



Land at the former Portessie Station

Preliminary Contamination Assessment

May 2019

**Report prepared for
Moray Council - Estates Section**

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1 INTRODUCTION

1.1 Background

Moray Council Environmental Health Section was instructed by Moray Council Estates Section to undertake a preliminary contamination assessment for an area of land within the former Portessie Station site, Portessie, hereafter referred to as the 'site' or 'subject site'. The site is currently owned by Moray Council but is being considered for sale. As part of this process, a review was required of the site history and existing information to assess the potential risk associated with contamination from previous uses of the land and surrounding area. The aim of the assessment is to define the level of information required for the site to be "Sold with Information" in accordance with Test 3 of the Statutory Guidance on Part IIA of the Environmental Protection Act¹.

1.2 Scope of Works

The assessment comprises a desk study and site reconnaissance to identify potential contaminative uses of the site and to assess the risks to human health and the environment. The assessment includes the following:

- review of published data to provide information on the site's environmental setting;
- review of historical maps, historical aerial photographs and Council archives to identify the land use history of the site;
- site reconnaissance to record the current condition of the site; and
- assessment of information on previous uses to determine potential for contamination and risks posed to future users of the site and the environment in the context of Part IIA of the Environmental Protection Act 1990.

¹ Environmental Protection Act 1990: Part IIA Contaminated Land Statutory Guidance: Edition 2. May 2006, Paper SE/2006/44.

2 SITE DESCRIPTION

2.1 Location and Layout

The site is an area of roughly 6,000 square metres located adjacent to the U66L unclassified Portessie to Loanhead Road. The National Grid Reference for the centre of the site is 344500 866500.

The site consists predominantly of an area of dense vegetation. A metalled road, which is called Station Road in the west narrowing to a cycle track and footpath in the east, is located on the northwestern edge of the site. An area of grass is located to the north of the cycle track in the northeast of the site.

The site lies on a generally flat area at around 30 metres above sea level. Immediately to the north of the northeast of the site, the land slopes steeply downward. The Moray Firth is 150 metres to the north.

Appendix A contains a plan showing the location of the site. Photographs of the site are included in *Appendix B*.

The surrounding land use is as follows.

- Southeast – agricultural land, extending to 300 metres from the site;
- East and Northeast – unused woodland and heathland with a footpath/cycle track running through it;
- Northwest – residential properties on Station Road, beyond which are further residential areas of Portessie and unused steeply sloping ground;
- West – a minor road beyond which is a further area of unused ground with a footpath/cycle track.

2.2 Environmental Setting

2.2.1 Geology

British Geological Survey data show the uppermost strata beneath the site to be drift of Devensian Till, consisting of a heterogeneous mixture of clay, sand, gravel, and boulders. The steep slope immediately to the north of the site is the late glacial cliff line, with raised beach deposits at its foot.

The drift deposits are underlain by bedrock of the Cullen Quartzite Formation.

2.2.2 Hydrogeology

The Till deposits are classified as *Not a Significant Aquifer*. The quartzite is classified as having *Fracture Flow with Very Low Productivity*.

Groundwater Vulnerability is mapped as Class 4a (Vulnerable to those pollutants not readily adsorbed or transformed).

The SEPA website (<https://www.sepa.org.uk/data-visualisation/water-classification-hub/>) shows the site groundwater to be part of the Cullen groundwater body, which in 2017 was classified as 'good' for overall status.

There are no recorded groundwater abstractions within 500 metres of the site.

2.2.3 Hydrology

The nearest surface water shown on the 1:25,000 Ordnance Survey map is a drainage ditch immediately to the west of the site. A drain was found to enter the site from the agricultural land to the south. The nearest classified freshwater body is the Rathven Burn 800 metres southwest. The Moray Firth is 150 metres to the north.

2.2.4 Environmental Designations

There are no environmental designations within the immediate vicinity of the site.

3 SITE HISTORY

3.1 Historical Maps

Historical maps for the site and surrounding area are included as *Appendix C* and the relevant changes over time are summarised below.

The 1868 Ordnance Survey map shows the site and most of the surrounding area as open land. An arrow denotes a flow of water northwards along a field boundary in the centre of the site. At this time, a road ran along the western boundary. Steep slopes are marked five metres to the north. A well is marked 80 metres to the north. Houses and a chapel in Portessie were 100 metres to the north. No industrial premises are shown within the vicinity of the site.

On the 1904 map, the site is shown as railway land comprising two running lines of the North of Scotland railway in the north of the site, a running line and sidings of the Highland Railway (Keith and Buckie Branch) to the south, together with signal boxes and signal posts, and access roads to the adjacent station and rail yards either side of the railway lines. Topographic marks suggest the presence of embankments between the two sets of lines and to the north and south. The station, with platforms, footbridge and station building, was located from 20 to 110 metres to the east. A goods yard and goods shed were located 120 metres northeast and a maintenance yard with tank, turntable, engine shed and associated buildings were located 200 to 250 metres east. The road to west of the site had been diverted over a bridge 100 metres to the west of the site. Residential properties were present 10 metres to the northwest of the site, with more new houses further to the northwest.

The 1930 and 1938 map shows no significant changes on the site or the surrounding area except that railways had been renamed “LNER” and “LMSR Keith & Buckie Branch”. By the time of the 1959 map, the LMSR lines and associated railyard and engine shed are no longer shown. On the 1964 map, the area of former LMSR lines on the site is marked as marshland and the goods shed to the northeast is no longer shown.

On the 1988 map, the railway, including the sidings area to the northeast is no longer shown. No other significant changes are apparent.

3.2 Aerial Photographs

A high resolution aerial photograph from 1976 (included in *Appendix D*) shows no visible activity on the site. The trackbed of the more northerly railway lines is still visible although the rails appear to have been removed. The southerly lines and siding appear to be covered by grass or other short vegetation. A road ran along the north boundary of the site to the site of the former station to the northeast.

The 2004 photograph (included in *Appendix D*) shows the site was covered by trees apart from the road and grassed area in the northeast of the site. No significant changes are apparent on the site on the 2011 photograph.

3.3 Archive and Internet Research

According to the Railscot website, www.railscot.co.uk, Portessie was a three-platform station built by the Great North of Scotland Railway (GNSR), which ran services to Elgin and Aberdeen, but it was shared with the Highland Railway, which ran services to Keith. The Highland line opened first in 1884 but traffic proved limited and the tracks were removed in 1915. A short stretch to Buckie reopened in 1919 and finally closed in 1933. The GNSR lines opened in 1886 and closed in 1968. To the south of Findochty Junction to the east, there were sidings for exchange between the two companies' lines and to serve the Highland Railway's turntable, water tank and locomotive shed. To the north of the station was the GNSR's goods yard. The station building was on the north side of the lines, adjacent to GNSR's eastbound platform. There was a waiting room and footbridge. The site itself consisted of five lines comprising: two GNSR through lines; one Highland Railway line running to Findochty junction, one line connecting to its engine shed and one short siding – these three lines reduced into two lines within the site and then one line just to the west of the site.

3.4 Ground Investigations

A ground investigation was undertaken in 2004 by Terrenus on the wider Portessie Station site, which included coverage of the area of the goods yard, engine shed and sidings area. The report is included in *Appendix E*. The investigation comprised six boreholes to a maximum depth of 1.2 metres and 11 trial pits to a maximum depth of 3.0 metres. Chemical analysis was undertaken on 11 samples from nine locations for metals, cyanide, phenols, total petroleum hydrocarbons, and asbestos identification.

Only one of the sampling locations from this investigation was within the current subject site, which was a trial pit (TP10) on the eastern boundary of the subject site, from which one sample from a depth of 0.3 metres was analysed. The trial pit log shows 0.45 metres of made ground (gravelly sand with cobbles) over gravelly fine to coarse sand. Some ash was noted in the Highland Railway sidings area to the east.

None of the analysis results exceeded the human health screening levels used in the report and no asbestos was detected, either at TP10 or across the wider Portessie station site.

3.5 Site Walkover

The current condition of the site was checked on 26 April 2019. Photographs of the site are included in *Appendix B*.

The majority of the site is covered by a largely inaccessible area of dense vegetation consisting of trees and scrub, mostly willow and sycamore with an understorey of gorse and broom. The topography of the scrubland area is characterised by linear mounds running the length of the site, consistent with the embankment topography between the railway lines shown on the historical

maps. A drain was found entering the site from the agricultural land to the south and the low lying areas between the mounds on the site typically contained standing water.

On the north side of this area is a metalled road which in the east of the site narrows to become a footpath and cycleway. In the northeast of the site is an area of grass.

4 PRELIMINARY CONCEPTUAL SITE MODEL

A conceptual model is a representation of a site, incorporating what is known about the ground and groundwater conditions; the actual and potential contamination; the physical conditions and environmental setting; the receptors; and potential pathway linkages between contamination sources and receptors. The conceptual model is first formulated during preliminary research on a site to identify any uncertainties and informs subsequent investigations required to meet the overall objectives of an assessment².

4.1 Potential Contaminants/Sources

The site was formerly an area of five railway lines, including three through lines, a loop line and a short siding. The metalled road on the north side of the site was the access road to the station while, along the south side of the site, there was historically an access road to the Highland Railway yard to the east.

Potential contamination associated with historical railway lines and passage of trains is mostly associated with:

- hydrocarbons from lubricants used in rolling stock;
- material used in construction of track beds including, for example, ash which may contain metals, phenols, sulphate and polycyclic aromatic hydrocarbons;
- metals and asbestos used in braking systems;
- herbicides used to clear vegetation from tracks and;
- airborne contamination from locomotives and cargoes, such as coal dust and metal particulates.

Other than the extension of the railway in an easterly and westerly direction from the site, no other potentially contaminative industrial sites are recorded in the vicinity of the subject site. The more contaminative railway operations on the wider station site are likely to have occurred in the vicinity of the engine shed and, to a lesser extent, the goods yard, which were located 200 metres and 120 metres to the east, respectively.

Previous investigations suggest a limited thickness of made ground and so, based on current information, there is unlikely to be a substantial ongoing source of ground gas.

² BSI, 2017. Investigation of potentially contaminated sites – Code of practice. BS10175:2011+A2:2017.

4.2 Potential Receptors

The most recent use of the site is as a road, footpath and cycleway with a small area of grass that could be used for informal recreation. The area of former railway lines, now covered by dense vegetation, is largely inaccessible and its current use is limited.

Groundwater in the drift deposits and bedrock aquifer beneath the site are potential receptors. However, the drift deposits are not a significant aquifer and the quartzite bedrock is of very low productivity, and there are no nearby recorded abstractions.

4.3 Potential Pathways

The principal pathways for human receptors under the current site use are from direct contact, and ingestion/inhalation of on-site soil and dust.

Mobile contaminants may leach in percolating water and migrate off-site in shallow groundwater. Groundwater flow is likely to be towards the north and so mobile contaminants could reach the Moray Firth, 150 metres to the north.

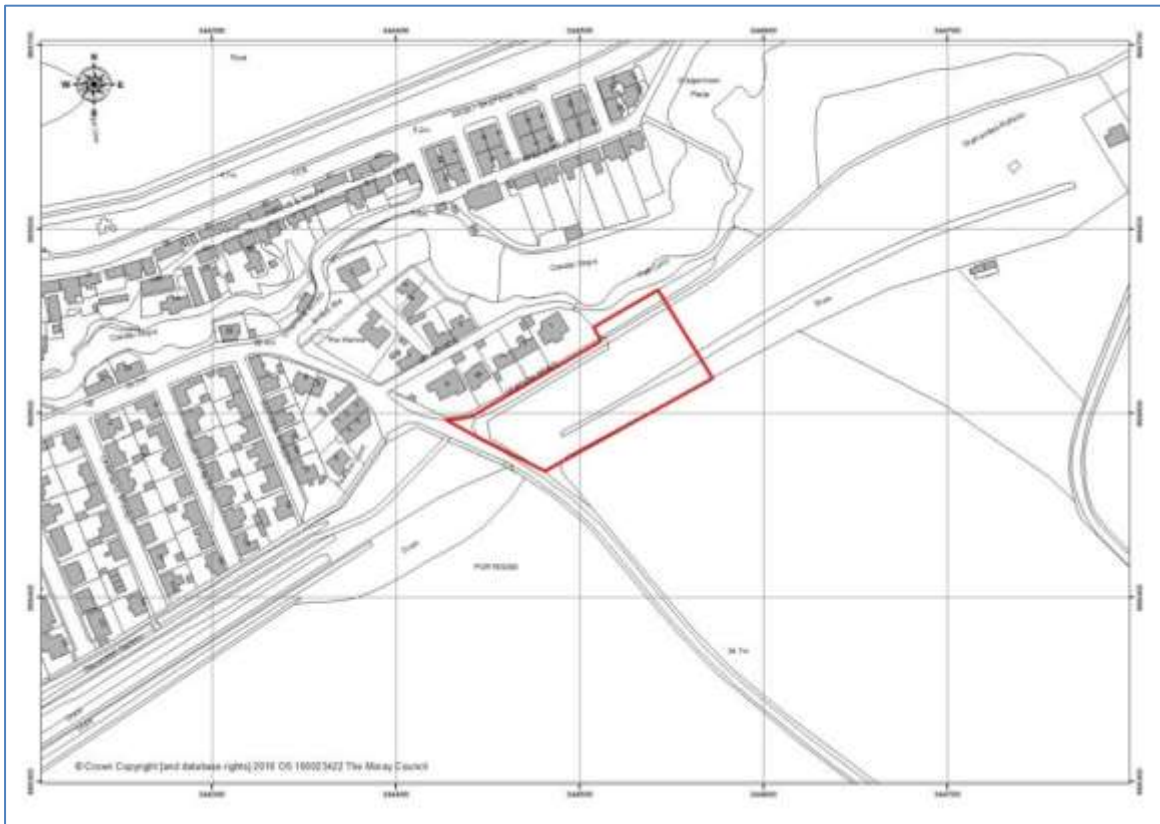
4.4 Preliminary Risk Assessment Summary

The site was previously crossed by railway lines, some of which operated for around 80 years. A range of contaminants associated with railway use over such a period of time may be present. However, the area of former lines is now largely inaccessible and site users' exposure to potential contaminants associated with the historical use is currently low.

The risk to the water environment from leaching of contaminants appears low, given the low permeability of the underlying strata. However, if a substantial contaminant source and a groundwater pathway are present, contaminants may reach the Moray Firth. Since groundwater flow is likely to be towards the north, contaminants associated with the wider Portessie Station and associated railway yard to the east, are unlikely to affect the subject site.

Under the current site use, and with the information available on site history, the site is not considered likely to fall under the definition of Contaminated Land in Part IIA of the Environmental Protection Act 1990 and associated Statutory Guidance. As such, no further investigation is considered to be required for the site to be "Sold with information". In the event of a change of use, further investigation is likely to be required to confirm suitability of the site for the new use as part of the planning process.

Appendix A: Site Location Plan



Appendix B: Photographs



Photo 1. Footpath/cycleway on the north side of the site, looking west



Photo 2 Linear mound in the north of the densely vegetated area



Photo 3. View of the western boundary of the site from the public road



Photo 4. Drain on the southern boundary of the site and dense scrub



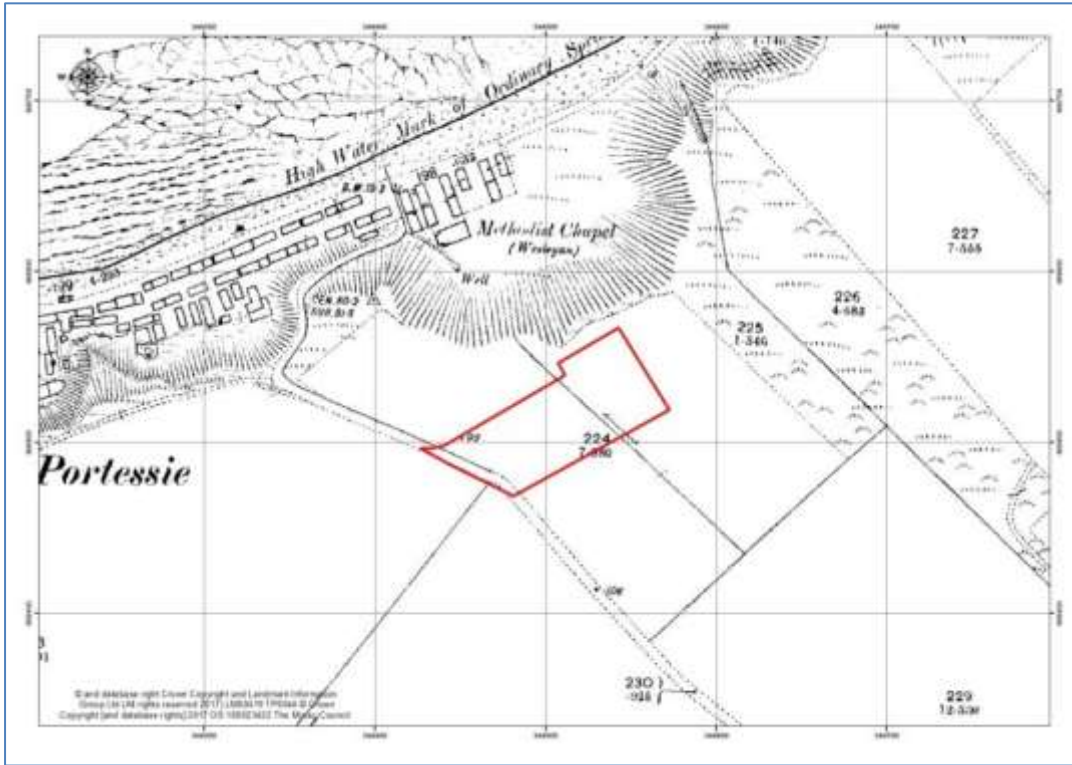
Photo 5. Standing water between the linear mounds in the densely vegetated area.



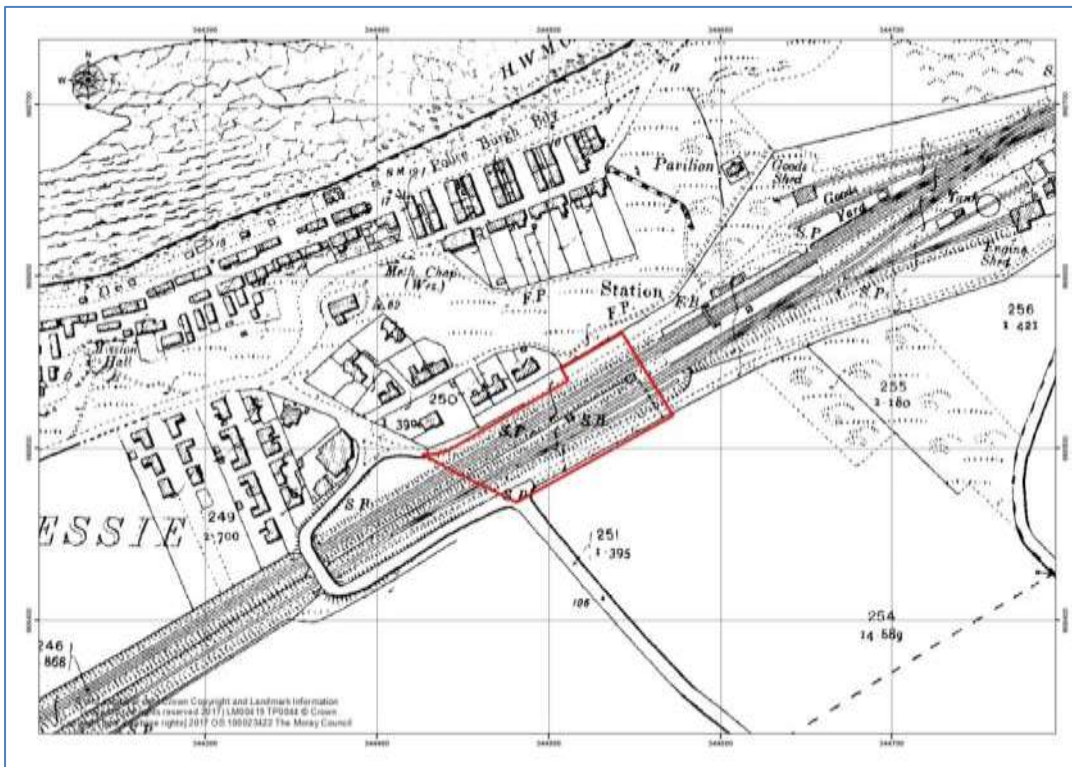
Photo 6. View of the site across agricultural land south of the site, looking northeast.

Appendix C: Historical Maps

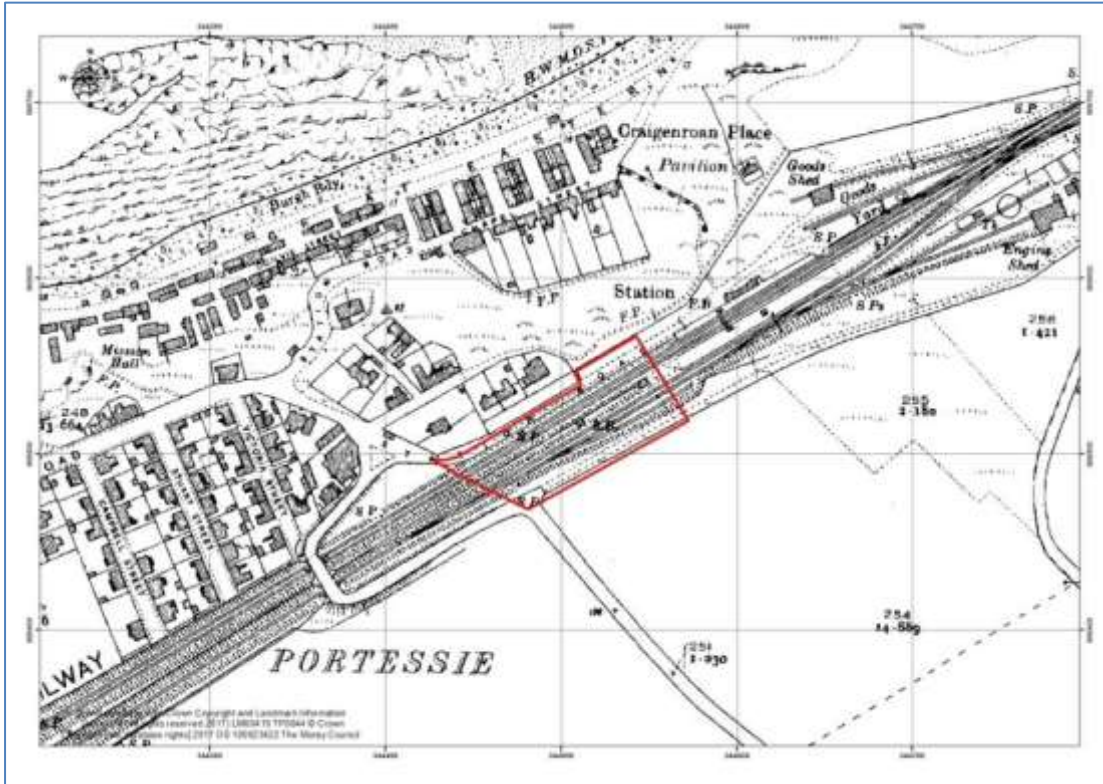
1868 1:2,500 Ordnance Survey Map



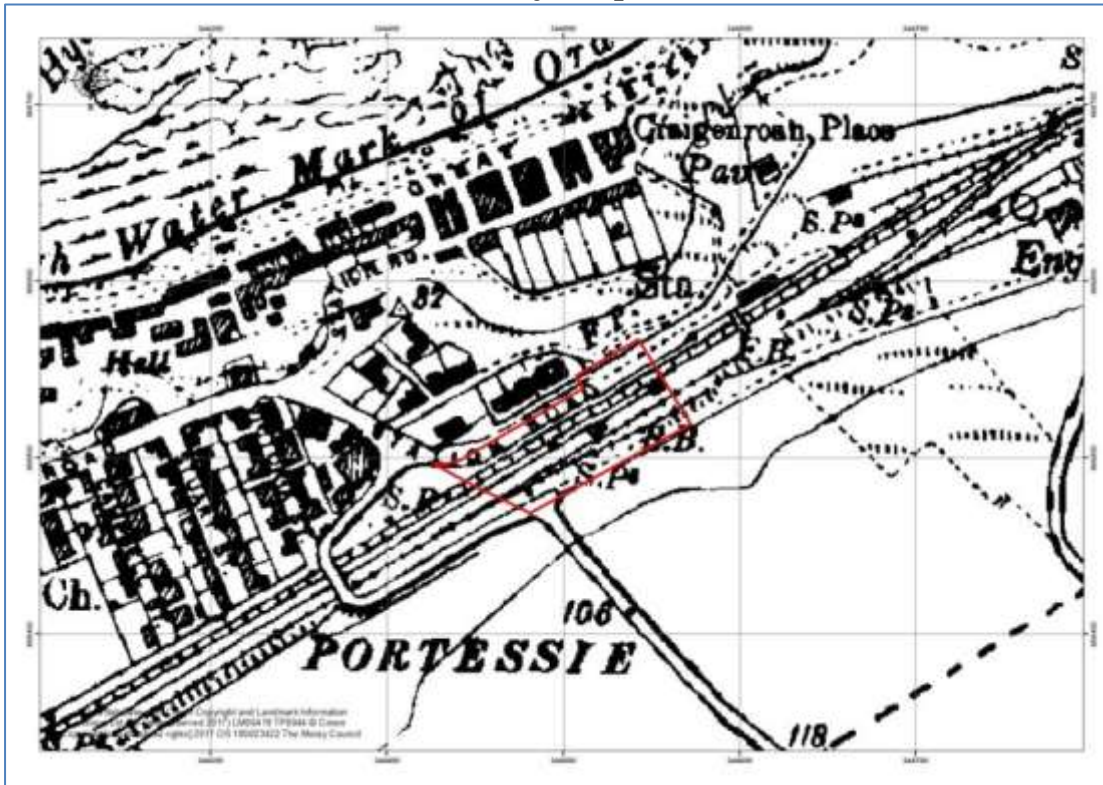
1904 1:2,500 Ordnance Survey Map



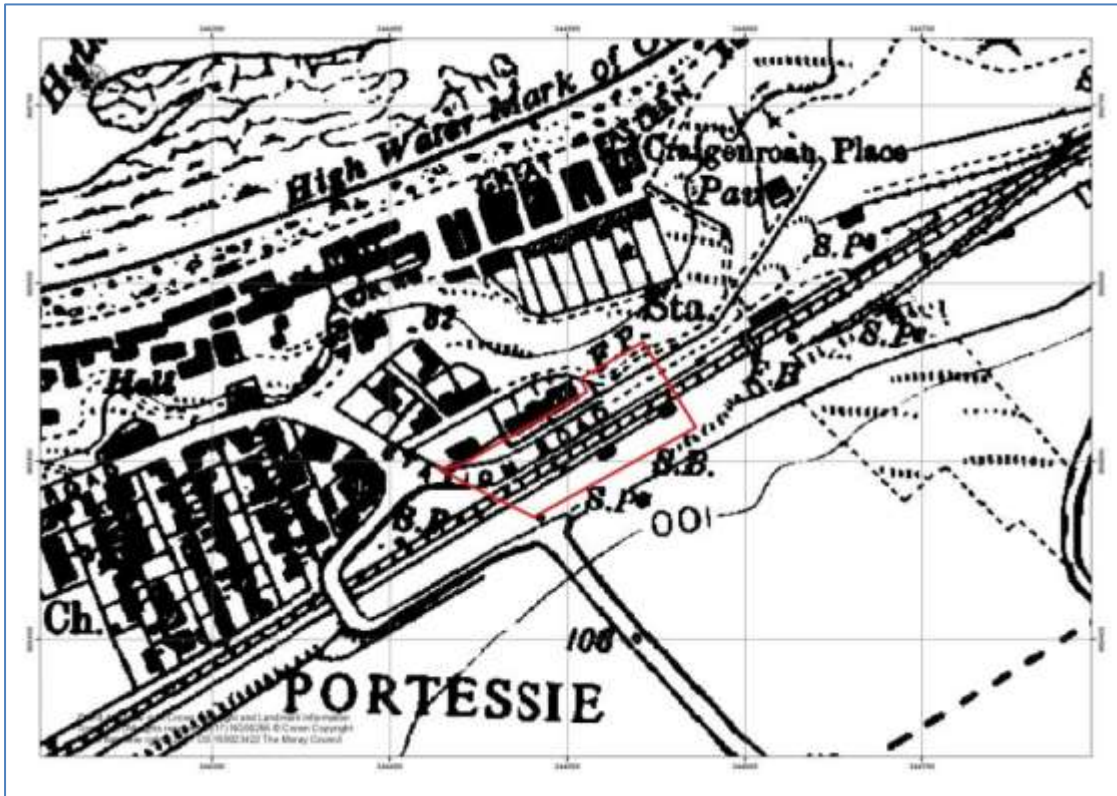
1930 1:2,500 Ordnance Survey Map



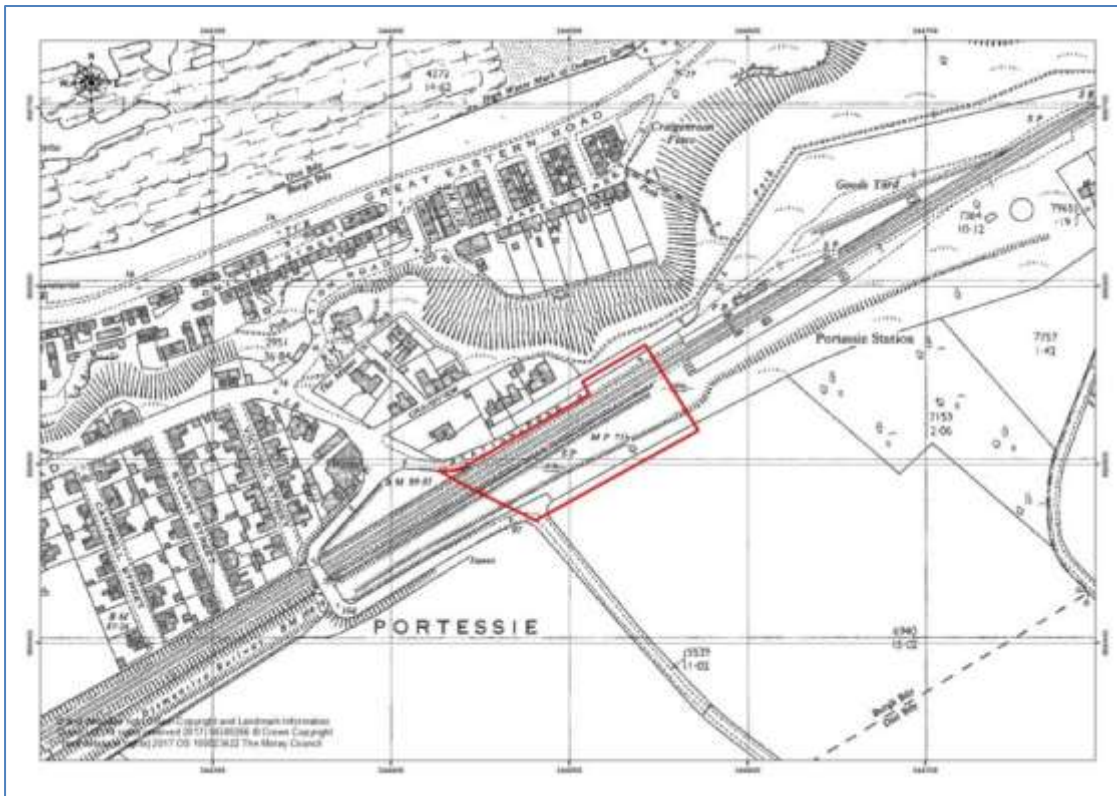
1938 1:10,000 Ordnance Survey Map



1959 1:10,000 Ordnance Survey Map



1964 1:2,500 Ordnance Survey Map



Appendix D: Aerial Photographs

1976



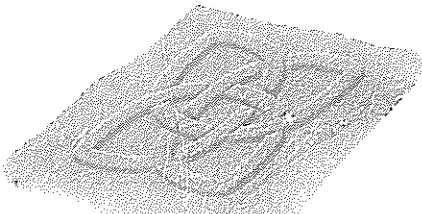
2004 Aerial photograph



2011 Aerial photograph



Appendix E: Site Investigation Report



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**COMBINED PHASE 1 / PHASE 2 INVESTIGATION
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

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**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

SITE SUMMARY INFORMATION

Name of Site:	Portessie Station
Ordnance Survey Grid Reference:	NJ 4470 6663
Site Address:	Portessie Railway Station, Portessie, Buckie
Local Authority:	The Moray Council
Current Site Owner:	The Moray Council
Current Site Use:	Open space
Proposed Site Use:	Residential
Areas (hectares):	3.5
On site buildings:	no
Type of Investigation:	Phase 2 (Stage 2) Investigation following Phase 1 investigation by The Moray Council

**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
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**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

1 INTRODUCTION

1.1 BACKGROUND

The Moray Council propose to allow residential development of the Portessie Station site. The site is therefore to be 'sold with information' in terms of Scottish Executive Circular 1/2000, Annex 3, Chapter D. In order to assess the site to meet with the above requirements, Terrenus Consulting Ltd was appointed by The Moray Council to undertake a Phase 2 investigation of the site. Phase 1 information pertaining to the site was provided by the Council for consideration as part of this report. This document sets out the findings of the investigation, as requested in a letter by The Moray Council dated 10th April 2004.

1.2 SCOPE OF STUDY

The Phase 1 Investigation carried out by the Council comprised a review of available information to establish the likely ground conditions associated with the site. The study included an examination of published geological and historical maps and plans. This was supported by a walkover inspection of the site to provide further information on environmental issues or concerns.

The Phase 2 Investigation comprised site investigation fieldworks, the laboratory analysis of soil samples, and the monitoring of soil gas and groundwater levels. The full methodology and scope of the Phase 2 Investigation is described in Section 7 of this report.

1.3 OBJECTIVES OF INVESTIGATION

The aims of the Phase 2 investigation are as follows:

- To establish the ground conditions at the site;
- To determine the environmental conditions with respect to ground contamination, groundwater pollution and soil gases; and,
- To identify constraints to development arising from the above conditions.

It should be recognised that the investigation in respect of ground contamination is exploratory in nature, as defined in BS10175; 2001 "Investigation of Potentially Contaminated Sites – Code of Practice".

1.4 PROPOSED SITE END-USE

It is understood that the site will be developed for residential purposes. Details of the development are not known at this stage.

1.5 LIMITATIONS OF REPORT

Terrenus Consulting Ltd. has prepared this report for the sole use of the Client, in accordance with generally accepted consulting practice and for the intended purpose as stated in the related contract agreement. No other warranty, expressed or implied, is made as to the professional advice included in this report.

To the best of our knowledge, information contained in this report is accurate at the date of issue; however subsurface conditions including groundwater levels and contaminant concentrations may vary spatially and with time. It should be noted, however, that this report is based on the information provided by The Moray Council and obtained during the Phase 2 investigations. There may be conditions pertaining at the site not disclosed by these sources, which might have a bearing on the recommendations provided if such conditions were known. We have, however, used our professional judgement in attempting to limit this during the investigation.

It is important that these implications be clearly recognised when the findings of this study are being interpreted. In addition, this should be borne in mind if this report is used without further confirmatory testing after significant delay.

The investigation in respect of ground contamination is exploratory in nature, as defined in BS10175; 2001 "Investigation of Potentially Contaminated Sites – Code of Practice". Further investigations may be required in respect of ground contamination for planning and design purposes.

2 DESK STUDY INVESTIGATION

A desk study investigation of the site was carried out by the Council. Extracts of this investigation as supplied by the Council are included in the Appendix to this report.

Elements of this desk study have been used in the compilation of this investigation and this report should be read in conjunction with the information contained in the Appendix.

3 SITE DESCRIPTION

3.1 LOCATION

The site is situated in a coastal location at the north eastern end of the village of Portessie, to the east of Buckie, Moray.

The location of the site is shown on Figure 1, included in the Appendix to this report.

3.2 DESCRIPTION

The site occupies an elevated position some 20 to 25m above Ordnance Datum and overlooking the Moray Firth to the north.

The site is bounded to the south and east by agricultural land and rough grazing. To the west there is housing and a minor road. The north of the site forms a steep escarpment leading down to the A942 from Buckie to Portknockie and the Moray Firth beyond. A minor road runs to the south of the site before curving to the east and crossing the former railway line via a stone bridge.

The ground surface of the site slopes gently to the escarpment noted above and is in places gently undulating. A number of features relating to the former site use as a railway station remain in evidence across the southern part of the site. These include platform features; a stone built water tower and a locomotive turning platform recess. Also associated with the former railway station is a number of east – west trending embankments.

A number of ditches or drains are noted to run approximately east west across the site. These ditches were noted to contain water and to be associated with water logged areas. No discernable flow however was observed during the site visits. A further minor seepage was noted to issue from the central part of the site and flow to the north prior to sinking some 50m from the northern boundary of the site.

3.3 SITE NEIGHBOURS

Residential areas lie to the west and north west of the site with a caravan park noted at the base of the escarpment to the north. A golf course is noted to the north east of the site and a number of farm buildings and cottages lie to the east and south.

3.4 CURRENT SITE USE

The majority of the site is currently vacant, although a footpath crosses the site from west to east. The site may be divided into two principle parts with the bulk of the southern part being overgrown with heavy bush growth and occasional immature trees. The north of the site is currently under rough grass and gorse bushes.

3.5 PHYSICAL CONSTRAINTS TO INVESTIGATION

The following physical constraints to investigation were observed:

- Potential soft ground for access;
- Heavy growth in the south of the site; and
- Presence of embankments in the south of the site.

4 SITE HISTORY

4.1 INTRODUCTION

The development history of the site was determined by an examination of recent and historical Ordnance Survey maps dated 1868 to 1988 undertaken by The Moray Council. Details of this examination are included in the Appendix

A summary of the development history of the site and surrounding area as described by the Council is provided below.

4.2 DEVELOPMENT HISTORY OF SITE AND SURROUNDING AREA

The general area is shown to be in agricultural use on the earliest map dated 1868. Portessie railway station is recorded on the 1904 sheet together with goods shed; water tank, engine shed, tracks and platforms. The surrounding area following the railway development remained in agricultural use.

By 1959 a reduction in the size of the railway station including the removal of the southern line and associated engine shed is indicated. The 1965 map shows little change, although a marsh area is shown to the south of the railway track and west of the platform.

The 1988 map shows only a few features remaining including the turning circle, platform and water tower building.

4.3 SUPPLEMENTARY INFORMATION

The Council indicate that two railway lines were served by Portessie Station. The Highland Railway line is likely to have been opened in 1884 with the Great North of Scotland line being opened in 1886. The former line was closed in 1944 with the latter line remaining in use until 1968.

It is understood that the engine shed may have ceased as a railway feature in 1909 but continued to be used for a number of years as a concrete block factory.

5 ENVIRONMENTAL SETTING

5.1 GEOLOGY

Superficial deposits are likely to comprise glacial sand and gravel below the west of the site and glacial morainic drift below the east. The Council reports that made ground is likely to overlie highly and weakly permeable superficial deposits.

The underlying solid strata below the west of the site are representative of Grit and Schist deposits of Dalradian age. Below the east of the site rocks of the Middle Old Red Sandstone of Devonian age are anticipated. The Council reports that the solid geology is considered to represent both high and weakly permeable strata.

5.2 HYDROGEOLOGY

The Groundwater Vulnerability Map of Scotland indicates the strata below the site are Class 2 (Moderately Permeable) strata in the west and Class 3 (Weakly Permeable) strata in the east. These formations seldom produce large quantities of water for abstraction, but are important for supplying base flow to rivers.

The superficial deposits below the site are non-aquifer and are classified as Type 2 or 3 soils (intermediate or low leaching potential) on the Groundwater Vulnerability Map. Such soils have some potential to attenuate diffuse and free-phase contaminants.

The Hydrogeological Map of Scotland records the rock strata beneath the west of the site may represent an aquifer that is locally important. Below the east of the site the rocks are generally without groundwater except at shallow depth.

The Council note that private wells are recorded in the vicinity of the site including at West Scotstoun Farm some 650m to the south east. It is not known if these wells are currently in use and no public abstraction exists in the general area.

5.3 HYDROLOGY

There is no hard-standing within the site boundary; therefore percolation to groundwater from the ground surface is likely. Infiltration to the shallow soils is likely to vary and possibly form shallow perched aquifers on the underlying bedrock. Boggy areas with surface water are known within the site boundaries.

A minor water flow was noted at the eastern end of the former railway station passing from an area of surface water to the north before disappearing some 200m to the south of the escarpment.

Run off from the site is most likely to pass to the north and hence to the Spey Bay.

6 QUALITATIVE RISK ASSESSMENT

6.1 BACKGROUND

Contaminated land is addressed in statute by the Contaminated Land (Scotland) Regulations 2000, which implement Part IIA of the Environmental Protection Act 1990. These Regulations deal specifically with land contamination which is causing or has the potential to cause significant harm or pollution for any current land use. For proposed development sites, however, contaminated land issues are dealt with under Planning Advice Note PAN33¹. The stated objectives of PAN33 are to provide advice on:

- The implications of the Contaminated Land (Scotland) Regulations for the planning system;
- The development of contaminated land;
- The approach to contaminated land in development plans;
- The determination of planning applications where a site is or may be contaminated; and
- Where further information or advice can be found.

PAN33 states that the Scottish Executive considers the “suitable for use” approach is the most appropriate to deal with contaminated land. This approach focuses on the risks presented by contaminated land, recognising that the risks will vary dependent on the nature and level of contamination, the proposed site end-use and the means by which ground contamination can cause harm or pollution. The assessment of risk must, therefore, be assessed on a site-specific basis.

The following Qualitative Risk Assessment has been prepared in accordance with the requirements of Planning Advice Note PAN 33 and in recognition of the proposed use of the site for residential purposes as stated by The Moray Council.

6.2 METHODOLOGY

In order to provide an evaluation of the risks presented by ground contamination, a Conceptual Site Model (CSM) is built to identify and assess the following elements which must be in place before contamination can lead to harm or pollution:

- **Source** – The location, nature, severity and extent of contamination on any given site.
- **Pathway** – The routes by which receptors could be harmed or polluted by the contamination.
- **Receptor** – Target which could be damaged by exposure to contamination.

The presence of a source-pathway-receptor linkage (Pollutant Linkage) is indicative that there is a potential risk of harm or pollution arising from ground contamination at the site. For the purposes of the Qualitative Risk Assessment, the severity of the risk is assessed as follows:

¹ PAN33 – Development of Contaminated Land, Scottish Executive, October 2000.

		CONSEQUENCE			
		Severe	Medium	Mild	Minor
PROBABILITY	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Insignificant Risk

Adapted from CIRIA Report C552 – Contaminated Land Risk Assessment – A Guide to Good Practice.

The risk assessment considers the risk to the receptors identified in Scottish Executive Circular 1/2000; Environmental Protection Act 1990: Part IIA Contaminated Land. In this respect, the CSM sets out the potential pollutant linkages identified for each receptor, based on the descriptions of Significant Harm and the Significant Possibility of Significant Harm provided in Tables A and B in Annex 3, Chapter A of Circular 1/2000.

6.3 CONCEPTUAL SITE MODEL

6.3.1 Sources

Potential contamination was considered possible arising from the historical land use and the potential presence of made ground on the site. Potential sources are identified below:

On-site sources	Off-site sources
• Railway lines including ballast material	• Agricultural land

A review of available documentary reports, including the DoE² Industry Profiles and DEFRA³ CLR 8 – “Potential Contaminants for the Assessment of Land”, identified the following potential contaminants that may be found at the site at this time:

- Asbestos
- Heavy metals;
- Inorganic compounds; and
- Organic compounds (petroleum hydrocarbons, PAH, chlorinated aliphatic hydrocarbons and polychlorinated biphenyls (PCB's)).

² Department of the Environment

³ Department of Environment, Food & Rural Affairs

6.3.2 Type 1 Receptor – Human Health

6.3.2.1 Pathways

Current best practice adopts the Contaminated Land Exposure Assessment⁴ (CLEA) model to assess the risk to Human Health. In this regard a comparison has been undertaken with the available default exposure pathways included in the conceptual exposure models presented in CLR 10 to ascertain if the site under study is broadly compliant with the available scenarios. This comparison is presented in the following table.

		CLEA Land Use			
		Residential	Allotments	Commercial / Industrial	Site under study
CLEA Exposure Pathways	Ingestion of soil	✓	✓	✓	✓
	Ingestion of indoor dust	✓	✓	✓	✓
	Ingestion of contaminated vegetables	⊙	✓	×	✓
	Ingestion of soil attached to vegetables	⊙	✓	×	✓
	Dermal contact with soil	✓	✓	✓	✓
	Dermal contact with building dust	✓	✓	✓	✓
	Inhalation of fugitive soil dust	✓	✓	✓	✓
	Inhalation of fugitive building dust	✓	✓	✓	✓
	Inhalation of vapours outside	✓	✓	✓	✓
	Inhalation of vapours inside	✓	×	✓	✓

✓ - Included in default exposure model

×- Not included in default exposure model

⊙- Optional in default exposure model

From the table above, it can be ascertained that the site under study matches the exposure pathways relevant to the residential scenario.

6.3.2.2 Receptors

The following human health receptors are considered potentially at risk due to the possible presence of contamination at the site:

- Current site users;
- Site neighbours;
- Construction site workers; and
- Future site users.

Consideration is also given to human health via exposure to contamination via water drawn from private wells in the vicinity of the site.

⁴ DEFRA and the Environment Agency, 2002.

6.3.2.3 Pollutant Linkages and Assessed Risks

The risk to human health from soil contamination to the current site user is assessed to be **Insignificant** for the majority of the site rising to **Very Low** within the vicinity of the former engine shed and railway yard. This assessment is based on the fact that short-term exposure is anticipated and the risk from acute exposure is minor.

An **Insignificant Risk** to human health from soil contamination has been assessed for site neighbours.

Unprotected construction workers are considered to be at an **Insignificant** risk across most of the site. However, within the vicinity of the engine shed and railway yard this risk rises to **Low** due to the former use and date of past activity.

The risks to residents following construction are considered to be **Insignificant** across most of the site. However, within the vicinity of the engine shed and railway yard this risk rises to **Moderate to High** due to the former use and date of past activity and the likelihood of exposure to contamination.

The risk to human health via exposure to contaminated groundwater extracted from wells in the vicinity of the site is considered to be **Insignificant**. This assessment is made on the basis that the wells are upgradient of the site and will not be impacted by contamination from the site.

6.3.3 **Type 2 Receptor – Ecological Systems**

There are no receptors in the vicinity of the site and the Pollutant Linkage is, therefore, incomplete. The risk to this receptor is assessed to be **Insignificant**.

In view of the above, no further consideration of this receptor will be made in this report.

6.3.4 **Type 3 Receptor – Property (Animals and Crops)**

6.3.4.1 Pathways

Direct uptake by the roots in vegetation would be the pathway associated with plants.

The pathways for domestic animals and livestock are similar to that for humans; therefore the same pathways can be used, as were stated above in Section 6.3.2.1.

6.3.4.2 Receptors

Under the current site usage domestic pets are the main receptors. Subsequent to development and construction this changes to domestic pets, and garden plants and soft landscaped areas.

6.3.4.3 Pollutant Linkages and Assessed Risks

The risk to plants is assessed to be **Insignificant** across most of site, rising to a **Low Risk** in previously developed areas. However, no evidence of plant die back was observed, therefore the risk is re-assessed to be **Very Low**.

The risk to domestic pets and livestock is assessed to be **Insignificant** out-with the previously developed areas. Within the vicinity of the former engine shed and railway yard this risk rises to **Low**. However, the site has been used for walking dogs for many years with no recorded evidence of harm; therefore the risk is reassessed as **Very Low**.

6.3.5 Type 4 Receptor – Property (Buildings)

6.3.5.1 Pathways

The fabric of a building may be detrimentally affected by direct contact with contaminated soils, contaminated groundwater or the accumulation of soil gases.

6.3.5.2 Receptors

The following building receptors are considered possible on this site:

- Buildings;
- Building materials (plastics and concrete), and
- Underground services (including cables, water supply and drainage pipes).

6.3.5.3 Pollutant Linkages and Assessed Risks

An **Insignificant Risk** to building materials and underground services is assessed for the areas out with the former development. The risk is assessed to rise to **Low** to **Moderate** due to exposure to contaminated soils within the engine shed and railway yard areas.

6.3.6 Controlled Waters – Surface Water

6.3.6.1 Pathways

Leaching and direct run-off from the site to the sea shore to the north via minor water courses would be the principle potential pathways for contamination.

6.3.6.2 Receptors

A number of minor watercourses present within the site and the Moray Firth are the main receptors.

6.3.6.3 Pollutant Linkages and Assessed Risks

There is direct run-off from the former railway yard; therefore a **Moderate Risk** is assessed is assessed to minor water courses. The risk to the Moray Firth is assessed to be **Insignificant** due to the distance from the site and the dilution factors that will impact on run-off from the site.

6.3.7 Controlled Waters - Groundwater

6.3.7.1 Pathways

Leaching from the fill material via surface water infiltration is the main pathway by which groundwater could be impacted by contamination.

6.3.7.2 Receptors

Perched water above bedrock and groundwater present in the bedrock are the main receptors.

6.3.7.3 Pollutant Linkages and Assessed Risks

The risk to perched groundwater is assessed to be **Moderate** due to the possible presence of contamination and the presence of permeable superficial deposits at the site.

The risk to the Devonian aquifer is assessed to be **Low-Moderate** due to the permeability of these strata and recognising potential attenuation effects to contamination in the unsaturated zone.

The risk to groundwater in the Dalradian bedrock is assessed to be **Insignificant** due to the permeability of these deposits.

6.4 **UNCERTAINTIES**

No information on the nature and extent of potential contamination at the site was utilised for in the construction of the Qualitative Risk Assessment..

7 PHASE 2 INVESTIGATIONS

7.1 SCOPE OF WORKS

The scope of works for the intrusive investigation was as follows:

- 6 No. 'Competitor' percussion boreholes;
- 11 No. trial pits;
- Soil samples were recovered for geochemical and geotechnical testing; and
- Monitoring of groundwater and soil gas for a period of 4 weeks following completion of site works.

7.2 METHODOLOGY

7.2.1 Fieldworks

The fieldworks were carried out by Aitken Laboratories Ltd between the 17th and 29th March 2004. The fieldworks comprised:

- Six number percussion boreholes designated BH P1 to BH P6; and,
- Eleven number mechanically excavated trial pits, designated TP P1 to TP P11.

The penetration of the competitor boreholes through the superficial deposits was limited due to obstructions in the superficial deposits. For this reason a number of standpipes were placed in selected trial pits during backfilling in order to monitor the soil gas concentrations and groundwater levels, and obtain water samples.

Details of the strata encountered at the exploratory locations, together with information on groundwater strikes and seepages, are provided on the trial pit and borehole record sheets, included in the Contractor's factual report and contained in the Appendix to this report.

The exploratory locations are shown on drawing number 1027-001-01, included in the Appendix.

7.2.2 Justification of Site Investigation Locations

The site investigation fieldworks were located to target specific potential contaminant sources as described below:

Trial Pit / Borehole	Justification
BH P04	Targeted former engine shed in east of site
BH P01 – P03 & P05	Targeted railway yard and track line
BH P06	Placed in north of site for monitoring purposes
TP P4 – P10	Targeted railway yard and track line
TP P1 – P3 & P11	Placed in north of site and within way leave for general site coverage

7.2.3 Site Monitoring

Gas monitoring standpipes were installed in a number of boreholes and selected trial pits, as described on the record sheets.

The standpipes were monitored at approximately weekly intervals over a four week period, commencing 8th April 2004, to determine gas concentrations, atmospheric data and groundwater levels.

The following data was recorded during each visit:

- Methane, carbon dioxide and oxygen concentrations;
- Borehole (relative) pressure;
- Gas flow, if relative pressure >0.2 Mb;
- Atmospheric Pressure; and
- Water levels.

The gas monitoring and atmospheric pressure data was recorded using a Geotechnical Instruments GA94 Gas Analyser, calibrated on 13th November 2003.

7.2.4 Laboratory Testing – Geotechnical

Aitken Laboratories undertook the geotechnical testing, in house, upon samples as scheduled by Terrenus Consulting Ltd. The testing included the following:

- 15 No. Moisture Content;
- 14 No. pH;
- 14 No. Water soluble sulphate;
- 4 No. Particle Size Distribution (PSD);
- 10 No. Remoulded California Bearing Ratio (CBR);

All testing was carried out to BS 1377 A full copy of the test results and certificates is available in the contractor's factual report, in the appendix.

7.2.5 Laboratory Testing – Chemical

The laboratory, City Analytical Services (CAS), carried out the geochemical testing as appointed and scheduled by Terrenus Consulting Ltd.

A total of 11 soil samples and 2 water samples were recovered from the trial pits and boreholes and submitted for geochemical analysis. In addition 1 sample of surface water was recovered from the minor water course flowing to the north.

The laboratory test certificates, setting out the results of these tests, are provided in the Contractor's factual report, enclosed in the Appendix.

8 GROUND CONDITIONS

8.1 SUMMARY

The ground conditions encountered across the site broadly concur with the Stage 1 findings from the geological sheets. A discontinuous layer of made ground was encountered in the vicinity of the former railway station. The site is covered in a layer of gravelly sand with cobbles, with probable shallow bedrock, which was encountered at one location at a depth of 1.6m.

8.2 STRATIGRAPHY

8.2.1 Topsoil

Topsoil and sandy subsoil was encountered across much of the site, being absent only in certain parts of the former railway station. The thickness of the topsoil where encountered varied between 0.05m and 1.00m, although thickness of between 0.15m and 0.50m are more typical.

8.2.2 Made Ground

The made ground material was encountered at ground surface or below the topsoil layer in the vicinity of the former railway station including the engine shed and the sub-base of the railway lines. The material was generally described as gravelly sand with cobbles which, from the percussion boreholes, was assessed as medium dense to dense. Although found below the topsoil within trial pits TP P3, P5, P6, P7, P9 and P10 to be between 0.45m and 1.90m thick, the same material did not appear as extensive within the boreholes. The only borehole to encounter this material was BH P4 at 0.30m depth, with a recorded thickness of 0.10m.

8.2.3 Superficial Granular Material

Granular deposits generally comprising gravelly sand with cobbles was encountered in all exploratory locations. All the boreholes terminated in these materials at a depth of less than 1.20m. In addition, all the trial pits terminated in this material at depths of between 1.60m and 3.00m except TP P1 which encountered an obstruction (probable bedrock) at 1.60m depth.

The granular material was found to be slightly clayey and silty in the south and east of the site, suggesting that the finer material in these areas may represent glacial morainic drift. The coarser granular material in the west may represent glacial sand and gravel.

8.2.4 Possible Bedrock

Possible bedrock was encountered at one location only (TP P1) at a depth of 1.60m.

8.3 GROUNDWATER OBSERVATIONS

Groundwater was observed during the trial pitting or borehole drilling works at one location only (TP P3) where a water strike was recorded at a depth of 0.95m. It is noted that this trial pit was located close to the sink of the small water course mentioned in Section 5.3 above.

8.4 MONITORING RECORDS

The soil gas and groundwater monitoring records are provided in Table 1, enclosed in the Appendix. The results are summarised below.

Location	CH ₄	CO ₂	O ₂	Water Level
	(%v/v)			Metres (below existing ground level)
Within area of former railway line and station ¹	ND	ND – 3.40	18.30 – 21.10	0.00 – 2.28

Notes: ND – Not detected.
 1 – BH P02, P03 P06, TP P4, P5, P6

Borehole (relative) pressures were close to zero throughout the monitoring period.

Elevated levels of carbon dioxide were recorded in standpipes TP P4 and TP P5 and were accompanied by slightly depressed oxygen levels.

9 LABORATORY TEST RESULTS

9.1 GEOTECHNICAL

The geotechnical laboratory test results are set out in the factual report as presented by Aitken Laboratories and enclosed in the Appendix to this report.

9.1.1 Moisture Content

Moisture content of the granular glacial material was found to vary between 14% and 23%. The moisture content of the more clayey material to the south and east of the site was generally slightly lower.

9.1.2 California Bearing Ratio (CBR)

CBR tests were carried out in the natural granular material at between 0.90m and 1.40m depth across the site. The tests returned CBR values of between 3.9% and 17.6%, with an average value in the order of 8.2%.

9.1.3 pH and Sulphate Testing

Testing was carried out on samples of the topsoil, made ground and underlying natural granular material. Levels of total sulphate as SO₃ were all found to be below the detection limit of 0.05%. Testing by 2:1 water extract revealed SO₄ values of between 0.048 and 0.211g/l.

Levels of pH within the same samples varied between 5.9 and 7.7.

9.2 CHEMICAL

9.2.1 Soil Test Results

The test results are set out in Tables 2 and 2A enclosed in the Appendix and detailed test certificates for the analyses are included with the Contractor's factual report. From the test results no substances were found to exceed the Tier 1 site specific assessment criteria (SSAC).

No asbestos fibres were detected in any of the analysed soil samples.

9.2.2 Water Test Results

Two samples of groundwater and one sample of surface water were submitted for analysis. The test results are set out in Table 3 enclosed in the Appendix and detailed test certificates for the analyses are included with the Contractor's factual report. Test results for substances exceeding the Tier 1 site specific assessment criteria (SSAC) are summarised below.

DETERMINANT	UNITS	Strata	SSAC ¹	Max observed concentration
Copper	ug/l	Encountered in all water samples	5	9.4
Nickel			30	47
Zinc		Encountered in groundwater	40	900
Total Phenol			30	370

1 – Based on Coastal and Estuarine Environmental Quality Standards.

Although the EQS were exceeded for copper, nickel and zinc, all concentrations were well below the respective drinking water standards.

The mercury concentrations recorded were below the limit of detection of the test method (1 µg/l). Although the limit of detection is greater than the saltwater EQS, it is equivalent to the drinking water standard.

10 QUANTITATIVE RISK ASSESSMENT

10.1 METHODOLOGY

This section presents the risk assessment for chemicals detected in soil & groundwater at Portessie Station. The methodology is based on the UK Department of Environment, Food & Rural Affairs (DEFRA), Environment Agency (EA) and Scottish Environment Protection Agency (SEPA) “best practice” in regard to the assessment of contaminated land, and on Terrenus’ experience of risk assessment in the UK.

The assessment adopts the “Suitable for Use” approach in accordance with Scottish Executive objectives and policy. In this regard, the assessment considers the potential risks to receptors, given the particular source – pathway – receptor linkages (Pollutant Linkages), present at the site following development. For the purpose of the risk assessment it is assumed that no remedial measures will be implemented for development.

As stated above, the development proposal comprises residential use; however no details of the proposed development are available at this stage.

10.2 SUMMARY OF APPROACH

The risk assessment is of a tiered nature, with the first level including a comparison of measured chemical concentrations in soil and groundwater against conservative “Tier 1” screening criteria (either Soil Guideline Values⁵ (SGV) or Site Specific Assessment Criteria⁶ (SSAC)). Contaminants whose concentrations fall below the Tier 1 levels need not be considered further, as they are deemed not to present a significant risk of significant harm. Contaminant concentrations which exceed the Tier 1 SGV or SSAC require further consideration in a more detailed and site specific “Tier 2” risk assessment. The Tier 2 assessment would take into consideration additional site specific data in an attempt to reduce the uncertainty inherent within the conservative Tier 1 SGV and SSAC. Where SSAC developed under Tier 2 are exceeded remedial works may be necessary to break any associated Pollutant Linkage.

10.2.1 Tier 1 and 2 Screening Criteria

The choice of suitable Tier 1 screening criteria is largely dependant on the precise requirements of the risk assessment and the suitability of a particular risk assessment tool to the specific site circumstances and receptor under study.

The previously most widely used contaminated land assessment document, ICRCL 59/83⁷, was officially withdrawn in England and Wales by DEFRA in December 2002. The reason for its withdrawal was that the document failed to comply with site-specific risk assessment as required under Part IIA of the Environmental Protection Act 1990. It is intended that contaminated land will be assessed using the Contaminated Land Exposure Assessment (CLEA) model.

⁵ Soil Guideline Values can only be published by DEFRA in the CLR SGV Reports.

⁶ Developed using risk assessment modelling tools.

⁷ ICRCL 59/83: Guidance on the assessment and redevelopment of contaminated land, 1983.

In Scotland the responsibility for contaminated land policy is devolved and, as such, the position in Scotland remains the same as before the announcement by DEFRA. i.e. for the time being *both the ICRL and CLEA guidance may be used*. Clearly the reasons for withdrawing ICRL Guidance Note 59/83 apply equally in Scotland and it is understood that the Scottish Executive are currently considering whether to follow DEFRA's lead. It is understood that the Executive is likely to withdraw the ICRL 59/83 in the near future.

In light of this information, Terrenus Consulting Ltd. considers it unwise to use ICRL Guidance Note 59/83 for human health risk assessment. Although the use of the Guidance note may be acceptable at present, it may lead to the invalidation of the report prior to completion of the planning process if the guidance note is withdrawn.

Other modelling tools are available for the assessment of risk to human health and the built environment that comply with the requirements of site-specific risk assessment. However, at present, no modelling techniques are available for the assessment of phytotoxic hazards and, in the absence of such a model, the ICRL threshold values for phytotoxic contaminants have been adopted in this report.

The Site Specific SGV and SSAC adopted are set out in the Appendix, together with information describing their derivation. Also included is an explanation of the statistical evaluation of the soils data in accordance with the CLEA model (CLR 7⁸).

10.2.2 Risk Assessment Models

10.2.2.1 Human Health

Human Health risk assessments were carried out using the following methods where appropriate:

- CLEA framework and Soil Guideline Values;
- SNIFFER⁹ Framework; and
- Risk Based Corrective Action (RBCA) Model¹⁰

The SNIFFER and RBCA models have been utilised to derive SSAC for inorganic contaminants, petroleum hydrocarbons and organic contaminants not currently covered by the CLEA mode. The appropriate SNIFFER and RBCA output sheets have been included electronically and as hard copy respectively in Volume 2 of this report. Where the RBCA model has been used, the Human Health exposure data have been modified to comply with UK policy on contaminated land assessment contained within CLR 10¹¹.

⁸ DEFRA/Environment Agency R&D Report CLR7, Assessment of Risks to human Health from Land Contamination: An Overview of the Development of Soil Guideline Values and Related Research.

⁹ SNIFFER Framework, Method for deriving site specific human health assessment criteria for contaminants in soil, LQM, April 2003.

¹⁰ Risk Based Corrective Action Toolkit for Chemical Releases, Version 1.3a, Groundwater Services Inc.

¹¹ DEFRA/Environment Agency R&D Report CLR10, The Contaminated Land Exposure Assessment Model (CLEA): Technical Basis and Algorithms.

10.2.2.2 Vegetation

Risks to plants from phytotoxic contaminants were assessed under available guidance. At present this comprises ICRCL 59/83.

10.2.2.3 Buildings

Potential risks to buildings & structures were assessed against:

- Building Research Establishment Special Digest 1;

10.2.2.4 Controlled Waters

Controlled waters have been screened using appropriate SSAC derived from a number of sources, including:

- Environmental Quality Standards (EQS).

10.2.3 Statistical Analysis

Statistical analysis¹² of the soil results was undertaken to determine whether the measured determinant values present a significant possibility of significant harm to Type 1 (Human Health), Type 3 (Property – animals & crops) and Type 4 (property – Buildings) receptors (as defined in Annex 3 of Scottish Executive Circular 1/2000).

10.3 PHASE 2 CSM

The following sub-sections modify the Phase 1 Qualitative CSM in accordance with the findings of the Phase 2 investigations. The modification includes an assessment of the chemical analytical data, presented in Tables 2 to 3 included in the Appendix to this report. These data have been applied to the Pollutant Linkages identified by the Stage 2 CSM.

10.3.1 Type 1 Receptor – Human Health

10.3.1.1 Sources

From the results of the intrusive investigation, it appears that none of the determinants tested were found to be in excess of the adopted screening levels. Slightly elevated levels of carbon dioxide were however recorded on site.

10.3.1.2 Pollutant Linkages and Assessed Risks

The mean value test for Nickel in the topsoil resulted in an exceedence of the CLEA Tier 1 level and therefore failed. Only two samples were, however, tested from the topsoil horizon and the maximum value recorded was only 42% of the Nickel SGV. It is, therefore, considered that this result reflects the number of tested samples and not the values themselves. In view of this and the low nickel concentrations recorded in all other samples it is our professional judgement that nickel recorded does not constitute a significant risk of significant harm to human health.

¹² In accordance with Appendix A of the DEFRA/Environment Agency R&D Publication CLR7.

The other results of the investigation do not suggest a risk to human health from the soil samples.

Levels of carbon dioxide encountered on site suggest a potential risk to human health. Suggested remedial measures with respect to soil gas levels are provided below.

10.3.2 Type 4 Receptor – Property (Buildings)

10.3.2.1 Sources, Pollutant Linkages and Assessed Risks

Following the laboratory analysis no specific risk to property were identified.

10.3.3 Controlled Waters – Surface Water

10.3.3.1 Sources, Pollutant Linkages and Assessed Risks

Analysis of the surface water on site suggests elevated levels of copper with respect to the adopted EQS (approximately twice the EQS). The principle surface water body that may be impacted by surface water from the site is the Moray Firth. Dilution of surface water run-off from the site when it enters the Firth will render the copper concentration insignificant. The risk to the Firth is, therefore, considered to be insignificant.

10.3.4 Controlled Waters - Groundwater

10.3.4.1 Sources

Concentrations of copper, nickel, zinc and phenol in excess of the saltwater Environmental Quality Standards were identified in groundwater recovered during the site works. The source(s) of the apparent pollution were not identified by the investigation as all soil concentrations recorded were relatively low.

10.3.4.2 Pollutant Linkages and Assessed Risks

Although there is evidence of groundwater pollution by copper, nickel, zinc and phenol the source of the pollution has not been identified. The Pollutant Linkage to the site has not, therefore, been confirmed.

10.4 UNCERTAINTIES

Following the development of the Stage 2 CSM a number of uncertainties remain in consideration to the site. These uncertainties are listed below:

- The source of apparent pollution in the groundwater is not known at this stage and requires further consideration.

This uncertainty is considered further in the recommendations to this report.

11 DISCUSSION AND CONCLUSIONS

11.1 GROUND ENGINEERING

11.1.1 Foundation Support Conditions

It is considered that throughout the site the natural granular glacial deposits will provide suitable bearing strata for normal shallow foundation loads of up to 100kPa. In the vicinity of the former station and where made ground was encountered, foundation excavations may require to be in the order of 1.90m deep.

11.1.2 Groundwater and Drainage

During the fieldworks, a number of surface depressions that were wet were noted; however, trial pits and boreholes were generally dry with little or no groundwater ingress.

Although the geology of the area suggests that superficial deposits in the south and east of the site are weakly permeable and that surface water may be held in hollows and produce wet areas the general landform does not suggest the likelihood of groundwater springs. In addition an unrecorded small bore water pipe was encountered in TP P7 and it is suggested that the existing small watercourse running to the north through the former station may be as a result of a leak from an unrecorded water pipe.

A sewer is known to pass through the centre of the site from south west to north east.

11.1.3 Sustainable Urban Drainage Systems (SUDS) Strategy

Given the present use of the site and the existing drainage in place on site it is considered that residential development of the site will have a possible adverse effect on the hydrology of the area. A drainage system involving first order permeable surfaces, swales and soakaways, particularly in the west of the site, is likely to provide a sustainable solution.

11.1.4 Road Pavement Design

Final road layout and levels have not been confirmed; however laboratory CBR tests for the natural granular material indicate an average value in the order of 8.2%. On the basis of the above and minimum CBR values a 300mm capping layer should be considered for both the distributor and access roads.

Soft or otherwise unsuitable material encountered at formation level will require to be removed and replaced with selected granular fill.

11.2 GROUND CONTAMINATION

11.2.1 Soil

The intrusive investigation revealed no evidence of contamination present at concentrations in excess of the adopted screening levels. These findings suggest that there is an insignificant risk to human health or other receptors from contamination at the site.

Although the mean value test for nickel in topsoil failed it is our professional judgement that the elevated levels of nickel recorded on site do not constitute a risk to human health.

11.2.2 Water

From the analysis of water samples and the general land form it is suggested that the minor issue of water to the north from the former railway station is not in continuity with the underlying groundwater and may be the result of a leaky unrecorded water pipe. Other wet areas throughout the south of the site may be the result of ponding due to the low permeability of the underlying superficial deposits.

Analysis of the surface water on site suggests slightly elevated levels of copper with respect to the adopted EQS standards. In addition, analysis of the groundwater recovered from standpipes placed in the trial pits recorded elevated levels of copper, nickel, zinc and phenol. The principal potential source for contamination of groundwater may be the former railway station although no obvious source of contamination was identified by the Phase 1 or Phase 2 investigations. Further investigation is required to determine if the apparent pollution is derived from contamination present within the site.

11.2.3 Soil Gas

Levels of carbon dioxide encountered on site suggest a low risk to human health in the east of the site.

Carbon dioxide was encountered in two standpipes (TP P4 and TP P5). The low or absent gas pressures and flow rates are indicative of late stages of gas production possibly from a made ground source in the vicinity of the former railway station.

Soil gas levels and pressures comply with Characteristic Situation 2, as described in CIRIA Report 149 "Protecting Development from Methane", or Gas Regime B as defined in the DETR Report "Passive Venting of Soil Gases Beneath Building, Research Report, Guide for Design".

12 RECOMMENDATIONS

12.1 INTRODUCTION

The recommendations set out below are provided for guidance in formulating a development strategy for the site. Further consideration of specific design issues is necessary to ensure all regulatory and service authority requirements are satisfied. Full consideration of the final design, including the provision of a Remediation Statement if necessary, is required in consultation with the regulatory and service authorities.

12.2 ADDITIONAL INVESTIGATIONS

The investigations were exploratory in nature and further investigations are likely to be required for detailed planning and design purposes.

12.2.1 Geotechnical

Attention should be given to the recovery of CBR samples for detailed road design. Further consideration may also be given to appropriate SUDS design.

12.2.2 Chemical

Additional investigations are required in respect of ground contamination, particularly to provide spatial coverage of the site in accordance with BS10175 and to determine the presence or otherwise of a Pollutant Linkage to groundwater.

12.3 SOIL GAS

It is recommend that gas protection measures be installed to prevent gas build-up in the proposed buildings. In accordance with current best practice these measures should include:

- Well constructed ground slab with minimum penetration by services;
- Low permeability gas barrier;
- Well ventilated internal spaces; and
- Passive gas ventilation for service chambers and street furniture.

12.4 FOUNDATIONS

Normal shallow foundations are considered suitable for the proposed residential buildings with loadings up to 100kPa.

12.5 FOUNDATION CONCRETE

For design purposes concrete should comply with the requirements of Design Sulphate Class DS-1, and ACEC Class AC-1s (BRE Special Digest 1).

12.6 P.U. SERVICES

Services should be placed as high as practicable and above the groundwater, which, over the majority of the site, is below 1.50m depth.

12.7 WASTE DISPOSAL

All waste arisings from the site should be disposed of in accordance with the Environmental Protection (Duty of Care) Regulations 1991 and other appropriate legislation. In this regard it is recommended that proposed waste disposal contractors are provided with the soil test results in order that Duty of Care requirements can be fully assessed and implemented.

12.8 HEALTH AND SAFETY

Contractors involved in the development of the site or post-development maintenance should be advised of the site history and presence and nature of ground contamination at the site. This information is necessary to ensure compliance with the requirements of the Construction (Design and Management) Regulations 1994, the Control of Substances Hazardous to Health (COSHH) Regulations 1994 and other relevant health and safety regulations.

-00000-

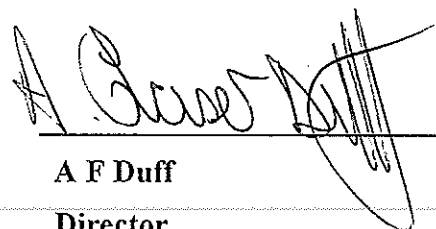
Terrenus Consulting Ltd wishes to thank The Moray Council for the opportunity to prepare this report and trust that it meets with your requirements. However, should you wish to discuss the contents of the report then please do not hesitate to contact the undersigned.

Signed for and on behalf of
Terrenus Consulting Ltd

PP 

W. Hume

Director



A F Duff

Director

**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

APPENDICES

**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

REFERENCES

**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

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The following lists contain the main references used in compiling this report. Other specific references may be listed as footnotes within the text of the report.

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**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
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THE MORAY COUNCIL**

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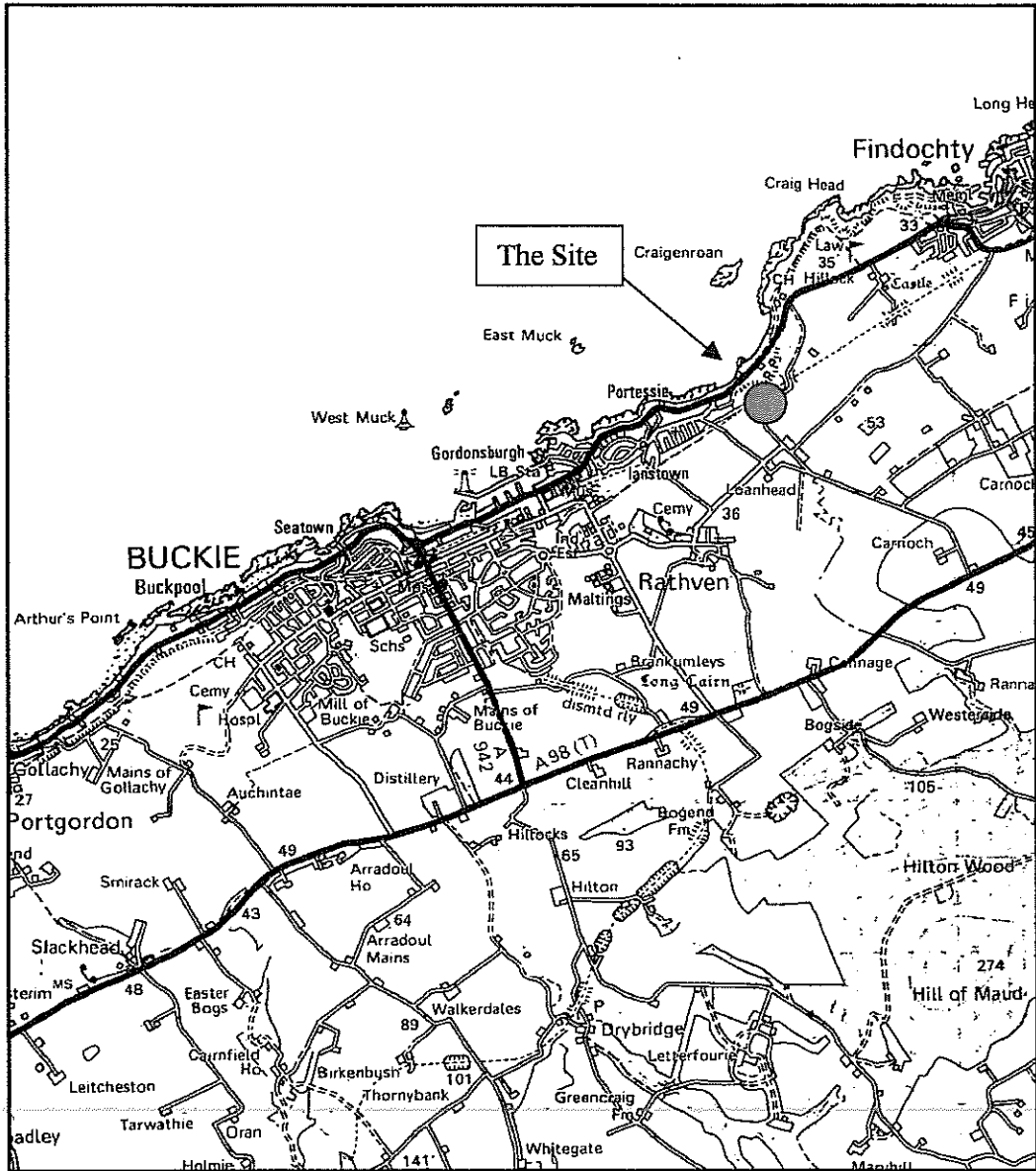
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**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

FIGURES



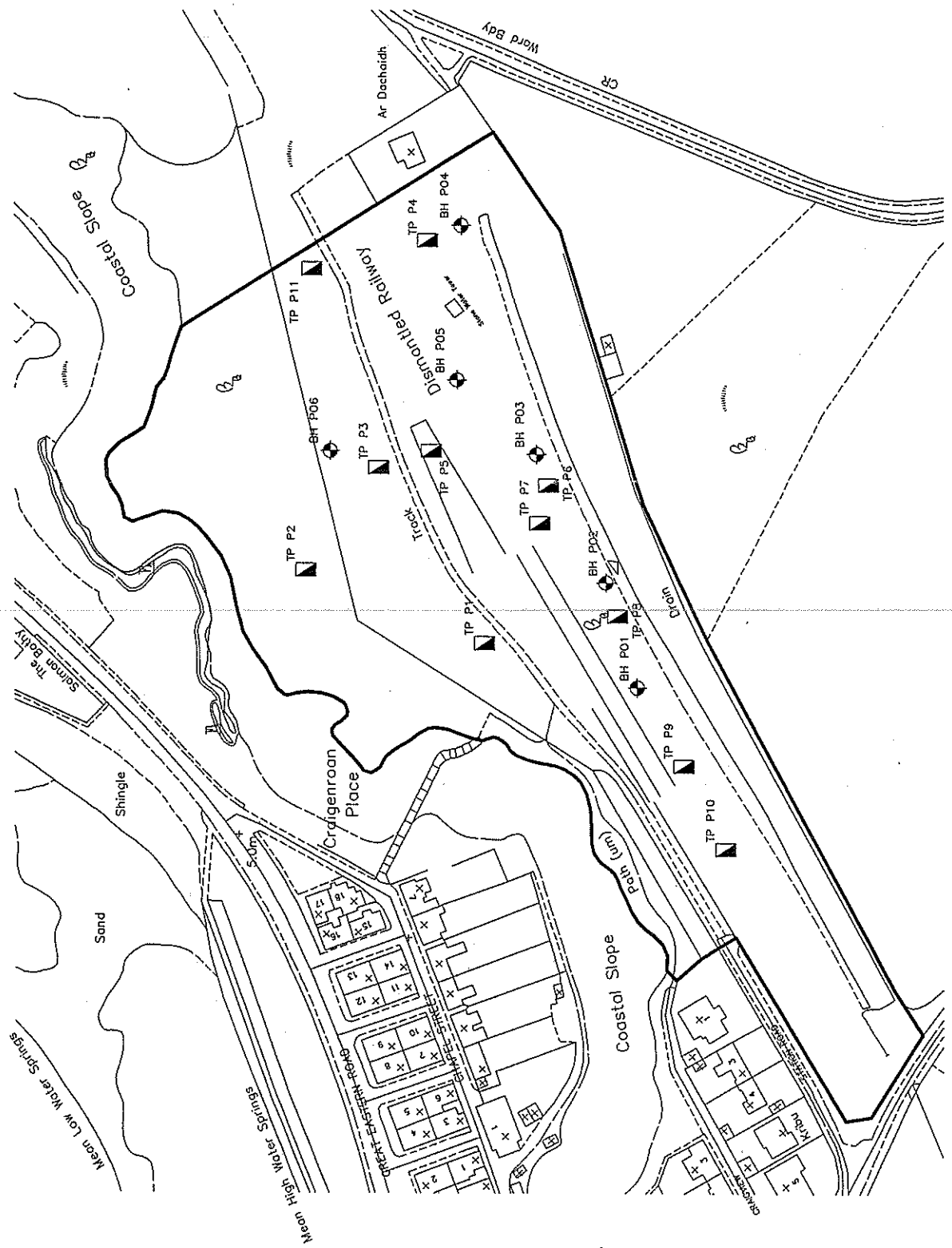
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<p>Client: The Moray Council.</p>	<p>Drawing Title: Site location plan</p>	 TERRENUS CONSULTING LTD James Watt Building, Scottish Enterprise Technology Park, East Kilbride, G75 0QD Tel: 01355 272 400 Fax: 01355 272 403
<p>Project: Portessie Station, Buckie</p>	<p>Job No: 1027-001</p>	
<p>Date: 16-03-04</p>	<p>Figure 1</p>	<p>DO NOT SCALE</p>
<p>Grid Ref: NJ 4470 6665 SCALE: N.T.S.</p>		

**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**


DRAWINGS

DO NOT SCALE



- Legend**
- TP P5 : DENOTES TRIAL PIT LOCATION CARRIED OUT IN MARCH 2004
 - BH P05 : DENOTES BOREHOLE LOCATION CARRIED OUT IN MARCH 2004
 - [Symbol: Dashed line] : SITE BOUNDARY

Rev	Description	By	Date


TERRENUS CONSULTING LTD
 James Watt Building,
 Scottish Enterprise Technology Park,
 East Kilbride, G75 0QJ
 Tel: 01352 22749 Fax: 01352 77746

Client: **THE MORAY COUNCIL**

Project: **PORTESSIE STATION, BUCKIE**

Drawing Title: **SITE INVESTIGATION LOCATION**

Drawn: WH	Checked:	Approved:
Date: 16-03-2004		
Scale: 1:1500		1027-001-01

ORIGINAL DRAWING A3

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**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

PHOTOGRAPHIC RECORD OF SITE

**PHASE 2 INVESTIGATION,
PORTESSIE STATION,
FOR,
THE MORAY COUNCIL**

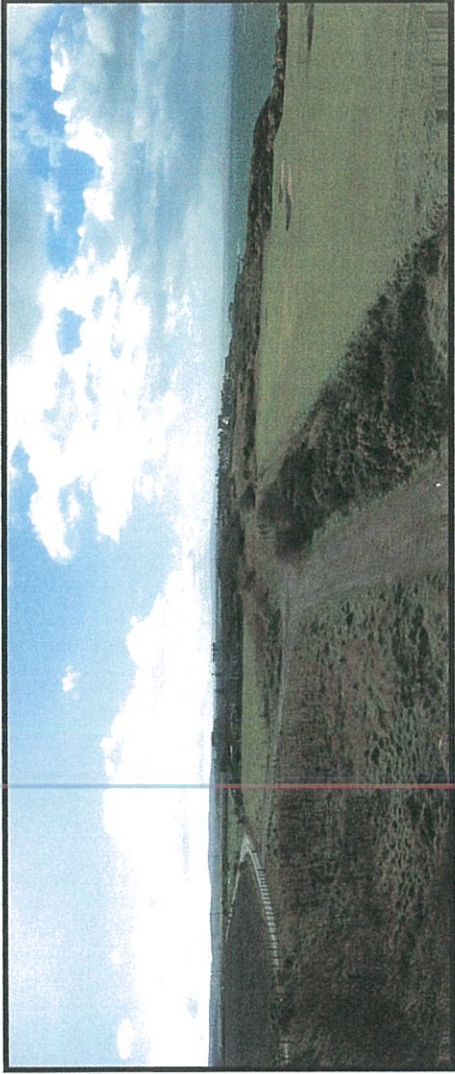


Plate 1: View of Site from East

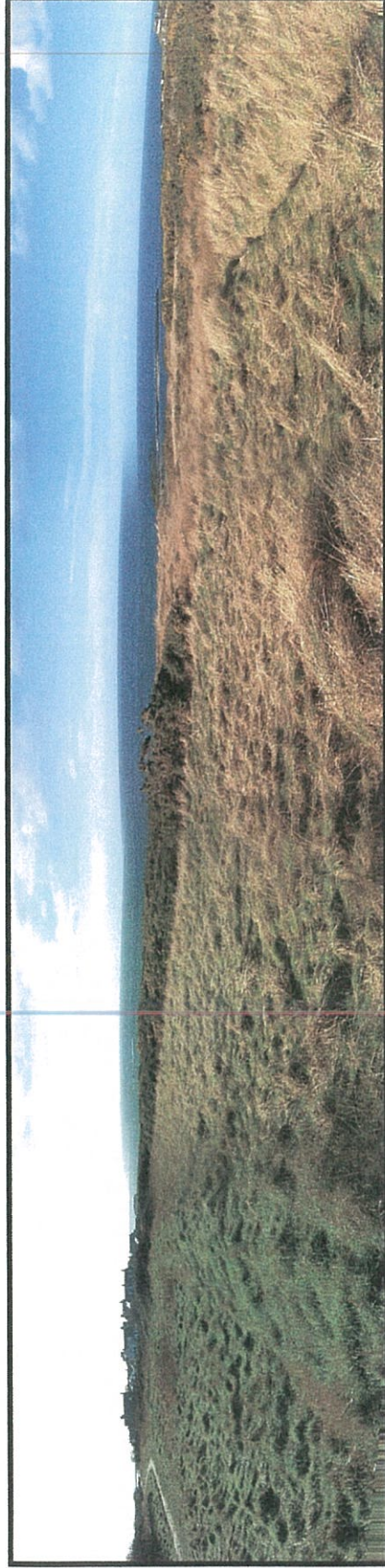


Plate 2: View of northern part of Site.

**PHASE 2 INVESTIGATION,
PORTESSIE STATION,
FOR,
THE MORAY COUNCIL**

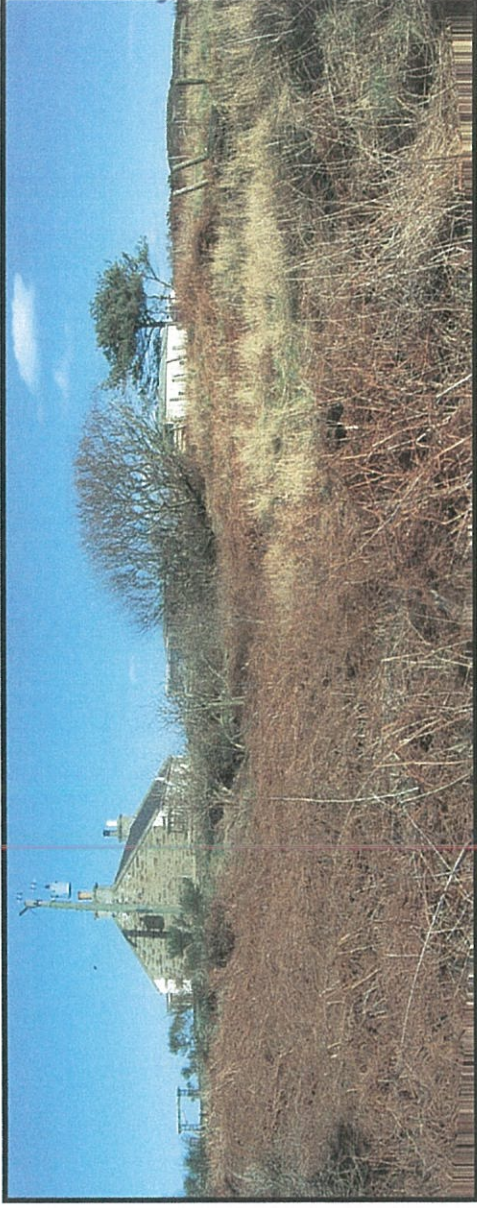


Plate 3: Location of former engine shed



Plate 4: View of remains of stone built water tower with turning circle in right of picture.

**PHASE 2 INVESTIGATION,
PORTESSIE STATION,
FOR,
THE MORAY COUNCIL**



Plate 5: View of small water course running to north from former railway station.

**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

TABLES

Portessie Station

Installation	Date	CH ₄		CO ₂		O ₂		Rel Press	Gas Flow	Atmos Press	Ratio CO ₂ :CH ₄	WL	WL	TD
		30 sec	60 sec	30 sec	60 sec	30 sec	60 sec							
BH P02	8-Apr-04					No access to well								
	16-Apr-04					No access to well								
	23-Apr-04	0.00	0.00	0.40	0.30	20.60	20.60	n/a		1013			DRY	0.50
	29-Apr-04					No access to well								
BH P03	8-Apr-04					Water at ground level							water at GL	
	16-Apr-04					Water at ground level							water at GL	
	23-Apr-04	0.00	0.00	0.00	0.00	20.70	20.70	n/a		1013			water at GL	1.00
	29-Apr-04					Water at ground level							water at GL	
BH P06	8-Apr-04					No valve on well							DRY	
	16-Apr-04					No valve on well							DRY	
	23-Apr-04	0.00	0.00	0.40	0.40	20.30	20.30	n/a		1013			DRY	0.50
	29-Apr-04					No valve on well							DRY	
TP P4	8-Apr-04					No access to well								
	16-Apr-04	0.00	0.00	1.50	1.80	21.10	19.80	0.00		1002	0.00		1.55	2.55
	23-Apr-04	0.00	0.00	3.00	3.00	18.40	18.30	0.00		1013	0.00		2.00	
	29-Apr-04	0.00	0.00	3.40	3.40	18.40	18.30	0.00		1005	0.00		1.93	
TP P5	8-Apr-04	0.00	0.00	1.90	1.90	19.90	19.80	0.00		1012	0.00		2.27	
	16-Apr-04	0.00	0.00	1.00	1.20	20.10	19.90	0.00		1003	0.00		2.28	
	23-Apr-04	0.00	0.00	1.10	1.20	19.90	19.60	0.00		1013	0.00		dry	2.50
	29-Apr-04	0.00	0.00	3.00	3.00	19.40	19.40	0.00		1005	0.00		2.27	
TP P6	8-Apr-04					No access to well								
	16-Apr-04					No access to well								
	23-Apr-04	0.00	0.00	0.00	0.00	20.80	20.80	0.00		1013	0.00		0.60	2.50
	29-Apr-04					No access to well								

~ : No reading taken

Table 1 - Gas and Groundwater Monitoring

PORTESSIE STATION

Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	pH units
Sample Identity	Depth (m)	Horizon	Arsenic (Total)	Boron (Soluble)	Cadmium (Total)	Chromium (Total)	Copper (Total)	Lead (Total)	Mercury (Total)	Nickel (Total)	Selenium (Total)	Zinc (Total)	Cyanide (Total)	Phenols (Total)	Sulphate (Total) as SO3		pH
BH4	0.30m	Made Ground	1.3	0.37	0.5	7.7	5.4	8.7	0.1	5.8	0.10	27	0.5	0.5	0.05	7.4	
TP3	0.50m	Made Ground	2.2	0.91	0.5	5.0	7.2	26.0	0.1	3.3	0.30	19	0.5	0.5	0.05	6.4	
TP5	0.30m	Made Ground	3.5	0.86	0.5	8.8	23.0	53.0	0.11	12.0	0.30	39	0.5	0.5	0.05	7.6	
TP6	0.30m	Made Ground	3.2	0.59	0.5	14.0	25.0	46.0	0.1	15.0	0.24	40	0.5	0.5	0.05	7.0	
TP7	0.30m	Made Ground	5.9	0.66	0.5	9.3	12.0	31.0	0.1	7.1	0.28	37	0.5	0.5	0.05	7.0	
TP9	1.00m	Made Ground	2.5	0.41	0.5	5.0	5.3	37.0	0.1	3.0	0.32	12	0.5	0.5	0.05	6.0	
TP10	0.30m	Made Ground	1.8	0.29	0.5	9.5	5.7	13.0	0.1	6.2	0.14	33	0.5	0.5	0.05	6.5	
TP2	0.30m	Topsoil	2.2	1.10	0.5	5.4	4.3	14.0	0.1	3.0	0.32	12	0.5	0.5	0.05	6.1	
TP8	0.50m	Topsoil	1.5	0.47	0.5	11.0	4.7	14.0	0.1	21.0	0.13	22	0.5	0.5	0.05	6.5	
BH4	0.40m	Natural Sand and Gravel	2.2	0.60	0.5	7.4	2.8	11.0	0.1	4.7	0.21	22	0.5	0.5	0.05	6.6	
TP7	0.90m	Natural Sand	3.2	0.74	0.5	9.0	8.4	19.0	0.1	5.2	0.22	37	0.5	0.5	0.05	6.9	
		No of Made Ground analyses	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
		No of Topsoil analysis	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
		No of Natural analysis	2	2	2	2	2	2	2	2	2	2	2	2	2	2	

Made Ground	Max	5.9	0.91	N/D	14	25	53	0.11	15	0.32	40	N/D	7.6
	Min	1.3	0.29		5	5.3	8.7	0.1	3	0.1	12		6
	Mean	2.9	0.6		8.5	11.9	26.1	0.1	7.5	0.2	29.6		6.8
	SD	1.5	0.2		3.1	8.6	16.3	0.0	4.5	0.1	10.7		0.6

Topsoil	Max	2.2	1.1	N/D	11	4.7	14	N/D	21	0.32	22	N/D	6.5
	Min	1.5	0.47		5.4	4.3	14		3	0.13	12		6.1
	Mean	1.9	0.8		8.2	4.5	14.0		12.0	0.2	17.0		6.3
	SD	0.5	0.4		4.0	0.3	0.0		12.7	0.1	7.1		0.3

Natural Sand / Sand and Gravel	Max	3.2	0.74	N/D	9	8.4	19	N/D	5.2	0.22	37	N/D	6.9
	Min	2.2	0.6		7.4	2.8	11		4.7	0.21	22		6.6
	Mean	2.7	0.7		8.2	5.6	14.5		5.0	0.2	29.5		6.8
	SD	0.7	0.1		1.1	4.0	5.7		0.4	0.0	10.6		0.2

Tier 1 Human Health Screening Criteria	SOURCE																
	CLEA	20			130		450	8	50	35							
	Mean Value Test Made Ground	4.0			10.7		39.0	0.1	10.8	0.3							
	Pass / Fail	PASS			PASS		PASS	PASS	PASS	PASS							
	Mean Value Test Topsoil	4.1	N/A	N/D	25.9	N/A	14.0	N/D	66.8	0.8	N/A						
	Pass / Fail	PASS			PASS		PASS	N/D	FAIL	PASS							
	Mean Value Test Natural	5.9			13		40	N/D	7	0.25							
Pass / Fail	PASS			PASS		PASS	N/D	PASS	PASS								

Tier 1 Phytotoxicity Screening Criteria	ICRCL																
	Mean Value Test Made Ground	3.00			130							300					
	Pass / Fail	0.8			18.2							37.5					
	Mean Value Test Topsoil	2.8	N/A	N/A	5.8							48.6					
	Pass / Fail	PASS			PASS							PASS					
	Mean Value Test Natural	1.1			23							77					
	Pass / Fail	PASS			PASS							PASS					

Tier 1 Building Screening Criteria	BRE																
	Mean Value Test Made Ground	5.5															
	Pass / Fail	7.3															
	Mean Value Test Topsoil	7.6															
	Pass / Fail	PASS															
	Mean Value Test Natural	7.7															
	Pass / Fail	PASS															

Below test method detection limit
Applicable SGV / SSAC

* TPH worst case scenario assumes 100% aromatic C8 - C10 fraction
** PAH worst case scenario assumes 100% BbP
NBFO No Bulk fibres Identified
53 + Tier 1 Human Health Screening Criteria

N/A Not applicable
ND Not Detected
NS Not submitted for analysis
#DW/DI Indefinite data to process

TABLE 2 - SUMMARY OF SOIL ANALYSES

PORTESSIE STATION

Units			>> TPH SUITE			
Sample Identity	Depth (m)	Horizon	mg/kg	mg/kg	mg/kg	mg/kg
			TPH by GC (>C6-C10)	TPH by GC (>C10-C20)	TPH by GC (>C20-C40)	TPH by GC (>C6-C40)
BH4	0.30m	Made Ground	50	50	50	50
TP3	0.50m	Made Ground	50	50	50	50
TP5	0.30m	Made Ground	50	50	72	72
TP6	0.30m	Made Ground	50	50	50	50
TP7	0.30m	Made Ground	50	50	85	85
TP9	1.00m	Made Ground	50	50	51	51
TP10	0.30m	Made Ground	50	50	53	53
TP2	0.30m	Topsoil	50	50	54	54
TP8	0.50m	Topsoil	50	50	50	50
BH4	0.40m	Natural Sand and Gravel	50	50	50	50
TP7	0.90m	Natural Sand	50	50	50	50
No of Made Ground analyses			7	7	7	7
No of Topsoil analysis			2	2	2	2
No of Natural analysis			2	2	2	2

Made Ground	Max	N/D	85	85
	Min		50	50
	Mean		58.7	58.7
	SD		14.1	14.1

Topsoil	Max	N/D	54	54
	Min		50	50
	Mean		52.0	52.0
	SD		2.8	2.8

Natural Sand / Sand and Gravel	Max	N/D		
	Min			
	Mean			
	SD			

Tier 1 Human Health Screening Criteria	SOURCE				
	RBCA		22	220	
	Mean Value Test Made Ground		N/D	69.0	69.0
	Pass / Fail			PASS	PASS
	Mean Value Test Topsoil		N/D	2.8	2.8
	Pass / Fail			PASS	PASS
	Mean Value Test Natural		N/D		
	Pass / Fail				

Below test method of
Applicable SGV / SS

* TPH worst case scenario assumes 100% aromatic C8 - C10 fraction
 ** PAH worst case scenario assumes 100% BaP
 NBFO No Bulk fibres Identified
 53 > Tier 1 Human Health Screening Criteria

N/A Not applicable
 N/D Not Detected
 N/S Not submitted for analysis
 #DIV/0! Indufficient data to process

TABLE 2A - SUMMARY OF SOIL ANALYSES

**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

**SOIL GUIDELINE VALUES
SITE SPECIFIC ASSESSMENT CRITERIA and
STATISTICAL PROCEDURES**

**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

**SOIL GUIDELINE VALUES / SITE SPECIFIC ASSESSMENT CRITERIA
ADOPTED FOR
RESIDENTIAL WITH GARDENS**

Determinant	SGV / SSAC	Units	Derivation
Arsenic	20	mg/kg	DEFRA/Environment Agency R&D publication SGV1. "Soil Guideline Values for Arsenic Contamination". Soil Guideline Value for Residential with Gardens.
Boron (Water Soluble)	N/A		Human Health SSAC Developed on a site specific basis using SNIFFER 2003 framework model - see SNIFFER output sheets.
	3		ICRCL Guidance Note 59/83 "Guidance on the assessment and redevelopment of contaminated land". Table 3, Group B; Threshold Value for any use where plants are to be grown.
Cadmium	N/D		DEFRA/Environment Agency R&D publication SGV3. "Soil Guideline Values for Cadmium Contamination". Soil Guideline Value for Residential with Gardens.
Chromium	130		DEFRA/Environment Agency R&D publication SGV4. "Soil Guideline Values for Chromium Contamination". Soil Guideline Value for Residential with Gardens.
Copper	10326		Human Health SSAC Developed on a site specific basis using CLEA model - see CLEA output sheets.
	130		ICRCL Guidance Note 59/83 "Guidance on the assessment and redevelopment of contaminated land". Table 3, Group B; Threshold Value for any use where plants are to be grown.
Lead	450		DEFRA/Environment Agency R&D publication SGV10. "Soil Guideline Values for Lead Contamination". Soil Guideline Value for Residential with Gardens.
Mercury	8		DEFRA/Environment Agency R&D publication SGV5. "Soil Guideline Values for Inorganic Mercury Contamination". Soil Guideline Value for Residential with Gardens.
Nickel	50		DEFRA/Environment Agency R&D publication SGV7. "Soil Guideline Values for Nickel Contamination". Soil Guideline Value for Residential with Gardens.
	70		ICRCL Guidance Note 59/83 "Guidance on the assessment and redevelopment of contaminated land". Table 3, Group B; Threshold Value for any use where plants are to be grown.
Selenium	35		DEFRA/Environment Agency R&D publication SGV9. "Soil Guideline Values for Selenium Contamination". Soil Guideline Value for Residential with Gardens.
Zinc	N/A		Human Health SSAC Developed on a site specific basis using SNIFFER 2003 framework model - see SNIFFER output sheets.
	300		ICRCL Guidance Note 59/83 "Guidance on the assessment and redevelopment of contaminated land". Table 3, Group B; Threshold Value for any use where plants are to be grown.
Sulphide	N/A		ICRCL Guidance Note 59/83 "Guidance on the assessment and redevelopment of contaminated land". Table 4; Action Value for all proposed uses.
Sulphate	1.20		BRE Special Digest 1 "Concrete in Aggressive Ground". Table 2.
Cyanide	N/D		Human Health SSAC Developed on a site specific basis using CLEA model - see CLEA output sheets.
Phenols	105	Human Health SSAC Developed on a site specific basis using CLEA model - see CLEA output sheets.	
Total Petroleum Hydrocarbons	1400	Human Health SSAC developed using Risk Based Corrective Action (RBCA) model assuming a worst case scenario. Refer attached RBCA output sheets.	
PAH (BaP)	1.3	Human Health SSAC Developed on a site specific basis using CLEA model - see CLEA output sheets.	

Notes: NC – Not Calculated by model

COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL

STATISTICAL ANALYSIS OF CHEMICAL TEST RESULTS

The statistical analysis of the chemical test results is based on the procedures set out in Appendix A of the joint DEFRA / Environment Agency R&D publication, CLR 7; "Assessments of Risks to Human Health from Land Contamination: An Overview of the Development of Soil Guideline Values and Related Research". This document sets out two statistical tests, as described below.

Test 1 – The Mean Value Test

The Sample Mean Value χ , based on a few samples, may be a poor estimate of the true (population) mean. Therefore, a no remedial action decision based on χ less than the Soil Guideline Value G, may not be adequately health protective when χ is computed from a small number of samples. The Mean Value Test provides a method by which the 95th percentile level of confidence that χ is less than G can be determined. The test involves five steps:

1. Calculate the arithmetic mean of the contaminant concentration;
2. Calculate the unbiased standard deviation;
3. Select the appropriate t value from standard tables. These are based on the sample size, n ;
4. Calculate the 95th percentile bound sample – ($US_{95} = \chi + t.s/\sqrt{n}$);
5. Compare the US_{95} value with G.

Where US_{95} is less than G then the Mean Value Test has been passed, and the site may be considered not to present a significant possibility of significant harm to Human Health in the context of Part IIA of the Environmental Protection Act 1990. If, however, US_{95} is greater than G, then the test is failed and consideration of further testing or remedial works is required.

Test 2 – The Maximum Value Test

Where the Soil Guideline Value G is exceeded in some samples further consideration of remedial action is required, even where the Mean Value Test is passed. In considering whether further sampling and analysis is required, it is useful to determine whether the maximum value in a set of results form part of the population of the other measurements or whether it comprises an outlier. The Maximum Value Test is carried out to make this determination.

A value T is calculated using the following formula: $T = (y_{\max} - \bar{y})/S_y$

Where y_{\max} is the logarithm of the maximum sample value, \bar{y} is the log of the mean sample range, and S_y is the log Standard Deviation.

The T value is then compared against a T_{crit} derived from standard tables, dependant upon the sample size and the percentile level of confidence required. Where T is less than T_{crit} then the maximum value can be considered a part of the sample population. Where T is greater than T_{crit} the maximum value represents an outlier and may represent a local area or hotspot of contamination.

-oo0oo-

**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

**ADOPTED SCREENING LEVELS
FOR CONTROLLED WATERS**

Determinant	Units	Guideline Value	Derivation
Arsenic	mg/l	25	Environmental Quality Standards (EQS) for List 2 dangerous substances (76/464/EEC)
Cadmium		N/D	Environmental Quality Standards (EQS) for List 2 dangerous substances (76/464/EEC)
Chromium		0.05	Environmental Quality Standards (EQS) for List 2 dangerous substances (76/464/EEC)
Lead		N/D	Environmental Quality Standards (EQS) for List 2 dangerous substances (76/464/EEC)
Mercury		0.001	Environmental Quality Standards (EQS) for List 2 dangerous substances (76/464/EEC)
Selenium		N/D	The Water Supply (Water Quality) (Scotland) Regulations 2001
Copper		N/D	Environmental Quality Standards (EQS) for List 2 dangerous substances (76/464/EEC)
Nickel		N/D	Environmental Quality Standards (EQS) for List 2 dangerous substances (76/464/EEC)
Zinc		5	Environmental Quality Standards (EQS) for List 2 dangerous substances (76/464/EEC)
Cyanide		0.05	The Water Supply (Water Quality) (Scotland) Regulations 2001
Phenols		0.0005	Environmental Quality Standards (EQS) for List 2 dangerous substances (76/464/EEC)
TPH		0.01	Environmental Quality Standards (EQS) for Bathing Waters
pH	Units	5.5 – 9.5	The Water Supply (Water Quality) (Scotland) Regulations 2001

**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

**LABORATORY TEST CERTIFICATES
&
CHEMICAL TEST RESULTS**

28 April 2004

Mr G McGarrity
Terrenus Consulting Limited
James Watt Building
Scottish Enterprise
Technology Park
East Kilbride
G75 0QD

Test Report : TER /94190

Dear Mr McGarrity

Please find enclosed the results of the analysis carried out on the samples submitted from Portessie Station on Wednesday, April 21, 2004.

I trust you will find these satisfactory but should you have any queries please contact customer services.

Yours sincerely



R J Gibbs
AUTHORISED SIGNATORY



Determinations marked * in this certificate are not included in the UKAS accreditation schedule for our laboratory. Opinions and interpretations expressed herein, and marked #, are outside the scope of UKAS accreditation. Determinations marked \$ were subcontracted. Unless otherwise stated, CAS Ltd was not responsible for sampling. Information about methods and performance characteristics of the determinations are available on request. Unless otherwise agreed, as received soils will be disposed of after 30 days; dried soils after 30 days and waters/leachates after 10 days from the issue of the final report. Soil analysis is carried out on air-dried and ground test portion of the sample.

Soil Analysis

TER /94190
Portessie Station
Your Reference:- 1027-001
Your Order:-

CAS Number:			495922	495923	495924
Sample Ref			BH4	BH4	TP2/D1
Detname	Method	Units	0.30m	0.40m	0.30m
Arsenic (Total)	30/30C	mg/kg	1.3	2.2	2.2
Boron (Soluble)	6	mg/kg	0.37	0.6	1.1
Cadmium (Total)	30	mg/kg	< 0.50	< 0.50	< 0.50
Chromium (Total)	30	mg/kg	7.7	7.4	5.4
Copper (Total)	30	mg/kg	5.4	2.8	4.3
Lead (Total)	30	mg/kg	8.7	11	14
Mercury (Total)	30C	mg/kg	< 0.10	< 0.10	< 0.10
Nickel (Total)	30	mg/kg	5.8	4.7	3
Selenium (Total)	30C	mg/kg	0.1	0.21	0.32
Zinc (Total)	30	mg/kg	27	22	12
Cyanide (Total)	14	mg/kg	< 0.50	< 0.50	< 0.50
Phenols (Total)	40A	mg/kg	< 0.50	< 0.50	< 0.50
Sulphate as SO3 (2:1 Water Extract)	46	g/l	< 0.05	< 0.05	< 0.05
pH	39	pH units	7.4	6.6	6.1
>> TPH SUITE <<			.	.	.
TPH by GC (>C6-C10)	317	mg/kg	< 50	< 50	< 50
TPH by GC (>C10 - C20)	317	mg/kg	< 50	< 50	< 50
TPH by GC (>C20-C40)	317	mg/kg	< 50	< 50	72
TPH by GC (>C6 - C40)	317	mg/kg	< 50	< 50	72



Key
AGS N/S - Not Scheduled
 I/S - Insufficient Sample



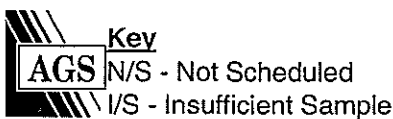
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Registered in England 2050581

City Analytical Services Limited
 Rayner House, 80 Lockhurst Lane, Coventry CV6 5PZ
 Tel +44 (0)24 7658 4800 Fax +44 (0)24 7658 4848 • info@cityanalytical.co.uk

Soil Analysis

TER /94190
Portessie Station
Your Reference:- 1027-001
Your Order:-

CAS Number:			495925	495926	495927
Sample Ref			TP3/D1	TP5/D1	TP6/D1
Detname	Method	Units	0.50m	0.30m	0.30m
Arsenic (Total)	30/30C	mg/kg	2.2	3.5	3.2
Boron (Soluble)	6	mg/kg	0.91	0.86	0.59
Cadmium (Total)	30	mg/kg	< 0.50	< 0.50	< 0.50
Chromium (Total)	30	mg/kg	< 5.0	8.8	14
Copper (Total)	30	mg/kg	7.2	23	25
Lead (Total)	30	mg/kg	26	53	46
Mercury (Total)	30C	mg/kg	< 0.10	0.11	< 0.10
Nickel (Total)	30	mg/kg	3.3	12	15
Selenium (Total)	30C	mg/kg	0.3	0.3	0.24
Zinc (Total)	30	mg/kg	19	39	40
Cyanide (Total)	14	mg/kg	< 0.50	< 0.50	< 0.50
Phenols (Total)	40A	mg/kg	< 0.50	< 0.50	< 0.50
Sulphate as SO3 (2:1 Water Extract)	46	g/l	< 0.05	< 0.05	< 0.05
pH	39	pH units	6.4	7.6	7
>> TPH SUITE <<			.	.	.
TPH by GC (>C6-C10)	317	mg/kg	< 50	< 50	< 50
TPH by GC (>C10 - C20)	317	mg/kg	< 50	< 50	< 50
TPH by GC (>C20-C40)	317	mg/kg	< 50	85	51
TPH by GC (>C6 - C40)	317	mg/kg	< 50	85	51



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Soil Analysis

TER /94190
Portessie Station
Your Reference:- 1027-001
Your Order:-

CAS Number:			495928	495929	495930
Sample Ref			TP7/D1	TP7/D2	TP8/D1
Defname	Method	Units	0.30m	0.90m	0.50m
Arsenic (Total)	30/30C	mg/kg	5.9	3.2	1.5
Boron (Soluble)	6	mg/kg	0.66	0.74	0.47
Cadmium (Total)	30	mg/kg	< 0.50	< 0.50	< 0.50
Chromium (Total)	30	mg/kg	9.3	9	11
Copper (Total)	30	mg/kg	12	8.4	4.7
Lead (Total)	30	mg/kg	31	19	14
Mercury (Total)	30C	mg/kg	0.1	< 0.10	< 0.10
Nickel (Total)	30	mg/kg	7.1	5.2	21
Selenium (Total)	30C	mg/kg	0.28	0.22	0.13
Zinc (Total)	30	mg/kg	37	37	22
Cyanide (Total)	14	mg/kg	< 0.50	< 0.50	< 0.50
Phenols (Total)	40A	mg/kg	< 0.50	< 0.50	< 0.50
Sulphate as SO3 (2:1 Water Extract)	46	g/l	< 0.05	< 0.05	< 0.05
pH	39	pH units	7	6.9	6.5
>> TPH SUITE <<					
TPH by GC (>C6-C10)	317	mg/kg	< 50	< 50	< 50
TPH by GC (>C10- C20)	317	mg/kg	< 50	< 50	< 50
TPH by GC (>C20-C40)	317	mg/kg	53	54	< 50
TPH by GC (>C6 - C40)	317	mg/kg	53	54	< 50



Key
AGS N/S - Not Scheduled
 I/S - Insufficient Sample



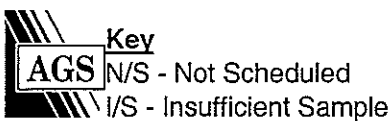
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Soil Analysis

TER /94190
Portessie Station
Your Reference:- 1027-001
Your Order:-

CAS Number:			495931	495932
Sample Ref			TP9/D2	TP10/D1
Detname	Method	Units	1.00m	0.30m
Arsenic (Total)	30/30C	mg/kg	2.5	1.8
Boron (Soluble)	6	mg/kg	0.41	0.29
Cadmium (Total)	30	mg/kg	< 0.50	< 0.50
Chromium (Total)	30	mg/kg	< 5.0	9.5
Copper (Total)	30	mg/kg	5.3	5.7
Lead (Total)	30	mg/kg	37	13
Mercury (Total)	30C	mg/kg	< 0.10	< 0.10
Nickel (Total)	30	mg/kg	3	6.2
Selenium (Total)	30C	mg/kg	0.32	0.14
Zinc (Total)	30	mg/kg	12	33
Cyanide (Total)	14	mg/kg	< 0.50	< 0.50
Phenols (Total)	40A	mg/kg	< 0.50	< 0.50
Sulphate as SO3 (2:1 Water Extract)	46	g/l	< 0.05	< 0.05
pH	39	pH units	6	6.5
>> TPH SUITE <<				
TPH by GC (>C6-C10)	317	mg/kg	< 50	< 50
TPH by GC (>C10 - C20)	317	mg/kg	< 50	< 50
TPH by GC (>C20-C40)	317	mg/kg	< 50	< 50
TPH by GC (>C6 - C40)	317	mg/kg	< 50	< 50



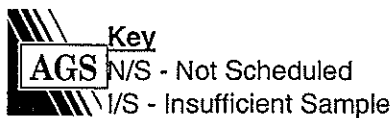
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Text Data

TER /94190
Portessie Station
Your Reference:- 1027-001
Your Order:-

CAS No	Sample Ref	Asbestos Identification*
495922	BH4 0.30m	Non Detected
495923	BH4 0.40m	N/S
495924	TP2/D1 0.30m	Non Detected
495925	TP3/D1 0.50m	Non Detected
495926	TP5/D1 0.30m	Non Detected
495927	TP6/D1 0.30m	Non Detected
495928	TP7/D1 0.30m	Non Detected
495929	TP7/D2 0.90m	Non Detected
495930	TP8/D1 0.50m	Non Detected
495931	TP9/D2 1.00m	Non Detected
495932	TP10/D1 0.30m	Non Detected



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4 May 2004

Mr W Hume
Terrenus Consulting Limited
James Watt Building
Scottish Enterprise
Technology Park
East Kilbride
G75 0QD

Test Report : TER /94651

Dear Mr Hume

Please find enclosed the results of the analysis carried out on the samples submitted from Portessie Station on 27 April 2004.

I trust you will find these satisfactory but should you have any queries please contact customer services.

Yours sincerely



R J Gibbs
AUTHORISED SIGNATORY

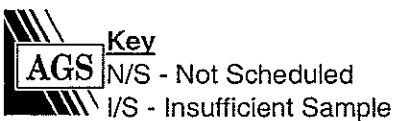


Determinations marked * in this certificate are not included in the UKAS accreditation schedule for our laboratory. Opinions and interpretations expressed herein, and marked #, are outside the scope of UKAS accreditation. Determinations marked \$ were subcontracted. Unless otherwise stated, CAS Ltd was not responsible for sampling. Information about methods and performance characteristics of the determinations are available on request. Unless otherwise agreed, as received soils will be disposed of after 30 days; dried soils after 30 days and waters/leachates after 10 days from the issue of the final report. Soil analysis is carried out on air-dried and ground test portion of the sample.

Water Analysis

TER /94651
 Portessie Station
 Your Reference:- 1027-001
 Your Order:-

CAS Number:			498915	498916	498917
Sample Ref			TP4	TP6	Surface Water
Detname	Method	Units			
Arsenic (Soluble)*	25C	µg/l	< 10	< 10	< 10
Cadmium (Soluble)	53	µg/l	< 5.0	< 5.0	< 5.0
Chromium (Soluble)	56	µg/l	3.29	3.57	< 2.00
Copper (Soluble)	56	µg/l	9.4	< 5.0	< 5.0
Lead (Soluble)	53	µg/l	19	< 10	< 10
Mercury (Soluble)*	25C	µg/l	< 1.0	< 1.0	< 1.0
Nickel (Soluble)	53	µg/l	< 10	47	< 10
Selenium (Soluble)*	25C	µg/l	< 2.0	< 2.0	< 2.0
Zinc (Soluble)	53	µg/l	900	< 10	< 10
Cyanide (Total)*	14A	mg/l	< 0.05	< 0.05	< 0.05
Sulphate as SO ₃	60	g/l	< 0.10	< 0.10	< 0.10
pH	31	pH units	6.7	7.1	7.9
>> TPH SUITE <<*					
TPH by GC (>C6 - C10)*	TPHWB	µg/l	< 10	< 10	< 10
TPH by GC (>C10 - C20)*	TPHWB	µg/l	< 10	< 10	< 10
TPH by GC (>C20 - C40)*	TPHWB	µg/l	< 10	< 10	< 10
TPH by GC (>C6 - C40)*	TPHWB	µg/l	< 10	< 10	< 10
Total Phenol*	PHOHLOW	µg/l	79	370	< 0.50



**COMBINED PHASE 1 / PHASE 2 INVESTIGATION,
PORTESSIE STATION
FOR
THE MORAY COUNCIL**

CONTRACTORS FACTUAL REPORT

**FACTUAL REPORT
ON
GROUND INVESTIGATION
AT
STATION ROAD
PORTESSIE**

May 04

Ref No: D308

Engineer: Terrenus Consulting Limited



Aitken Laboratories Ltd

SITE INVESTIGATION CONTRACTORS

Castlehill House, Slamannan FK1 3EZ.
Tel: 01324-851389 Fax: 01324-851326

Terrenus Consulting Limited
James Watt Building
Scottish Enterprise Technology Park
East Kilbride
G75 0QD

Date: May 17, 2004

Our Ref: JA/D308

Your Ref:

FAO: Mr W. Hume

Dear Sirs

SITE INVESTIGATION AT STATION ROAD, PORTESSIE

Please find enclosed our report for the above ground investigation.

This report was prepared by Mr A. Dobinson.

We trust this report is satisfactory, however if we can be of any further assistance please do not hesitate to contact us.

Yours faithfully
for and on behalf of
AITKEN LABORATORIES LIMITED

Alastair Dobinson
B. Eng. (Hons), C. Eng., M.I.C.E.

CONTENTS

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1. INTRODUCTION	1 of 3
2. SITE WORK	1 of 3
3. LABORATORY WORK	2 of 3
4. REFERENCES	3 of 3

Appendix 1

Site Plan
Soils Borehole Logs
Trial Pit Logs

BH 1 – 6
TP P1 – P11

Appendix 2

Laboratory Test Report

Laboratory Testing References		
Summary of Test Results	Table 1	Page 1 of 7
Summary of Chemical Tests Results	Table 2	Page 2 of 7
Summary of CBR Test Results	Table 3	Page 3 of 7
PSD Test Results		Page 4 - 7 of 7

**FACTUAL REPORT
ON
GROUND INVESTIGATION
AT
STATION ROAD
PORTESSIE**

1. INTRODUCTION

It is proposed to construct a residential development at Station Road, Portessie.

At the request of Terrenus Consulting Engineers Limited, an investigation was carried out to confirm the ground conditions at the site.

This report presents the information established by observation, boring, sampling and insitu testing. It should be noted that natural strata vary from point to point and that man made deposits are subject to an even greater diversity. Groundwater conditions are dependent upon seasonal and other factors. Whilst an attempt is made in reporting to assess the likelihood or extent of such variations at the site, it should be recognised that there may be conditions pertaining, which are not disclosed by the investigation.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

2. SITE WORK

The field works were carried out during the period 17th to 29th March 2004 and comprised:-

6 No. Terrier Rig Boreholes to a maximum depth of 1.20 metres

11 No. Machine Excavated Trial Pits

Details of the boreholes and trial pits including daily progress of hole and casing, descriptions of strata encountered, records of sampling and insitu testing carried out, observations of groundwater conditions while boring and depths to changes in strata are presented in the exploratory hole records in Appendix 1.

3. LABORATORY TESTING

The samples of soil taken during the site works were transported to the laboratory for systematic examination and testing. The characteristics of the soils determined in the laboratory were used to supplement field observations in the preparation of the final borehole records.

Testing was carried out on selected samples to the requirements of the relevant British Standards, or in accordance with current good practice, as appropriate.

The Laboratory Testing References section of Appendix 2 details the tests performed in the laboratory which are UKAS accredited.

Tests marked "Not UKAS Accredited" in this report are not included in the UKAS Accreditation Schedule for our laboratory.

Laboratory Testing Comprised :-

- Classification Tests
- California Bearing Ratio Tests
- Chemical Analysis

The results are presented in summary and detailed Tables and Figures in Appendix 2.

REFERENCES

1. BS5930:1999 Code of Practice for "Site Investigation" British Standard Code of Practice, British Standards Institution, London
2. BS1377:1990 Parts 1 to 9 British Standard "Methods of Test of Soils for civil engineering purposes". British Standards Institution, London.
3. BS10175:2001 Investigation of potentially contaminated site – Code of Practice.
4. Building Research Establishment, 1991 (New Edition 1996), BRE Digest 363 "Sulphate and acid resistance of concrete in the ground.

Appendix 1



AITKEN LABORATORIES LTD

Site
STATION ROAD, PORTESSIE
Borehole Number
1

Boring Method TERRIER RIG	Diameter	Ground Level (mOD)	Client	Job Number D308
	Location	Dates 17/03/2004	Engineer TERRENUS	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B1			17/03/2004:DRY		0.05	TOPSOIL		
						0.15 (0.10)	#COBBLES		
						0.40 (0.25)	#SAND and GRAVEL		
						0.60	Brown slightly clayey gravelly fine to coarse SAND. Gravel content is fine to coarse.		
						1.00	Complete at 1.00m		

Remarks Borehole terminated due to lack of progress. # Denotes drillers' description. Excavating from 0.00m to 0.50m for 1 hour.	Figure No. D308.1	Scale (approx) 1:50	Logged By RL
--	----------------------	------------------------	-----------------



AITKEN LABORATORIES LTD

Site
STATION ROAD, PORTESSIE
Borehole Number
2

Boring Method TERRIER RIG	Diameter	Ground Level (mOD)	Client	Job Number D308
	Location	Dates 17/03/2004		

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.50	B1			17/03/2004: DRY		0.15 (0.25)	TOPSOIL			
						0.40 (0.40)	#SAND and GRAVEL			
						0.80	Brown slightly silty gravelly fine to coarse SAND with cobbles. Gravel content is fine to coarse.			
							Complete at 0.80m			

Remarks # Denotes drillers' description. Borehole terminated due to lack of progress. A 50mm diameter standpipe was installed at a depth of 0.80m. Excavating from 0.00m to 0.50m for 1 hour.	Figure No. D308.2	Scale (approx) 1:50	Logged By RL
--	----------------------	------------------------	-----------------



AITKEN LABORATORIES LTD

Site
STATION ROAD, PORTESSIE

Borehole Number
3

Boring Method TERRIER RIG	Diameter	Ground Level (mOD)	Client	Job Number D308
	Location	Dates 17/03/2004	Engineer TERRENUS	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
0.50	B1			17/03/2004:DRY		(0.40)	TOPSOIL	
						0.40	Brown slightly clayey gravelly fine to coarse SAND with cobbles. Gravel content is fine to coarse.	
						(0.60)		
						1.00	Complete at 1.00m	

Remarks # Denotes drillers' description. Borehole terminated due to lack of progress. A 50mm diameter standpipe was installed at a depth of 1.00m. Excavating from 0.00m to 0.50m for 1 hour.	Figure No. D308.3	Scale (approx) 1:50	Logged By RL
--	----------------------	------------------------	-----------------



AITKEN LABORATORIES LTD

Site
STATION ROAD, PORTESSIE

Borehole Number
4

Boring Method TERRIER RIG	Diameter	Ground Level (mOD)	Client	Job Number D308
	Location	Dates 18/03/2004		

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.50	B1			18/03/2004:DRY		(0.30)	TOPSOIL			
						0.30	MADE GROUND (Sand with ash)			
						0.40	Brown very clayey gravelly fine to coarse SAND with cobbles. Gravel content is fine to coarse.			
						1.20	Complete at 1.20m			

Remarks Borehole terminated due to lack of progress. # Denotes drillers' description. Excavating from 0.00m to 0.50m for 1 hour.	Figure No. D308.4	Scale (approx) 1:50	Logged By RL
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AITKEN LABORATORIES LTD

Site
STATION ROAD, PORTESSIE
Borehole Number
5

Boring Method TERRIER RIG	Diameter	Ground Level (mOD)	Client	Job Number D308
	Location	Dates 18/03/2004	Engineer TERRENUS	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	B1			18/03/2004:DRY		0.05 0.20 (0.15) (0.50) 0.70	TOPSOIL #COBBLES Brown slightly clayey gravelly fine to coarse SAND. Gravel content is fine to coarse. Complete at 0.70m		

Remarks Borehole terminated due to lack of progress. # Denotes drillers' description. Excavating from 0.00m to 0.50m for 1 hour.	Figure No. D308.5	Scale (approx) 1:50	Logged By RL
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AITKEN LABORATORIES LTD

Site
STATION ROAD, PORTESSIE

Borehole
Number
6

Boring Method TERRIER RIG	Diameter	Ground Level (mOD)	Client	Job Number D308
	Location	Dates 18/03/2004	Engineer TERRENUS	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.50	B1			18/03/2004:DRY		0.40	TOPSOIL			
						0.40	Brown slightly clayey gravelly fine to coarse SAND with cobbles. Gravel content is fine to coarse.			
						0.80	Complete at 0.80m			

Remarks A 50mm diameter standpipe was installed at a depth of 0.80m. Borehole terminated due to lack of progress. # Denotes drillers' description. Excavating from 0.00m to 0.50m for 1 hour.	Figure No. D308.6	Scale (approx) 1:50	Logged By RL
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AITKEN LABORATORIES LTD

Site
STATION ROAD, PORTESSIE

Trial Pit Number
TP P1

Excavation Method JCB 3CX	Dimensions 0.60x2.00m	Ground Level (mOD)	Client	Job Number D308
	Location	Dates 29/03/2004	Engineer TERRENUS	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	D1				(1.00)	TOPSOIL		
1.20	B2				1.00 (0.60)	Brown silty gravelly fine and medium SAND with cobbles. Gravel content is fine to coarse.		
1.50	D3				1.60	OBSTRUCTION (Probable Bedrock) Complete at 1.60m		

Plan

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Remarks

Trial pit remained dry and stable throughout.

Scale (approx)	Logged By	Figure No.
1:50	GTD	D308.TP P1



Excavation Method JCB 3CX		Dimensions 0.60x2.00m		Ground Level (mOD)		Client		Job Number D308	
		Location		Dates 29/03/2004		Engineer TERRENUS		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.20	D1				(0.30) 0.30	MADE GROUND (Brown gravelly sand with cobbles)			
1.00 1.00	B3 D2				(1.30)	MADE GROUND (Dark brown silty gravelly fine and medium sand with cobbles)			
1.90 1.95	D4 B5				1.60 (0.90)	Light brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse.			
					2.50	Complete at 2.80m			

Plan .	Remarks Trial pit remained dry and stable throughout.		
	Scale (approx) 1:50	Logged By GTD	Figure No. D308.TP P9



AITKEN LABORATORIES LTD

Site
STATION ROAD, PORTESSIE

Trial Pit
Number
TP P11

Excavation Method JCB 3CX	Dimensions 0.60x2.00m	Ground Level (mOD)	Client	Job Number D308
	Location	Dates 29/03/2004	Engineer TERRENUS	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	D1				(0.50)	TOPSOIL		
0.60	D2				0.50	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse.		
1.00	B3				(2.50)			
2.00	D4				3.00			
						Complete at 3.00m		

Plan 	Remarks Trial pit remained dry and stable throughout.		
	Scale (approx) 1:50	Logged By GTD	Figure No. D308.TP P11

Appendix 2
Laboratory Test Report

Laboratory Testing References

Laboratory Test	Standard Specification in Accordance with
Moisture Content	BS 1377: Part 2 1990: Clause 3.2
Liquid Limit	BS 1377: Part 2 1990: Clause 4.3
Plastic Limit	BS 1377: Part 2 1990: Clause 5.3
Plasticity Index and Liquidity Index	BS 1377: Part 2 1990: Clause 5.4
Density Measurement	BS 1377: Part 2 1990: Clause 7.2
Particle Size Distribution	BS 1377: Part 2 1990: Clause 9.2
Particle Size Distribution	BS 1377: Part 2 1990: Clause 9.3
Particle Size Distribution	BS 1377: Part 2 1990: Clause 9.5
Sulphate Content of Soil and Groundwater	BS 1377: Part 3 1990: Clause 5.6
pH	BS 1377: Part 3 1990: Clause 9
California Bearing Ratio	BS 1377: Part 4 1990: Clause 7
Compressibility Test	BS 1377: Part 5 1990: Clause 3
Undrained Shear Strength, Triaxial Compression	BS 1377: Part 7 1990: Clause 8
Undrained Shear Strength, Triaxial Compression (Multi-stage)	BS 1377: Part 7 1990: Clause 9

*** Tests marked with asterisk are not UKAS Accredited.**

D308, Station Road, Portessie

Soil Test Results Summary

Table 1

Approved by:
Checked by:

AD

Date:
Date: 17/05/24.

Drawn by:
Rev:

Date:

BH/T P No	SAMPLE		DESCRIPTION OF SAMPLE	MC (%)	OTHER TESTING AND REMARKS
	DEPTH (m)	TYPE			
4	0.50	B1	Brown very clayey gravelly fine to coarse SAND with cobbles. Gravel content is fine to coarse		PSD
TP1	1.20	B2	Brown silty gravelly fine and medium SAND with cobbles. Gravel content is fine to coarse	15	CBR, SO4, pH
TP2	0.90	B2	Light brown silty gravelly fine to coarse SAND with cobbles. Gravel content is fine to coarse	20	PSD, CBR, SO4, pH
TP3	0.50	D1	MADE GROUND (Dark brown silty gravelly sand with cobbles)		SO4, pH
TP3	1.00	B2	Light brown silty gravelly fine and medium SAND with cobbles. Gravel content is fine to coarse	23	CBR, SO4, pH
TP4	1.00	B3	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse	17	CBR, SO4, pH
TP5	1.50	B3	MADE GROUND (Brown silty gravelly sand with ash, brick, concrete and cobbles)	19	CBR, SO4, pH
TP5	2.20	B5	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse		SO4, pH
TP6	0.30	D1	MADE GROUND (Brown silty sandy gravel)		SO4, pH
TP6	1.00	B3	Brown mottled very clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse	14	PSD, CBR, SO4, pH
TP8	1.00	B2	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse	14	CBR, SO4, pH
TP9	1.00	B3	MADE GROUND (Dark brown silty gravelly fine and medium sand with cobbles)	23	CBR, SO4, pH
TP9	1.95	B5	Light brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse		SO4, pH
TP10	1.40	B2	Light brown very silty gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse	19	PSD, CBR, SO4, pH
TP11	1.00	B3	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse	17	CBR, SO4, pH

D308, Station Road, Portessie

Chemical Test Results Summary

Table 2

BH No	Sample No	Depth From	Depth To	<2.0mm (%)	2:1 SO4 (g/l)	pH	Description
TP1	B2	1.20	-	64	0.132	6.3	Brown silty gravelly fine and medium SAND with cobbles. Gravel content is fine to coarse
TP2	B2	0.90	-	71	0.096	7.1	Light brown silty gravelly fine to coarse SAND with cobbles. Gravel content is fine to coarse
TP3	D1	0.50	-	61	0.105	6.9	MADE GROUND (Dark brown silty gravelly sand with cobbles)
TP3	B2	1.00	-	58	0.124	7.7	Light brown silty gravelly fine and medium SAND with cobbles. Gravel content is fine to coarse
TP4	B3	1.00	-	67	0.182	6.9	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse
TP5	B3	1.50	-	73	0.057	7.2	MADE GROUND (Brown silty gravelly sand with ash, brick, concrete and cobbles)
TP5	B5	2.20	-	69	0.211	6.1	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse
TP6	D1	0.30	-	70	0.105	6.1	MADE GROUND (Brown silty sandy gravel)
TP6	B3	1.00	-	73	0.096	7.4	Brown mottled very clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse
TP8	B2	1.00	-	61	0.124	6.9	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse
TP9	B3	1.00	-	69	0.067	6.4	MADE GROUND (Dark brown silty gravelly fine and medium sand with cobbles)
TP9	B5	1.95	-	67	0.153	5.9	Light brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse
TP10	B2	1.40	-	68	0.048	6.9	Light brown very silty gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse
TP11	B3	1.00	-	77	0.096	7.4	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse

NOTES

1. The preparation of all samples was carried out as per section 7.5 of BS 1377:Part 1:1990.
2. The sulphate content was determined using the ion exchange method as per section 5.6 of BS 1377:Part 3:1990.
3. The pH value was determined using the electrometric method as per section 9.5 of BS 1377:Part 3:1990.

D308, Station Road, Portessie

CBR Test Results

Table 3

BH/TP No	Sample No	Depth (m)	MC (%)	B.D (Mg/m3)	% Retained on 20mm Sieve	CBR (%)	Description
TP1	B2	1.20	15	1.89	21	3.9	Brown silty gravelly fine and medium SAND with cobbles. Gravel content is fine to coarse
TP2	B2	0.90	20	1.88	33	17.6	Light brown silty gravelly fine to coarse SAND with cobbles. Gravel content is fine to coarse
TP3	B2	1.00	23	1.84	16	8.9	Light brown silty gravelly fine and medium SAND with cobbles. Gravel content is fine to coarse
TP4	B3	1.00	17	1.74	21	6.3	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse
TP5	B3	1.50	19	1.98	19	12.6	MADE GROUND (Brown silty gravelly sand with ash, brick, concrete and cobbles)
TP6	B3	1.00	14	1.98	22	8.0	Brown mottled very clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse
TP8	B2	1.00	14	1.89	12	4.3	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse
TP9	B3	1.00	23	1.98	10	6.1	MADE GROUND (Dark brown silty gravelly fine and medium sand with cobbles)
TP10	B2	1.40	19	2.04	19	7.7	Light brown very silty gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse
TP11	B3	1.00	17	1.77	26	6.9	Brown mottled slightly clayey gravelly fine to coarse SAND with frequent cobbles. Gravel content is fine to coarse

Notes

1. Sample tested in accordance with Clause 7 of BS 1377 : Part 4 : 1990



Site : STATION ROAD, PORTESSIE

Job Number

D308

Client :

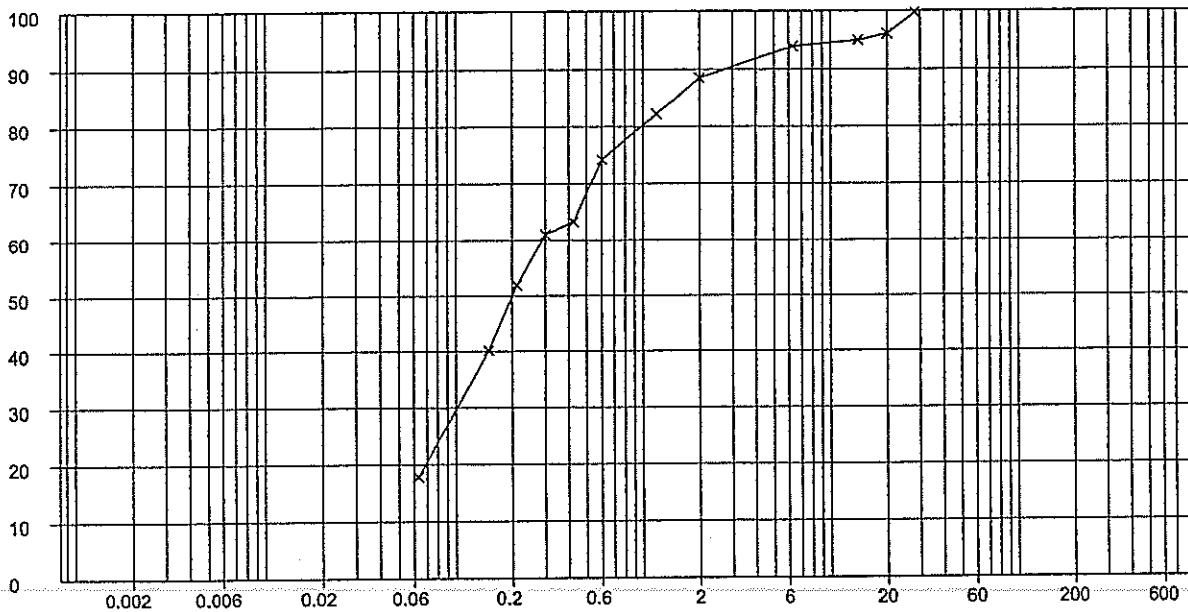
Sheet

1/4

Engineer: TERRENUS

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Description
4	0.50	B1	



Sieve / Particle Size	% Passing
28 mm	100.0
20 mm	96.3
14 mm	95.2
6.3 mm	94.1
2 mm	88.6
1.18 mm	82.3
600 µm	74.3
425 µm	63.3
300 µm	61.1
212 µm	52.0
150 µm	40.2
63 µm	17.9

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Grading Analysis	
D85	1.5 mm
D60	287.7 µm
D10	<63.0 µm
Uniformity Coefficient	-

Particle Proportions	
Cobbles + Boulders	-
Gravel	11.4%
Sand	70.7%
Silt	-
Clay	-

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :



Site : STATION ROAD, PORTESSIE

Client :

Engineer : TERRENUS

Job Number

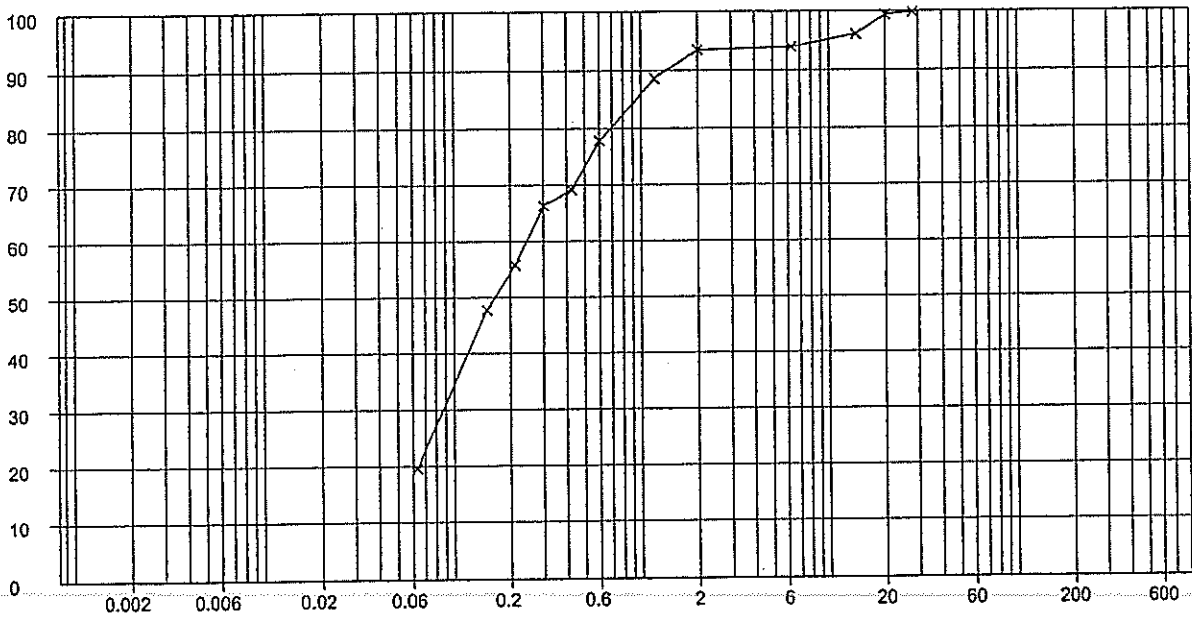
D308

Sheet

3/4

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Description
TP P6	1.00	B3	



Sieve / Particle Size	% Passing
28 mm	100.0
20 mm	99.6
14 mm	96.3
6.3 mm	94.1
2 mm	93.6
1.18 mm	88.7
600 µm	77.9
425 µm	69.2
300 µm	66.4
212 µm	55.8
150 µm	47.8
63 µm	19.6

CLAY	Fine	Medium	Coarse	SILT	Fine	Medium	Coarse	GRAVEL	COBBLES	BOULDERS

Grading Analysis	
D85	935.9 µm
D60	243.3 µm
D10	<63.0 µm
Uniformity Coefficient	-

Particle Proportions	
Cobbles + Boulders	-
Gravel	6.4%
Sand	74.0%
Silt	-
Clay	-

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

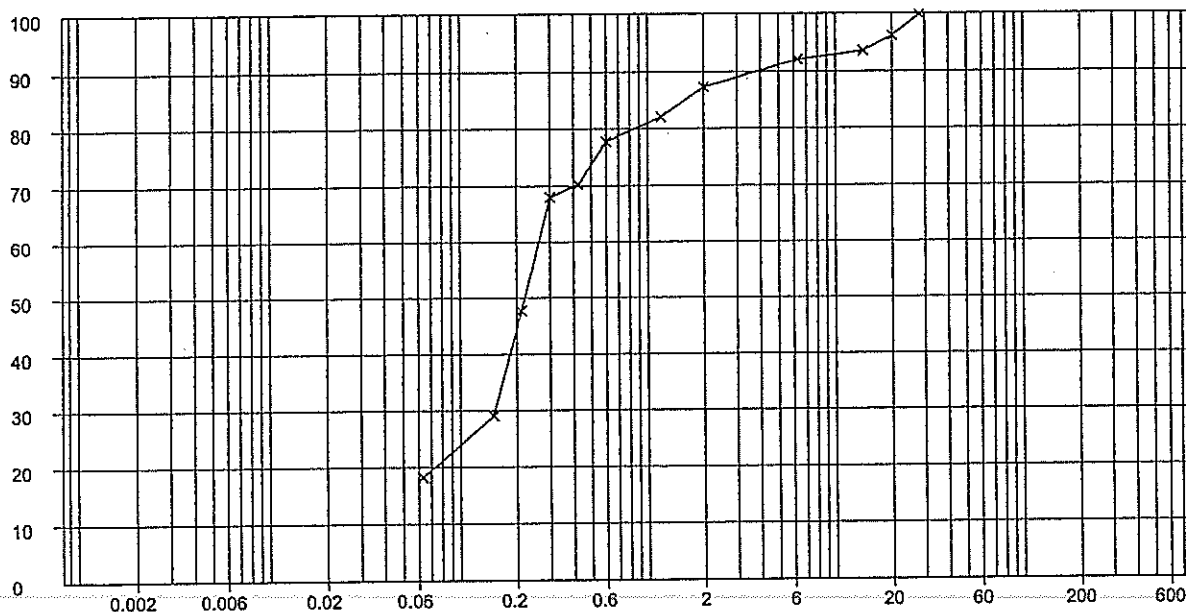


Site : STATION ROAD, PORTESSIE
 Client :
 Engineer : TERRENUS

Job Number : D308
 Sheet : 4/4

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Description
TP P10	1.40	B2	



Sieve / Particle Size	% Passing
28 mm	100.0
20 mm	96.3
14 mm	93.6
6.3 mm	92.1
2 mm	87.4
1.18 mm	82.1
600 µm	77.8
425 µm	70.3
300 µm	68.1
212 µm	47.8
150 µm	29.1
63 µm	18.2

CLAY	Fine	Medium	Coarse	SAND	GRAVEL	COBBLES	BOULDERS
	SILT						

Grading Analysis	
D85	1.6 mm
D60	261.2 µm
D10	<63.0 µm
Uniformity Coefficient	-

Particle Proportions	
Cobbles + Boulders	-
Gravel	12.6%
Sand	69.2%
Silt	-
Clay	-

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :