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|--------------|-----------------------------------|
| Report type: | Remediation Method Statement      |
| Site:        | Kings Road, Spalding              |
| Client:      | Reliant Building Contractors Ltd. |
| Ref:         | GRM/P7343/RMS                     |
| Date:        | May, 2016                         |

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KINGS ROAD, SPALDING

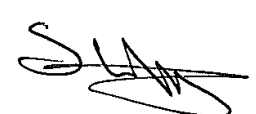
## REMEDIATION METHOD STATEMENT FOR RELIANT BUILDING CONTRACTORS LTD

**Project Ref:**  
P7343

**Date:**  
May 2016

**Prepared for:**  
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This report has been prepared in accordance with GRM's Accredited Quality Procedures

|                                                                                     |                                                                                      |
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## **1 INTRODUCTION**

### **1.1 PREAMBLE**

GRM Development Solutions Ltd (GRM) was instructed by Reliant Building Contractors Ltd. (Client) to produce a Remediation Method Statement for the re-development of the site at Kings Road, Spalding with residential properties. A Proposed Development Layout Plan presented in Appendix B.

The following reports have been used in the preparation of this document:

- Desk Study at Kings Road, Spalding for Reliant Building Contractors Limited, Desk Study by Sub Surface South East Ltd. report ref: No.SE1144, dated December 2008.
- 'Phase II Site Appraisal, Kings Road, Spalding' for Reliant Building Contractors Ltd, by GRM, Ref: GRM/P7343/F1, dated April 2016.

GRM have assumed that the Sub Surface report has been assigned and can be relied upon.

GRM Standard Limitations of Reporting are provided in Appendix A of this report.

### **1.2 OBJECTIVES OF THIS ASSESSMENT**

The principal aims of the Remediation Method Statement were as follows:

- a) Set out the remediation and validation processes to be followed on site to ensure the site developed does not pose a risk to human health and controlled waters.

Whilst every effort has been made to pre-empt the likely requirements of the Local Authority and the Environment Agency, they are likely to have specific requirements that will need to be discussed and addressed at a later date.

## **2 SUMMARY PHASE I DESK STUDY AND SITE OBSERVATIONS**

The site is located 325m north east of Spalding Railway Station. The National Grid Reference (NGR) for the approximate centre of the site is TL 276 963. Site Location and Site Boundary Plans are provided in Appendix C. The site covers an area of approximately 1.23Ha and comprises an irregular shaped plot. The boundaries are formed by a car garage and associated yard to the north, by Kings Road to the south, to the east by residential properties and by common land owned by network rail and railway tracks beyond. The site is generally level.

The site is currently used as a BT storage depot in the south eastern half of the site, with the northern half of the site previously had mature trees and dense vegetation that required clearance, which has been done recently.

Historically the site was undeveloped until circa 1950 when the current BT storage depot is shown on the site. This remains the same to the present day, with the western half of the site historically been part of the adjacent railway sidings, though no tracks are recorded to have been on site.

Before carrying out the siteworks, GRM were provided with buried service plans for the BT storage depot by BT. These identified buried fuel storage tanks located in the centre of the depot area. The condition, extent or if they had been previously decommissioned was not known.

### **3 SUMMARY PHASE II INVESTIGATION AND RISK ASSESSMENT**

#### **3.1 GROUND INVESTIGATION**

GRM undertook a ground investigation in January 2016. The results are found within the GRM Phase II Site Appraisal, dated April 2016, (GRM/P7343/F1).

The geology recorded during the investigation comprised Made Ground consisting of granular and cohesive soils, underlain by superficial Tidal Flats deposits consisting of soft clay and silt. The BT storage depot is mainly hardstanding at the ground surface comprising a mixture of concrete and tarmac. The BGS record the bedrock as Oxford Clay Formation at approximately 20m depth, however the investigation so far did not identify any solid geology. The Made Ground consists of asphalt and concrete over a granular sub-base material containing chunks of tarmac. Generally limited amounts of made ground soils were identified across the site, with TP01 recording 2.60m depth of made ground but generally across the site the other exploratory holes recorded less than 0.50m. TP08 and TP09 were located adjacent to TP01 to delineate the area of deeper made ground and both recorded approximately 1.50m of made ground soils.

The investigation works comprised the excavation of nine trial pits and six window samples over a general grid with WS02 and WS03 targeted at the buried fuel tanks identified on the service plans provided to GRM by BT.

Chemical analysis of the soils surrounding the buried fuel tanks revealed no significantly elevated hydrocarbon concentrations. Additionally no visual or olfactory evidence of contamination was recorded in the adjacent exploratory holes. However, whilst no gross hydrocarbon contamination was observed it is likely that some areas of localised contamination will be present given the anticipated age of the tanks. As part of the proposed development of the site, the tanks will require to be removed. During the tank removal process, the walls and base of the excavation should be validated with chemical analysis to determine if all contaminated soils have been removed.

It should be noted the fuel tanks were not in use at the time of the siteworks, and appeared that all vent pipes and pumps had been removed.

In TP01, a significant thickness of made ground was identified and hydrocarbon odours were encountered below the made ground in the top of the natural soils and within the groundwater encountered.

Asbestos cement sheeting on the ground surface was also recorded adjacent to TP07 in the north east corner with some small piles of general construction waste. A sample of this was tested and confirmed the presence of bound chrysotile fibres.

During the investigation, the BT storage depot was still operational, and therefore the buildings present were still all in use and in accessible. Accordingly, the GRM Site Appraisal Report also recommends additional works post demolition of the buildings to assess any further remediation requirements.

### 3.2 GROUND GAS RISK ASSESSMENT

As the ground investigation has identified limited thicknesses of made ground, with only small isolated sources of contamination, gas monitoring has not been undertaken. However; given the recorded presence of organic material (thought to be decomposing wood / reads etc.) within the Tidal Flats Deposits and the organic nature of the Tidal Flats Deposits posing a potential source of ground gases, it is recommended that gas protection measures are utilised for all proposed buildings.

Therefore, the site has been assessed as 'Characteristic Situation 2' as outlined BS8485:2015 for which gas protection measures are required.

Therefore, the gas protection measures should comprise:

- Pre-cast (beam and block) floorslab, a suitable gas resistant membrane, underfloor venting and sealed joints/service entries.

Additionally, due to the permeable nature of the underlying natural soils, isolated pocket of identified hydrocarbon contamination, potential contamination from buried fuel tanks and shallow natural groundwater, a hydrocarbon/VOC resistant membrane is recommended in the area of identified contamination (TP01) and potential contamination (buried fuel tanks) to protect the end users from the remnant risk of vapours in the near surface soils.

A gas protection verification plan will be produced as a separate document in order to confirm that the all gas protection measures were designed, installed by a specialist contractor and verified in accordance with BS8485:2015 and CIRIA C735 (2014).

### 3.3 HUMAN HEALTH RISK ASSESSMENT

#### On-site – Human Health

The ground investigation to date has revealed an area of hydrocarbon contamination on the western side of the site, present in TP01 from 2.60m to 3.0m below the existing ground level. The works have also shown that limited amounts of asbestos cement sheeting is also present within small piles of general construction rubble in the north eastern area of the site. The investigation also identified the BT storage depot to be mainly laid to concrete and tarmac hardstanding with a layer of sub-base beneath. Locally pieces of tarmac were observed to be mixed with the sub-base.

The samples of site won topsoil analysed revealed that there is the potential for reuse elsewhere on the development in gardens and soft landscaping. However, given the possibility for mixing with contaminated soils during the development of the site, the topsoil should be stockpiled and subject to additional chemical analysis to confirm its suitability for reuse.

A plan showing the apparent extent of the contamination is presented in Appendix D.

Consequently it is considered that the identified soil contamination and potential contamination from the buried fuel tanks pose a significant risk to human health and remedial works will be required.

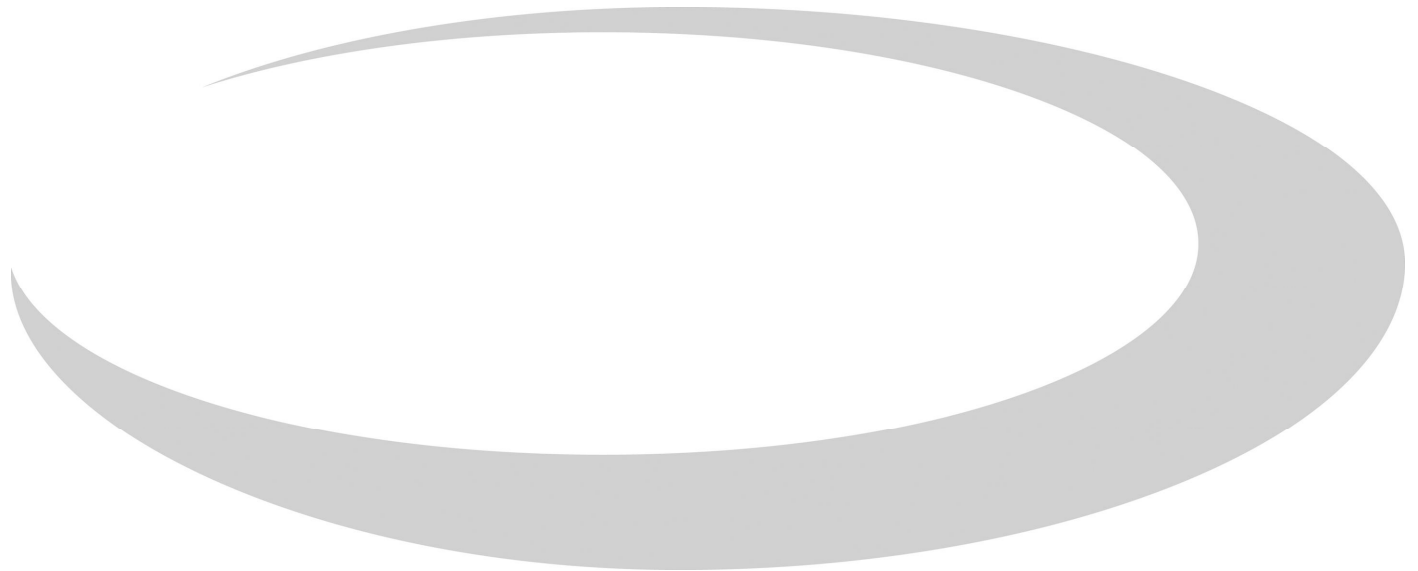
### **3.4 CONTROLLED WATERS RISK ASSESSMENT**

For controlled waters, the Environment Agency classified the superficial Tidal Flats deposits as a Non-aquifer.

There are two recorded surface water features on site, both being unnamed culverted drains running east to west across the centre of the site.

The primary receptors for the site have been identified as the culverted drains running across the site. Accordingly, the risk posed to controlled waters from the identified soil contamination and buried fuel tanks is assessed as moderate.

The Phase II Conceptual Model (pre-demolition) is presented on the following page.



## Phase II Conceptual Model (pre-remediation)

| HUMAN HEALTH                                                                                                |                                                                                                                                                                                                                                            |                                     |                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Source                                                                                                      | Pathway                                                                                                                                                                                                                                    | Receptor                            | Remedial Solution                                                                                                                  |
| Locally elevated levels of hydrocarbons in made ground and locally in natural strata and buried fuel tanks. | Indoor and outdoor inhalation of soil/soil dust and vapours, ingestion of, and dermal contact with contaminated soil and soil dust, ingestion of vegetables that have taken up contamination and contaminated soil attached to vegetables. | End users.                          | Source removal of contaminated soils, buried fuel tanks and associated infrastructure.                                             |
|                                                                                                             |                                                                                                                                                                                                                                            | Construction workers.               |                                                                                                                                    |
| Made ground, organic material within natural strata.                                                        | Inhalation of carbon dioxide and methane.                                                                                                                                                                                                  | End users.                          | Allow for gas protection measures to be required (Scope to be confirmed).                                                          |
| Potential asbestos containing materials existing with buildings and identified sheeting adjacent TP07.      | Inhalation.                                                                                                                                                                                                                                | Construction workers and end users. | Survey and removal by specialist contractor.                                                                                       |
| Elevated levels of hydrocarbons in made ground.                                                             | Migration of contamination through leaks and joints, degradation of water pipe materials.                                                                                                                                                  | End Users.                          | PE water supply pipes and clean backfill required post removal of contamination sources (to be confirmed by water supply company). |
| CONTROLLED WATERS                                                                                           |                                                                                                                                                                                                                                            |                                     |                                                                                                                                    |
| Elevated levels of hydrocarbons in made ground and locally natural soils and underground fuel tanks.        | Leaching of contaminants and lateral migration to the surface water.                                                                                                                                                                       | Drain (surface water).              | Source removal of contamination identified in TP01 and removal and validation of fuel tanks and infrastructure.                    |

## **4 REMEDIAL STRATEGY**

The works outlined below are those considered necessary to commence the development of the site.

### **4.1 REMEDIATION AND VALIDATION**

#### **4.1.1 Remedial Strategy For Human Health**

##### **Soil Contamination**

Contaminated made ground and natural materials have been identified within the area of TP01, in the western part of the site, as shown on the plan included in Appendix D. In order to protect human health it is proposed to undertake the following:

- Excavation of the hydrocarbon impacted soils located around TP01 and chase out any additional contamination identified.
- Removal and validation of buried fuel tanks.
- Break out of all hardstanding and together with layer of granular sub-base beneath.
- Post demolition investigation of ground beneath the existing buildings.
- Segregation of contaminated soils for off-site disposal and near surface made ground potentially suitable for re-use on-site.
- Validation of the sides and base of the excavation following the removal of the contaminated soils.
- Capping of gardens with a clean cover system.

The TPH contaminated soils were encountered between depths of 2.60m and 3.00m in TP01. The impacted soils will be excavated to the full depth within the area beneath the proposed building footprints. Soils will be excavated across the area of the proposed rear gardens, as required in order to facilitate the installation of a clean capping layer. For budgetary purposes, an allowance should be made for the removal of 75m<sup>3</sup> of hydrocarbon impacted soils in total, including from the area around TP01 and from soils around the fuel tanks.

Following the excavation TPH impacted soils each face and the base of the resultant excavation will be initially screened using the PID and subsequently validated with samples taken and sent for chemical analysis.

Once validation of the excavation is complete, the area will be backfilled with clean suitable site-won materials to the formation level for the redevelopment.

The extent of the contamination excavation is included in Appendix D.

Materials being excavated will be segregated based upon a visual and olfactory inspection for Volatile Organic Compound (VOC) by screening using a PID. Materials grossly impacted by TPH are not suitable for retention on-site and require offsite

treatment/disposal. It is intended that the majority of the grossly contaminated TPH soils will be excavated directly into wagons and sent to an appropriate off-site facility if required. A limited volume of TPH contaminated materials will be temporarily stockpiled in a bunded and lined cell prior to off-site disposal.

Where there is no visual/olfactory evidence of contamination within the materials overlying the TPH hotspot these materials will be excavated, segregated and retained on-site for future re-use, following VOC screening with a PID and confirmatory chemical analysis.

The decision as to whether or not the material will be reused on-site will be made by the remediation contractor together with GRM, following receipt of the results of the chemical analysis.

The excavated materials will be stockpiled separately in designated areas of the site. Contaminated materials that will be stockpiled temporarily on-site will be placed on a plastic membrane and covered over.

The hardstanding within the BT storage depot consists of consists of a mixture of concrete and tarmac. As part of the development process this will be broken out and with the underlying sub-base material and stockpiled where it may be used beneath hardstanding or disposed of off-site.

#### **Underground Tanks Removal**

- Removal and validation of the underground tanks and associated infrastructure, located approximately in the centre of the BT Storage compound.

As the condition, extent or if any treatment has taken place of the tanks is not known, it is assumed they are untreated as a worst case scenario.

Prior to removal of the underground tanks the contents inside will be pumped out into a tanker and disposed off-site to a suitable waste facility (not necessary if they have been already treated). The tanks will then be removed and the resultant sides and base will be inspected for visual or olfactory evidence of contamination. This process will be supervised by GRM. Should contamination be present, these materials will be excavated and disposed/treated off-site. Following the removal of any hydrocarbon contaminated soils the sides and base will be validated with one sample taken for each face and the base.

Following the validation of the excavation the area can be backfilled with site-won materials proven to be suitable for use on-site.

#### **Capping Garden Areas**

- Within the areas of TPH contamination a clean capping layer of 600mm thickness will be required.
- For other garden and landscaping areas where contamination has not been identified it is recommended that 300mm of topsoil will be sufficient to provide a suitable growing medium.

- Remedial measures below hardstanding and houses are considered not to be necessary.

#### **4.1.2 Remedial Strategy For Human Health (Ground Gas)**

As covered in Section 3.2, the site should be assessed as 'Characteristic Situation 2' and will require gas protection measures. In addition, it is recommended that a VOC resistant membrane is allowed for in plots in the areas of the identified hydrocarbon contamination in TP01 and the buried fuel tanks.

A gas verification plan will be provided separately.

#### **4.1.3 Remedial Strategy For Controlled Waters**

It is considered that the remediation detailed above will remove any remnant risk to controlled waters.

#### **4.1.4 Remedial Strategy For Construction Materials**

Due to the elevated TPH contaminated soils protection of PE/PVC pipes will be required for water supply pipes as suggested under current UKWIR guidance. It is recommended that the local water supply company be contacted to confirm to their requirements.

#### **4.1.5 Post Remediation Validation**

##### **Contaminated Soils**

Validation of the resultant excavations will comprise a minimum of one sample per side and base will be taken, if the excavation exceeds 10m in length or greater than 5m in depth, two samples will be taken from each side and the base. The samples will be sent to a UKAS Accredited laboratory for a validation suite of testing including petroleum hydrocarbons and chlorinated solvents. The results will be compared against the GRM Remedial Targets based upon the Tier 1 Assessment Criteria for residential end-use with plant uptake (Appendix E).

##### **Underground Tanks**

Following the removal of the underground tanks, the sides and base will be validated with a minimum one sample taken from each side and base. The samples will be analysed for petroleum hydrocarbons and VOCs. The results will be compared against the GRM Remedial Targets as shown in Appendix E.

#### **4.1.6 Validation Reporting**

Once the remediation detailed is complete, a validation report will be produced and include confirmation of the removal of the identified contaminated soils. Chemical validation analysis of the hotspot and tank areas and confirmation of the suitability for use of clean backfill materials will be included. Additionally, copies of haulage notes confirming the export of excavated soil and disposal of the contaminated water from the tank will also be required.

The verification of the gas protection measures will be outlined in a separate report.

## 5 **FURTHER WORKS**

It is considered that further works are necessary these include;

- Installation and validation of the gas protection measures within the proposed properties.
- Additional ground investigation in the footprint of the existing buildings, during demolition with subsequent reassessment of the risk to human health and controlled waters.
- Stockpiling of the site won topsoil and additional chemical analysis to determine its suitability for reuse on site.



# A P P E N D I X A

**GRM Development Solutions provides  
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## GENERAL APPRAISAL COMMENTS

### **i INFORMATION SOURCES**

Where available the following sources have been used for the identification and assessment of potential ground hazards:

- Relevant British Standards
- British Geological Survey (BGS) Geology Map Scale 1:10,000 for local area
- British Geological Survey (BGS) Geology Map Scale 1:50,000/1:63,320
- BGS Memoir
- BGS Borehole Records
- Environment Agency Groundwater Vulnerability Maps
- Historical Ordnance Survey (OS) Maps
- Environmental Data Report
- Environment Agency Website: <http://www.environment-agency.gov.uk/>
- Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR, 2010.
- Coal Authority Records / Coal Mining Report
- DEFRA/Environment Agency Contaminated Land publications and DoE Industry Profiles
- BRE Guide BR211 (2007), 'Radon: Guidance on protective measures for new buildings'
- HPA-RPD-033 (2007), 'Indicative Atlas of Radon in England and Wales'
- NRPB Publication W26 (2002), 'Radon Atlas of England and Wales'
- CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'
- Other technical references used throughout this document are detailed in the text.

### **ii CONTAMINANTS OF CONCERN**

The DoE Industry Profiles are normally used to assess likely contaminants from past land use and potential nearby industrial sources. For land uses where no profile is available, likely contaminants of concern are selected by GRM based on past experience of similar sites, a general screening suite of contaminants covered by CLEA and common contaminants from the Industry Profiles.

- |            |                   |                                          |
|------------|-------------------|------------------------------------------|
| • Arsenic  | • Copper          | • Water soluble sulphate                 |
| • Cadmium  | • Nickel          | • PAH (polycyclic aromatic hydrocarbons) |
| • Chromium | • Zinc            |                                          |
| • Lead     | • Phenols         |                                          |
| • Mercury  | • cyanide (total) |                                          |
| • Selenium | • pH              |                                          |

Asbestos and PCBs are listed in the vast majority of profiles. PCBs are listed as the profiles expect electricity substations and switch boxes on all industrial sites. There is the potential for asbestos containing material to be mixed up with made ground, following any demolition works.

### **iii CONCEPTUAL MODEL METHODOLOGY**

The consideration of contamination is based upon the principles of risk assessment, using the 'source-pathway-receptor' model in order to establish the presence, or potential presence, of a pollutant linkage.

To create a risk, contamination must have the potential to cause harm to susceptible targets or receptors such as humans, the water environment or the built environment. The potential for harm to occur requires three conditions to be satisfied to form a pollutant linkage:

- The presence of substances that may cause harm (SOURCE).
- The presence of a target which may be harmed (RECEPTOR).
- The existence of a plausible migration route between the source and the receptor (PATHWAY).

In the absence of a plausible pollutant linkage there is no risk. Where a potential linkage is identified in order for it not to pose a risk to the identified receptor it must be broken.

#### **iv INTRUSIVE INVESTIGATION SAMPLING METHODOLOGY**

The ground investigation (including fieldwork, sampling, monitoring and laboratory analyses) has been designed to identify and assess potential ground related problems and to allow cost effective solutions to be advised. It has been planned on the basis of the desk study, site inspection and the proposed development layout (where available). All fieldwork and soil descriptions were carried out in general accordance with relevant British Standards.

The exploratory holes have been positioned and advanced to depths to determine the general ground/groundwater/gas conditions below the site. A general grid pattern has been adopted, where possible, to provide sufficient information based on the current proposed layout scheme. Some holes have been targeted at particular hazards identified in the Phase I assessment. The resultant exploratory hole density is considered to be commensurate with the complexity of the site conditions and detail of information required for this phase of the investigation.

#### **v GROUND GAS RISK ASSESSMENT METHODOLOGY**

Gas monitoring programmes undertaken by GRM are designed to broadly comply with the recommendations outlined in CIRIA Report C665 'Assessing risks posed by hazardous ground gas to buildings' (2007).

To assess the risks posed by ground gases such as radon, carbon dioxide and methane, the relevant current guidance has been used. For radon the site has been assessed following the guidelines in 'Radon: guidance on protective measures for new dwellings (BR211: 2007)'. For methane and carbon dioxide the primary guidance document used to determine if protection measures are required is CIRIA Report C665 'Assessing risks posed by hazardous ground gases to buildings' (2007). This uses Gas Screening Values (GSVs), which are gas concentrations multiplied by borehole flow rate, along with additional limiting factors (such as maximum methane concentrations) to classify the gas regime of a site.

The guidance document includes two methods of characterising a site. The main method 'Situation A' is based on work by Wilson and Card and is used for all types of development except low rise housing that meets the assumptions of 'Situation B'. The 'Situation B' method proposed by Boyle and Witherington for the NHBC assumes all properties have pre-cast suspended floors (beam and block) with ventilated underfloor voids.

Where flow is not recorded during the monitoring a default flow rate of 0.1l/hr will be used in the assessment to produce a positive result.

#### **vi HUMAN HEALTH RISK ASSESSMENT METHODOLOGY**

Guidance contained in the Environment Agency's CLEA Report has been used to assess the risks posed to human health.

For residential developments that include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land with plant uptake' are used, i.e. a female with a start age class of one and an end age class of six. All pathways are considered including the consumption of home-grown vegetables.

For residential developments that do not include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land without plant uptake' are used, i.e. a female with a start age class of

one and an end age class of six. All pathways are considered except the consumption of home-grown vegetables.

For commercial/industrial developments the default Tier 1 Assessment Criteria (TAC) for 'commercial/industrial' are used, i.e. a female with a start age class of sixteen and an end age class of eighteen. All pathways are considered except the consumption of home-grown vegetables.

The TAC used by GRM include Soil Guideline Values (SGV) published by the EA, values calculated by GRM using the CLEA v1.06 risk assessment and values and chemical data developed by LQM/CIEH. The TAC used in the assessment are selected based on the lowest site specific SOM values returned as part of the chemical analysis.

Where soil chemical analysis results are found to exceed the TAC, Site-Specific Risk Assessments may be undertaken using the CLEA v1.06 risk assessment software using the age classes and pathways described above.

## **vii RISK TO SITE WORKERS – GENERAL COMMENTS**

The risks to site workers are similar to those posed to site end users, although likely to be less severe due to the site workers' shorter exposure to the identified contamination. However, site workers (particularly groundworkers) are more likely to come into direct contact with contaminated soils due to the nature of their work. On this basis ground and construction workers should be provided with basic Personal Protective Equipment based on the site's general health and safety risk assessment, but including as a minimum safety footwear, gloves and overalls.

A site specific risk assessment should be carried out for all hazards identified within the ground investigation in accordance with current health and safety legislation. This assessment should identify any measures required to further reduce risks i.e. providing further Personal Protective Equipment, welfare facilities and if necessary preventing access to certain areas.

Demolition and dismantling of existing structures on the site must be carried out to a safe and acceptable standard, in accordance with current UK guidance and best practice. Whilst not ground related, asbestos and hazardous substances surveys should be conducted prior to any demolition.

Any unusual colours, odours and suspicious ground should be reported immediately to site management and then GRM.

Whilst this appraisal has considered the long-term effects of contamination, GRM can also help during the formulation of Health and Safety documentation, if required.

## **viii CONTROLLED WATERS RISK ASSESSMENT METHODOLOGY**

Where the desk study and fieldwork do not reveal a potential source of contamination no leachate or groundwater testing will be performed. Where a potential source is identified the testing will comprise leachate testing on the material considered most likely to pose a risk, groundwater testing will be undertaken if water is present at shallow depth.

The UK Drinking Water Standards (UKDWS) or Environmental Quality Standards (EQS) are usually adopted for comparison with the leachate/groundwater test results. When the most sensitive receptor is considered to be the an aquifer (groundwater) UKDWS will be adopted as the Initial Tier 1 screening values. Where the most sensitive receptor is a surface water feature the EQS values will be used as Initial Tier I Screening values.

## **ix CONSTRUCTION MATERIALS RISK ASSESSMENT METHODOLOGY**

The 'screening levels' adopted for the assessment of risk to construction materials are taken from the following documents:

- UK Water Industry Research (UKWIR) Contamination thresholds for sub-surface water pipes, for the protection of buried pipes.
- Building Research Establishment (BRE) Special Digest SD1 (2005), 'Concrete in Aggressive Ground', for the protection of buried concrete.

## **WASTE DISPOSAL AND SITE WASTE MANAGEMENT PLANS**

Under current Waste Management Regulations, waste soil materials produced from the site will require characterisation to enable it to be disposed of correctly.

The chemical analysis results included in this report should be provided to the relevant landfill operators to establish the characterisation of the waste, confirm its suitability for landfill disposal and provide estimated costings. If material is classified as hazardous, then the site will need to be registered with the Environment Agency prior to the movement of the waste. Depending on the receiving landfill's current permit, further chemical analysis, incorporating Waste Acceptance Criteria (WAC) leachate analysis, may be required.

All materials removed from the site will be classified as 'waste' and therefore must be removed by a suitably licensed carrier of waste. This applies whether or not the waste is contaminated. All waste removed to landfill will attract Landfill Tax.

The developer/builder is likely to be classed as the waste producer and therefore, has a duty of care to ensure that all waste is disposed of appropriately. This includes ensuring the waste carrier is licensed and disposes of the waste to a suitably licensed landfill site. They are also required to keep a paper trail from 'cradle to grave' including copies of the waste disposal tickets.

Efficient materials management on site is recommended as it can lead to significant cost savings when compared to the traditional side casting or single stockpile of arisings. Likewise making the site as volume neutral as possible will reduce the costs of development.

Site Waste Management Plans allow better waste management practices, help to reduce the amount of waste produced and identify best environmental disposal options. Implementing a Site Waste Management Plan (SWMP) can reduce costs (increasing business profits) and maximise resource efficiency.

SWMPs are a legal requirement for all projects with an overall development cost of over £300k. GRM can assist in the production of SWMPs which comply with the Code of Practice and identify best environmental disposal options when dealing with waste.

## **GEOTECHNICAL ASSESSMENT GENERAL COMMENTS**

Where finished floor levels of proposed structures have not been provided by the Client, then for the purposes of initial assessment, GRM will assume that finished levels will not vary appreciably from the existing ground levels. If the depths of any underground engineering works (i.e. sewers, pumping stations etc.) are unknown they will not be taken in to account in the assessment and it will be assumed that any such works will not compromise foundation or ground stability.

Should the development proposals or finished levels be different from these assumptions then the comments/recommendations in the Geotechnical Assessment may require revising.

It should be noted that the results of window sampling and/or cable percussive boreholes may not give a true indication of a soils actual engineering properties (i.e. stability, mass structure etc). GRM consider that that prior to development trial pitting should be undertaken to confirm the recommendations in the Geotechnical Assessment.

## **GEOTECHNICAL ASSESSMENT – ENGINEERING GROUND TREATMENT**

Near surface soils have the potential to be disturbed by weathering and site traffic. Precautions should always be taken to avoid this, as excessive disturbance may lead to more onerous floor slab designs, road cap thickness and increased amounts of off site disposal etc.

Near surface soils may need treatment or reinforcing to allow safe movement of construction plant and labour. An assessment by the contractor should be undertaken once the type of machinery/plant needed to complete the development is known.

**GEOTECHNICAL ASSESSMENT – EXCAVATIONS**

Excavation instability (over-break) can result in damage to existing services or structures (e.g. foundations, roads or boundary walls/fences) both on and off-site, as well as increased foundation concrete costs. In order to minimise this, all excavations deeper than 1.2m deep (or any excavation within 1.5m of any existing structure or service) should be supported. Full support should be provided to the full depth of all near vertically sided excavations in made ground, soft and very soft clays and granular soils. A reduction to intermediate support should be acceptable within firm and stiffer natural clays.

Wherever possible, man entry into excavations should be prevented; however, where this is not possible, entry to, and time spent in, excavations should be kept to a minimum.

The build program should be tailored to reflect the impact that deep excavations through potentially unstable strata can have on adjacent properties, so that they are not undermined.

All excavations on site should be in accordance with HSE guidelines and stability should be practically maintained at all times. Reference should be made to HSE construction information sheet No. 8 (Revision 1) 'Safety in Excavations'.

Care should be taken to ensure that falls from excavation faces do not adversely affect the integrity of foundation concrete.

If contaminated water enters excavations it should be removed and transported to an appropriate treatment facility by a suitably licensed carrier before construction begins.

**GEOTECHNICAL ASSESSMENT – SUBSTRUCTURES**

Where practicable, existing buried construction should be fully removed; however, if this is not practicable all new foundations should be carried down to fully penetrate it and it should be broken well away from all new structures.

There may be existing structures and/or infrastructure in close proximity to the proposed development. New build foundations may be constructed next to pavements with existing underground services beneath them, or excavations may be required near existing footings associated with adjacent properties. These potential hazards need to be taken into consideration when designing foundations and the groundworker needs to be made aware of their potential impact during the redevelopment works. Foundations close to existing underground services or buildings may require alternative foundation techniques (such as piling) to protect the integrity of these structures.

The contractor for the works should carry them out in such a fashion so as to not cause excessive overbreak, concrete usage or undermine existing buildings/roads/ services that are to be retained.

**GEOTECHNICAL ASSESSMENT – SOAKAWAYS**

Soakaway testing in trial pits by GRM is broadly carried out in accordance with BRE 365 (1991). The testing comprises the excavation of a test pit to a suitable depth, and the placement of water into the pit. The level of water present is then monitored over time. For borehole installations, the permeability testing (falling head/rising head) is undertaken in accordance with BS5930.

If it is decided to proceed with the use of soakaway drainage, then the following general points should be noted:

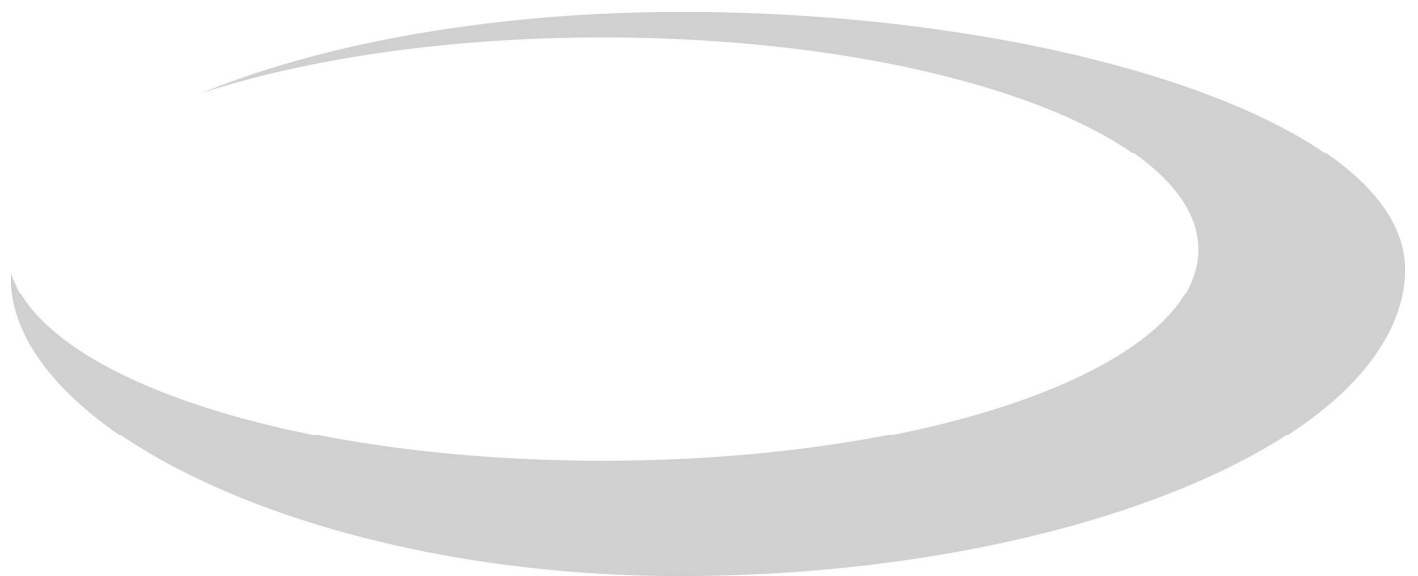
- Soakaways should not be placed so that water can be discharged through potentially contaminated made ground.
- The Environment Agency may require soakaways to be sealed systems such that only roof run off falls to soakaway.
- Interceptors are likely to be required for soakaways for highway drainage. The adopting authority for the highways should be consulted at the earliest opportunity regarding the use of soakaways for highways drainage.
- Consideration of site levels and slopes should be taken into account during the design.

- The construction of all soakaways should be in accordance with the current building regulations.
- Soakaways should not be placed within 5m of a proposed building.
- Placement of soakaways needs to be considered so as to avoid ponding of water down slope.
- The base of a soakaway should not be below the highest recorded water level.
- The Environment Agency prefer 1m of dry soil to be present between the base of a soakaway and the water table to provide attenuation for contamination.

**xvi GEOTECHNICAL ASSESSMENT – FOUNDATIONS**

If soft or hard spots are encountered during foundation excavation then they should be replaced with suitably compacted material or the footings deepened to suitable strata, to avoid differential settlement.

If strata of differing bearing character (e.g. sand and clay) are encountered at foundation levels within the excavations for a single plot then the excavation depths should be altered as appropriate to ensure the foundations rest on a single stratum, or strata that will not induce differential settlement. Where this is impractical then GRM should be contacted to assess a reinforced concrete detail or an alternative foundation solution (e.g. piles or vibro-replacement).



---

**NOTES ON LIMITATIONS****General**

GRM Development Solutions Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement had been executed, or with whom an assignment had been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from GRM Development Solutions Limited; a charge may be levied against such approval.

GRM Development Solutions Limited accepts no responsibility or liability for:

- a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and
- b) the consequences of this document being used by any third party with whom an agreement has not been executed.

**Phase I Environmental Audits/ Desk Studies**

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, GRM Development Solutions Limited reserves the right to review such information and as considered necessary and appropriate to modify the opinions accordingly. It should be noted that any risks identified in a Phase 1 report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

**Phase II Environmental Audits (Contamination Investigations)**

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated with potential human targets, building materials, and controlled waters.

The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to the areas unoccupied by the building(s) on the site and by buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues need to be resolved.

For these reasons if costs have been included in relation to site remediation these must be considered as provisional only and must, in any event, be confirmed by a commercial adviser.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. Whilst exploratory testing is intended to gain an accurate representation of the site, the very nature of sampling and testing is such that it cannot ensure that all localised conditions are detected.

The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

**Phase II Geo-environmental Investigations (Combined Geotechnical and Contamination Investigations)**

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions to provide a reasonable assessment of the environment risks together with engineering and development implications. If costs have been included in relation to site development a commercial adviser must confirm these.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site for each of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

The comments made on groundwater conditions are based on observations made at the time the site work was conducted. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects. The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.

The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.



# A P P E N D I X B

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- Structural Engineering Services
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- Site Services

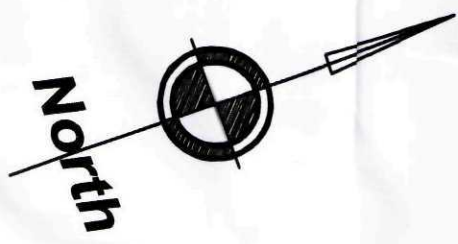
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[info@grm-uk.com](mailto:info@grm-uk.com)

**Fax: 01283 211968**

[www.grm-uk.com](http://www.grm-uk.com)

BRITANNIA GARDENS



Key to Trees

- Existing trees to be retained
- Existing trees to be removed
- Proposed trees mature standards
- Proposed trees ornamental

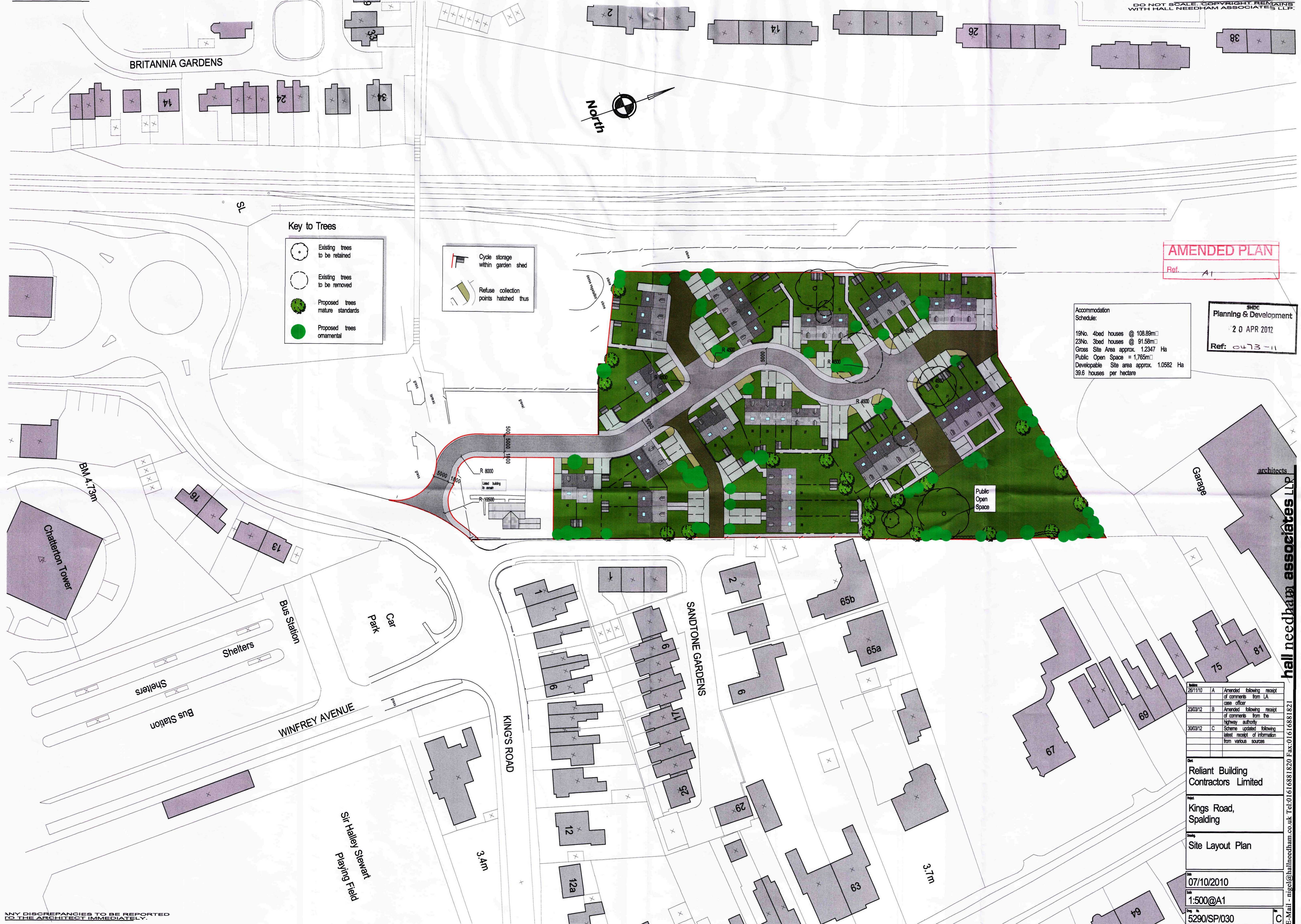
- Cycle storage within garden shed
- Refuse collection points hatched thus

AMENDED PLAN

Ref. A1

Accommodation Schedule:  
 19No. 4bed houses @ 108.89m<sup>2</sup>  
 23No. 3bed houses @ 91.58m<sup>2</sup>  
 Gross Site Area approx. 1.2347 Ha  
 Public Open Space = 1,765m<sup>2</sup>  
 Developable Site area approx. 1.0582 Ha  
 39.6 houses per hectare

SHDE  
 Planning & Development  
 20 APR 2012  
 Ref: 0473-11



| Date     | Rev | Description                                                                 |
|----------|-----|-----------------------------------------------------------------------------|
| 28/11/10 | A   | Amended following receipt of comments from LA case officer                  |
| 23/03/12 | B   | Amended following receipt of comments from the highway authority            |
| 30/03/12 | C   | Scheme updated following latest receipt of information from various sources |

Client:  
 Reliant Building Contractors Limited

Project:  
 Kings Road, Spalding

Drawing:  
 Site Layout Plan

Date:  
 07/10/2010

Scale:  
 1:500@A1

File No:  
 5290/SP/030

hall needham associates LLP



# A P P E N D I X C

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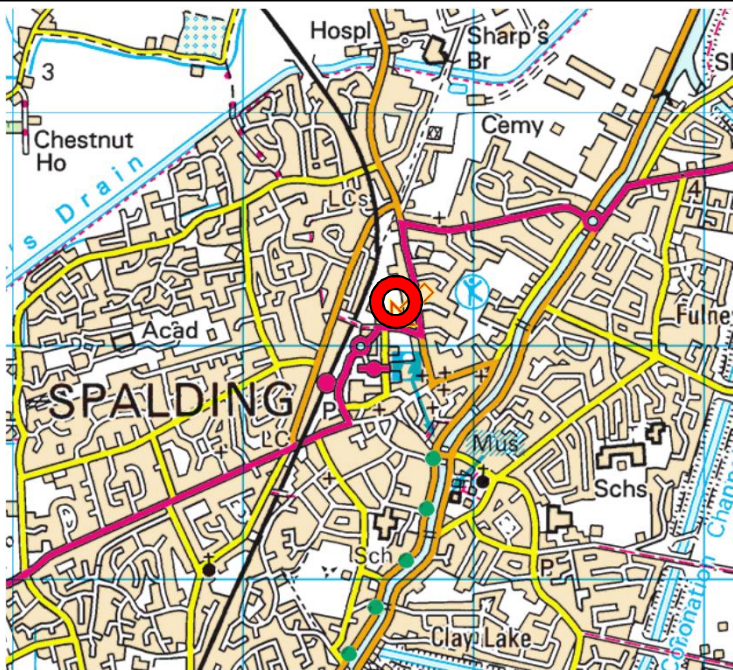
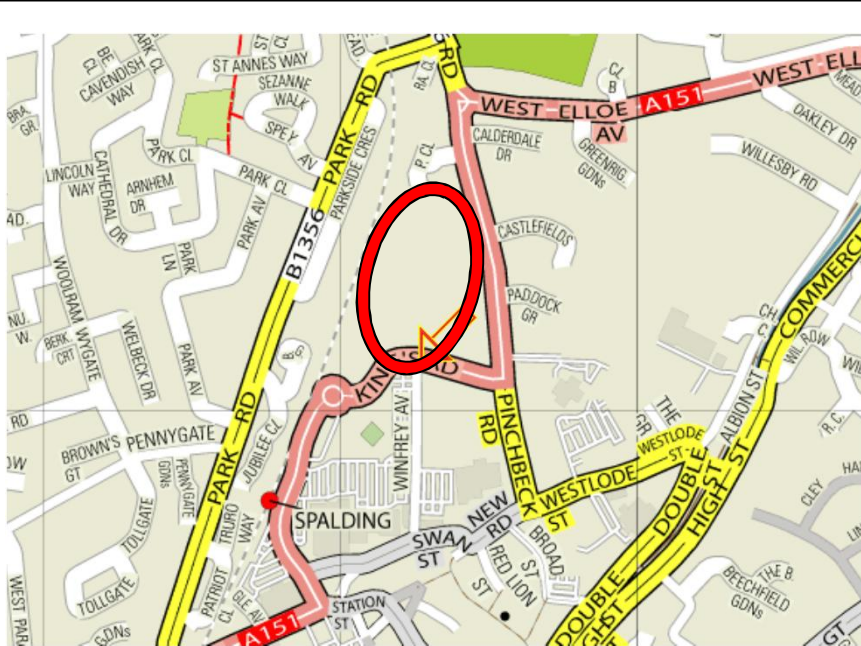
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- Structural Engineering Services
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DO NOT SCALE

NOTES:



Approx. site location



Approx. site boundary

Nearest Post Code:  
PE11 1QJ



**GRM Development Solutions Ltd**

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Tel: 01283 551 249 Fax: 01283 211 968

[mail@grm-uk.com](mailto:mail@grm-uk.com) [www.grm-uk.com](http://www.grm-uk.com)

CLIENT:

PROJECT:

Kings Road, Spalding

TITLE:

Site Location Plan

SCALE@SIZE:

NTS

ISSUE:

FINAL

DESIGN/DRAWN:

RJH

DATE:

02/2016

PROJECT No:

P7343

DRAWING No:

Fig 1

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Area of hydrocarbon contamination in TP01, requires fully excavating and chasing out.

Asbestos sheeting requires removal from site.

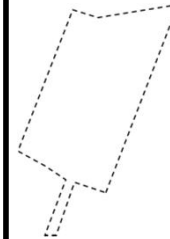
Buried fuel tanks require removal and validation of excavations.

Existing buildings require investigation beneath post demolition.

Area of hardstanding requires breaking out and removal along with sub-base material.

DO NOT SCALE

NOTES:



Approximate site boundary.



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[mail@grm-uk.com](mailto:mail@grm-uk.com) [www.grm-uk.com](http://www.grm-uk.com)

CLIENT:

Reliant Building Contractors

PROJECT:

Kings Road, Spalding

TITLE:

Remediation Plan

SCALE@SIZE:

NTS

ISSUE:

FINAL

DESIGN/DRAWN:

RJH

DATE:

05/2016

PROJECT No:

P7343

DRAWING No:

Fig 2

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# A P P E N D I X E

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|                               | GRM TIER 1 ASSESSMENT CRITERIA |        |        |
|-------------------------------|--------------------------------|--------|--------|
| LAND USE                      | Residential with Plant Uptake  |        |        |
| CONTAMINANT                   | 1%                             | 2.50%  | 6%     |
| <sup>e</sup> Arsenic          | 37                             | 37     | 37     |
| <sup>e</sup> Cadmium          | 26                             | 26     | 26     |
| <sup>b</sup> Chromium III     | 2590                           | 2590   | 2590   |
| <sup>e</sup> Chromium VI      | 21                             | 21     | 21     |
| <sup>e</sup> Lead             | 200                            | 200    | 200    |
| <sup>c</sup> Mercury          | 170                            | 170    | 170    |
| <sup>a</sup> Selenium         | 350                            | 350    | 350    |
| <sup>a</sup> Nickel           | 130                            | 130    | 130    |
| <sup>b</sup> Phenols          | 240                            | 471    | 951    |
| <sup>b</sup> Copper           | 2300                           | 2300   | 2300   |
| <sup>b</sup> Zinc             | 4590                           | 4590   | 4590   |
| <sup>d</sup> Cyanide          | 34                             | 34     | 34     |
| <sup>e</sup> Benzene          | 0.20                           | 0.36   | 0.87   |
| <sup>b</sup> Toluene          | 118                            | 267    | 609    |
| <sup>b</sup> Ethylbenzene     | 64                             | 151    | 349    |
| <sup>b</sup> o - xylene       | 43                             | 101    | 235    |
| <sup>b</sup> m - xylene       | 41                             | 98     | 228    |
| <sup>b</sup> p - xylene       | 40                             | 93     | 217    |
| <b>Non Genotoxic PAHs</b>     |                                |        |        |
| <sup>b</sup> Acenaphthene     | 333                            | 746    | 1450   |
| <sup>b</sup> Acenaphthylene   | 170                            | 407    | 906    |
| <sup>b</sup> Anthracene       | 3770                           | 7890   | 13700  |
| <sup>b</sup> Fluoranthene     | 391                            | 690    | 981    |
| <sup>b</sup> Fluorene         | 166                            | 939    | 849    |
| <sup>b</sup> Naphthalene      | 1.5                            | 3.5    | 8.2    |
| <sup>b</sup> Phenanthrene     | 149                            | 316    | 558    |
| <sup>b</sup> Pyrene           | 867                            | 1560   | 2270   |
| <b>Genotoxic PAHs</b>         |                                |        |        |
| <sup>e/f</sup> Benzo(a)pyrene | 5                              | 5      | 5      |
| <b>ALIPHATIC HYDROCARBONS</b> |                                |        |        |
| <sup>b</sup> C5-C6            | 28                             | 51     | 105    |
| <sup>b</sup> C6-C8            | 68                             | 152    | 347    |
| <sup>b</sup> C8-C10           | 18                             | 43     | 102    |
| <sup>b</sup> C10-C12          | 87                             | 215    | 509    |
| <sup>b</sup> C12-C16          | 709                            | 1680   | 3400   |
| <sup>b</sup> C16-35           | 128000                         | 128000 | 128000 |
| <b>AROMATIC HYDROCARBONS</b>  |                                |        |        |
| <sup>b</sup> C5-7 (benzene)   | 64                             | 128    | 271    |
| <sup>b</sup> C7-8 (toluene)   | 118                            | 267    | 609    |
| <sup>b</sup> C8-C10           | 26                             | 63     | 146    |
| <sup>b</sup> C10-C12          | 69                             | 165    | 364    |
| <sup>b</sup> C12-C16          | 141                            | 325    | 662    |
| <sup>b</sup> C16-C21          | 264                            | 547    | 938    |
| <sup>b</sup> C21-C35          | 1120                           | 1490   | 1720   |

#### Notes

- a SGV (2009)
  - b LQM/CIEH values or derived using CLEAv1.06 with LQM/CIEH Data.
  - c SGV for inorganic Hg used (ref.2009 SGV, Pg5, Para.4)
  - d Atkins ATRISKsoil Value
  - e C4SL - SP1010 (2014)
  - f Benzo(a)pyrene is a surrogate marker for the 8 genotoxic PAHs (Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(ah)anthracene, Ideno(1,2,3-cd)pyrene)
- NB Where C4SLs/SGVs have not been produced, all TACs have been revised in line with report SP1010 (2014), however, the default consumption rates in the CLEAv1.06 model have been retained.

**GRM.TAC.08.14**

|                               | GRM TIER 1 ASSESSMENT CRITERIA    |        |        |
|-------------------------------|-----------------------------------|--------|--------|
| LAND USE                      | Public Open Space 1 (residential) |        |        |
| CONTAMINANT                   | 1%                                | 2.50%  | 6%     |
| <sup>e</sup> Arsenic          | 79                                | 79     | 79     |
| <sup>e</sup> Cadmium          | 220                               | 220    | 220    |
| <sup>b</sup> Chromium III     | 10500                             | 10500  | 10500  |
| <sup>e</sup> Chromium VI      | 23                                | 23     | 23     |
| <sup>e</sup> Lead             | 630                               | 630    | 630    |
| <sup>g</sup> Mercury          | 502                               | 502    | 502    |
| <sup>g</sup> Selenium         | 1380                              | 1380   | 1380   |
| <sup>g</sup> Nickel           | 622                               | 622    | 622    |
| <sup>b</sup> Phenols          | 8760                              | 8810   | 8840   |
| <sup>b</sup> Copper           | 16400                             | 16400  | 16400  |
| <sup>b</sup> Zinc             | 80700                             | 80700  | 80700  |
| <sup>d</sup> Cyanide          | 34                                | 34     | 34     |
| <sup>e</sup> Benzene          | 140                               | 140    | 140    |
| <sup>b</sup> Toluene          | 55,000                            | 55100  | 55200  |
| <sup>b</sup> Ethylbenzene     | 24,400                            | 24600  | 24700  |
| <sup>b</sup> o - xylene       | 40,600                            | 42000  | 42800  |
| <sup>b</sup> m - xylene       | 40,500                            | 41900  | 42800  |
| <sup>b</sup> p - xylene       | 40,400                            | 41800  | 42700  |
| <b>Non Genotoxic PAHs</b>     |                                   |        |        |
| <sup>b</sup> Acenaphthene     | 14600                             | 14600  | 14600  |
| <sup>b</sup> Acenaphthylene   | 14600                             | 14600  | 14600  |
| <sup>b</sup> Anthracene       | 72900                             | 72900  | 72900  |
| <sup>b</sup> Fluoranthene     | 3030                              | 3035   | 3040   |
| <sup>b</sup> Fluorene         | 9710                              | 9710   | 9710   |
| <sup>b</sup> Naphthalene      | 3990                              | 4360   | 4360   |
| <sup>b</sup> Phenanthrene     | 3020                              | 3020   | 3020   |
| <sup>b</sup> Pyrene           | 7290                              | 7290   | 7290   |
| <b>Genotoxic PAHs</b>         |                                   |        |        |
| <sup>e/f</sup> Benzo(a)pyrene | 10                                | 10     | 10     |
| <b>ALIPHATIC HYDROCARBONS</b> |                                   |        |        |
| <sup>b</sup> C5-C6            | 567000                            | 583000 | 596000 |
| <sup>b</sup> C6-C8            | 550000                            | 565000 | 581000 |
| <sup>b</sup> C8-C10           | 12300                             | 12400  | 12400  |
| <sup>b</sup> C10-C12          | 12400                             | 12400  | 12400  |
| <sup>b</sup> C12-C16          | 12400                             | 12400  | 12400  |
| <sup>b</sup> C16-35           | 249000                            | 249000 | 249000 |
| <b>AROMATIC HYDROCARBONS</b>  |                                   |        |        |
| <sup>b</sup> C5-7 (benzene)   | 54800                             | 55000  | 55100  |
| <sup>b</sup> C7-8 (toluene)   | 55000                             | 55100  | 55200  |
| <sup>b</sup> C8-C10           | 4950                              | 4960   | 4970   |
| <sup>b</sup> C10-C12          | 4970                              | 4970   | 4970   |
| <sup>b</sup> C12-C16          | 4980                              | 4980   | 4970   |
| <sup>b</sup> C16-C21          | 3730                              | 3730   | 3730   |
| <sup>b</sup> C21-C35          |                                   |        |        |

#### Notes

- a SGV (2009)
- b LQM/CIEH values or derived using CLEAv1.06 with LQM/CIEH Data.
- c SGV for inorganic Hg used (ref.2009 SGV, Pg5, Para.4)
- d Atkins ATRISKsoil Value
- e C4SL - SP1010 (2014)
- f Benzo(a)pyrene is a surrogate marker for the 8 genotoxic PAHs (Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(ah)anthracene, Ideno(1,2,3-cd)pyrene)
- g Based on SGV TOX data with revised exposure parameters
- NB Where C4SLs/SGVs have not been produced, all TACs have been revised in line with report SP1010 (2014), however, the default consumption rates in the CLEAv1.06 model have been retained.

**GRM.TAC.08.14**