

PROJECT REFERENCE: 16.9061

February 2018

VALIDATION REPORT
Former Turnpike Motors, Walberton

FOR



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Name:	Signature:	Date:	Nature of revision:
Name:	Signature:	Date:	Nature of revision:
Name:	Signature:	Date:	Nature of revision:

Contents

1. INTRODUCTION.....	5
2. PHYSICAL SETTING	7
3. PREVIOUS REPORTS	8
4. OUTLINE OF REMEDIAL WORKS	11
5. FINAL STATEMENT AND RECOMMENDATIONS.....	16

Appendices

Appendix A – Site Plans	
Appendix B – Test Position Site Plan	
Appendix C – Photographic Log	
Appendix D – Tank Pull Details	
Appendix E – Waste Transfer Tickets	
Appendix F – Watching Brief and Supporting Email	
Appendix G – Import Documentation	
Appendix H – Hand Pit Plan	
Appendix I – Import Laboratory Analysis	
Appendix J – Potable Water Pipe Details	

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Professional Interpretation

The recommendations made and opinions expressed in the report are based on the conditions revealed by the site works together with an assessment of the data from the insitu and laboratory testing or in respect of the desktop reports. No responsibility can be accepted for conditions that have not been revealed by the research, site works and testing.

The Client is advised that the conditions observed on site by Constructive Evaluation Limited at the time of any site survey may be subject to change. Certain indicators of the presence of hazardous substances may have been latent at the time of the most recent site reconnaissance and they may subsequently have become evident. It is not possible to assess areas which are inaccessible or where access is not granted and CE accept no liability for risks subsequently identified therein.

The conceptual model, Risk assessment and sampling regime has been formulated in accordance with current UK guidance at time of production based upon the relevant information gained from Phase 1 and Phase 2 investigations. While the model and assessment offer opinions and interpretations of these guidelines, the comments made are for guidance only and no liability can be accepted for their accuracy. It is possible that aspects of desktop study may need to be altered to conform to the requirements of the statutory regulatory bodies.

Intrusive Field Operations

The data collected through direct operations in the production of this report has been so obtained, unless directly otherwise stated, in accordance with current UK guidance, law or accepted industry practice, including but not limited to: BS.5930: 1990 Code of Practice for Site Investigations (Amendment 2: 2010), BS.10175: 2011 + A1: 2013 Investigations into Potentially Contaminated Sites, and BS.8576:2013 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds. Exact exploratory locations will depend upon access conditions, site use and plant capability, CE do not accept liability for issues arising from material identified between or outside of the area of exploratory locations.

Laboratory Testing

Unless stated otherwise within the text, all geotechnical and material laboratory tests have been performed in accordance with the relevant British Standard Documents. Laboratory testing for contaminated land assessment is completed under the UKAS / MCERTS accreditation schemes, unless identified as otherwise in the report.

Human Health Risk Assessment Criteria

The Environment Agency has recently undertaken revision of the Soil Guideline Values (SGVs) which are partially complete. Where standards are available using the "new" approach, these have been utilised for correlative purposes. Where standards have not yet been revised, guidance following the "old" approach has been utilised. Please note that upon release of the remaining guidelines, the standards contained within this report may be subject to change. In addition, the second edition of the LQM CIEH guidance has now been released and will be utilised in favour of previously published guideline values.

Third Parties

The findings and opinions conveyed in this report are based on information obtained from a variety of sources, including that from previous Site investigations and chemical testing laboratories. Constructive Evaluation Limited has assumed that such information is correct. Constructive Evaluation Limited cannot and does not guarantee the authenticity or reliability of the information it has relied upon and can accept no responsibility for inaccuracies with the data supplied by other parties.

The accuracy of the historical map extracts supplied can not be guaranteed and it should be noted that different conditions may have existed between mapping sheet editions. Therefore, there can be no certainty that all areas of contamination have been identified during the Phase 1 investigation.

Definitions

Reference to the word "contamination" in this report does not relate to the statutory definition of contaminated land under 1990 Environmental Protection Act unless otherwise stated. The definition used in this report is: "Land that contains substances that, when present in sufficient quantities or concentrations, are likely to cause harm, directly or indirectly, to man, to the environment, or on occasion to other targets" (NATO CCMS, 1985).

1.0 INTRODUCTION

Constructive Evaluation (CE) Limited were instructed by Globe Estates Ltd. (EQ12193, dated 16th October 2017) to compile a 'Validation Report' following the issue of a Phase 2 Report (Ref: 16.9061 REV1) in July 2016, for a site formerly know as Turnpike Motors Walberton, West Sussex, BN18 0PG.

A number of previous reports (detailed in Section 3.0) have been issued in relation to the site. These should be read in conjunction with this report.

The site is currently under development into six semi-detached, two-storey residential dwellings with private gardens. Historically the site was used for the MOT, repair and storage of cars and various car components. Site Plans can be viewed in **Appendix A**.

CE provided remedial measure recommendations, detailed within the Phase 2 Report, based on findings of an intrusive investigation. This Validation Report serves to confirm that the recommendations set out by CE have been completed, and provides the relevant certified documentation to enable the discharge of the relevant planning condition(s). This report has been written in accordance with *Contaminated Land Report 11 (CLR11): Model Procedures for the Management of Land Contamination – DEFRA/ EA*.

1.1 Site Setting

The site is located in the village of Walberton to the west of Arundel, centred on National Grid Reference 497050, 106042, with a site area of approximately 0.15 hectares, and is surrounded by residential dwellings with a small chapel to the west.

The site comprises of an irregular shaped parcel of land that slopes down towards the north. Historically, the main use on site was for the MOT, repair and storage of cars and various car components. There was a single storey brick building, used as office and storage space, in the north of the site with an adjoining double height blockwork workshop building.

The workshop had a double layered roof comprising (asbestos containing) corrugated cement sheeting overlain by corrugated metal sheeting. Vehicle maintenance was undertaken within the workshop within which there was an inspection pit present, the concrete floor of which was heavily stained by oil during the intrusive works. Various car parts, tools, oils and lubricants were stored within the main maintenance building and within the adjoining storage area to the east, staining was also noted on the floor within the storage area.

A single metal Aboveground Storage Tank (AST) was located to the south of the workshop on a brick base, understood to be used for waste oil. Surrounding the tank were several plastic and metal containers used for various oils and solvents. The tank and containers are underlain by hard standing.

A second newer double height maintenance building with inspection pit was present in the west of the site used to undertake MOTs. Limited staining was noted on the concrete slab and there was limited storage of car parts and oil within. To the south of this was a small corrugated metal and wood garage, no access was available at the time of the site walkover.

In the south of the site was a gravelled area with weeds and brambles used to store tyres, two skips, gas cylinders, wood, breeze blocks, building sand, and various vehicles.

In the north of the site were historic Underground Storage Tanks (UST) set within a tank nest. Prior to site works, the tanks had been decommissioned and foam filled.

2.0 PHYSICAL SETTING

2.1 Published Geology

The Geology of Britain Viewer (British Geological Survey (BGS), 2017) indicates the site is underlain by Superficial Geology of River Terrace Deposits and Bedrock Geology of the London Clay Formation.

- *River Terrace Deposits* – Sand and gravel, locally with lenses of silt, clay or peat. These superficial deposits are classified as a **Secondary (A) Aquifer** – permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
- *London Clay Formation* – Typically consists of dark bluish to brownish grey, stiff heavily fissured Clay, containing variable amounts of fine grained sand and silt (particularly at the top and base of the deposit), weathering to orange brown clay near surface. The bedrock geology is classified as **Unproductive Strata** – rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

2.2 Controlled Waters

There are eight records of abstraction licenses within 2000m, the closest of which is located approximately 900m south for direct spray irrigation. There are no potable abstraction licenses within 2000m of the site. There are no surface water features within 400m of the site boundary.

3.0 PREVIOUS REPORTS

Four relevant geo-environmental/ asbestos reports have been completed in association with the site. A summary is provided below although these should be read in conjunction with this report for completeness.

Reference	Report Title	Date	Author
14.7898	Stage 1: Desktop Study and Walkover Survey	January 2014	CE
16.9061	Site Investigation Scheme	May 2016	CE
16.9122	Refurbishment and Demolition Asbestos Survey	June 2016	CE
16.9061 REV1	Phase 2: Site Investigation Report	July 2016	CE

3.1 Stage 1: Desktop Study and Walkover Survey

Following a review of historical maps and public records, and site reconnaissance, the Stage 1 Report identified specific sources of potential contamination as detailed below:

- Vehicle workshop, above and below ground tanks, and car parts kept on site and potential leakages or spills of fuels, oils and lubricants over time. Hydrocarbon staining was observed during the site walkover; and
- Asbestos Containing Materials (ACMs) identified on the ground as well as the roof of the workshop.

No potential off site sources were identified. A summary of the Preliminary Conceptual Site Model (CSM) is shown below:

Source	Pathway	Receptor	Potential Risk
1. Hydrocarbons including Total Petroleum Hydrocarbons (TPH), Polycyclic Aromatic Hydrocarbons (PAH), BTEX and MTBE from on site garage and associated tanks. Heavy metals from on site garage and associated tanks. VOCs/ SVOCs from on site garage and associated tanks.	Inhalation, ingestion and dermal contact from exposure to contaminated soils.	End users	Moderate
		Site workers	Moderate
	Impacted soils.	Services	Moderate
	Volatilisation of hydrocarbons underlying soils and groundwater to indoor and/or outdoor air.	End users and proposed development	Moderate
		Site workers	Moderate
2. ACM from workshop roof.	Migration of soil contaminants to groundwater	Secondary (A) Aquifer	Moderate
		Inhalation, ingestion and dermal contact from exposure to contaminated soils.	
		End users	High
		Site workers	High

Based on the findings of the Stage 1 Report it was deemed that a Site Investigation would be required to assess/ refine the potential pollutant linkages identified within the preliminary CSM.

3.2 Site Investigation Scheme

Arun District Council required a standalone Site Investigation Scheme prior to conducting intrusive works on site.

The report was compiled so that proposed works could be agreed upon prior to breaking ground.

Details of the Site Investigation are summarised in Section 3.4 of this report.

3.3 Refurbishment and Demolition Asbestos Survey

The objective of the inspection was to locate and assess ACMs, in accordance with HSG264 and the Control of Asbestos Regulations 2012 prior to demolition works.

In terms of source-pathway-receptor pollutant linkages, and risk from ACMs was treated as a separate issue, and therefore has not been discussed within subsequent CSMs. Please refer to the full Asbestos Report for findings and recommendations.

3.4 Phase 2: Site Investigation Report

3.4.1 Field Works

Intrusive works were carried out on 23rd to 24th June 2016 and supervised by a Geo-Environmental Scientist from CE.

Five windowless sample boreholes were advanced to a maximum depth of 6.00mbgl using a tracked percussive rig. Three of these boreholes were installed with 50mm diameter monitoring well equipment to allow gas and groundwater monitoring. Five additional hand dug trial pits were advanced to a maximum depth of 0.80mbgl in areas proposed as private gardens.

Intrusive locations were positioned in order to target the following: UST nest in the northern part of the site (former forecourt); inspection pits in the main workshop building and new workshop building; AST south of the main workshop building; proposed gardens; and, sufficient site coverage for geo-environmental assessment.

A site layout plan indicating the position of the test locations is provided in **Appendix B**.

3.4.2 Ground Conditions

Made Ground was identified to a maximum depth of 0.60m – note Made Ground is deeper in the specific location of the tank nest. River Terrace Deposits (RTD) were noted below the Made Ground to a maximum drill depth of 6.00m. RTD comprised Clay, Gravel locally Sand, and Clay.

Groundwater was encountered between approximately 3.50 and 4.00mbgl during the drilling process, which was consistent with soil arising observations. Following installation of monitoring wells, groundwater was observed between 3.00 and 3.95mbgl.

Other than limited depths of Made Ground identified, there was no visual or olfactory evidence of contamination. This was consistent with Photoionisation Detector (PID) readings, which recorded a maximum of just 15.0ppm (BH3 – 2.25m).

3.4.3 Soil Analysis

Soil samples were obtained from each exploratory location and submitted to QTS Environmental, a UKAS and MCERTS accredited laboratory testing facility, for a screen of contamination testing from both the Made Ground and underlying natural soils.

There were limited exceedances of the GAC from three soil samples, which were all obtained from depths shallower than 0.40mbgl. Asbestos was not identified within any of the soil samples obtained from across the site. All identified exceedances were from soil samples removed from shallow Made Ground and are considered attributable to limited general fill materials including brick fragments. The limited number of soil exceedances were considered consistent with observations made in the field – in that PID screens and visual/ olfactory evidence was not indicative of heavily impacted soils. Natural soils (generally 0.40m depth) are not considered to be impacted.

Following soil VOC/SVOC analysis (all determinands below LOD), and field screening with a PID (maximum 16.6ppm (HP5-0.30m)) it was not considered necessary to carry out soil vapour monitoring.

3.4.4 Groundwater Gauging

A groundwater gauging round was completed on 30th June 2016 following installation of groundwater monitoring wells during the drilling exercise. Groundwater analysis was not considered necessary due to the following: limited number of soil exceedances identified following laboratory analysis; limited soil exceedances were identified at shallow depths (maximum 0.40mbgl), and groundwater levels across the site were identified between approximately 3.00 and 4.00mbgl, therefore it was unlikely that groundwater was unlikely to be impacted; and, there was no visual/ olfactory evidence of contamination observed during drilling process and/ or groundwater gauging round.

3.4.5 Recommendations

Made Ground soils were not considered chemically or physically suitable for use in proposed gardens and therefore establishment of a suitable capping layer was recommended. Remedial measures are discussed in further detail within Section 4.0.

4.0 OUTLINE OF REMEDIAL WORKS

4.1 Tank Pull

Although locations immediately adjacent (up and down gradient) of the tank nest were investigated, there was the potential for undetected areas of contamination specifically beneath the historical tanks.

The client informed CE that historical tanks would be removed as part of the development, and therefore CE recommended that as part of the tank pull exercise, validation screening, sampling and analysis should be conducted as part of the validation works. It was suggested that screening included PID detection, visual and olfactory assessment of soils, and laboratory analysis. If VOCs/SVOCs were detected following laboratory analysis, soil vapour monitoring would be carried out.

Photographs relating to the Tank Pull Exercise can be viewed in **Appendix C**.

4.1.1 Validation

Tank removal and validation was conducted from 18th to 21st November 2016 in accordance with guidance – *Design, Construction, Modification, Maintenance and Decommissioning of Filling Stations* (APEA/ EI, June 2011).

CE were in attendance following a strip of hardstanding from across the site. It was agreed that CE would attend site once the underground storage tanks (UST) were ready to pull from the ground to enable inspection of soils directly beneath.

18th November 2016

Upon arrival, the eastern UST was ready for removal. The western UST was encased within a concrete bund and therefore could not be removed with equipment that was currently on site.

Following removal, the tank was inspected for obvious signs of corrosion and possible leak points. The UST was noted to be foam filled (as per anecdotal evidence received while on site). A number of small holes (maximum 20mm Ø) were noted at the top of the tank most likely caused by ageing and corrosion. The UST measured 1.40m Ø by 1.40m length, with the base of the tank noted to be at ~1.50mbgl.

Based on the identified holes within the tank, as a precautionary measure, an additional 0.50m was excavated from beneath the tank prior to validation sampling. Five samples were removed from the pit; four from the sides (all at 1.80mbgl) and one from the base at 2.00mbgl. Soils were inspected for visual and olfactory signs of contamination prior to field screening using a PID. The maximum PID result was 0.30ppm, which was detected on the sample obtained from the southern side of the excavation (TPD).

21st November 2016

The western UST was removed after carefully breaking through the concrete bund with a breaker. The tank measured 2.10m Ø by 3.80m length, with the base of the tank noted to be at ~3.00mbgl, and appeared in good condition with no corrosion or holes noted – the tank appeared foam filled.

Following this additional excavation, five samples were removed from the pit; four from the sides (between 2.80 and 3.00mbgl) and one from the base at 3.00mbgl. Soils were inspected for visual and olfactory signs of contamination prior to field screening using a PID. The maximum PID result was 0.3ppm, which was detected on the sample obtained from the southern side of the excavation (TPJ).

A site plan detailing field samples obtained and subsequent field screening results can be viewed in **Appendix D**.

Excavations were backfilled with compacted type 1 prior to development works.

Laboratory Analysis

Six soil samples were submitted to QTS Environmental, a UKAS and MCERTS accredited laboratory testing facility, to validate soils left *in situ*. One sample was submitted from each of the (now connected) excavation sides, with an additional two samples from the excavation base.

Samples were analysed for a general contaminant screen inclusive of heavy metals, PAHs, TPH CWG, BTEX, MTBE and asbestos. Additional to this, selected samples were submitted for VOC and SVOC analysis.

There were no exceedances of applicable screening criteria and thus soils were deemed suitable to remain *in situ*.

Laboratory Certificates can be viewed within **Appendix D**.

4.2 Proposed Gardens

Made Ground soils were not considered chemically or physically suitable for use within the proposed gardens/ residential scenario, therefore establishment of a suitable capping layer was required.

It was recommended the following measures should be implemented:

- Removal of existing Made Ground soils; and,
- Provision of at least 300mm thickness of imported certified topsoil.

It was advised that topsoil requirements outlined within *BS3882:2015* should be used as guidance for the composition and chemical analysis required for the imported material. Additional chemical analysis including heavy metals, total phenols, cyanide, PAHs and speciated TPH, would ensure soils were suitable for use.

4.2.1 Validation

Export of Material

Unsuitable material was removed from site between 28th November 2016 and 27th June 2017 through 111no. spoil collections. All material was removed by Penfold Verrall, and delivered to

the corresponding waste facility, dependent on waste type. Waste transfer tickets can be viewed in **Appendix E**.

Following the removal of material, soils remaining *in situ* were visually inspected for anthropogenic material indicative of Made Ground by representatives from Holmes Building Services Ltd., as per the Watching Brief (**Appendix F**). Dig depth was verified using a tape measure, photos relating to this process can be viewed in **Appendix C**.

Import of Soils

Soils were imported to site over two delivery phases. Photographs relating to this process can be viewed in **Appendix C**. Import documentation is provided in **Appendix G**.

- Plots 1-2 – 1no. load on 24th April, 1no load 23rd June, 2no. loads 13th July 2017; and
- Plots 3-6 – 2no. loads on 20th October, 2no. loads on 14th November, and 1no. load on 4th December 2017.

In total, approximately 155 tonnes of soil was brought onto site over the two delivery phases. If 1.8 tonnes is equal to 1m³, 155 tonnes equates to approximately 86m³.

Soils imported to site in April and June 2017 were supplied (via Eurogreen Environmental) by Parker Building Supplies. All other deliveries were supplied by Eurogreen Environmental from their Titnore Lane facility in Worthing.

The soil supplier provided analytical test certificates for analysis carried out by Oema Chem at (soil) source. Analysis was conducted on a batch by batch basis at the soil source facility by way of aliquot sampling (once consistency was positively identified).

BS 3882 soil testing includes analysis of the suitability of soil for use as a multipurpose topsoil. Although this analysis includes limited chemical testing, it is not considered detailed enough for the purposes of this risk assessment. Further to this, additional chemical testing was conducted which included analysis of PAHs and TPH.

A summary of analysis completed is provided in the table below.

Batch #	BS 3882 Analysis	Chemical Testing	Imported to
Batch 6	15 th February 2017	Not tested	Plots 1-2
Batch 7	26 th June 2017	Not tested	Plots 1-2
Batch 8	Not tested	14 th August 2017	-
Batch 9	3 rd October 2017	3 rd October 2017	Plots 3-6

Following a review of laboratory analysis, CE were concerned that soils delivered to site during Phase 1 had not been subject to chemical testing. Further to this, CE recommended *in situ* chemical testing of soils delivered to Plots 1 and 2 by means of hand dug trial pits. This would also allow additional verification of imported soil depth.

Due to Plot 1 being occupied it was only possible to sample from Plot 2, but seeing as soil was delivered to both plots during the same phase of importation, this was not considered an issue.

A site plan detailing the location of the hand pits can be viewed within **Appendix H**. Two samples were removed from two different hand pits on 19th January 2018 and sent to Oema Chem for analysis mirroring chemical analysis as detailed above. Photographs relating to this process can be viewed within **Appendix C**.

BS 3882 analysis confirmed all soils delivered to site fall within the 'Multipurpose Topsoil Range'. Chemical analysis and subsequent screening against applicable assessment criteria has confirmed soil is suitable for use. Laboratory certificates are presented in **Appendix I**.

4.3 Areas of Hardstanding/ Engineered Fill

Although importation of soils was not required in areas of hardstanding or engineered fill, Site Plans were required to verify the breaking of any potential source-pathway-receptor pollutant linkage.

The latest Site Plan received from the client is presented within **Appendix A**.

4.4 Services

It was recommended that the local water board were contacted to determine the type of pipework that should be used on the site, on the basis of the historical soil results. Portsmouth Water Statement of Costs relating to the installation of said services can be viewed within **Appendix J**.

All potable water pipes were installed using GPS Protecta Barrier Pipe and Connections as per the invoice presented in **Appendix J**. Photographs detailing the installation are presented within **Appendix C**.

4.5 Watching Brief

It was the responsibility of the site manager to ensure a watching brief was undertaken and documented. This was to be undertaken as part of good working practices and in case there were any areas of unidentified contamination.

Please refer to the Watching Brief statement presented within **Appendix F**. The Watching Brief was carried out by Gareth Watkins of Holmes Building Services Ltd during the first phase of groundworks, during further excavations, reduce dig and sub structure works. Mr Watkins also supervised the import of materials and topsoil – there was no visual or olfactory evidence of contamination noted during this phase.

The remaining building period was managed by Joel Murray, a Site Manager also of Holmes Ltd. There was no visual or olfactory evidence of contamination noted during this build period.

4.6 Decommissioning of Boreholes

As stated within the Phase 2 Report, the monitoring wells on site required decommissioning in accordance with the EA's guidance document '*Decommissioning Redundant Boreholes and Wells*'.

After CE had confirmed the monitoring wells were not required for further data collection, the standpipes were removed with an excavator grab bucket and the borehole was backfilled with natural soils. A bentonite seal of at least a metre was applied above this.

5.0 FINAL STATEMENT AND RECOMMENDATIONS

5.1 Site Status

At the time of writing this report, development works at the site were at final stages with only internal finishing to be completed.

According to information collated within this report CE can confirm that capping layer Remedial Measures as detailed within the July 2016 Phase 2 Report have been implemented to all areas of soft landscaping across the site, as per the site plan within **Appendix A**. With reference to the Conceptual Site Model within Section 9.1 of the Phase 2 Report, source-pathway-receptor pollutant linkages previously identified as **Low** to **Moderate**, have been broken through implementation of the capping system, and therefore residual risks to receptors are now classified as **Low**.

Currently, and following implemented remediation measures, the site is fit for the proposed residential land use.

We would recommend that this report is forwarded to the Local Authority to seek their comments and subsequent approval for discharge of the relevant planning conditions.

5.2 Post-Treatment Management

While the site continues to be used for its intended residential use, there are no requirements for ongoing monitoring for remedial effectiveness. Furthermore, there is no need for constraints on future (residential) activities to avoid damage to capping layers.

If in the event a change of use is proposed, the requirement for ongoing management may need to be re-addressed. In this instance, we would recommend investigation and report details are made available to relevant parties.

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