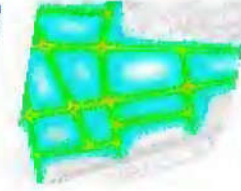





**GEO-ENVIRONMENTAL SITE ASSESSMENT
FORMER FILLING STATION,
ROBERTON,
ML12 6RR**

**REC REFERENCE: 1-CO100755P1R0
REPORT PREPARED FOR: CALUM HAMILTON
23RD DECEMBER 2015**



QUALITY ASSURANCE

Issue/revision	Issue 1	Revision 1	
Remarks	Final		
Date	11 th December 2015		
Prepared by	C Gothard		
Signature			
Checked by	P Thompson		
Signature			
Authorised by	S Brough		
Signature			
Project number	1-CO100755		

EXECUTIVE SUMMARY	
Site Address	Former Filling Station, Robertson, Bigger, ML12 6RR
Grid Reference	E: 294326 , N: 628225
Site Area	0.18 ha
Current Site Use	Disused rectangular shaped parcel of land currently disused. The former petrol station is understood to have occupied the eastern section of the site, which has been demolished to slab level, and the forecourt which is surfaced in bound macadam.
Adjacent Site Uses	Residential, agricultural and immediately east, the A73.
Environmental Setting	Geology: Bedrock – Leadhills Supergroup wacke. Drift –Alluvial deposits Hydrogeology: Locally important aquifers with fracture flow type Hydrology: River Clyde ~200m East Sensitive Land Uses: Residential properties located immediately adjacent to site
Site History	Site is shown as in residential use from pre-1856 until present. At no point do historical maps indicate a petrol station is located on site.
Landfill Sites & Ground Gases	No Landfill sites located within 250m of site.
Radon	The UK radon map indicates the site is situated in an area where less than 1% of homes are above the Action Level and that the BGS reports that full radon protective measures are not necessary
Coal Mining / Land Stability	The site is not within a historical or current coal mining area
Intrusive Ground Investigation	
Ground Conditions	Made Ground – Typically reworked dark brown sandy gravelly CLAY with inclusions of glass, tile, slate and ceramics from 0.3m – 1.3m bgl Drift – Typically orangeish brown/grey sandy CLAY from 0.4m – 2.0m bgl Solid Geology – not encountered Groundwater – Encountered in all Trial Pits between 1.30m bgl and 1.80m bgl
Tier II Contaminated Land Risk Assessment	
Human Health	No1 No. exceedance for Lead within TP15/05 @ 1.0m bgl.
Water Environment	No significant level of contaminants has been recorded at the site and it is therefore considered that the site does not represent a significant risk to the water environment.
Geotechnical Assessment	
Sulphate Assessment	DS-1, AC-1s.
Developed Conceptual Site Model (CSM)	
Human Health The Tier II Human Health Risk has not identified any significant level of contamination that poses a Human Health Risk, with the exception of Lead in TP15/05. Off-site disposal of the soils will remove the source and reduce the risk to receptors.	
Water Environment No significant level of contaminants has been recorded at the site and it is therefore is considered that the site does not represent a significant risk to the water environment.	
Recommendations	
Tanks at the site should be rendered inert and either left in-situ or removed from site. A watching brief should be undertaken if the tanks are to be removed from site. A UKWIR assessment should be undertaken if new freshwater pipes are to be installed at the site.	

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1.0 INTRODUCTION

1.1 Background

Resource and Environmental Consultants Ltd (REC) has been commissioned by Calum Hamilton to undertake a Phase I and II Geo-Environmental Site Assessment at a site in Robertson, South Lanarkshire. A site location plan Drawing No. 1-CO100755p1r0-001 is contained in Appendix III.

All acronyms used within this report are defined in the Glossary presented in Appendix II.

1.2 Proposed Development

It is understood that the client intends to redevelop the site for a residential end use.

1.3 Objectives

The objectives of the geo-environmental investigation are to:

- Review historical plans, geology, hydrogeology, site sensitivity, flood-plain issues, mining records and any local authority information available in order to complete a Desk Study in line with Environment Agency (EA) document Model Procedures for the Management of Contaminated Land (Contaminated Land Report 11 (CLR11));
- Undertake a preliminary stage of sampling and analysis to provide an overview of environmental issues identified;
- Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors;
- Assess the geotechnical information and provide preliminary recommendations in relation to foundations; and,
- Provide recommendations regarding future works required.

1.4 Sources of Information

Background information was sought from the following sources:

- Groundsure Database Search;
- Historical mapping dated 1856 to 2014. A selection of historical maps are reproduced in Appendix V;
- On-line planning records held by South Lanarkshire Council;
- Consultations with representatives of South Lanarkshire Council;
- SEPA River Basin Management Plan Interactive Map;
- SEPA Interactive Flood Risk Map;
- Radon: Guidance on protective measures for new buildings (BRE Document BR 211, 2007); and,
- British Geological Survey Map (Sheet 023, 1:50,000, Hamilton, Solid and Drift editions).

1.5 Risk Classification

REC Ltd has utilised the available data to classify the site on the basis of its likely contaminated land liability and potential for geotechnical constraints in relation to the property development. The risk classification definitions are summarised below:

Risk	Definition
Low	There are unlikely to be significant contaminated land liabilities/geotechnical constraints associated with the property.
Low-Moderate	There are unlikely to be significant contaminated land liabilities/geotechnical constraints associated with the property with regard to the proposed use. However, minor issues may require further consideration in the event of a future redevelopment of the site etc.
Moderate	Some potential contaminated land liabilities/geotechnical constraints are likely to affect the property as a result of historical and/or current activities. The risks identified are unlikely to pose an immediate significant issue but the purchaser/developer may wish to make further enquiries of the vendor or undertake further environmental improvements. Redevelopment of the site will likely require further site investigation.
Moderate-High	Some potentially significant contaminated land liabilities/geotechnical constraints have been identified at the property that requires further assessment including intrusive ground investigations.
High	Significant potential contaminated land liabilities/geotechnical constraints have been identified at the property. Further assessment including intrusive ground investigation will be required to determine to level of risk and associated liability.

1.6 Limitations

The limitations of this report are presented in Appendix I.

2.0 SITE SETTING

2.1 Site Details

Site Address	Former Petrol Station, Roberton, South Lanarkshire, ML12 6RR
National Grid Reference	E: 294325, N: 628224
Site Area	0.18 ha

The subject site is located to the south of Roberton, a village on the A73 in South Lanarkshire. The site is immediately adjacent to A73 with residential properties on the north and south.

A site location map Drawing No. 1-CO100755-001 is presented in Appendix III.

2.2 Current Site Use

2.2.1 Site Walkover Brief

A site walkover was undertaken on 24th November 2015 during the intrusive investigation works. The following site description comprises the site's current layout / features based on the REC Engineer's observations at the time of the site walkover. The walkover is primarily used to identify potential sources of soil and water contamination present at the site. The walkover is not a professional assessment of any potential future remedial, demolition or decommissioning works required and advice on such matters should be sought by the appropriate specialist contractors.

A selection of site photographs are presented in Appendix IV.

2.2.2 Site Description

The site is a currently disused rectangular shaped area of land. A former petrol station occupies the eastern section of the site, which has been demolished to slab level, and the forecourt which is surfaced in bound macadam. Underground fuel tanks are present on the south eastern section of the site. The remainder of the site comprises overgrown vegetation on the northern and western section. The site is accessed directly off the A73 to the east.

The perimeter of the east of the site is secured with heras fencing, the north, west and south of the site are bound by wooden post fencing. Semi-mature trees are present along the site's south western boundary.

The site is relatively flat and level in elevation; however some local variations are present.

2.2.3 Hazardous Materials Storage

No above ground storage tanks (AST) were noted during the site walk over.

Underground Storage Tanks (USTs) were observed on the south eastern section of the site. The area surrounding the underground fuel tank was excavated to expose and assess the condition of the tanks. The tanks were found to be encased in concrete, with a concrete bund on the base and three openings on the top of the concrete pad. The dimension of the concrete bund was 5.00m X 4.60m X 2.10m. No olfactory or visual signs of leakage or contamination were noted during the exposure of the tanks. Anecdotal evidence from the site owner suggests that the tanks have previously been

treated, however no evidence has been provided to REC to confirm the status of the tanks.

2.2.4 Polychlorinated Biphenyls (PCBs)

No equipment that may potentially contain PCBs was observed at the site

2.2.5 Asbestos Containing Materials (ACMs)

No potential ACMs were observed at the site, however given the age of the former petrol station building the presence of ACM cannot be ruled out.

2.2.6 Waste Storage

No potentially hazardous waste streams are currently generated at the property.

2.3 Surrounding Area

The surrounding land uses are summarised below:

Direction	Land Use
North	Residential properties and associated gardens.
East	Immediately the A73 then agricultural land.
South	Residential properties and associated gardens.
West	Agricultural land.

3.0 SITE HISTORY

3.1 On-Site Historical Development

A review of historical mapping pertinent to the site are summarised in Table 3.1 below.

Table 3.1 Summary of Potentially Contaminative Historical Land Uses

Dates	Historical Land Use
1856 - 1910	The site is shown as part of a residential property with a building shown on the north east, with only slight changes to the building occurring during this time period.
1910 - 1954	Two buildings are now shown on site on the south section of site and the west section of site.
1954 - 1979	No changes on site.
1979 - Present	The site is shown with the fore court, however no building showing the former petrol station is shown on historical mapping.

There is relatively little recorded on-site historical development, however it should be noted that historical mapping for the area is limited with large gaps in the time line. At no point on the historical mapping is the site shown as a petrol station.

3.2 Off-Site Historical Development

A review of potentially contaminative uses identified on historical Ordnance Survey maps within influencing distance of the site, shows that the surround area has been used as residential properties to the north and south and agricultural land on the east and west of the site since the first edition of mapping in 1856 with very limited development. No potentially off site contaminative land uses have been identified within influencing distance of the site.

3.3 Planning History

REC has undertaken a review of on-line planning records held by South Lanarkshire Council and 11 No. planning applications are held for the area, review of the online planning applications did not reveal any environmentally pertinent information.

4.0 GEO-ENVIRONMENTAL SETTING

4.1 Geology & Hydrogeology

The British Geological Survey (BGS) map for the site, (Sheet 023E, 1:50,000, Hamilton, Solid and Drift editions) indicates that the site is underlain by the following geological sequence:

Geological Unit	Classification	Description	Aquifer Classification
Superficial	Alluvial deposits	Sand and Gravel Terraces	N/A
Bedrock	Leadhills Supergroup	Wacke	Locally Important Aquifer

The GroundSure report indicates that alluvium deposits of clay, silt, sand and gravel on the site with intergranular flow type with very low to high permeability on the west of the site.

Further to the above classification, the GroundSure report also indicates the presence of glaciofluvial deposits in the centre and east of the site comprising gravel, sand and silt with intergranular flow and moderate to very high permeability.

The GroundSure report indicates the presence of the Leadhills Supergroup – Wacke underlying the site. Deposits are shown to have locally important aquifers with fracture flow type which is dominantly within fissures and other discontinuities and low to moderate permeability.

The SEPA River Basin Management Plan Interactive Map and associated data sheets indicate that the site is underlain by the Upper Clydebank bedrock and localised Sand and Gravel aquifers, which have been classified as overall poor status with high confidence. This groundwater is classified as a Drinking Water Protection Zone by SEPA.

4.2 Hydrology

Surface water features in the vicinity of the subject site are as follows:

Surface Water Feature	Quality	Distance (m)	Direction
Unnamed drainage ditch	N/A	~30	South East
Ladygill Burn (Tributary of the River Clyde)	N/A	~60	North
River Clyde	Poor with Medium Confidence	~200	South East

No other surface water features have been identified within a 750m radius of the site.

Based on the local topography it is considered likely that shallow groundwater, if present, will flow in a generally easterly direction towards the River Clyde. It is considered that the site represents a **low to moderate risk** to the local hydrology.

The site is not located within an area currently defined by SEPA as at risk of flooding. Flooding represents a **low risk** to the site.

4.3 Natural Geological Hazards

Geotechnical Data presented within the GroundSure report identifies the following summary of potentially hazardous ground conditions:

Hazard	Hazard Risk Rating
Shrink-Swell Clay	Very Low.
Landslides	Very Low.
Ground Dissolution	Negligible.
Compressible Ground	Moderate.
Collapsible Deposits	Very Low.
Running Sand	Low.

It is recommended that moderate compressible ground is taken into consideration during any construction phases on site and changes to water levels in the superficial deposits may require further investigation.

4.4 Mining and Mineral Extraction

The site is within an area unaffected by former coal mining and as such a Coal Authority report has not been obtained for this report.

The GroundSure report indicates that the closest known mineral extraction is 740m north south of the site at Hillend where surfacing mining works occurred extracting sandstone however the Groundsure reports that mining works have ceased. The report further indicates that rare and localised small scale mining may have occurred on the site.

It is considered that mining and mineral extraction represents a **very low** risk to the site.

4.5 Radon Risk Potential

The UK radon map indicates the site is situated in an area where less than 1% of homes are above the Action Level and that the BGS reports that full radon protective measures are not necessary in the construction of new dwellings or extensions. Radon represents a **low** risk to the site

4.6 Industrial Land Uses

The site is situated within a predominantly rural context and residential area, no industrial land uses have been identified within 250m of the site.

It is considered that industrial land uses represents a **low** risk to the site.

4.7 Sensitive Land Uses

Residential properties are located immediately adjacent to the site on the north and south.

The River Clyde is located ~200m south east of site.

4.8 Site Sensitivity Assessment

The site is considered to be located within a **low to moderate** sensitivity setting in regard of human health on the basis that the site is adjacent to a number of residential dwellings with private gardens.

The site is considered to be located within a **low to moderate** sensitivity setting in regard of the water environment on the basis that the site is recorded to be underlain by very low to very high permeability drift deposits which would allow the migration of mobile contaminants into the underlying aquifer and the nearest surface water feature is ~30m east of the site.

4.9 Geotechnical Assessment

The following potential geotechnical constraints have been identified:

- Mature trees are present on the site and therefore an assessment of the underlying clay is required for shrink and swell susceptibility;
- Existing floor slabs and relict foundations associated with the former filling station are likely to be present; and,
- Existing underground fuel storage tank on site.

5.0 REGULATORY INFORMATION

5.1 Contaminated Land Officer

The Contaminated Land department at South Lanarkshire Council was contacted regarding the site, however at the time of publication no formal response has been received.

5.2 Landfill Sites and Waste Treatment Sites

No SEPA landfill sites, GroundSure landfill sites, SEPA or historic waste treatment sites are identified within 250m of the site

5.3 Regulatory Database

The following information has been obtained from a commercially available environmental database. The summary table only includes records not otherwise detailed in the

Table 5.1 Summary of Regulatory Activities

Activity	0-249m	250-500m	Details
Records of Petrol and Fuel Site	0	0	N/A
Part A(1), IPPC and historic IPC Authorisations	0	0	N/A
Part A(2) or Part B Authorisations	0	-	N/A
Sites Designated As Contaminated Land or under investigation under Part 2A	0	0	N/A

6.0 INITIAL CONCEPTUAL SITE MODEL (CSM)

6.1 Initial CSM

In accordance with Environment Agency, CLR 11 (2004) and BSI 10175 (Code of Practice for Investigation of Potentially Contaminated Land), REC Ltd have developed an initial CSM to identify potential contamination sources, migration pathways and receptors within the study area.

6.2 Contaminant Sources

On-site Potential Sources








The site has previously been used as a petrol filling station, the Department of Environment Industry Profile – Road Vehicle Fuelling, Service and Repair indicates that fuelling station may give rise to heavy metals (specifically Lead), sulfates, polycyclic aromatic hydrocarbons, asbestos and hydrocarbons. Furthermore, as the site has been historically developed there is the potential for Made Ground deposits to be present on site which may give rise to ground gas generation.

Off-site Potential Sources

No potentially contaminative sources have been identified off site.

6.3 Potential Pathways




Receptors may be potentially at risk from the identified potential sources of contamination via the following pathways:

-  Migration of mobile contaminants on or off site via services, sewers and manmade conduits;
-  Migration of mobile contaminants and gases through permeable bands within drift deposits;
-  Direct contact, ingestion and inhalation of contaminants on site;
-  Migration of contaminated dusts during earthworks;
-  Migration of mobile contaminants into groundwater and transport into surface waters;
-  Migration of hazardous gases via permeable strata and mine workings; and,
-  Uptake of toxins/phytotoxins by plants.



6.4 Potential Receptors

The following potential receptors have been identified:

Human Health

-  Site investigation and construction workers from hazardous short term exposure;
-  Future users of the site and buildings (residents); and,
-  Adjacent residents due to off-site migration of gases or contaminated dust.

The Water Environment

-  Groundwater; and,
-  Surface water features.

6.5 Preliminary Risk Assessment

Human Health

The potential for on-site contamination is considered to be **low to moderate**, based on the following rationale:

- There is potential for localised hydrocarbon contamination from fuel storage tanks on site; and,
- Potential for shallow and localised deposits of Made Ground on site.

The overall risk associated with off-site sources is considered **very low** on the basis the lack of identified potential sources.

Water Environment

Groundwater

The site has been shown to be underlain by Alluvium and Glaciofluvial deposit of gravels, sands and silts which will allow the migration of mobile contaminants. Given the limited development history of the site and its former use as a petrol station, it is considered that the risk of contamination to the underlying groundwater is **low to moderate**.

Surface Waters

The closest surface water feature is an unnamed drainage ditch ~30m south east of the site, given the granular nature of underlying drift deposits, it is considered that the risk of contamination to surface water receptors is **low to moderate**.

Buildings, Foundations and Services




Future redevelopment of the site will include the construction of new foundations. Elevated sulphate concentrations could affect the integrity of buried concrete structures. Services may be affected by the presence of aggressive contaminants which may corrode or penetrate services, such as water supply pipes which are susceptible to penetration by hydrocarbons and can then affect the quality of the water supply.

7.0 SITE INVESTIGATION

7.1 General

A preliminary ground investigation was designed to assess the tanks and conduct a brief contamination assessment based on the findings of the desk study with exploratory holes advanced to target specific potential contaminant sources summarised in Section 6.0. In addition, exploratory holes have also been advanced to provide information on baseline conditions across the site and to collect geotechnical information to assist in the design and construction of the development. No gas assessment was conducted on site at the request of the client. An Exploratory Hole Location Plan is presented as Drawing No. 1-CO100755p1r0-002 contained in Appendix III.

The general scope of works comprised the following:

-  Trial pits around the site;
-  Trial trenches to expose existing underground tanks; and,
-  Chemical laboratory analysis;

7.2 Site Investigation

Exploratory fieldwork was completed on the 24th of November 2015 and the works are summarised in Table 7.1 below.

Table 7.1 Summary of Fieldwork

Location Hole	Potential Source/Rationale	Type	Maximum Depth (m bgl)
TP15/01	Baseline conditions	Machine Excavated Trial Pit	2.00
TP15/02			2.00
TP15/03	Former building on site		2.00
TP15/04	Baseline conditions		1.50
TP15/05	Underground Fuel Tank		1.30
TT North			2.70
TT East			2.70
TT South			2.70
TT West			2.70

The ground conditions encountered are indicated in the exploratory hole logs, which are provided in Appendix VI.

Soil samples destined for chemical analysis were collected in appropriate sampling containers. All samples were subsequently stored in cooled boxes prior to submission to analytical laboratory. The samples were collected using appropriate PPE and sampling equipment and a more detailed copy of REC Ltd sampling methodology, QA procedures and laboratory chain of custody forms can be provided upon request.

It should be noted that superficial deposits within the area of TT East had previously been excavated and as such no samples were taken as they are considered to be unrepresentative of the strata.

7.3 Laboratory Analysis

Selected soil samples were submitted for a range of chemical analysis comprising, metals, pH, total sulfate, water soluble sulfate (2:1 extract), cyanide, phenols, total and speciated polycyclic aromatic hydrocarbons (PAHs), asbestos, BTEX, MTBE and banded total petroleum hydrocarbons (TPH).

Scientific Analysis Laboratories (SAL) Ltd of East Kilbride undertook the analytical work in accordance with their UKAS (1549) accreditation and the testing results are included in Appendix VI and discussed in Section 9.0.

8.0 GROUND AND GROUNDWATER CONDITIONS

8.1 Ground Conditions

8.1.1 Summary of Ground Conditions

The ground investigation shows the superficial deposits to be broadly uniform across site. A summary of strata encountered is shown in the table below.

Table 8.1 Summary of Strata

Strata	Typical Description	Min Depth to Top of Strata (m)	Max Depth to Top of Strata (m)	Max Thickness (m)
Topsoil	Light Brown slightly clayey gravelly SAND with frequent rootlets	0.00	0.70	0.70
Made Ground	Dark Brown sandy gravelly clay with frequent sub angular to sub rounded cobbles with inclusions of glass, tile, slate and ceramics	0.3	1.3	1.0
Drift	Grey gravelly very sandy CLAY with noted sub rounded to rounded cobbles	0.4	2.00	1.6
	Orangeish brown slightly clayey very gravelly fine to coarse SAND with frequent sub angular to rounded cobbles	0.4	2.00	1.6

8.1.2 Topsoil

Topsoil was encountered throughout the majority of the site as a light brown slightly clayey gravelly sand to a maximum depth of 0.70m bgl.

8.1.3 Made Ground

Shallow Made Ground deposits were encountered within TP15/05. The Made Ground was a reworked dark brown sandy gravelly clay with inclusions of glass, tile, slate and ceramics.

The pit was terminated at 1.30m bgl due to a possible drain being encountered, deeper deposits may be present locally.

The site engineer did not note any olfactory or visual evidence of contamination at any of the exploratory locations.

8.1.4 Drift Deposits

Drift deposits were highly uniform across the site and comprised of either sands or sandy clay. Drift deposits typically extended to a depth of 2.00m, however they may extend further as all pits were terminated due to groundwater and pit instability.

8.1.5 Solid Geology

Solid geology was not encountered during site investigation.

8.1.6 Side Stability and Ease of Excavation

The exploratory trial pits were excavated with a JCB 3CX to depths of up to 2.0m, instability and side collapse was encountered within all of the trial pits, associated with ground water influx.

8.1.7 pH and Sulfate

Chemical analyses for pH and soluble sulfate content contained in Appendix VIII, shows that the soils at the site meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE Special Digest 1 (2005).

Table 8.2 Summary of Concrete classification

Location	Depth(m)	SO ₄ in 2:1 soil (mg/l)	pH Value	Classification
Tank North	1.0	<10	8.0	DS-1 AC-1s
Tank South	2.0	22	7.6	DS-1 AC-1s
TP15/02	0.5	<10	6.6	DS-1 AC-1s
TP15/05	1.0	<10	7.7	DS-1 AC-1s

8.3 Groundwater Conditions

Groundwater strikes were encountered across the site, typically at depths ranging between 1.30m and 1.80m bgl. The depth of the water strikes are shown on the exploratory hole records and summarised in Table 8.3 below:

Table 8.3 Summary Groundwater Strikes

Location	Depth to strike (m)	Inflow Rate
TP15/01	1.80	Moderate- Fast
TP15/02	1.80	Moderate- Fast
TP15/03	1.80	Moderate - Fast
TP15/04	1.30	Moderate - Fast
TP15/05	Not encountered	N/A

9.0 TIER II QUANTATIVE CONTAMINATED LAND RISK ASSESSMENT

REC has undertaken a Tier II quantitative risk assessment to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable level of risk to the identified receptors.

9.1 Human Health Risk Assessment

At a Tier II stage, the long term (chronic) toxicity risk to human health is assessed by utilising appropriate and conservative generic assessment criteria (GAC) to determine whether there are actual or potential unacceptable risks at the site and if any viable pollutant linkages are present.

To undertake the Tier II assessment within the context of the development proposal, REC has determined that the most appropriate GAC values available will be those based upon a residential land use with the cultivation and ingestion of home-grown produce taken into account.

The following assessment, summarised below and overleaf in Table 9.1, has primarily adopted the S4UL (Suitable for Use Levels reference values published by LQM/CIEH in 2015, the S4ULs). Currently, no published GAC value is available for cyanide and therefore REC has utilised the Environmental Agency Contaminated Land Exposure Assessment Tool (CLEA v1.06) to derive the relevant GAC for this proposed land use. Due to the absence of a published lead GAC for direct use within the planning regime, the 2014 Defra C4SL (Category 4 Screening Level) has been used as this value is considered to incorporate the latest toxicological, bioaccessibility and exposure modelling research to date.

Table 9.1 Summary of Toxicity Assessment for a Residential End Use

Determinand	Units	GAC	GAC Source	n	[mc]	Location	Primary Pathways	Assessment
Inorganics								
Arsenic	mg/kg	37	(i)	4	10		1	No Further Action
Cadmium	mg/kg	11	(i)	4	<1		1, 2	
Chromium (VI)	mg/kg	6	(i)	4	<1		1, 2, 3	
Lead	mg/kg	200	(iv)	4	820	WS15/05 @1.0	1, 2	See discussion
Mercury [Inorganic]	mg/kg	40	(i)	4	<1		1, 2	No Further Action
Nickel	mg/kg	130	(i)	4	49		1	
Selenium	mg/kg	250	(i)	4	<3		1, 2	
Copper	mg/kg	2,400	(i)	4	76		1, 2	
Zinc	mg/kg	3,700	(i)	4	330		1, 2	
Cyanide [Total]	mg/kg	791	(v)	4	<1		1	
Asbestos	-	D.	-	4	N.D.		3	
Organics – PAHs and Phenol								
Phenols	mg/kg	280	(ii)	4	<1	N/A	2	No Further Action
Naphthalene	mg/kg	2.3	(ii)	4	0.03		4	
Acenaphthylene	mg/kg	170	(ii)	4	0.01		2	
Acenaphthene	mg/kg	210	(ii)	4	0.01		2	
Fluorene	mg/kg	170	(ii)	4	0.01		2	
Phenanthrene	mg/kg	95	(ii)	4	0.18		2	
Anthracene	mg/kg	2,400	(ii)	4	0.06		2	
Fluoranthene	mg/kg	280	(ii)	4	0.65		1, 2	
Pyrene	mg/kg	620	(ii)	4	0.57		1, 2	
Benzo(a)Anthracene	mg/kg	7.2	(ii)	4	0.24		1	
Chrysene	mg/kg	15	(ii)	4	0.21		1	
Benzo(b) fluoranthene	mg/kg	2.6	(ii)	4	0.34		1	
Benzo(k)Fluoranthene	mg/kg	7.7	(ii)	4	0.17		1	
Benzo(a)Pyrene	mg/kg	2.2	(ii)	4	0.25		1	
Indeno(123-cd)Pyrene	mg/kg	27	(ii)	4	0.13		1	
Dibenzo(a,h)Anthracene	mg/kg	0.24	(ii)	4	0.03		1	
Benzo(ghi)Perylene	mg/kg	320	(ii)	4	0.16		1	
Organics – TPHs								
TPH C ₆ -C ₈	mg/kg	100	(iii)	4	<1		4	
TPH C ₈ -C ₁₀	mg/kg	27	(iii)	4	<1		4	
TPH C ₁₀ -C ₁₂	mg/kg	74	(iii)	4	<1		4	
TPH C ₁₂ -C ₁₆	mg/kg	140	(iii)	4	1		1, 2	
TPH C ₂₁ -C ₃₅	mg/kg	1,100	(iii)	4	12		1	
Key for Table 9.1								
[mc]	Maximum Concentration Recorded							
D.	Detected							
N.D.	None Detected (Limit of Detection = <0.0001%)							
Primary Pathways								
1	Ingestion of soil and indoor dust and / or oral background exposure;							
2	Consumption of home-grown produce and attached soil;							
3	Inhalation of dust (background and indoor);							
4	Inhalation of vapour (background and indoor);							
Generic Assessment Criteria (GAC) Source								
(i)	LOM/CI/SH Suitable For Use Level (S4UL) (2015);							
(ii)	S4UL – Conservative Assessment Approach of 1% SOM;							
(iii)	S4UL –1% SOM and assumed worst case aliphatic / aromatic compound;							
(iv)	Defra Category 4 Screening Level (2014);							
(v)	CLEA 1.06 Derived Value.							
(vi)	EA Values							

In addition to the previously mentioned contaminants, samples were also tested for Hydrocarbon Range Organics, BTEX and MTBE. The results were found to be at the limit of detection for all.

Referring to Table 9.1, the results of this direct comparison indicates that the screening values have been exceeded for the determinands at the locations and depths as shown in Table 9.2 below.

Table 9.2 Summary of Exceedance Locations

Exploratory Location	Determinands exceeding GAC	Depth (m bgl)	Strata
TP15/05	Lead	1.0	Dark brown sandy gravelly clay MADE GROUND

9.1.1 Human Health Risk Assessment

Lead

An exceedance of Lead was detected in one sample on site (WS15/05 @ 1.0m). The main exposure pathway for lead is dust / soil inhalation and it is therefore recommended that any lead impacted materials can be dealt with through the removal of the viable exposure pathway in the proposed development. It is also noted that due to the depth of material containing exceedance of lead, it is unlikely that there is a viable exposure pathway.

It is understood by REC Ltd that the underground storage tank is being removed by a suitable qualified contractor and replaced by clean fill. It is recommended that during this process any Lead contaminated made ground adjacent to the UST is also removed during this process and replaced accordingly.

9.2 The Water Environment

The GroundSure report indicated that groundwater within superficial deposits underlying the site would have intergranular flow with very low to high permeability. A locally important aquifer with fractured flow type and low to moderate permeability was indicated to be within the solid deposits. The nearest surface water body is the Ladygill Burn (a tributary of the River Clyde) located ~60m to the North of the site.

The SEPA River Basin Management Plan Interactive Map and associated data sheets indicate that the site is underlain by the Upper Clydebanks bedrock and localised Sand and Gravel aquifers, which have been classified as overall poor status with high confidence. Given the relatively low concentrations of contaminants recorded within soil samples it is considered that there is no significant risk posed to the water environment from the site.

9.3 Revised Conceptual Site Model

The initial conceptual site model has been revised in light of the ground investigation and is shown in Table 9.3 overleaf.

Table 9.3 Revised Conceptual Site Model

Receptor	Potential Risk	Current Residual Risk	Mitigation
Human Health	<i>Uptake of contaminants by food plants grown in contaminated soil</i>	NO	N/A
	<i>Ingestion</i>	YES	Off-site disposal will remove the source and reduce the risk to receptors.
	<i>Inhalation</i>	NO	N/A
	<i>Skin contact</i>	NO	N/A
	<i>Irradiation</i>	NO	N/A
	<i>Fire and explosion</i>	UNKNOWN	Not assessed as part of this investigation.
<i>Fire and explosion</i>	UNKNOWN		
Buildings	<i>Chemical attack on building materials and services</i>	NO	Soils present at the site are consistent with design sulfate class DS-1 and ACEC AC-1s. Water supply pipes – A UKWIR should be completed if fresh water pipes are required.
Natural Environment	<i>Phytotoxicity</i>	NO	N/A
	<i>Contamination of Controlled waters</i>	NO	N/A

The analysis of chemical laboratory samples submitted indicates that no exceedances were recorded for determinands, based on a residential end-use, with the exception of TP15/05. Off-site disposal of the soils within this area will remove the source and reduce the risk to receptors.

A visual inspection of the tanks, undertaken during the site investigation, indicates that there was no damage to the tanks and any leakages are likely to be limited in nature.

As part of this investigation a ground gas assessment was not undertaken.

If new freshwater pipes are to be installed at the site, it is recommended that a UKWIR freshwater pipe assessment is undertaken to determine a suitable pipe material.

10.0 CONCLUSIONS & RECOMMENDATIONS

Geotechnical Assessment

Concrete Design Class

Concrete design sulphate class DS-1 and ACEC AC-1s classifications apply.

Revised Conceptual Site Model

Human Health

The Tier II Human Health Risk has not identified any significant level of contamination that poses a Human Health Risk, with the exception of Lead in TP15/05. Off-site disposal of the soils will remove the source and reduce the risk to receptors.

Water Environment

No significant level of contaminants has been recorded at the site and it is therefore is considered that the site does not represent a significant risk to the water environment.

Recommendations

Tanks at the site should be rendered inert and either left in-situ or removed from site. A watching brief should be undertaken if the tanks are to be removed from site. A UKWIR assessment should be undertaken if new freshwater pipes are to be installed at the site.

END OF REPORT

APPENDIX I
LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Ltd and the Client as indicated in Section 1.2.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not be made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. In addition to the above REC Ltd note that when investigating, or developing, potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and also with time. The absence of certain ground, ground gas, and contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Due to the presence of existing buildings and structures access could not be obtained to all areas. Additional contamination may be identified following the removal of the buildings or hard standing.
7. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
8. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.
9. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
10. This report presents an interpretation of the geotechnical information established by excavation, observation and testing. Whilst every effort is made in interpretative reporting to assess the soil conditions over the Site it should be noted that natural strata vary from point to point and that man made deposits are subject to an even greater diversity. Groundwater conditions are dependent on seasonal and other factors. Consequently there may be conditions present not revealed by this investigation.
11. REC can not be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.
12. Rather, this investigation has been undertaken to provide a preliminary characterisation of the existing sub-surface geotechnical characteristics and make up and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.
13. This investigation has been undertaken to reasonably characterise existing sub-surface conditions and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.