0.5	5.1	5.2	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	6.7	< 0.6	24	14	3.5	6.9
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	180	< 1.4	310	57	4.8	83
Aromatic C5-C35	DETSC 3072*	10	mg/kg	190	< 10	340	77	< 10	90
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	240	< 10	440	77	< 10	100

Summary of Chemical Analysis

Soil Samples

Our Ref 16-66137

Client Ref 13658

Contract Title Ty-Newydd Farm

Lab No	986389	986390	986391	986392	986393	986394
Sample ID	TP01	TP02	TP03	TP04	TP05	TP06
Depth	0.40-0.50	1.70-1.80	1.00-1.10	2.80-2.90	2.50-2.60	1.10-1.20
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	10/05/16	10/05/16	10/05/16	10/05/16	10/05/16	10/05/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.08	0.03	0.06	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.05
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.08	< 0.03	0.31	0.26	0.19	0.20
Fluorene	DETSC 3303	0.03	mg/kg	0.07	< 0.03	0.32	0.22	0.18	0.12
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.48	0.06	1.2	0.99	0.53	1.0
Anthracene	DETSC 3303	0.03	mg/kg	0.14	< 0.03	0.32	0.18	0.13	0.41
Fluoranthene	DETSC 3303#	0.03	mg/kg	1.1	0.11	1.5	1.7	0.68	3.4
Pyrene	DETSC 3303#	0.03	mg/kg	0.88	0.08	1.1	1.2	0.56	2.8
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.60	0.05	0.62	0.73	0.28	1.7
Chrysene	DETSC 3303	0.03	mg/kg	0.60	0.05	0.62	0.79	0.30	1.8
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.82	0.06	0.72	0.96	0.36	2.5
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.23	< 0.03	0.27	0.30	0.12	0.68
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.56	0.04	0.49	0.57	0.23	1.6
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.33	< 0.03	0.26	0.30	0.13	0.87
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	0.12	< 0.03	0.09	0.10	0.04	0.36
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.43	< 0.03	0.28	0.35	0.13	0.98
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	6.5	0.44	8.2	8.7	3.9	19
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	0.5	< 0.3	< 0.3	0.7	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 16-66137

Client Ref 13658

Contract Title Ty-Newydd Farm

Lab No	986395	986396
Sample ID	TP07	TP09
Depth	1.70-1.80	0.50-0.60
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	10/05/16	10/05/16
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	9.1	7.7
Cadmium	DETSC 2301#	0.1	mg/kg	0.9	0.6
Chromium	DETSC 2301#	0.15	mg/kg	23	15
Chromium III	DETSC 2301*	0.15	mg/kg	23	15
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	24	27
Lead	DETSC 2301#	0.3	mg/kg	94	77
Mercury	DETSC 2325#	0.05	mg/kg	0.07	0.10
Nickel	DETSC 2301#	1	mg/kg	15	16
Selenium	DETSC 2301#	0.5	mg/kg	2.1	1.7
Zinc	DETSC 2301#	1	mg/kg	120	120
Inorganics					
pH	DETSC 2008#			8.6	9.1
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.2	0.3
Organic matter	DETSC 2002#	0.1	%	4.1	6.3
Sulphate as SO ₄ , Total	DETSC 2321#	0.01	%	0.11	0.13
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	8.7	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	8.1	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	69	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	78	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	86	< 10

Summary of Chemical Analysis

Soil Samples

Our Ref 16-66137

Client Ref 13658

Contract Title Ty-Newydd Farm

Lab No	986395	986396
Sample ID	TP07	TP09
Depth	1.70-1.80	0.50-0.60
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	10/05/16	10/05/16
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
PAHs					
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	0.07	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	0.06	0.04
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.31	0.16
Anthracene	DETSC 3303	0.03	mg/kg	0.09	0.04
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.64	0.22
Pyrene	DETSC 3303#	0.03	mg/kg	0.51	0.18
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.27	0.10
Chrysene	DETSC 3303	0.03	mg/kg	0.30	0.10
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.37	0.12
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.12	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.24	0.09
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.13	0.06
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.14	0.05
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	3.3	1.2
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.5	0.6

Summary of Asbestos Analysis Soil Samples

Our Ref 16-66137

Client Ref 13658

Contract Title Ty-Newydd Farm

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
986389	TP01 0.40-0.50	SOIL	NAD	none	Andrew Little
986390	TP02 1.70-1.80	SOIL	NAD	none	Andrew Little
986391	TP03 1.00-1.10	SOIL	Chrysotile	Bundle of Chrysotile fibres present	Andrew Little
986392	TP04 2.80-2.90	SOIL	NAD	none	Andrew Little
986393	TP05 2.50-2.60	SOIL	NAD	none	Andrew Little
986394	TP06 1.10-1.20	SOIL	NAD	none	Andrew Little
986395	TP07 1.70-1.80	SOIL	Chrysotile	Small Bundles of Chrysotile fibres present	Andrew Little
986396	TP09 0.50-0.60	SOIL	NAD	none	Andrew Little

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 16-66137
 Client Ref 13658
 Contract Ty-Newydd Farm

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
986389	TP01 0.40-0.50 SOIL	10/05/16	GJ 250ml, PT 1L		
986390	TP02 1.70-1.80 SOIL	10/05/16	GJ 250ml, PT 1L		
986391	TP03 1.00-1.10 SOIL	10/05/16	GJ 250ml, PT 1L		
986392	TP04 2.80-2.90 SOIL	10/05/16	GJ 250ml, PT 1L		
986393	TP05 2.50-2.60 SOIL	10/05/16	GJ 250ml, PT 1L		
986394	TP06 1.10-1.20 SOIL	10/05/16	GJ 250ml, PT 1L		
986395	TP07 1.70-1.80 SOIL	10/05/16	GJ 250ml, PT 1L		
986396	TP09 0.50-0.60 SOIL	10/05/16	GJ 250ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Appendix A - Details of Analysis

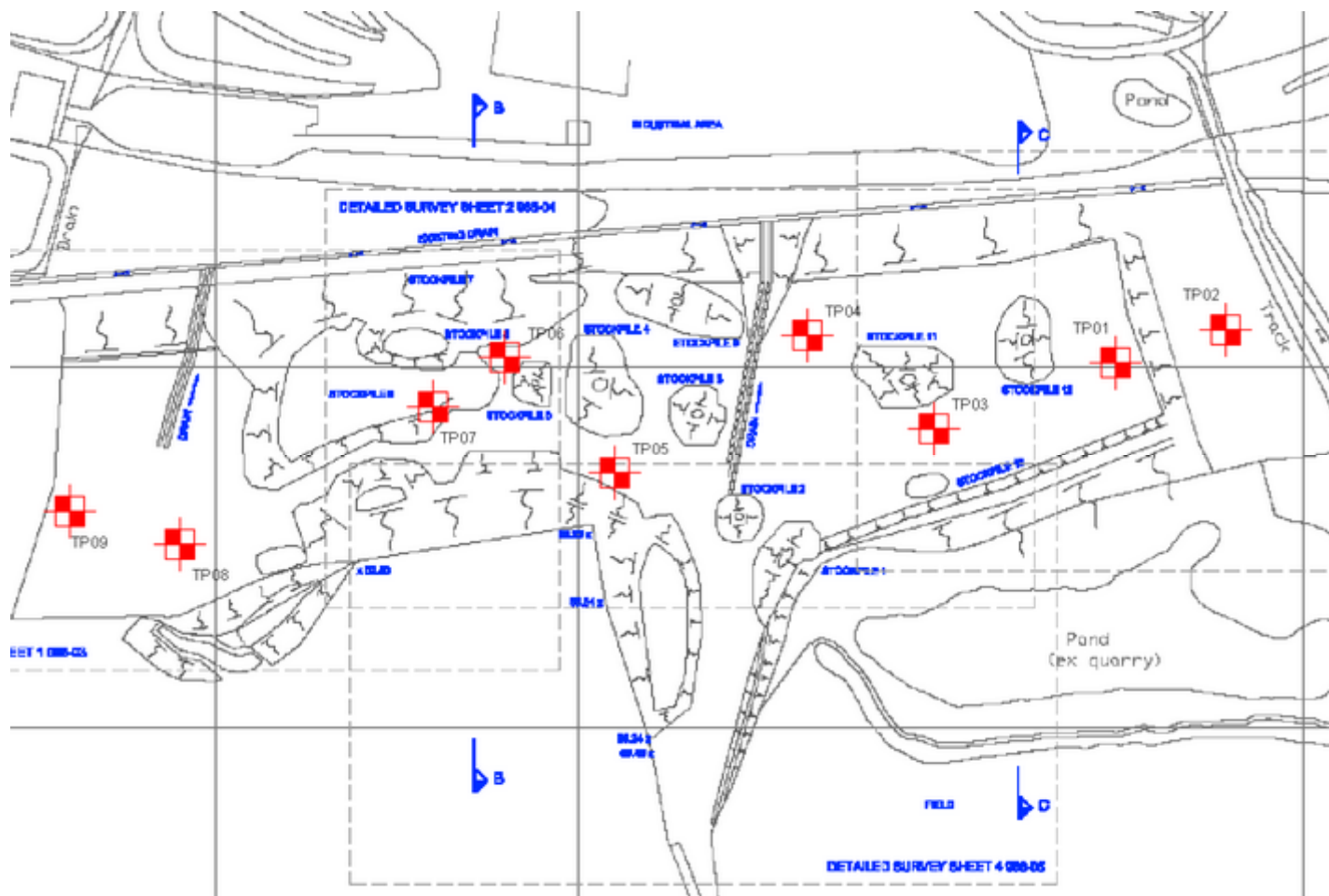
Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETS 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETS 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETS 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETS 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETS 2076	Sulphate Aqueous Extract as SO ₄	mg/l	10	Air Dried	No	Yes	Yes
DETS 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETS 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETS 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETS 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETS 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETS 2321	Total Sulphate as SO ₄	%	0.01	Air Dried	No	Yes	Yes
DETS 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETS 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETS 2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS 2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS 2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETS 2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS 2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS 2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETS 2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETS 2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETS 2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETS 2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETS 2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETS 2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETS 2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETS 2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETS 2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETS 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETS 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETS 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETS 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETS 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETS 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETS 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETS 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETS 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETS 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETS 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETS 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETS 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETS 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETS 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETS 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETS 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETS 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETS 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETS 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETS 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

DRAWINGS



Job Number:
13685

Job Title:
Ty-Newydd Farm

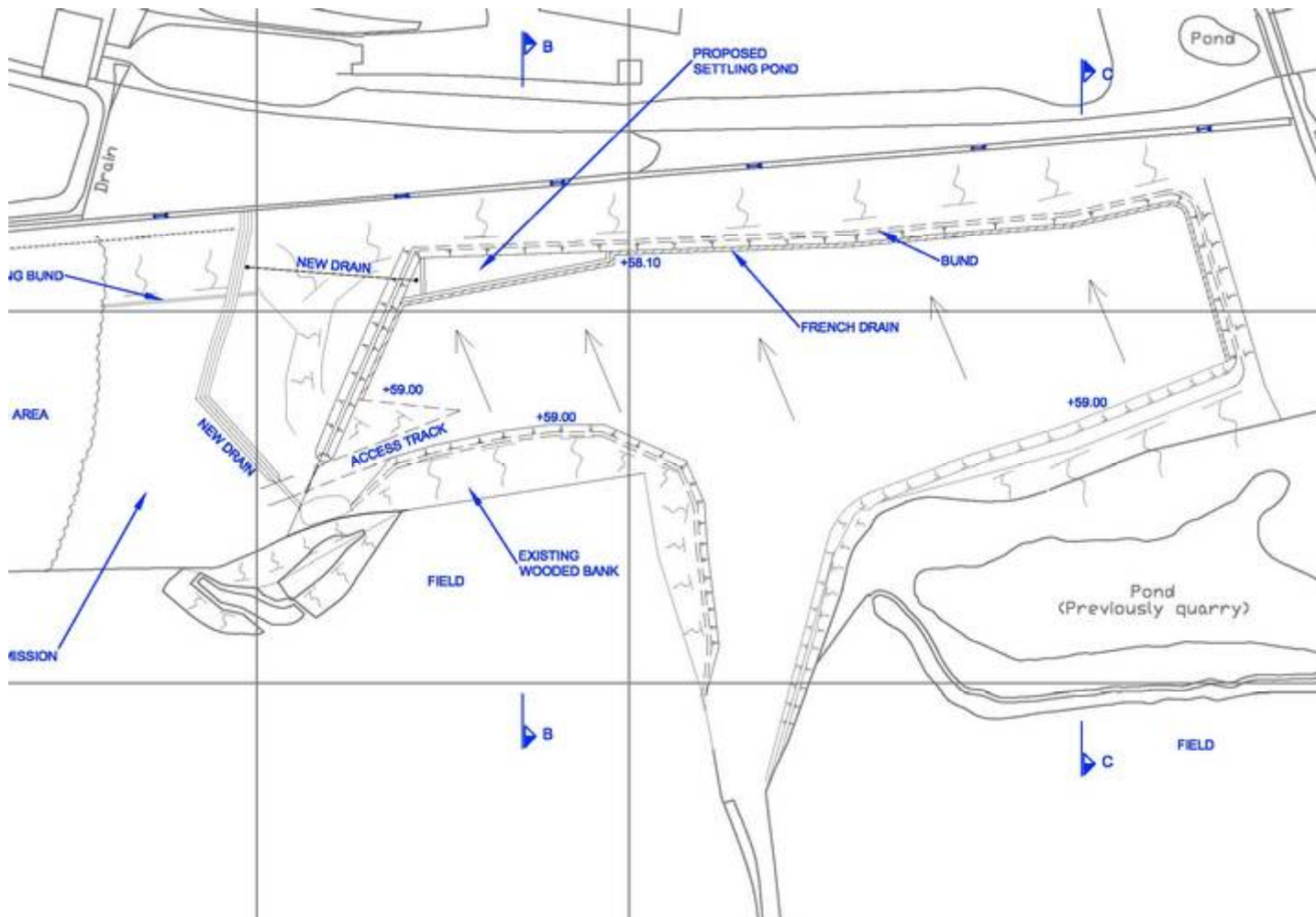
Drawing Title:
Existing Site Layout

Drawing Number:
01

Scale:
Not To Scale

North





Job Number:
13685

Job Title:
Ty-Newydd Farm

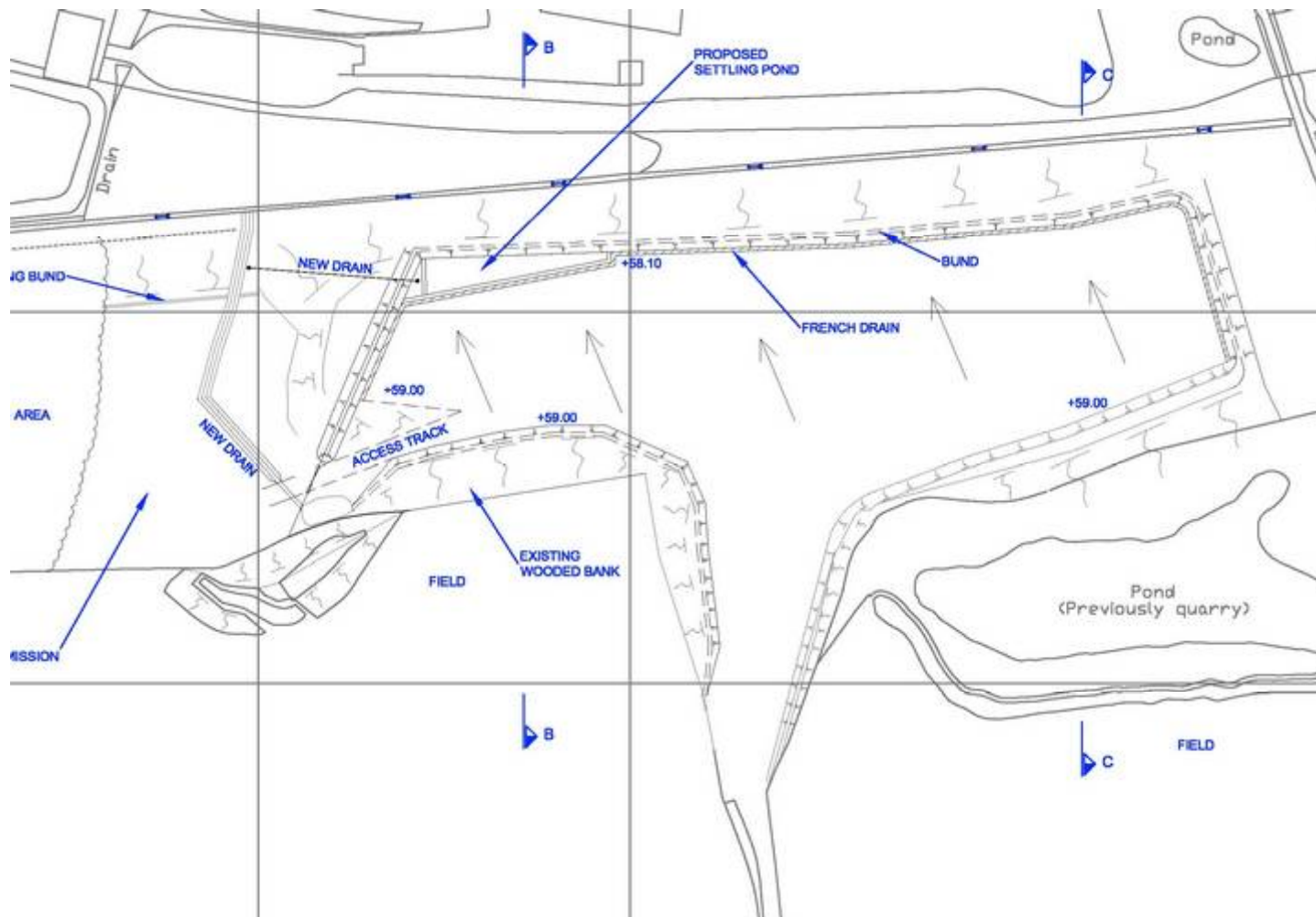
Drawing Title:
Proposed Site Layout

Drawing Number:
02

Scale:
Not To Scale

North





Job Number:
13685

Job Title:
Ty-Newydd Farm

Drawing Title:
Proposed Site Layout

Drawing Number:
02

Scale:
Not To Scale

North

