

**GWYNEDD COUNCIL**  
Cyfadran Adnoddau/Resources Directorate  
Gweinyddol a Gwarchod y Cyhoedd/Administration and Public Protection  
Adain Iechyd Yr Amgylchedd/ Environmental Health Section  
Uned Llygredd/ Pollution Unit



**ENVIRONMENTAL PROTECTION ACT 1990 – PART IIA, Section 78E (1)**  
**THE CONTAMINATED LAND (WALES) REGULATIONS 2001 SI 2001 No. 2197 (W.157)**

**REMEDIATION NOTICE**

To:

This Notice is served on you by **Gwynedd Council** (hereupon referred to as “the Local Authority”) pursuant to section 78E of Part IIA of the Environmental Protection Act 1990 (“the Act”) in relation to contaminated land identified by the Local Authority under section 78B of the Act.

A notice of the identification of contaminated land, dated 3<sup>rd</sup> of October 2006 was given to you by the Local Authority.

The location and extent of the contaminated land to which this Notice relates is set out in **Schedule 1**.

The Local Authority considers that you are an appropriate person within the meaning of the Act by reason of having caused or knowingly permitted the substance, by reason of which the land to which this Notice relates is contaminated land, to be in, on or under the land.

The things that you are required to do by way of remediation and the period within which you are required to do these things is set out in **Schedule 2**.

Further matters relating to this Notice are set out in **Schedules 3 to 7.**

Signed: .....  .....

Date: ..... 7/8/07 .....

**Dilys A Phillips**  
**Head of Administration and Public Protection**

If you require further information with regard to this Notice, please contact:

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## **SCHEDULE 1**

### **Location and extent of Contaminated Land to which this Notice relates [Regulation 4(1)(b) of SI 2001 No. 2197 (W.157)].**

The extent of the contaminated land as identified under section 78B of the Act is shown outlined in red on the map overleaf (National Grid Reference at centre SH 52580 67705). The land incorporates the following premises:

- Number 10, Bangor Street, Y Felinheli, Gwynedd, LL56 4JD  
and
- Number 12, Bangor Street, Y Felinheli, Gwynedd, LL56 4JD.



**10 & 12 Stryd Bangor/Bangor Street Y Felinheli, LL56 4JD**  
**Contaminated Land Outlined in red**



**Legend**

Scale - 1 : 300  
 NGR - SH 52580 67705

Atgynhyrchir y map hwn o Ddeunydd yr Ordnance Survey gyda chaniatâd yr Ordnance Survey ar ran Rheolwr Llyfrfa Ei Mawrhydi. © Hawlfraint y Goron. Mae atgynhyrchu heb ganiatâd yn torri hawlfraint y Goron a gall hyn arwain at erlyniad neu achos sifil. Cyngor Gwynedd - 100023387 - 2005

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## **SCHEDULE 2**

### **Remediation Requirements and Periods [Section 78E(1) of the Act]**

This Local Authority acknowledges that the defective oil fired central heating boiler which caused the contamination has been removed.

The Local Authority requires that you implement a Remediation Scheme that ensures that the Contaminated Land described in Schedule 1 is treated so that it reaches a standard whereby the significant possibility of significant harm being caused is removed.

The Remediation Scheme must follow the recommendations outlined in the **Remediation Strategy, 'R908-R02' May 2007**, composed by Smith Grant LLP on behalf of this Local Authority. The Remediation Strategy can be found in **Appendix 1** at the end of this Notice.

All remediation works and validation reports, as described in the Remediation Strategy must be completed **within 9 months of this Notice being served**.

### **SCHEDULE 3**

**Particulars of the significant harm and the substances by which the Contaminated Land is contaminated [Regulation 4(1)(e) and (f) of SI 2001 No. 2197 (W.157)].**

The substance of concern by which the land is Contaminated Land, is **Naphthalene**.

The particulars of significant harm are shown in the table below:

<b>Pollutant</b>	<b>Source</b>	<b>Pathway</b>	<b>Receptor</b>
Naphthalene	Within the soil below the footprint of both dwellings	Inhalation of Naphthalene vapour within both dwellings	Human beings (residents/visitors – critical receptor a female child 0-6 years old)

There is a significant possibility of significant harm from the inhalation of naphthalene. Possible health effects of chronic inhalation include; behavioural changes, headaches, confusion, malaise, nausea, vomiting, jaundice, hepatomegaly, elevated liver enzymes, ascites, feet oedema and death from liver toxicity. Exposure to large amounts of naphthalene may cause haemolytic anaemia. Corneal ulceration, cataracts, lenticular opacities and general opacities have been reported with chronic exposure to vapour. Individuals with a hereditary deficiency of glucose-6-phosphate dehydrogenase (G6PD) are particularly susceptible to the haemolytic effects of naphthalene metabolites.

#### **SCHEDULE 4**

**Reasons for this Local Authority's decisions as to the things that the Appropriate Person is Required to do by way of Remediation [Regulation 4(1)(g) of SI 2001 No. 2197 (W.157)].**

The reasons for this Local Authorities decisions concerning the above is described in detail in, '**Section 3 – Options Appraisal**' of the Environmental Consultant's (Smith Grant LLP) Report (R908-R02), which can be found in **Appendix 1** of this Notice.



## **SCHEDULE 5**

**Other Appropriate Persons [Section 78E(3) of The Act and Regulation 4(1)(h), (i) & (j) of SI 2001 No. 2197 (W.157)].**

Gwynedd Council considers that you [REDACTED] of [REDACTED]  
[REDACTED] and [REDACTED] of the same  
address are the appropriate persons and are therefore responsible for the remediation  
described in Schedule 2 of this Notice.

We consider you both to have equal responsibility for carrying out the remediation  
and therefore liable for half the cost of the remediation works each.

**SCHEDULE 6**

Names and Addresses of the Owners of the Contaminated Land and the persons whose consent is required for the purpose of remediation [Regulation 4(1) (k) & (l) of SI 2001 No. 2197 (W.157)].

- [REDACTED]

- [REDACTED]

and

- [REDACTED]

## **SCHEDULE 7**

### **Offences, Penalties and Appeals [Regulation 4(1) (n) & (o); and Regulation 4(2) (a), (b) and (c) of SI 2001 No. 2197 (W.157)].**

#### **Offences and Penalties (Section 78M of The Act)**

Under the above section of The Act, it is an offence to fail, without reasonable excuse, to comply with any of the requirements of this Notice.

A person who commits such an offence is liable to the following penalties:

- Where the contaminated land to which the notice relates is “industrial, trade or business premises” as defined in section 78M(6) of the Act, on summary conviction, to a fine not exceeding £20, 000 or such greater sum as the secretary of State may from time to time by order substitute and to a further fine of an amount equal to one tenth of that sum for each day on which the failure continues after conviction of the offence and before the enforcing authority has begun to exercise its powers by virtue of section 78N(3)(c) of the Act.
- Where the contaminated land to which the notice relates is not “industrial, trade or business premises”, on summary conviction, to a fine not exceeding level 5 on the standard scale and to a further fine of an amount equal to one tenth of level 5 on the standard scale for each day on which the failure continues after conviction of the offence and before the enforcing authority has begun to exercise its powers by virtue of section 78N(3)(c).

#### **Right of Appeal (Section 78L of The Act)**

You have a right of appeal against this Notice, under the above section. If you wish to appeal you must do so, within the period of twenty one days beginning with the day on which the notice is served. In this instance the notice is served by a local authority and thus the appeal must be made to a magistrates' court.

#### **Appeals to a Magistrates' Court (Regulation 8 of SI 2001 No. 2197 (W.157))**

The above regulation states the following with regard to the appeal procedure:

- (1) An appeal under section 78L(1) to a magistrates' court against a remediation notice shall be by way of complaint for an order and, subject to section 78L(2) and (3) and regulations 7(3), 12 and 13, the Magistrates' Courts Act 1980(a) shall apply to the proceedings.
- (2) An appellant shall, at the same time as he makes a complaint, -
  - (a) file a notice ("notice of appeal") and serve a copy of it on -
    - (i) the enforcing authority;
    - (ii) any person named in the remediation notice as an appropriate person;
    - (iii) any person named in the notice of appeal as an appropriate person;



- (iv) any person named in the remediation notice as the owner or occupier of the whole or any part of the land to which the notice relates;
  - (b) file a copy of the remediation notice to which the appeal relates and serve a copy of it on any person named in the notice of appeal as an appropriate person who was not so named in the remediation notice; and
  - (c) file a statement of the names and addresses of any persons falling within paragraph (ii), (iii) or (iv) of sub-paragraph (a) above.
- (3) The notice of appeal shall state the appellant's name and address and the grounds on which the appeal is made.

Grounds Of Appeal against a Remediation Notice (Section 78L of The Act and Regulation 7 of SI 2001 No. 2197 (W.157))

Regulation 7 states the following:

- (1) The grounds of appeal against a remediation notice under section 78L(1) are any of the following -
  - (a) that, in determining whether any land to which the notice relates appears to be contaminated land, the local authority -
    - (i) failed to act in accordance with guidance issued by the National Assembly for Wales under section 78A(2), (5) or (6); or
    - (ii) whether by reason of such a failure or otherwise, unreasonably identified all or any of the land to which the notice relates as contaminated land;
  - (b) that, in determining a requirement of the notice, the enforcing authority -
    - (i) failed to have regard to guidance issued by the National Assembly for Wales under section 78E(5); or
    - (ii) whether by reason of such a failure or otherwise, unreasonably required the appellant to do anything by way of remediation;
  - (c) that the enforcing authority unreasonably determined the appellant to be the appropriate person who is to bear responsibility for anything required by the notice to be done by way of remediation;
  - (d) subject to paragraph (2) below, that the enforcing authority unreasonably failed to determine that some person in addition to the appellant is an appropriate person in relation to anything required by the notice to be done by way of remediation;
  - (e) that, in respect of anything required by the notice to be done by way of remediation, the enforcing authority failed to act in accordance with guidance issued by the National Assembly for Wales under section 78F(6);
  - (f) that, where two or more persons are appropriate persons in relation to anything required by the notice to be done by way of remediation, the enforcing authority -
    - (i) failed to determine the proportion of the cost stated in the notice to be the liability of the appellant in accordance with guidance issued by the National Assembly for Wales under section 78F(7); or
    - (ii) whether, by reason of such a failure or otherwise, unreasonably determined the proportion of the cost that the appellant is to bear;
  - (g) that service of the notice contravened a provision of subsection (1) or (3) of section 78H (restrictions and prohibitions on serving remediation notices) other than in circumstances where section 78H(4) applies;

- (h) that, where the notice was served in reliance on section 78H(4) without compliance with section 78H(1) or (3), the enforcing authority could not reasonably have taken the view that the contaminated land in question was in such a condition by reason of substances in, on or under the land, that there was imminent danger of serious harm, or serious pollution of controlled waters, being caused;
- (i) that the enforcing authority has unreasonably failed to be satisfied, in accordance with section 78H(5)(b), that appropriate things are being, or will be, done by way of remediation without service of a notice;
- (j) that any thing required by the notice to be done by way of remediation was required in contravention of a provision of section 78J (restrictions on liability relating to the pollution of controlled waters);
- (k) that any thing required by the notice to be done by way of remediation was required in contravention of a provision of section 78K (liability in respect of contaminating substances which escape to other land);
- (l) that the enforcing authority itself has power, in a case falling within section 78N(3)(b), to do what is appropriate by way of remediation;
- (m) that the enforcing authority itself has power, in a case falling within section 78N(3)(e), to do what is appropriate by way of remediation;
- (n) that the enforcing authority, in considering for the purposes of section 78N(3)(e), whether it would seek to recover all or a portion of the cost incurred by it in doing some particular thing by way of remediation -
  - (i) failed to have regard to any hardship which the recovery may cause to the person from whom the cost is recoverable or to any guidance issued by the National Assembly for Wales for the purposes of section 78P(2); or
  - (ii) whether by reason of such a failure or otherwise, unreasonably determined that it would decide to seek to recover all of the cost;
- (o) that, in determining a requirement of the notice, the enforcing authority failed to have regard to guidance issued by the Environment Agency under section 78V(1);
- (p) that a period specified in the notice within which the appellant is required to do anything is not reasonably sufficient for the purpose;
- (q) that the notice provides for a person acting in a relevant capacity to be personally liable to bear the whole or part of the cost of doing any thing by way of remediation, contrary to the provisions of section 78X(3)(a);
- (r) that service of the notice contravened a provision of section 78YB (interaction of Part IIA of the Environmental Protection Act 1990 with other enactments), and -
  - (i) in a case where subsection (1) of that section is relied on, that it ought reasonably to have appeared to the enforcing authority that the powers of the Environment Agency under section 27 might be exercised;
  - (ii) in a case where subsection (3) of section 78YB is relied on, that it ought reasonably to have appeared to the enforcing authority that the powers of a waste regulation authority or waste collection authority under section 59 might be exercised; or
- (s) that there has been some informality, defect or error in, or in connection with, the notice, in respect of which there is no right of appeal under the grounds set out in sub-paragraphs (a) to (r) above.



- (2) A person may only appeal on the ground specified in paragraph (1)(d) above in a case where -
- (a) the enforcing authority has determined that he is an appropriate person by virtue of subsection (2) of section 78F and he claims to have found some other person who is an appropriate person by virtue of that subsection;
  - (b) the notice is served on him as the owner or occupier for the time being of the contaminated land in question and he claims to have found some other person who is an appropriate person by virtue of that subsection; or
  - (c) the notice is served on him as the owner or occupier for the time being of the contaminated land in question, and he claims that some other person is also an owner or occupier for the time being of the whole or part of that land.
- (3) If and in so far as an appeal against a remediation notice is based on the ground of some informality, defect or error in, or in connection with, the notice, the appellate authority shall dismiss the appeal if it is satisfied that the informality, defect or error was not a material one.

Suspension of a Remediation Notice Upon Appeal (Regulation 14 of SI 2001 No. 2197 (W.157))

Regulation 14 states the following:

- (1) Where an appeal is duly made against a remediation notice, the notice shall be of no effect pending the final determination or abandonment of the appeal.
- (2) An appeal against a remediation notice is duly made for the purposes of this regulation if it is made within the period specified in section 78L(1)(a) and the requirements of regulation 8(2) and (3) (in the case of an appeal to a magistrates' court) or regulation 9(1) and(2) (in the case of an appeal to the National Assembly for Wales) have been complied with.



**APPENDIX 1**

**“10 & 12 Bangor Street, Y Felinheli, Remediation Strategy, For: Gwynedd County Council, May 2007”.**

**Authors: Smith Grant LLP**

**Report Reference Number: R962-R01**

*Contaminated Land  
Air Quality  
Environmental Audit*



Partnership No: OC 300776

**10 & 12 BANGOR ST, Y FELINHELI**

**REMEDIATION STRATEGY**

**For: Gwynedd County Council**

**May 2007**

**R908-R02**

**DOCUMENT CONTROL SHEET**

**Report Title:** 10 & 12 BANGOR ST, Y FELINHELI REMEDIATION  
STRATEGY

**Client:** Gwynedd County Council

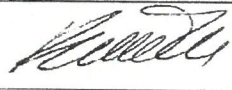

**Report Reference Number:** R962-R01

**Report Status:** Final

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**Report Date:** May 2007

**Signed For Smith Grant LLP**

	Name		Signature	Date
<b>Author</b>	<b>Ben Thomas</b> BSc, MSc	<b>Consultant</b>		18/05/07
<b>Reviewer</b>	<b>A F Smith</b> BSc, PhD, MCIWM, SILC	<b>Chairman</b>		18/5/07



**10 & 12 BANGOR ST, Y FELINHELI**

**REMEDIATION STRATEGY**

**For: Gwynedd County Council**

**May 2007**

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## 1 Introduction

- 1.1 Smith Grant LLP (SGP) was instructed by Gwynedd County Council (GCC) to design a remedial strategy for two residential properties; numbers 10 and 12 Bangor Street, Y Felinheli. A leak of central heating fuel oil from an outside boiler and associated pipework located to the rear of No. 10 has resulted in the migration of hydrocarbons into soils below part of both building footprints and the migration of volatile hydrocarbons into the buildings.
- 1.2 An earlier site assessment commissioned by GCC identified a potential health risk to occupants of the properties through exposure to hydrocarbon vapors within the properties, and an odor nuisance has been reported in both properties. GCC is preparing to issue a remediation notice under Part IIA of the Environmental Protection Act 1990 which will include a description of remediation works required to reduce significant risks associated with the contamination present on/under the affected land.
- 1.3 This assessment is intended to form part of the framework for contaminated land assessment set out in the EA/DEFRA Contaminated Land Report 11; "Model Procedures for the Management of Land Contamination", 2004. The model procedures are primarily intended to act as a framework to manage contamination with the potential to affect human health or the wider environment.
- 1.4 Following a review of available information by SGP, a remedial strategy to break source-pathway-target contaminant linkages has been developed. This report does not contain any risk assessment elements as remedial targets for indoor air quality have previously been reviewed by GCC. Where contaminant concentrations have been identified in excess of remedial targets, an options appraisal to identify potential remediation methods has been carried out and the most appropriate remediation strategy is recommended along with an outline implementation plan. Details of appropriate validation testing to determine the success of the remediation strategy are also presented.
- 1.5 This report is intended to assist GCC in selecting and securing the implementation of a remediation strategy for the site. In identifying an appropriate remediation strategy consideration is given to the nature, concentration and distribution of contaminants of concern, the reduction in concentrations required to achieve the appropriate remedial targets, the ground conditions present on the site, the presence of existing buildings, the presence of underground services, timescales, potential disruption to residents, sustainability (i.e. minimisation of waste generation, lorry movements etc) and feasibility (costs).

## 2 Background Information

### 2.1 Physical Description

2.1.1 The site is centred on national grid reference 252300, 367250. The site location is indicated on Drawing 01. No. 10 occupies approximately 330m<sup>2</sup> with about half the site occupied by a terraced house and the remainder garden areas. The adjoining property (No.12) is of similar size and layout but contains outbuildings to the rear of the terrace.

2.1.2 The site is mainly level but the surrounding area slopes southeast to northwest. To the southeast both properties are bounded by Bangor Street and by a back alley to the northwest. To the northeast No. 10 is bounded by Pen Ceunant and to the southwest No. 12 is bounded by No.14.

### 2.2 Historical Uses

2.2.1 The site is understood to have been used as residential housing since development approximately 100 years ago. SGP has been advised that the owner of No. 10 moved in during January 2005 and removed the boiler, at the same time identifying the oil contamination during February 2005. The resident of No. 12 advised SGP that she noticed the oil odour around 1998-1999 but did not report the issue to GCC until 2005. The volume of oil leaked into the ground is unknown.

### 2.3 Soils and Geology

2.3.1 The gardens are covered by a mix of turf and hardstanding. Topsoil is present in some parts of the site, however the depth and quality appear to be variable, and thin deposits (<0.10m) of made ground were observed in some locations. These variable deposits overlie subsoil consisting of poorly sorted cobble to gravel sized stone in a sandy clayey matrix. These are likely to be glacial in origin.

2.3.2 Bedrock was not encountered in any of the site investigations but given the topography of the area is likely to be present at shallow depth. Geological maps of the area indicate the site is underlain by intrusive igneous rocks which are not part of a major aquifer and do not lie within any groundwater source protection zone.



## 2.4 Structures and Services

2.4.1 The houses and outbuildings are of brick construction with solid walls and a mixture of suspended wooden floors overlying a ventilated sub floor void and ground bearing concrete slabs which may be underlain by a damp proof membrane. A survey of the buildings foundations and floors was carried out by Muir Associates Consulting Engineers. The findings of the survey are presented in a letter attached as Appendix A.

2.4.2 The foundation depths for the properties are 370-500mm below external ground level with a minimum of 445mm from the finished internal ground floor to the underside of the foundation. The exception to this is the kitchen extension to No 10 which consists of brick founded at ground level. The outbuildings of No. 12 were not investigated but are probably of similar construction.

2.4.3 Service connections are likely to be from Bangor Street to the houses, running through their front gardens. Other services and land drains may be present in the gardens. The presence or absence of other buried services on the site cannot be confirmed. If excavations or site investigations are to take place reference should be made to the service providers and safe digging practice adhered to.

## 2.5 Distribution of Contamination

2.5.1 Previous contamination assessment by ExCAL Ltd. (report ref: ES1560/KKE, June 2005) and SGP (report refs: R845-R01, September 2005 and R908-R01, June 2006) have been carried out and submitted to GCC. This report should be read in conjunction with the earlier site investigations and risk assessments.

2.5.2 The assessments have indicated that naphthalene is the primary contaminant of concern as far as risks to human health are concerned but that the presence of other volatile or semi volatile hydrocarbons are likely to contribute to the odour nuisance being experienced in the properties. For the purposes of this review, unacceptable contamination is defined as soils that contain concentrations of naphthalene that could result in indoor air concentrations in excess of the remedial targets calculated in the previous risk assessments.

- 2.5.3 The source of the hydrocarbon leak is the site of the former boiler which was located in the rear garden of No. 10 directly adjacent to the kitchen walls of No's 10 and 12. Elevated concentrations of hydrocarbons appear to be of limited lateral extent. The known extent of the source area is marked on Drawing 02.
- 2.5.4 Elevated photo ionisation detector (PID) readings were recorded in the source area externally to No. 10 and in the kitchen of No. 12. However the results of indoor air quality monitoring indicate elevated concentrations of naphthalene throughout both buildings. The effect is more pronounced in the kitchen of No.12 which corresponds with elevated naphthalene concentrations in soils directly beneath the slab which were absent in the entry in the kitchen of No.10.
- 2.5.5 It appears that the hydrocarbon leak has resulted in the migration of liquid phase heating oil beneath No's 10 and 12. Although the lateral extent of the liquid phase is unconfirmed it is likely to be limited in comparison to the extent of vapour phase hydrocarbons present in the soil atmosphere and in voids and cracks in the structure of the building. The majority of vapour migration into the building appears to be through cracks and fissures at the edge of the concrete slabs in the kitchens of No's 10 and 12 which are close to the source area. Although migration through the timber floor of No.12 may also contribute to the elevated concentrations within the house, this is likely to be limited by ventilation of the sub floor void.

## 2.6 Conceptual Model

- 2.6.1 The presence of a source of elevated concentrations of hydrocarbons in the soils both inside and outside the building footprint has been identified. Potential pathways which could cause exposure to this material are through vapour migration into the buildings and inhalation.
- 2.6.2 Inhalation of vapours outdoors is unlikely to present an unacceptable risk due to attenuation through dilution but vapour migration occurring from the source area into the buildings has been demonstrated as causing a potentially unacceptable risk to human health.

- 2.6.3 The source-pathway-target linkage which require breaking by remediation and mitigation to reduce risks to human health is therefore: indoor air inhalation of vapours migrating from the source area in No's 10 and 12.
- 2.6.4 This pathway is also the cause of the odour nuisance experienced by the residents and a robust remediation strategy to reduce the risks to human health identified will also decrease ingress of odorous hydrocarbon vapours into the buildings. It is noted, however that the odours associated with hydrocarbons are generally perceptible at lower concentrations than the remedial targets derived to protect human health.

### 3 Options Appraisal

#### 3.1 Remediation Objectives

- 3.1.1 The remediation objectives are to reduce indoor air concentrations of volatile and semi-volatile hydrocarbons to below levels where human health could potentially be affected in both properties.
- 3.1.2 The remediation strategy is required to reduce indoor air concentrations to background levels. This will also reduce the odour nuisance currently being experienced by the residents of both properties.
- 3.1.3 In addition the strategy should contain elements which will contribute to the reduction of the source area over time in order to reduce and remove any long term environmental liability associated with the leak.
- 3.1.4 The remediation strategy will need to be effective in meeting these objectives but must take account of cost-effectiveness and factors which will effect delivery of the programme, including restrictions imposed by the position of buried services, accessibility, length of programme, reliability of outcome, disruption to residents, damage to buildings and gardens, economic considerations and waste minimisation/sustainability issues.

#### 3.2 Additional Investigations

- 3.2.1 The lateral nature and extent of the contamination has been defined with sufficient accuracy to allow development of a remediation strategy without additional investigations.



3.2.2 It is noted that a degree of flexibility will be required as with any contamination remediation, due to the inherent uncertainties regarding the spread of contamination. In particular, observation of remediation works involving the "chasing out" of contamination and the application of any treatment or additional investigations resulting from unexpected conditions will be required as part of the remediation strategy. Although the likely extent of the area where remediation works are required has been determined this is subject to revision during the works. Any such amendments should be made by a suitably qualified and experienced person, with prior agreement of the relevant GCC Contaminated Land Officer.

3.2.3 Validation testing will be required to demonstrate the effectiveness of the remediation strategy. As the primary goal is to reduce indoor air concentrations and to isolate residents from residual contamination in garden areas this will require sampling and analysis of indoor air and sub floor voids. These activities should be carried out in accordance with the methods used to identify unacceptable contamination used in the previous contamination assessments carried out on the site and should be carried out by a suitably qualified and experienced person.

### 3.3 Identification and Evaluation of Feasible Remediation Methods

3.3.1 Volatile, mobile contaminants such as light aliphatic hydrocarbons, naphthalene and alkylbenzenes typically break down in soils over a period of years, with heavier aliphatic and aromatic hydrocarbons taking considerably longer. Natural attenuation has been assessed as inappropriate given the dominance of more recalcitrant diesel range hydrocarbons in the soil samples analysed from the site, and the nuisance and potential harm to human health from these substances.

3.3.2 The broad options for remediation include:

- physical excavation and removal from the site of impacted soils for off site treatment or disposal; considered potentially appropriate if excavation of contaminated material is required to enable other remediation methods; this method in isolation, however is unlikely to be successful in removing all of the contamination given the constraints imposed by the locations of load bearing walls etc
- excavation of impacted soils and on-site remediation using biological treatment (ex situ bioremediation); although technically feasible, the land

area required and disruption given the likely limited volume of arisings makes this impracticable;

- in situ treatment involving enhanced bioremediation (using oxygenation, nutrient and/or soil microbe amendments) or chemical treatment (oxidation) is feasible for dispersed hydrocarbons; applicability of this treatment would be limited given the ground conditions, but could be invoked for the contaminated source area; this method in isolation, however is unlikely to be successful in removing all of the contamination due to the cohesive ground conditions;
- vapour extraction or groundwater pumping and treatment are not applicable given the generally low volatile nature and predominantly soil-adsorbed phase of the fuel oil;
- a barrier system fitted within the buildings to prevent the ingress of hydrocarbon vapour into the living areas is likely to be the best method of reliably breaking the source-pathway-target linkage through vapour inhalation; this method may involve the use of barriers and/or ventilation, however the potential for limited migration via structural walls will remain unless these are fitted with vapour barriers.

3.3.3 Removal of some soil contaminants might be feasible, however given the lack of access, residential location and the likelihood that affected materials are concentrated along preferential flow pathways, large scale excavation and removal is not considered suitable for the site. Targeted removal of areas of high concentrations may be able to increase the efficiency of other treatment options by removing small volumes of heavily contaminated source material, revealing areas where other treatments could be concentrated and enhancing soil ventilation. However this will only take place where material requires removal as part of the final strategy (to accommodate gas protection measures etc). Any material removed would have to be disposed of in accordance with Waste Management Regulations and replaced with suitable clean granular fill.

3.3.4 Residual concentrations of hydrocarbons could potentially be reduced in-situ using a number of physical, biological or chemical processes. Various methods of in-situ remediation have been used successfully on hydrocarbon contamination in the UK although all of these methods depend on accessing the contamination effectively and their success is highly dependant on local ground conditions.

- 3.3.5 Chemical and biological treatment of hydrocarbon contamination has been demonstrated to be effective in reducing concentrations if the reactants or agents can be delivered to all of the affected material. In practice, this works best in saturated media or when the affected soil can be easily accessed and mixed with the reactant or agent. A treatment agent could be introduced to reduce residual hydrocarbon concentrations over time by enhancing the natural attenuation taking place. This method is considered unlikely to remove all of the contamination present and issues concerning the accessibility of much of the contaminated material remain unresolved.
- 3.3.6 Although source reduction will form part of the remediation strategy, given the problems accessing the affected materials, it is considered unlikely that source reduction removal or treatment will be effective as a sole remediation method. Some residual hydrocarbons are likely to remain in the soils and in the structural walls. To mitigate the potential for hydrocarbon vapour from residual hydrocarbons into the buildings a barrier system it is recommended a barrier system is installed following removal/treatment.
- 3.3.7 Designs for protection measures to prevent the migration of harmful ground gas into buildings are well developed and an accepted method within the UK framework for managing land contamination. Fitting such measures into existing buildings can be achieved in conjunction with the removal/treatment options already discussed and would provide immediate protection to residents. The results of the building survey indicate that the structure of the building should not be affected by the works however mitigation works to walls of the kitchen of No. 10 are a likely requirement given the lack of substantial foundations.
- 3.3.8 The recommended strategy will therefore combine three elements:
- A. Source Removal; external (partially completed) and internal (limited volume due to structural constraints); affected materials to be removed from site and disposed at a waste management facility licence to accept such waste;
  - B. Treatment of residual hydrocarbons by application of chemical treatment (e.g.: oxidising agent) or biological agent (e.g.: oxygen release compound) to be selected in consultation with specialist supplier.
  - C. Installation of gas barrier.



- 3.3.9 It is recognised that such techniques and preparatory works would initially cause significant temporary disruption to residents.

#### 3.4 Development of Remediation Strategy

3.4.1 The works will consist of a number of different elements, some of which will require contributions by specialist professionals; additionally the project will require management by a suitably experienced and qualified person. The remediation works will require contributions from the following:

- an environmental professional specialising in contaminated land assessment and remediation will be required to provide advice, carry out environmental monitoring and validate the works;
- a suitably qualified and experienced architect or engineer is required to design the gas protection measures in accordance with best practice;
- a building contractor will be needed to prepare the site, underpin/provide temporary support to the walls where necessary, break out /remove the floors of the buildings, arrange for removal of contaminated arisings and import of replacement fills as appropriate, apply chemical or biological treatment and install the gas protection measures;
- specialist suppliers will be required to provide certain materials (treatment agents and gas barrier components), and to advise the Contractor on application and installation as appropriate;
- other stakeholders include the relevant regulatory authorities and the residents who should be kept fully informed of the proposals.

3.4.2 The Contractor appointed should ideally have some experience in dealing with contaminated sites and the installation of gas protection measures and should adhere to all relevant environmental and health and safety legislation. Although large scale excavations and removal of materials are considered inappropriate for the site the proposed strategy involves some excavation and removal of material, some of which may be classed as contaminated. Heavy plant will not be used but a skip will be required to hold excavated material pending disposal.

3.4.3 The design of gas protection measures should be carried out by a suitably qualified and experienced engineer or architect. Reference should be made to CIRIA document C659 "Assessing risks posed by hazardous ground gases to buildings" and BRE document BR414 "Protective measures for housing on gas

contaminated land". The protection measures should consist of a membrane specified as resistant to hydrocarbon vapours and a sub floor void that can be ventilated either passively or actively to create a permeability contrast which will limit the ingress of hydrocarbon vapours into buildings.

- 3.4.4 The gas protection measures should be designed to fit beneath the full internal footprint of the affected areas of both properties. The likely extent of the works is indicated on Drawing 02, however this is subject to confirmation. The gas protection measures for each property should be designed and constructed to function independently of each other. A method statement containing complete drawings of the gas protection measures, the specification of the materials to be used and full details of the Contractors quality control and quality assessment procedures should be submitted to the GCC Contaminated Land Officer, Building Control and the person responsible for validation the works for approval before work commences.
- 3.4.5 The gas protection measures should be designed so that no adverse impacts to the structural integrity of the building occur during or following installation. The potential for damage to the walls of the kitchen of No.10 due to the poor foundations has already been recognised and these are likely to require underpinning before the works can commence (see Appendix A). It will be the responsibility of the Contractor to satisfy themselves that the remediation works can be carried out without causing damage to the buildings and additional surveys may be required. It may be appropriate for a detailed structural survey to be carried out before the commencement of works in order to demonstrate that the remediation works have not compromised the structural integrity of the buildings.
- 3.4.6 Following breaking out/removal of the existing floors an opportunity exists to access the contamination that has migrated beneath the buildings. Although the main aim of the strategy is to stop hydrocarbon vapours from migrating into the building it is proposed that treatment on the exposed soils should be carried out to enhance the natural attenuation of the hydrocarbons.
- 3.4.7 Any arisings that require removal in order to fit the gas protection measures should be removed and held in a skip prior to disposal to a licensed facility. Some of this material may be contaminated by hydrocarbons but the majority is likely to be uncontaminated. A suitably qualified and experienced geo-

environmental consultant should attend the site during the removal of floors and excavations to inspect arisings and carry out screening for contamination using a PID. Waste classification and waste acceptance criteria testing may be required for these materials in order that they are disposed of appropriately.

- 3.4.8 Once the extent of the contamination beneath the building footprint has been delineated an in-situ remediation treatment should be applied in targeted areas both inside and outside the buildings selected in consultation with the geo-environmental consultant.
- 3.4.9 It is recommended that a chemical or biological treatment is likely to be effective in reducing concentrations of the contaminants of concern. A treatment could consist of a chemical oxidising agent which will attack the hydrocarbon contamination or an oxygen release compound to enhance natural biological attenuation. The exact nature of the treatments will be selected in consultation with the specialist supplier however consideration must be given to health and safety and appropriate risk assessments and mitigation to reduce any unacceptable risks identified. As the reactant or agents are likely to require application in suspension or solution a suitable water supply will be required. It is anticipated that the Contractor will apply the treatment under the direction of the site chemist.
- 3.4.10 Following the removal and treatment of soils the gas protection measures can be installed. It is recommended that a well ventilated sub-floor void should cover the full internal footprint of the impacted rooms. The likely extent of the gas protection measures is indicated in Drawing 02; however this will require confirmation following breaking out/removal of the existing floors. The void could consist of proprietary void formers or of single sized stone. Consultation with suppliers should be carried out and specification of all materials should be included in the design. It is proposed that the areas where soil contamination is identified should initially be actively ventilated to remove as much of the volatile and semi volatile hydrocarbons as possible from the source area, including the breakdown products of the treated hydrocarbons. To allow this the air bricks that ventilate the main void must initially be sealed and slotted pipe work should be fitted located around all walls where hydrocarbon affected materials are present. A dedicated outflow for each property connecting the slotted pipe work to a pump or chimney should be positioned as near to the delineated contamination source as possible. A sampling point to monitor hydrocarbon



vapour concentrations in the outflow should be provided. These will offer a preferential flow pathway for hydrocarbon vapours which might otherwise migrate into the buildings between the existing walls and the gas barrier described below.

- 3.4.11 A membrane specified to resist hydrocarbon vapours should be fitted above the ventilated sub-floor void. The membrane should cover the full internal footprint of the affected area. The membrane could be prefabricated to fit the buildings or welded or taped on-site. Consultation with suppliers should be carried out and specification of all materials should be included in the design. It is recognised that some wicking of hydrocarbons into the wall may have occurred and the membrane should lap up the walls of the house with the lapping sealed to the walls to prevent any hydrocarbon in the brickwork volatilising into the properties. All service entries that penetrate the membrane will also require sealing. Once the membrane has been installed above the sub-floor void and venting systems previously described the floors of the properties can be re-instated.
- 3.4.12 It is recognised that the most common cause of failure of gas protection measures is damage to membranes during or after fitting, incomplete sealing and the blockage of ventilation. As part of the proposed system requires active ventilation sealing the gas membrane is particularly important. The Contractor should submit quality control and quality assurance details as part of their method statement and the works should be independently validated with regular site inspections carried out during key stages of the works.
- 3.4.13 At this stage the active ventilation system should be activated by attaching pumps or up pipes with cowls (if sufficient suction can be achieved) to the outflows from each building. These measures will be similar to active radon ventilation systems. Installed correctly, the gas protection measures should isolate the interior of the buildings from migration hydrocarbon vapour as soon as they are complete, therefore validation of the indoor air quality of the properties can begin as soon as the works are finished. Indoor air quality assessment should be carried out using the same protocol and methods as have been previously adopted with additional regular monitoring of the outflows from each building and the results assessed using the same risk assessment techniques.



- 3.4.14 It is recognised that odours may temporarily persist as hydrocarbons may have been adsorbed to various surfaces within the buildings and may be re-emitted for a period.
- 3.4.15 Once it has been established that the indoor air quality is satisfactory the active ventilation system should be maintained for a period of six months and the outflows regularly monitored to determine if concentrations of hydrocarbon vapours extracted have decreased following the removal and treatment of affected materials. When the active ventilation system is shut down the air bricks that will passively ventilate the main sub-floor void must be opened. At this stage a second indoor air quality validation exercise should be carried out to demonstrate that passive venting is sufficient to isolate the indoor air from any residual hydrocarbons remaining beneath the buildings. Once this has been demonstrated the remediation works can be considered to be complete.
- 3.4.16 A report on the remedial works detailing the information obtained during the works, volumes of contaminated material removed treatment zones, monitoring positions and the initial monitoring results should be issued by an environmental professional specialising in contaminated land assessment and remediation. The conclusions of this report will determine whether the land contamination has been satisfactorily addressed and determine the need for further works.

#### **4 Implementation of Remediation Strategy**

##### **4.1 Remedial Engineering**

- 4.1.1 The remediation strategy described below is subject to revision following consultation with the stakeholders involved in the scheme, contractors and consultants, the regulatory authority. Any necessary alterations to the strategy must be made in consultation with GCC. The strategy will be implemented by appropriate persons and will consist of the following elements:
- consultation with designer, Contractor, specialist material suppliers and regulatory authorities;
  - design of gas protection measures by a suitably qualified and experienced architect or engineer;
  - preparation of method statement by Contractor;
  - finalisation of estimated costs and programme of work;
  - consultation with residents;

- preparatory works, removal of fixtures and fittings;
- breaking out and removal of floors;
- excavation of materials
- in-situ treatment of residual hydrocarbons;
- installation of the agreed design of gas protection measures;
- validation testing and completion reporting.

#### 4.2 Limitation

4.2.1 SGP reserves the right to alter any of the foregoing information in the event of new information being provided and in the light of changes to legislation, guidelines and responses by the statutory and regulatory authorities.

4.2.2 This report has been prepared by SGP for the sole and exclusive use of Gwynedd County Council. Transfer of the benefit of this report to one other person. Transfer of benefit of this report will be permitted to one further assignee without the written permission of Smith Grant LLP. All reasonable skill, care and diligence has been exercised within the timescale and budget available, and in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team in undertaking the assessment and preparing this report, it is possible that other ground conditions and contamination as yet undetected may exist. Reliance on the findings of this report must therefore be limited accordingly. Such reliance must be based on the whole report and not on extracts which may lead to incomplete or incorrect conclusions when taken out of context.



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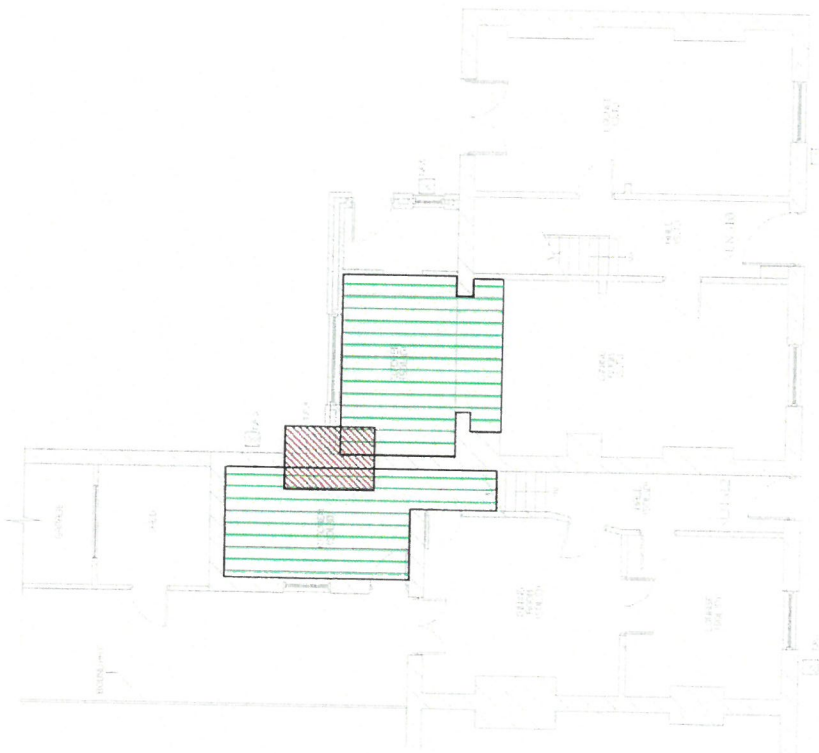
Drawn: SD	Checked: BJT
Date: 01/06/06	Scale: 1:25,000
Job No: R901	Drg No: 001



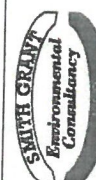
Known extent of soil Source Area



Area where removal/treatment/ gas protection required (subject to confirmation following breaking out and removal of floors)



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Project:  
10/12 Bangor St, Y Felinheli

Drawing: Site Layout

Drawn: BJT	Checked: AFS
Date: 2/10/07	Scale: 1:100
Job No: R908	Dwg No: 02



**Appendix A**  
**Engineers Report**

Our Ref: DMS181/LET1/JRT

RECEIVED

08 FEB 2007

7 February 2007

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**FAO Mr Ben Thomas**

Dear Sirs

**RE: 10/12 BANGOR STREET, Y FELINHELL, GWYNEDD.**

Further to a recent instruction received from you and David Williams from Gwynedd County Council, a visit was made to the above properties on 31<sup>st</sup> January 2007. Our brief was to carry out an inspection of the ground floor and foundations, in order to advise on the potential for various environmental remediation options, on the structural integrity of the properties, following an escape of heating oil into the ground adjacent to the party wall between 10 & 12 Bangor Street.

Prior to the survey Smith Grant Partnership issued us with three reports, for background information.

Our survey included a visual inspection of the properties and the excavation of 5 trial pits to confirm the nature and depth of the foundations to the property. Our findings are recorded on drawing DMS181-100, two copies are attached.

Generally the foundation depths to both properties are 370mm and 500mm below external ground level, giving a minimum depth of 445mm from finished ground floor to underside of foundation. The exception to this is kitchen extension to 12 Bangor Street, which appears to be founded off brickwork at ground level.

The ground floors to 12 Bangor Street are all concrete, and we understand were replaced approximately 8 to 9 years ago, as prior to this it was a tiled floor on dirt.

The ground floor to 10 Bangor Street is predominately suspended timber, with the exception of the kitchen extension / utility room, which is concrete.

We understand the preferred remediation method is to install a gas membrane with a ventilation system. Initial the venting system is to be active, but may eventually, subject to testing be converted to passive.



Directors: J.R. Gray BSc. C.Eng. MI Struct. E. MICE P.E. Day M.Eng. C.Eng. MICE J. Tobin I.Eng. AMI Struct. E.



19 April 2007.max

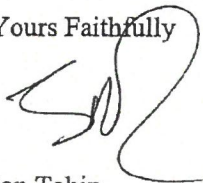
The depth of foundations related to the ground floor slab level to 12 Bangor Street, is sufficient to allow the construction of a new 125mm concrete slab on say 100mm of insulation, on a gas membrane, allowing 200mm of stone to form the venting medium. If required this could be increased to 300mm if insulation was not installed, subject to Building Control Approval.

The suspended floor to 10 Bangor Street, could be removed as required and a new insulated concrete slab installed, similar to 12 Bangor Street above. This would be subject to the acceptance of the owner.

Due to the shallow nature of the foundations to the kitchen / utility room floor slab to 10 Bangor Street, underpinning would be required to facilitate the installation of the gas membrane and venting system. Alternatively, if reduced headroom was acceptable, the existing concrete floor could be broken out and raised to the same level as the dining room / lounge area, giving additional depth to incorporate the venting zone.

From the structural prospective the underpinning would be the favoured option, as the present foundations to the kitchen extension would appear inadequate for the loads imposed. The underpinning would therefore be beneficial for the long-term stability of the extension and for the insertion of the gas membrane and venting system. A budget cost for the underpinning would be £5 to £7k.

Yours Faithfully



Jon Tobin  
Director  
For Muir Associates (UK) Ltd

cc  
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Environmental Health Section,  
Gwynedd County Council,  
Swyddfa Ardal Arfon,  
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