REMEDIATION STRATEGY
PROPOSED RESIDENTIAL DEVELOPMENT
HERBERT ROAD
NEWPORT

EXTANT CONSENT

Prepared for:
Greenhill Construction Limited

February 2014

Job No: 12032/RS-V3

terrafirma

REPORT TITLE	:	**Remediation Strategy : Proposed Residential Development, Herbert Road, Newport**
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Executive Summary

Greenhill Construction Limited is proposing the development of land off Herbert Road in Newport. The development is to comprise of approximately 150 to 180 houses and flats.

Investigation of the site was undertaken by Terra Firma (Wales) Limited. The details of the investigation were reported on in March 2013 (Geo-environmental and Geo-technical Report No. 12032).

Terra Firma (Wales) Limited has subsequently been commissioned to prepare a Remediation Strategy for the site. Based on the investigative works carried out the proposed remediation measures for the site are:

1. ***Cover of site with between 0.5m and 1.4m of imported fill (intended to raise site above flood plain).***

2. ***Cover is to include subsoil and topsoil material in garden and landscaped areas. A minimum of 600mm of fill is required in garden and landscaped areas.***

3. ***Monitoring and management of any soils disturbed and excavated at the location of TP7 to protect against asbestos fibres.***

4. ***Current minimum requirements is the installation of a 2000 gauge membrane suitable for protection against ground gas, radon gas and PCB vapours in all new buildings. Passive under-floor venting and taping and sealing of all joints will also be required. Dependant on further on-site gas monitoring more robust gas protection measures may be required.***

5. ***New water supply pipes to be chosen in accordance with UKWIR Report Ref No 10/WM/03/21 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'.***

6. ***Additional assessment of groundwater quality and recommendation of remedial measures where appropriate in agreement with Newport City Council Environmental Protection and National Resources Wales.***

7. ***Sampling and analysis of waters collected by band drains during site fill and settlement monitoring period. Recommendation for remedial measures, if appropriate.***

All works carried out on site should be documented and recorded, and reported to Newport City Council Environmental Protection and National Resources Wales in the form of a Validation Report.

Any unexpected ground conditions or contamination identified during site development should be inspected and appropriately investigated by a geo-environmental engineer. This may include suspension of site works until the details and severity of any contamination has been established and the potential risks to human health assessed.

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SECTION 1 Introduction and Proposed Development

Greenhill Construction Limited is proposing the residential development of land off Herbert Road in Newport.

Investigation of the site was undertaken by Terra Firma (Wales) Limited. The details of the investigation were reported on in March 2013 (Geo-environmental and Geo-technical Report No. 12032).

Terra Firma (Wales) Limited has subsequently been commissioned to prepare a Remediation Strategy for the site.

The objective of the Remediation Strategy is to address any human health risks and any risks to the aquatic environment previously identified, using the best practicable option.

1.1 Limitations and Exceptions

Greenhill Construction Limited has requested that a Remediation Strategy be prepared.

This report has been prepared for the sole internal reliance of Greenhill Construction Limited. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The report represents the findings and opinions of experienced geo-environmental and geo-technical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may also be required.

It is not within the scope of Terra Firma (Wales) Limited to:

- Provide Method Statements and Risk Assessments for the site preparation and development.
- Design, install and validate the pipes for potable water supply beneath the site.

SECTION 2 Summary of Terra Firma (Wales) Limited Geotechnical and Geo-environmental Report

2.1 Site Works

A site investigation was carried out between the 31st of October and the 8th of November 2012 comprising 19 trial pits and six cable percussive boreholes and three mini percussive boreholes.

2.2 Ground Conditions

The ground conditions encountered beneath the site can in general be summarised as shown in **Table 2.1.**

Table 2.1 Summary of Ground Conditions

Depth (m)			Thickness (m)	Stratum
GL	-	0.20/3.30	0.20/3.30	**MADE GROUND**
0.30	-	3.90/10.30	2.20/8.40	Soft grey and brown mottled **CLAY**
3.90/7.1	-	4.10/8.60	0.60/2.30	**PEAT**
4.10/8.60	-	5.90/9.70	0.00/1.80	**SAND & GRAVEL (intermittent)**
5.90/10.30 10.00/12.70		-	0.50/4.10	Firm becoming very stiff red brown gravelly **CLAY**
10.00/12.70	-	>12.90	-	**MUDSTONE**

The basal Sand & Gravel layer was not encountered in BH1, BH2, BH4 and BH5.

Very loose red brown silty SAND and very soft red sandy SILT was encountered between 6.20m and 7.00m and 7.00m and 8.80m respectively.

Soft grey sandy SILT was encountered between 6.20m and 9.10m.

2.3 Foundation Solution

Construction of shallow traditional foundations upon soft clay bands beneath the site would lead to high total and differential settlements.

Precast concrete driven piles founded within the underlying very weak red brown and grey mudstone with a suspended floor slab were therefore recommended.

2.4 Contamination Screening

During the intrusive investigation, small disturbed soil samples were collected for contamination screening. Groundwater wells were installed and groundwater samples were also retrieved for testing. Samples from the drainage reen that crosses the site were taken and analysed in June 2013.

Testing of soil and water samples for a standard suite of metals, inorganics and organics was undertaken as well as for asbestos, polycyclic aromatic hydrocarbons (PAH), petroleum hydrocarbons and polychlorinated biphenyls (PCBs)

A number of substances tested for were found to be above their respective threshold levels in soil. These exceedences are summarised in Table 2.2 below.

Table 2.2 Summary of Contaminants of Concern in Soil

Hole and depth (m bgl)	Chemical	Guideline (mg/kg)	Exceedance (mg/kg)
TP5 1.30m	Arsenic	32	40
TP2 0.90m	Cyanide	8	10
TP8 0.50m	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Chrysene Dibenzo(a,h)anthracene Indeno(1,2,3-c,d)pyrene	3.1 0.83 5.6 6 0.76 3.2	13 11 9 13 1.6 7.5
TP4 0.70m	Benzo(a)pyrene	0.83	0.90
TP6 0.60m	PCB 2,3',4,4',5-Pentachlorobiphenyl 2,2',4,4',5,5'Hexachlorobiphenyl 2,2',3,4,4',5'Hexachlorobiphenyl 2,2',3,4,4',5,5'Heptachlorobiphenyl	0.01 0.01 0.01 0.01 0.01	0.15 0.02 0.02 0.05 0.04
TP6 1.80m	Chrysotile – Loose Bundles	-	-
TP7 0.20m	Benzo(a)pyrene Chrysotile – Loose Bundles	0.83 -	1.90 -
TP9 1.00m	Benzo(a)pyrene	0.83	1.30
TP10 0.80m	Benzo(a)pyrene	0.83	1.50
TP13 0.60m	PCB 2,4,4'-Trichlorobiphenyl 2,2',5,5'-Tetrachlorobiphenyl	0.01 0.01 0.01	0.16 0.12 0.05

2.4 Contamination Screening (Continued)

Substances found to be elevated in groundwater and reen water are summarised in Table 2.2 below.

Table 2.3 Summary of Contaminants of Concern in Groundwater

Borehole	Chemical	Threshold (mg/l)	Exceedance (mg/l)
BH1 (08/01/2013)	Aliphatic C16-C21 Aliphatic C21-C35	0.01 0.01	0.11 0.14
BH2 (08/01/2013)	Aliphatic C16-C21 Aliphatic C21-C35	0.01 0.01	0.037 0.19
BH3 (08/01/2013)	Aliphatic C12-C16 Aliphatic C16-C21 Aliphatic C21-C35 Aromatic C12-C16	0.01 0.01 0.01 0.01	0.017 0.031 0.42 0.014
BH6 (08/012013)	Aliphatic C16-C21 Aliphatic C21-C35	0.001 0.001	0.03 0.011
Reen (Upstream)	Aliphatic C16 - C21 Aliphatic C21 - C35 Aromatic C10 - C12 Aromatic C21 - C35 Fluoranthene	0.01 0.0001	0.021 0.17 0.018 0.062 0.00013

The section of the site, north or the drainage reen, has previously been subject to significant remediation works by White Young Green (WYG) in 2009. This included removal of PCB waste and associated residue in buried drums and placement of a 600mm clean capping layer.

As seen in **Table 2.2** above, the occurrence of asbestos identified by Terra Firma was limited to two locations, TP7 (chrysotile bundles at 0.2m depth) and TP6 (chrysotile bundles at 1.6m depth).

Data for asbestos testing is not available from the former WYG investigation. Only one reference to asbestos is made by WYG in a trial pit log (TP902) stating possible asbestos at 2.0-2.4m depth. This trial pit was located in the far northwest of the site. However, no remedial works proposed and undertaken by WYG were devised to specifically treat the presence of asbestos on site, suggesting no such risks to human health were identified.

2.5 Gas Monitoring

The site is underlain by made ground of up to 3.3m thickness and the north of the site was previously used as a landfill. Peat deposits are present within the underlying alluvium. Nine gas monitoring wells were installed and a programme of gas monitoring for the presence of methane, carbon dioxide and oxygen was completed

In-situ gas monitoring results were also obtained from a previous investigation completed by White Young Green (WYG).

The Terra Firma and WYG results for the site are summarised in **Table 2.4** below.

Table 2.4 In-situ Gas Monitoring Results

Monitoring Point	Max CH4 (%)	Max CO2 (%)	Max Flow Rate
White Young Green			
BH409	0.0	1.9	0.3
BH507	12.8	2.3	2.6
BH508	80.6	20.5	3.8
BH516	0.0	0.5	0.5
BH519	43.8	7.6	0.3
BH529	0.0	3.1	0.0
BH530	0.1	5.8	0.2
Terra Firma			
BH1	0.3	12.9	0.0
BH2	6.0	22.0	0.1
BH3	57.9	6.4	0.0
BH4	0.3	0.2	0.1
BH5	0.3	3.7	0.1
BH6	0.3	7.1	0.0
WS1	0.4	12.6	0.4
WS2	1.1	8.9	0.0
WS3	0.5	5.0	0.0

It is also noted that WYG recorded a maximum flow rate of 7.4l/hour on land immediately north of the site.

The in-situ gas monitoring has proven that methane and carbon dioxide gas are being released from the peat beneath the site. There is a risk of these gases entering and accumulating in all new buildings constructed on site.

CIRIA Report C665 can be used to assess the results.

Using the maximum recorded methane concentration of 80.6% and the maximum recorded flow rate of 7.4/hr, a gas screening value (GSV) of 5.96/hr is calculated, as follows:

(80.6/100) x 7.4 = 5.96/hr

When this result is compared with Table 8.5 of CIRIA report C665, the site is classified as ‘gas characteristic situation 3-4’.

2.6 Human Health and Environmental Risk Assessment

2.6.1 Human Health

It was concluded that future site users are potentially at risk from contamination in site soils through the following pathways:

- *Dermal contact with soil and soil dust*
- *Ingestion of soil and soil dust*
- *Inhalation of soil dust*
- *Consumption of site grown vegetables/fruit*
- *Ingestion of groundwater*
- *Inhalation of asbestos fibres*

The site is currently deemed to be at risk from flooding from the adjacent River Usk. As part of a flood prevention scheme the site is to be raised by a thickness of between 0.5m and 1.4m prior to development. This will be achieved by the importation of suitable fill materials.

The fill layer will effectively form a barrier between the made ground on site and site end users, acting to sever the contamination to receptor pathway.

The engineered fill is discussed in **Section 3.2.**

All garden and landscaped areas will be finished with 600mm clean imported subsoil and subsoil. Please refer to **Section 3.3**.

Recorded asbestos on site was found at depth (including below 600mm clean capping cover in the north of the site) with the exception of the location of TP7 where chrysotile was noted at 0.2m depth.

TP7 was positioned in the far southwest corner of the main body of the site. It is likely to be a result of fly-tipped material given its shallow depth and isolated occurrence.

The asbestos at this location presents a potential risk to human health.

Apart from excavation for band drains and installation of piles no existing soils on site are to be disturbed.

If any such excavations are to be undertaken at the location of TP7 then appropriate measures should be made for monitoring for airbourne asbestos fibres and management of any materials to be removed from site. This is to ensure no adverse human health risks are created. A monitoring and management plan should be reviewed and agreed with Newport City Council Environmental Protection prior to site works.

If evidence of any previously unidentified asbestos is found during site works then this should be inspected by a geo-environmental engineer and appropriate measures made to assess the risks from this asbestos prior to proceeding.

2.6.1 Human Health (Continued)

- *Inhalation of radon gas*
- *Inhalation of ground gas/landfill gas*
- *Inhalation of vapours*

Basic radon protection measures should be incorporated into all new buildings on site.

The radon/gas barrier should also be effective as a barrier to PCB vapours.

Gas protection measures are to be installed in the new development. As a minimum the following protection measures will be implemented:

- A 2000 gauge DPM/reinforced gas membrane
- Passive under-floor venting
- All joints taped and sealed

Gas protection measures are discussed in greater detail in **Section 3.4**.

- *Permeation of drinking water pipes*

Prior to the placement of water supply pipes an assessment should be made, by the water provider, of soil along the route of the pipe with reference made to the material selection criteria quoted in UKWIR Report Ref No 10/WM/03/21 ‘Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites’.

2.6.2 Aquatic Environment

The River Usk flows along the western edge of the site and is considered as the most vulnerable environmental receptor.

The petroleum hydrocarbons identified during the first groundwater monitoring round were attributed to contamination that occurred from the drilling process. Following purging of the boreholes on the second round of water sampling all hydrocarbons were below guideline values.

The hydrocarbons noted at the reen were identified up-stream but not down-stream and it was concluded that all of the determinants exiting the site and entering the River Usk from the reen were below threshold values.

Monitoring of groundwater level in boreholes in January 2014 confirmed that there was no tidal influence on groundwater in underlying gravel and no hydraulic continuity between groundwater and the River Usk.

The River Usk and hydrological environment are not therefore considered to be at risk.

However, two further rounds of groundwater sampling and testing are proposed, to be carried out in March 2014. Testing of waters collected from band drains will also be undertaken during the intended 3 month period of surcharge and settlement monitoring.

Please refer to **Section 3.7**.

SECTION 3 Proposed Site Remediation

3.1 Remediation Summary

Based on the site investigative works the following is proposed to protect construction workers and future site end users:

1. Cover of site with between 0.5m and 1.4m of imported fill (intended to raise site above flood plain).

2. Cover is to include subsoil and topsoil material in garden and landscaped areas. A minimum of 600mm of fill is required in garden and landscaped areas.

3. Monitoring and management of any soils disturbed and excavated at the location of TP7 to protect against asbestos fibres.

4. Current minimum requirements is the installation of a 2000 gauge membrane suitable for protection against ground gas, radon gas and PCB vapours in all new buildings. Passive under-floor venting and taping an sealing of all joints will also be required. Dependant on further on-site gas monitoring (see Section 3.4) more robust gas protection measures may be required.

5. New water supply pipes to be chosen in accordance with UKWIR Report Ref No 10/WM/03/21 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'.

Any unexpected ground conditions or contamination identified during site development should be inspected and appropriately investigated by a geo-environmental engineer. This may include suspension of site works until the details and severity of any contamination has been established and the potential risks to human health assessed.

3.2 Importation of Fill for Engineering Purposes

In order to raise the site to desired levels an estimated 9500m^3 of permanent material is to be imported. In addition to this additional material is to be imported to surcharge the site. The entire site is to be filled and surcharged at the same time, but working a west to east direction. The total anticipated volume to be imported it 15,000m^3.

This majority of fill material is intended to comprise 'recovered' soils sourced from other Greenhill construction sites, but quarry stone will also be used in some locations.

Fill importation will need to take into account the location of the site adjacent to the River Usk and within a SSSI. Appropriate permits will therefore need to be in place.

The material to be used is classified under permit 170504 – Soil and Stones in accordance with Environment Agency Regulatory Guidance Series No. EPR 13 'Defining Waste Recover: Permanent Deposit of Waste on Land'.

In order to assess the suitability of recovered soils from the intended source sites the materials will need to undergo appropriate screening at source.

3.2 Importation of Fill for Engineering Purposes (Continued)

It is essential that any material brought on to site will not have an impact on the underlying ground and River Usk, and that it will not present an unacceptable risk to the human health of future site end users.

All fill should as a minimum be screened for the substances listed in **Table 3.1** on the following page.

As suggested by Newport City Council Environmental Protection, the sampling frequency may be reduced if fill is sourced from a quarry or quarried supply if accompanied with recent and representative analysis which includes heavy metals.

The Human Health Guidelines are based on CLEA Guidelines published by the Environment Agency, or in their absence Generic Assessment Criteria (GAC) for a residential setting, published by the Chartered Institute of Environmental Health (CIEH).

3.2 Importation of Fill for Engineering Purposes (Continued)

Table 3.1
Soil Determinants and Guideline Values
Imported Engineered Fill Material

Determinant	Comparable Guideline Value (mg/kg)			Source
Arsenic	32			CLEA
Beryllium	51			CIEH
Boron	291			CIEH
Cadmium	10			CLEA
Chromium III	627			CIEH
Chromium VI	4.3			CIEH
Copper	2330			CIEH
Lead	450			CLEA
Mercury	170			CLEA
Manganese	-			-
Molybdenum	-			-
Nickel	130			CLEA
Selenium	350			CLEA
Zinc	3750			CIEH
Cyanide	8			CLEA
Antimony	-			-
Phenol	420			CLEA
pH (acidity)	-			-
Asbestos	Non detectable			-
	≤ 1% SOM	**≤ 2.5% SOM**	**≤ 6% SOM**	
Naphthalene	1.5	3.7	8.7	CIEH
Acenaphthylene	170	400	850	CIEH
Acenaphthene	210	480	1000	CIEH
Fluorene	160	380	780	CIEH
Phenanthrene	92	200	380	CIEH
Anthracene	2300	4900	9200	CIEH
Fluoranthene	260	460	670	CIEH
Pyrene	560	1000	1600	CIEH
Benzo(a)anthracene	3.1	4.7	5.9	CIEH
Chrysene	6.0	8	9.3	CIEH
Benzo(b)fluoranthene	5.6	6.5	7.0	CIEH
Benzo(k)fluoranthene	8.5	9.6	10	CIEH
Benzo(a)pyrene	0.83	0.94	1.0	CIEH
Dibenzo(ah)anthracene	0.76	0.86	0.9	CIEH
Benzo(ghi)perylene	44	46	47	CIEH
Indeno(123cd)pyrene	3.2	3.9	4.2	CIEH

3.2 Importation of Fill for Engineering Purposes (Continued)

Table 3.1 (Continued)
Soil Determinants and Guideline Values
Imported Engineered Fill Material

Determinant	Comparable Guideline Value (mg/kg)			Source
Petroleum Hydrocarbons				
	≤ 1% SOM	**≤ 2.5% SOM**	**≤ 6% SOM**	
Aliphatic EC >5-6	30	55	110	CIEH
Aliphatic EC >6-8	73	160	370	CIEH
Aliphatic EC >8-10	19	46	110	CIEH
Aliphatic EC >10-12	93	230	540	CIEH
Aliphatic EC >12-16	740	1700	3000	CIEH
Aliphatic EC >16-35	45000	64000	76000	CIEH
Aliphatic EC >35-44	45000	64000	76000	CIEH
Aromatic EC >5-7 (benzene)	- 65	- 130	0.33 -	CLEA CIEH
Aromatic EC >7-8 (toluene)	- 120	- 270	610 -	CLEA CIEH
Aromatic EC >8-10	27	65	151	CIEH
Aromatic EC >10-12	69	160	346	CIEH
Aromatic EC >12-16	140	310	593	CIEH
Aromatic EC >16-21	250	480	770	CIEH
Aromatic EC >21-35	890	1100	1230	CIEH
Aromatic EC >35-44	890	1100	1230	CIEH

Table Notes
- CLEA - Soil Guideline Values for residential development
- CIEH - Generic Assessment Criteria for a residential setting
- SOM - Soil Organic Matter

The tables list a general test suite of general determinants for soils although additional determinants may be recommended for situations where the donor site is known to have a former industrial land use.

3.2 Importation of Fill for Engineering Purposes (Continued)

In respect to groundwater risk it is proposed that all materials will undergo 2:1 soil leachate analysis **in accordance with BS:EN:12457** for the substances listed in **Table 3.2**. Results should be compared to the Environment Agency Guidelines.

Table 3.2
Leachate Assessment Criteria

Determinant	Comparable Threshold (mg/l)	Source
Arsenic	0.025	WFD
Cadmium	0.0002	WFD
Chromium *	0.0006	WFD
Copper	0.005	WFD
Lead	0.0072	WFD
Mercury	0.0005	WFD
Nickel	0.02	WFD
Selenium	0.01	WHO
Zinc	0.04	WFD
Cyanide	0.001	WFD
Phenol	0.0077	WFD
Chloride	N/A	-
Fluoride	0.5	DSD
Speciated PAH		
Napthalene	0.0012	WFD
Acenaphthylene	-	-
Acenaphthene	-	-
Fluorene	-	-
Phenanthrene	-	-
Anthracene	0.0001	WFD
Fluoranthene	0.0001	WFD
Pyrene	-	-
Benzo(a)anthracene	-	-
Chrysene	-	-
Benzo(b)fluoranthene	0.00003	WFD
Benzo(k)fluoranthene	0.00003	WFD
Benzo(a)pyrene	0.00005	WFD
Dibenzo(ah)anthracene	-	-
Benzo(ghi)perylene	0.000002	WFD
Indeno(123cd)pyrene	0.00002	WFD

3.2 Importation of Fill for Engineering Purposes (Continued)

Table 3.2 (Continued)
Leachate Assessment Criteria

Determinant	Comparable Threshold (mg/l)	Source
Petroleum Hydrocarbons		
Aliphatic EC >5-6	-	-
Aliphatic EC >6-8	-	-
Aliphatic EC >8-10	-	-
Aliphatic EC >10-12	-	-
Aliphatic EC >12-16	-	-
Aliphatic EC >16-35	-	-
Aliphatic EC >35-44	-	-
Aromatic EC >5-7 (benzene)	0.008	WFD
Aromatic EC >7-8 (toluene)	0.04	WFD
Aromatic EC >8-10 (xylene)	0.03	WFD
Aromatic EC >10-12	-	-
Aromatic EC >12-16	-	-
Aromatic EC >16-21	-	-
Aromatic EC >21-35	-	-
Aromatic EC >35-44	-	-

Table Notes

- WFD – Water Framework Directive threshold for coastal and transitional waters/other waters (annual average)
- World Health Organisation threshold for drinking water (in absence of WFD threshold)
- DSD – Dangerous Substances Directive saltwater annual average (in absence of WFD threshold)
- *Threshold for Chromium VI
- - No guideline available

The number of representative samples of the fill that will require analysis will depend on the volume and number of sources.

For a total volume of 15,000m^3 to test according to 'Requirements for the Chemical Testing of Imported Materials for Various End Uses and Validation of Cover Systems' would have huge cost implications.

We therefore propose that for each 250m^3 (or part of) that 1 representative sample be taken for screening (although the final number will also be dependent on the number of sources).

As suggested by Newport City Council Environmental Protection, the sampling frequency may be reduced if fill is sourced from a quarry or quarried supply if accompanied with recent and representative analysis which includes heavy metals.

3.3 Importation of Soils for Gardens and Landscaped Areas

All garden and landscaped areas will be finished with both imported subsoil and topsoil upon development, measuring 600mm in thickness.

For all imported soils appropriate certification should be provided by the supplier as well as details of the soil source.

All imported material should be chemically screened to ensure its suitability for use in accordance with the Welsh Land Contamination Working Group 'Requirements for the Chemical Testing of Imported Materials for Various End Uses and Validation of Cover Systems'.

Ideally imported soils should be stockpiled upon site for sampling. Any stockpiled soils should not be dispersed on site until test results have been received and soil suitability confirmed.

Typically, per source, 4 representative samples should be screened for a volume between $20m^3$ and $250m^3$. For volumes exceeding $250m^3$, 4 samples per $250m^3$ should be analysed.

Should the imported soils already have been put down in garden and soft landscaped areas before sampling the number of samples required should be calculated according to the volume imported.

Once in place validation of the 600mm thickness will be required. This should comprise the hand excavation of a trial hole in 1 in 3 gardens and photographic evidence documenting measurement to the full depth.

Test results should be compared with residential Soil Guideline Values (SGVs) sourced from The Environment Agency Contaminated Land Exposure Assessment (CLEA). Where SGV values are not available reference should be made to Generic Assessment Criteria (GAC) for a residential setting provided by Land Quality Management Limited and the Chartered Institute of Environmental Health (CIEH).

3.3 Importation of Soils for Gardens and Landscaped Areas (Continued)

The required testing is detailed in **Table 3.3** below.

Table 3.3
Soil Determinants and Guideline Values
Imported Soils

Determinant	Comparable Guideline Value (mg/kg)			Source
Arsenic	32			CLEA
Boron	291			CIEH
Cadmium	10			CLEA
Chromium III	627			CIEH
Chromium VI	4.3			CIEH
Copper	2330			CIEH
Lead	450			CLEA
Mercury	170			CLEA
Nickel	130			CLEA
Selenium	350			CLEA
Zinc	3750			CIEH
Cyanide	8			CLEA
Phenol	420			CLEA
pH (acidity)	-			-
Asbestos	Non detectable			-
Speciated PAH				
Napthalene	1.5	3.7	8.7	CIEH
Acenaphthylene	170	400	850	CIEH
Acenaphthene	210	480	1000	CIEH
Fluorene	160	380	780	CIEH
Phenanthrene	92	200	380	CIEH
Anthracene	2300	4900	9200	CIEH
Fluoranthene	260	460	670	CIEH
Pyrene	560	1000	1600	CIEH
Benzo(a)anthracene	3.1	4.7	5.9	CIEH
Chrysene	6.0	8	9.3	CIEH
Benzo(b)fluoranthene	5.6	6.5	7.0	CIEH
Benzo(k)fluoranthene	8.5	9.6	10	CIEH
Benzo(a)pyrene	0.83	0.94	1.0	CIEH
Dibenzo(ah)anthracene	0.76	0.86	0.9	CIEH
Benzo(ghi)perylene	44	46	47	CIEH
Indeno(123cd)pyrene	3.2	3.9	4.2	CIEH

Table Notes

- CLEA - Soil Guideline Values for a residential development
- CIEH - Generic Assessment Criteria for a residential setting, developed as Land Quality Management by the Chartered Institute of Environmental Health
- SOM – Soil Organic Matter

3.4 Gas and Vapour Protection

The site has been classified as 'gas characteristic situation 3-4' in accordance with Table 8.5 of CIRIA Report C665.

The action of piling through underlying peat deposits and installing band drains will potentially open up preferential gas pathways, but the alluvial deposits between the peat and made ground can be expected to settle and seal around the piles and drains considerably minimising this risk.

Taking the above into consideration, gas protection measures in line with 'gas characteristic 2' may prove adequate to prevent the risk from ground gas to future site residents.

Table 8.6 of the CIRIA report confirms that for gas characteristic 2 sites, the following precautions are required:

- A 2000 gauge DPM/reinforced gas membrane
- Passive under-floor venting
- All joints taped and sealed

As a minimum these protection measures will be implemented. However, further on-site gas monitoring from already installed wells and from flux boxes is to be undertaken during development to confirm that this level of protection will be suitable.

It is proposed that following the installation of band drains (upon a 2.5m spaced grid) and engineered fill, during the period of surcharge and settlement monitoring, 10 flux boxes will be placed across the site and monitored on a fort-nightly basis for a period of 3 months.

Further flux box testing will be carried out once piling has commenced. The frequency and sampling locations will be considered once the piling schedule has been determined.

Should further monitoring identify concentrations of methane and/or carbon dioxide and flow rates beyond 'gas characteristic 2' criteria then more robust protection measures will be necessary.

In accordance with Table 8.6 of the CIRIA report, potential further protection measures could include:

- Proprietary gas resistant membrane
- Positively pressurised underfloor sub-space
- In-ground venting and venting wells

The results of all additional monitoring and consequent gas protection recommendations will be presented to Newport City Council for review.

The client will also provide details on proposed validation testing of the gas mitigation measures.

All test certification will be issued to Newport City Council prior to occupancy.

The radon/gas barrier should also be effective as a barrier to PCB vapours.

3.5 Asbestos Management and Monitoring

If excavations are to be undertaken at the location of TP7 prior to site fill works then appropriate measures should be made to ensure there are no risks to construction workers and neighbouring site occupants/users.

Monitoring for airbourne asbestos fibres would be required, including along the boundary of the site. A strategy should also be put in place to deal with any fibres, should they be detected.

Any materials to be removed from site should be appropriately managed to mitigate all potential risks.

If required, a strategy for monitoring asbestos and removing materials should be drawn up and approved by Newport City Council Environmental Protection prior to site works.

The details and data from any monitoring etc should be compiled and reported to Newport City Council Environmental Protection.

3.6 Potable Water Supply

Details of the proposed drinking water supply pipes should be supplied to Newport City Council for approval prior to development.

The UKWIR Report Ref No 10/WM/03/21 ‘Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites’ should be consulted.

3.7 River Usk and Groundwaters

Groundwater and reen water testing to date has not identified a risk to the River Usk. No hydraulic continuity between the river and groundwater has been identified.

In order to increase confidence that groundwater will not present a risk to the aquatic environment further assessment is proposed.

As a minimum this will entail two rounds of groundwater monitoring during March 2014 using eight existing wells on site.

There are five accessible deep wells, where groundwater within the underlying stiff red clay and mudstone bedrock are targeted in two wells, a sand and gravel horizon targeted in one well, and the underlying peat and alluvium being the area of response in two wells. Three shallow wells have response zoned within the made ground only.

The results from this monitoring will be assessed and reported to both Newport City Council and National Resources Wales in due course.

Should the results highlight an outstanding concern in groundwater quality further sampling or remedial measures will be agreed with Newport City Council and National Resources Wales as appropriate.

3.7 River Usk and Groundwaters (Continued)

During site fill and the 3 month period of surcharge and settlement monitoring water from band drains is to be directed to a specific collection point on site.

During this period it is proposed that a water sample is taken and tested from the collection point at intervals. Initially samples will be taken on a weekly basis for the first month, with further samples taken over the subsequent two months on a fort-nightly basis.

SECTION 2 Validation Report

All remedial works should be documented and details compiled in the form of a Validation Report. This should be submitted to Newport City Council and National Resources Wales for review.

The Validation Report should include, but not limited to, the following:

1. Details of source of imported material including imported stone/aggregate
2. A record of the number of soil sources, their origin, and their respective volumes
3. Chemical certificates for fill imported for engineering purposes
4. Chemical certificate for imported garden soils where available from the provider
5. Chemical tests results for garden and landscaped soils once tested on site
6. Validation of the 600mm capping thickness in garden and landscaped areas including photographs
7. Details of the gas protection measures employed, including photos, test results and certificates.
8. Data from any asbestos monitoring carried out
9. Records of any materials removed from site
10. Records of the flux box testing for methane gas