

Crown Trading Centre, Hayes Remediation Method Statement

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Appendices

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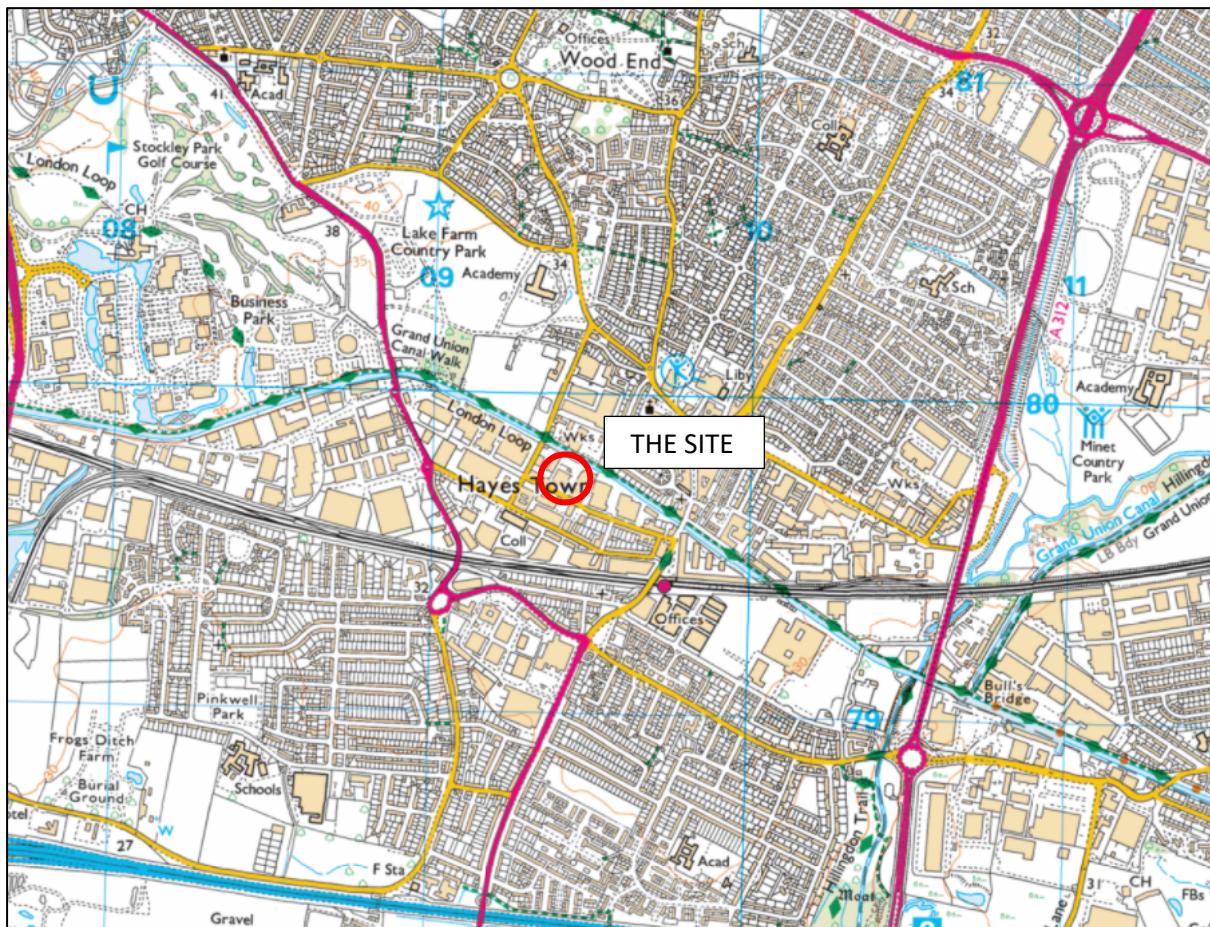
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1. Introduction

Turnkey Regeneration Limited (Turnkey) was instructed by Henry Construction Projects Ltd. (Henry's) to prepare a Remediation Method Statement (RMS) for the proposed remediation and earthworks at their Crown Trading Centre (CTC) site, Hayes (the site).

A site location plan is provided in Figure 1.1 below.

Figure 1.1: Site Location Plan



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1.1 Proposed Development and Planning Conditions

The proposed development is anticipated to comprise two large concrete framed residential buildings ranging in height from a two-storey podium area to ten storeys, which will occupy much of the site. Plans for the proposed development also includes roads, parking areas, shared communal space and playground areas. There are no private residential gardens proposed. The masterplan for the development is provided in Appendix A.

An outline Remediation Strategy (prepared by Soils Limited, reference 20227/RMS Rev 1.0, dated August 2022) was submitted to partially discharge Planning Condition 36i(a) (Ref: Hillingdon 73955/APP/2022/3516), however it was considered that a more detailed RMS was required. Thus, this RMS is provided to support discharge of Condition 36i(a). The wordings of this specific planning condition is outlined below:

"A written method statement providing details of a definitive and detailed remediation scheme and how the completion of the remedial works will be verified shall be agreed in writing with the LPA prior to commencement, along with the details of a watching brief to address undiscovered contamination. No

deviation shall be made from this scheme without the express agreement of the LPA prior to its implementation”

1.2 Objectives

The primary objective of this RMS is to describe the remediation scheme including incorporating procedures for dealing with unforeseen contamination & environmental management during the earthworks. Other objectives include the following:

- present a review of past ground investigations and risk assessments relating to the site;
- provide an overview of the remediation process by outlining the environmental works to be undertaken that enables future development; and
- provide details of the Verification Plan (Condition 36i(aiii) to be implemented during the works in line with the Remediation Strategy.
- Outline requirements to ensure that no contaminated soils (or other materials) will be imported to site, particularly soils for landscaping.

As discussed below, there is no specific requirement to undertake remediation at the site, and therefore, this RMS will cover primarily material management requirements, protecting environmental receptors and managing risks.

This RMS has been developed to satisfy the likely requirements of the regulatory authorities as part of the planning process for the works.

1.3 Structure of the Report

The report is structured as follows:

- Section 2: summarises the current site setting;
- Section 3: summarises the findings of previous environmental assessments and identified soil and groundwater contamination at the site;
- Section 4: outlines the pre-remediation conceptual site model (CSM);
- Section 5: presents the general requirements for managing remediation as set out in the Remediation Strategy;
- Section 6: presents any other requirements to be considered; and
- Section 7: describes the verification process which will be undertaken during the earthworks and outlines the information required in the Verification Plan;

1.4 Sources of Information

The following sources of information has contributed towards the preparation of this document:

- Preliminary Investigation Report at Brickfield Site, Clayton Road, Hayes, London for Engie by Soils Limited. Ref: 17424/PIR. January 2018.
- Main Investigation Report at Crown Trading Centre, Clayton Road, Hayes, London for Engie by Soils Limited. Ref: 17424/MIR_R27. May 2019.
- Supplementary Investigation Report at Crown Trading Centre, Clayton Road, Hayes, London for Engie by Soils Limited. Ref. 17840/SIR. November 2019.
- Letter Report for additional ground gas and groundwater monitoring by Soils Limited. Ref. 17840/GRMS. February 2020.
- Supplementary Investigation Report at Crown Trading Centre, Clayton Road, Hayes for Equans by Soils Limited. Ref. 20227/SIR Rev1.01. July 2022.

- Remediation Strategy¹ at Crown Trading Centre, Clayton Road, Hayes for Greystar Europe Holdings Limited by Soils Limited. Ref. 20227/RMS Rev1.0. August 2022 (provided in Appendix B).

1.5 Limitations and Reliance on 3rd Party Data

This report has been produced by Turnkey for use by Henrys in connection with the proposed development. It is not intended for and should not be relied upon by any third party except as provided for in Turnkey's agreement with Henrys.

Turnkey has based this report on the sources of information detailed within the report and believes them to be reliable but cannot and does not guarantee the authenticity or reliability of third party information. Notwithstanding the reasonable skill and care exercised by the professional team in undertaking this assessment, it is possible that ground conditions and constraints other than those potentially indicated by this report may exist at the site.

This report has been prepared based on current legislation, statutory requirements, planning policy and industry good practice prevalent at the time of writing. Any subsequent changes or new guidance may require the findings, conclusions and recommendations made in this report to be reassessed in light of the circumstances.

¹ also called a Remediation Method Statement, albeit in outline so didn't satisfy planning condition discharge.

2. Site Setting

2.1 Site Location and History

The site is located on Clayton Road, Hayes, UB3 1DU West London and is approximately centred at National Grid reference TQ094 797. The site covers an area of approximately 1.4 hectares.

Until recently, it was a multi-occupancy hard covered site comprising buildings of varying ages, heights and sizes dated from the 1930s to relatively modern redevelopments. According to the latest information provided, the site is currently vacant with demolition of the buildings recently completed.

Former rail lines were present in parts of the site leading from Clayton Road to the south towards the Grand Union Canal (GUC) to the north. The site included a variety of uses including small industrial, storage and commercial ventures including tyre replacement, printers, electronics, scaffolding, plastics, garage services and commercial offices.

According to historical maps, the site was redeveloped as Crown Oil Works with numerous surface tanks shown to be present between 1934 – 1965. Historical reports note that the site manufactured specialist oils. After this time period, the site was redeveloped as warehousing. The last of the tanks were no longer shown/removed after 2006.

2.2 Ground Conditions

2.2.1 Published Geology

The published geological records indicated that the site is underlain by the London Clay Formation (LCF) bedrock deposits with overlying superficial deposits of Lynch Hill Gravel Member (LHGM). Made Ground is also noted to be present on the site.

2.2.2 Site-Specific Geology

A summary of the ground conditions gleaned from review of historical data from previous ground investigation reports is provided in Table 2.1 below.

Table 2.1: Site-Specific Geology

Strata	Average Thickness (m)	General Description
Made Ground	1.20	Concrete slab over firm greyish brown sandy gravelly CLAY with fragments of brick, clinker, slate, ash and ceramics
LHGM	3.00 (where proven)	Orangish/brown slightly clayey fine to medium SAND/SAND & GRAVEL, locally gravelly CLAY
LCF	Not proven*	Firm to stiff brown/grey silty CLAY, locally with sand lenses and partings

*average thickness of at least ~25m established from two borehole locations

2.2.3 Hydrogeology and hydrology

The Environment Agency (EA) have classified the superficial geology (LHGM) underlying the site as a Principal Aquifer. The underlying bedrock (LCF) is classified as an unproductive stratum. The LCF consists of a low permeability clay deposits which will act as an aquitard that will limit downward groundwater flow.

The nearest surface water feature is the Grand Union Canal (GUC) located at the northern boundary of the site. It is assumed that the canal is effectively sealed and therefore not in hydraulic connectivity

with the site. This was further evidenced by the limited number of groundwater strikes recorded during the ground investigation works.

Contamination, which may be present at shallow depths, is considered unlikely to migrate to the deeper aquifers due to significant thickness of the LCF.

3. Summary of Previous Environmental Assessments

3.1 Previous Environmental Assessments

A number of soil and groundwater contamination assessments at the site was carried out by Soils Limited which was used in the development of their Remediation Strategy.

A list of desk-top and intrusive environmental investigations undertaken are detailed in Section 1.4 above.

3.1.1 Main Investigation Report Ref: 17424/MIR_R27, May 2019

The summary of the above-mentioned report is outlined below:

- The intrusive investigation was carried out between February – March 2019 and involved 19 no. windowless boreholes, 2 no. CP boreholes to 25m below ground level (m bgl) and 4 no. dual purpose groundwater and ground gas monitoring installations. Buildings were indicated to still be present at time of the investigation.
- Made Ground was encountered between 0.5 – 3.1mbgl with some evidence of hydrocarbon staining and potential asbestos containing material (ACM). Similar to published geology, the LHGM and LCF were present beneath this.
- Groundwater strikes were recorded in only two locations.
- Exceedances within the soil were recorded for lead, dibenz(a,h)anthracene, benzo(b)fluoranthene and TPH aromatic (C21 – C35). These exceedances were based on screening against Generic Assessment Criteria (GAC) for Public Open Space – residential land use scenario. The exceedances were written off using a number of reasons including comparing the exceedances against commercial end use GACs and their removal as outliers. The Tier 1 Quantitative risk assessment established that there was a risk to the human health receptors of construction workers or future end users. The utilisation of commercial end GAC as screening criteria for the soil contaminant could be considered as poor practice, however, not a major issue as pathway is broken by the proposed development design (i.e. hardstanding/buildings and a cover system comprising clean ['suitable for use'] soils in landscaped areas).
 - It is worth noting that rather than TPHCWG analysis, hydrocarbons were tested for Texas banding. This is an unusual approach and leads to the comparison to GAC needing to probably be more conservative than otherwise is possible, as the latter isn't split into aliphatic and aromatic fractions. This approach applies to the other phases of investigation.
- Organic contamination appeared to be concentrated in the north-western section of the site within the location of the historical oil tanks.
- Asbestos was detected in ten of thirty-four samples analysed. The nature of the ACM was recorded predominated as chrysotile with amosite also detected. Details of quantification was not provided, therefore it was not possible to recognise the true nature of the material, e.g. was it above or below the hazardous waste threshold.
- Groundwater was rarely encountered according to the ground investigation records. One groundwater sample was recovered following detection of hydrocarbon odour. The results showed no exceedance of relevant quality standards. Based on this, the groundwater risk assessment established that there was no risk to the groundwater receptors. In addition, it was also established that the GUC is likely not to be in hydraulic connectivity with the groundwater on the site. This was further evidence by the limited number of groundwater strikes recorded during the ground investigation works.

- The report also indicates that the lack of significant levels of volatile fractions in the hydrocarbon oil results suggests that a long period of leaching has probably removed most, if not all of the potentially soluble fractions (*if they were there in the first place - oils tend to be from the heavier end of the hydrocarbon fractions*). Therefore, on-going risks from leaching are relatively low and potentially negligible. It is important to note, however, that leachate testing of the soil was not undertaken.
- There was no ground gas monitoring data presented in this report and it was noted that this will be covered in an addendum Letter Report (presented below).
- Further investigation was recommended within the location of historical tanks after site strip and demolition of existing structures.

3.1.2 Supplementary Investigation Report Ref. 17840/SIR, November 2019

The highlights gleaned from the above mentioned report is outlined below:

- According to the report, this additional intrusive investigation was carried out for the following reasons:
 - undertake an additional assessment in and around the area of the former oil storage area;
 - delineate potential ACM underlying areas below the buildings; and
 - installation of additional standpipes to allow for continued ground gas and groundwater monitoring.
- Buildings were still shown to be present during the intrusive investigation although about 12 locations were present within the footprint of buildings in the eastern section.
- Strong hydrocarbon and oily odour were observed in most of the investigation locations across the site within Made Ground and the LHGM. Potential ACM was also encountered in two locations in the northern part of the site.
- Groundwater strikes were recorded in two locations.
- Similar soil concentrations exceedances (lead, dibenz(a,h)anthracene, benzo(b)fluanthene, Aromatic (C21- C35)) recorded during the 2019 main investigation was also recorded here. In a similar assessment implemented during the 2019 investigation, these exceedances were written off as outliers and/or comparison of averaged out concentrations against the respective GACs. The lead exceedances were attributed to paintwork, coverings or flashing in demo-based materials.
- Asbestos was detected in 19 out of 52 samples. The positive results appeared concentrated in the western half of the site where recent historical development has occurred. As with the previous investigation, primarily chrysotile was present but crocidolite in fibre form was also recorded in one location in the western section. As with the previous investigation, this was not quantified.
- No new information provided as regards groundwater monitoring with further monitoring details on-going (as at the time the related report was being written).
- Ground gas monitoring was still being undertaken as at the time the report was being written and therefore would be covered in a Letter Report (presented below).

3.1.3 Letter Report for additional ground gas and groundwater monitoring Ref. 17840/GRMS, February 2020

This letter report represents an addendum to the supplementary ground investigation works reported in November 2019, which includes ground gas and groundwater monitoring details. Highlights from the report are summarised below:

- The supplementary monitoring included monitoring at all initial locations and the new locations installed specifically in and around the area of the former tank area.
- The monitoring data presented with some locations showing high methane, carbon dioxide and flow readings (particularly within the former tank area). However, following implementation of procedure set out in CIRIA C665², calculations presented within the report assess the site as a Characteristic Situation (CS) 1, as all the results are significantly lower than CS2 threshold value of 0.07l/hr.
- The report notes that monitoring indicates that oily material is still present in the location of the former historical tanks and has been leached of its volatile and soluble components over time and currently presents no gas risk to the proposed development.
- It was recommended that oily waste should be segregated if encountered during works to reduce the overall volumes of material requiring disposal as hazardous or stable non-reactive hazardous material off-site. On the basis of the works to date, the report notes that underlying “natural” materials from below the water table should be suitable for re-use or disposal as inert, as none encountered to date appears to have been influenced by any of the near surface historical source contamination identified.
- There is mention of a “plume” area around the historical tank area. We, however, believe that this term has been used out of context as it is likely referring to contamination in soil as opposed to presence of free product or dissolved contamination in groundwater (which is the context the term is typically used in contaminated land assessment).
- The dip data for groundwater monitoring did not highlight any discernible free product (e.g. Light Non Aqueous Phase Liquid [LNAPL] or Dense Non Aqueous Phase Liquid [DNAPL]).
- Asbestos was still recognised as a potential major issue at the site. The findings to date from the supplementary investigation analysis indicate that the presence of such material will probably require licensed and notifiable works to be resolved.

3.1.4 Supplementary Investigation Report. Ref. 20227/SIR Rev1.01, July 2022

An additional supplementary ground investigation was carried out in 2022 primarily for engineering design parameters. Investigation locations were also placed within footprint of the former structures in the western section. A summary of the highlights of the report is outlined below:

- The constituents of the Made Ground and underlying natural strata were similar to the previous intrusive investigations.
- Evidence of contamination in the form of strong hydrocarbon odour within the Made Ground and LHGM was recorded in some locations in the western section. There was no ACM visually recorded in any locations during this investigation. Asbestos was, however, detected in one sample out of ten samples analysed. Quantification details were not provided.
- Soil concentrations compared against GAC for Public Open Space – residential end use recorded one exceedance for dibenz(a,h)anthracene (out of ten samples tested).
- Based on the shallow soils analysis undertaken as part of this investigation, the risk to groundwater was considered to be low.
- Groundwater was encountered in three locations.
- Four ground gas monitoring visits were shown to be part of this investigation with monitoring on-going (as at the time the report was being written). The results to be presented in a further addendum report. This had not been received as at the time of preparing this RMS, although the remediation strategy appears to bear in mind the results.

² CIRIA C665. Assessing risks posed by hazardous ground gases to buildings (2007)

4. Pre-Earthworks Remediation Conceptual Site Model

4.1 Introduction

The CSM follows the contaminant-pathway-receptor principle which is central in UK guidance and legislation.

The section below presents the final CSM for the site based on the intrusive ground investigations and risk assessments completed to date. The CSM provides the basis of the Soils Limited Remediation Strategy and in extension, this RMS.

4.2 Conceptual Site Model

The latest CSM for the site has been taken from the latest ground investigation report and is presented in Table 4.1 below.

Table 4.1: Revised CSM (extracted from Table E.1.2 of Supplementary Investigation Report July 2022)

Source (No off-site sources confirmed as significant)	Potential Contaminants	Exposure Pathway	Receptor	Risk	Comments
Industrial Use On-site historic and current site usage including Oil Works	Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPHs), Asbestos	Inhalation of dust	Site Workers/Site Maintenance	Low	Hardstanding/buildings will break pathways of non volatile contaminants for current users and significantly reduce potential infiltration.
			End Users	Very Low	
			Off-site Users	Very Low	
	TPHs, PAHs	Inhalation of Vapours/gases	Site Workers/Site Maintenance	Low	Proposed development may include soft landscaping which may increase potential risk from some pathways; however a clean cover system will mitigate this risk.
			End Users	Very Low	
			Off-site Users	Very Low	
	PAHs, TPHs, Asbestos	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Low	Services may be at risk if placed directly into hydrocarbon contaminated areas; however clean backfill will be adopted for utility corridors mitigating this risk.
			End Users	Very Low	
			Off-site Users	Very Low	
	PAHs, TPHs	Migration via surface runoff	Surface Water	Very Low	Site is located on bedrock of LCF, which was classified as an unproductive strata and would act as an aquiclude to the deeper Chalk groundwater receptor.
		Migration in solution via groundwater	Surface Water	Very Low	
			Shallow Aquifer	Very Low	
		Direct contact with construction material	Buried structures	Low	
			Buried services	Low	
	PAHs, TPHs	Migration of gases via permeable soils	Site Workers/Site Maintenance	Low	Oils and waters probably perched in granular materials over cohesive Made Ground. No direct linkage to surface waters identified.
			End Users	Very Low	
			Off-site Users	Very Low	
			Building and confined spaces	Very Low	

5. Remediation Strategy and Implementation

The works is designed to address any potential risks associated with the contamination at the site in line with the Soils Limited Remediation Strategy.

5.1 Remediation Strategy Highlights

The Soils Limited Remediation Strategy concluded that no formal soil remediation strategy is considered necessary for ground contamination risk mitigation. This is primarily as the proposed development and groundworks will mitigate a significant amount of the source material identified. Proposed hardstanding, buildings or landscape cover will be present on completion and therefore all longer-term pathways will be removed by this activity as a potential risk to end-users.

There may be potential risks during works to on and off-site receptors, however, which will require site specific consideration within the development. In accordance with the report, a formal method of validating and verifying proposed activities will be required. In summary, the following guidance was provided in the Remediation Strategy:

- Confirmation of the materials removed – including volume/weights and example tickets detailing the final destination of the “waste” in compliance with the site waste management plan and current legal requirements.
- Confirmation of the quality, suitability and fitness for purpose of any imported non-specified materials such as growing media in landscaped areas. Testing of as-received imported material is required and frequency of this would be set out in the Material Management Plan (although this is presented in Section 7 below).
- Any such importation is to be subject to compliance requirements to an agreed specification and further accepted by the supplier that any non-conforming material is removed and replaced (at their cost), if discovered later not to be to specification.
- Confirmation of the formal emplacement of a Discovery Strategy in the site works/H&S instructions will be required with formal written confirmation regarding its non-implementation should nothing of concern be located or reported during the works.
- Sufficient thickness of clean and certified growing media to support plant growth will be required. This will also be accompanied by a suitable barrier or warning material as applicable and agreed material. This could include or comprise a variety or combination of geotextile and/or granular materials of suitable thickness in line with current guidance. This approach will extend to service corridors that will be lined with a geotextile and backfilled with clean material.

The implementation of the points outlined above will be addressed in the next section.

5.2 Remediation Strategy Implementation

Based on the information provided in the Soils Limited Remediation Strategy, the following general works will be required to be carried out as part of the earthworks:

- Implementation of a Discovery Strategy.
- Removal of redundant underground structures.
- Excavation and removal of hydrocarbon impacted material within the ‘cut’ soil.
- Import of suitable material in areas of landscaping and service corridors.
- Reuse of site-won arisings on-site.
- Piling.

It is important to note that these activities are limited to the information provided to date and therefore may change, dependent on availability of new information/data.

5.3 Discovery Strategy

The Soils Limited Remediation Strategy indicates the requirement of a Discovery Strategy to be in place, in case any specifically deleterious and/or unexpected materials are encountered during the works. The guide on actions to be carried out was provided in the Remediation Strategy and is outlined below:

"There may be areas of contamination not identified during the course of previous ground investigation. Such occurrences may also be discovered during the demolition and construction phases for the redevelopment of the site.

Care should be taken during excavation works especially to investigate any soils, which appear by eye (e.g. such as fibrous materials, large amounts of ash and unusual discolouration), odour (e.g. fuel, oil and chemical type odours or unusual odours such as sweet odours or fishy odours) or wellbeing (e.g. light headedness and/or nausea, burning of nasal passages and blistering or reddening of skin due to contact with soil) to be contaminated or of unusual and/or different character to standard soils or those analysed.

In the event of any discovery of potentially contaminated soils or materials, this discovery should be quarantined and reported to the most senior member of site staff or the designated responsible person at the site for action. The location, type and quantity must be recorded and the Local Authority, and a competent and appropriate third-party Engineer/Environmental consultant notified immediately. An approval from the Local authority must be sought prior to implementing any proposed mitigation action.

The discovery strategy must remain in place at all times and must demonstrate a clear allocation of responsibility for reporting and dealing with contamination. A copy of the strategy must be placed on the health and safety notice board and /or displayed in a prominent area where all site staff are able to take note of and consult the document at any time. Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the discovery strategy."

5.4 Removal of Redundant Underground Structures

The demolition contractor (Squibb Ltd) identified redundant underground structures (possibly tanks) in the former tank area in the north-western section (see their site survey mark up in Appendix A). Removal of these structures will be undertaken as part of the construction works.

Before removal of the structures, it may be necessary to check the contents to allow dewatering of residual liquids prior to breaking out. Such material should be disposed off-site in line with Duty of Care. The redundant liquids will need to be tested to assess their content prior to disposal.

Following removal of the below ground structures, the soils surrounding will be inspected for visual and olfactory signs of contamination by Turnkey. If required, the excavation/void will be extended vertically and horizontally as far as deemed necessary for the proposed development until there is a general consensus that the impacted material has been removed and/or physical constraints prevent further excavation. If not removed immediately when excavated, the impacted arisings will be temporarily stockpiled on site in an impermeable area whilst awaiting preliminary assessment. Refer to Section 5.8 for details regarding soil segregation, reuse and disposal of excavated materials.

Where groundwater is encountered and observed to be impacted, with discernible free product, the liquid will need to be removed from site as it could contaminate the resultant void and backfill material. Contaminated water will need to be pumped out of the excavation as far as practicable.

Once impacted soil and groundwater has been suitably removed, the resultant void created will need to be validated in accordance with the Verification Plan provided in Section 7. Unless it is set for attenuation tanks (three are planned), for example, the void can then be backfilled with suitable material to the required levels.

5.5 Excavation and Removal of Hydrocarbon Contamination

If encountered during the earthworks (as part of the cut/fill operations), gross hydrocarbon contamination will need to be removed (gross contamination for this site considered to be free product, heavy oil staining or very strong hydrocarbon odours). The excavation will be extended vertically and horizontally as far as reasonably practical; if deemed to pass the re-use criteria (see Section 7) then no further excavation will be required. Unless removed from site at the point of excavation, the impacted material will be segregated and stockpiled on site whilst awaiting preliminary assessment.

The resultant void will be validated in accordance with the Verification Plan provided in Section 7. Once impacted soil has been suitably removed and the resultant void validated, the excavation can be backfilled with suitable material to the required levels unless it is set for an attenuation tank to be installed, for example.

5.6 Asbestos

The ground investigation information has indicated that asbestos remains a potentially major issue at this site. The report also shows that findings to date from the supplementary investigation analysis indicate that the presence of such material will probably require licensed and notifiable works to be resolved.

Post-demolition survey provided by the demolition contractor, shows areas of the site where ACM was encountered (see Appendix A). For clarity, where there are visible asbestos fragments or fibres present above 0.1%w/w, the material cannot be reused on-site. Visible asbestos removal will only be undertaken by trained and competent personnel.

When works are being undertaken within the 'hotspot' ACM areas (as indicated in the demolition drawing), a specialist competent licensed advice should be retained to ensure compliance with current guidance, H&S and legal requirements. As a general rule of thumb, if the material has to be excavated and disposed of off-site, due care is required to protect off-site receptors. Appropriate assessment (undertaken with regard to the Control of Asbestos Regulations (CAR, 2012)) and adequate PPE will mitigate this risk and should be implemented by a specialist contractor.

5.7 Piling

5.7.1 Piling Works Risk Assessment

According to the Remediation Strategy, a piling works risk assessment (PWRA) will be required for the proposed use of piled foundations. The risk assessment is required to demonstrate how creation of potential contaminant migration pathways will be mitigated via the chosen piling technique. This is yet to be produced (and requires verification that this is a project requirement – the outcome of this, plus summary if applicable, can be picked up in the verification report).

5.7.2 Arisings

Some excavation will be carried out in preparation for construction of the piling mat. The arisings should be managed as indicated in Section 5.8.2 below, which includes appropriate segregation (if required for grossly contaminated material) and temporary stockpiling. The guidance provided in the Discovery Strategy will be implemented if gross contamination is encountered.

During the piling works, there should be provision to monitor the piling arisings as they brought to the surface. Monitoring will entail visual and olfactory screening to assess whether material being brought

to the surface is likely to be a source of contamination. If any potentially contaminated material is identified, it should be treated in line with guidance provided in Section 5.8.2.

5.8 Material Reuse Strategy

The works will aim to maximise the reuse of site-won soils and minimise off-site disposal (in accordance with good practice), whilst reaching the finished works in compliance with the RMS. General cut and fill will be required to enable site levels. Overall, due to attenuation tanks and piling arisings, there is a cut surplus.

5.8.1 Soil Classification and Material Management

The material management will be carried out using the CL:AIRE Definition of Waste Industry Code of Practice (DoWCoP)³. The DoWCoP provides a consistent and efficient process which enables the reuse of excavated materials on-site or movement between sites. The implementation of DoWCoP can provide an alternative to Environmental Permits or waste exemptions.

The excavation, movement, tracking and placement of materials will be undertaken in accordance with a Materials Management Plan (MMP) for the site. This will be produced in due course.

Any site-won materials reused as general fill will be subject to certification and analysis against testing suites and frequencies detailed in the Verification Plan in Section 7. All excavations undertaken during the works will be backfilled with site-won material (in the first instance) that needs the fill re-use criteria or imported material which meets the import criteria.

5.8.2 Soil Segregation

Based on the information provided in the Remediation Strategy, it is not envisaged that grossly contaminated material will be encountered during the works (with the exception of around the former oil storage area). In the event that contaminated material is encountered, however, then excavated soils will need to be carefully segregated during excavation, based on visual and olfactory evidence of contamination. The soils will be segregated into the following waste streams:

- 'Clean' arisings; Arisings with no or minimal visual or olfactory evidence of contamination, which are likely to be verified as suitable for reuse on-site as general fill without the need for treatment. Verification analysis of these soils would be required (in line with the Verification Plan below) prior to reuse as general fill material.
- Grossly contaminated arisings: It is possible that a proportion of the excavated soils may be heavily impacted (e.g. presence of visible product). Where these soils cannot be reused on-site, off-site disposal may be required at an appropriately licenced treatment or waste management facility.

5.9 Material Importation Strategy

All imported material for use at the site will require certification to determine the materials suitability for use on-site prior to importation. Separate certification is required for each type of material utilised. All imported materials (with the exception of naturally sourced material) will need to be accompanied with chemical certification to demonstrate its suitability for use on-site.

Following importation to site, the material will be sampled and analysed to ensure it meets the necessary verification requirements (further details are provided in Section 7). The imported material will be subject to the following limitations:

- Free of visual/olfactory evidence of contamination (oil staining or odours, discolouration of soil, free product); and

³ The Definition of Waste: Development Industry Code of Practice (DoWCoP); CL:AIRE (2008)

- Free of visually identifiable ACM such as chrysotile cement sheets.

Where recycled aggregates are sourced, the producer of the aggregate must show the material has been fully recovered and is no longer a waste. This can be achieved by ensuring the producer has followed the quality protocol for the production of aggregate from inert waste, as outlined by WRAP or from a permitted source, for example.

5.10 Capping Layer/Soil Cover System

Where soft landscaping is proposed directly on the ground surface, a clean layer of material will be required to prevent direct contact with potentially contaminated Made Ground. This should be formed by a geotextile marker layer and at least 600mm thick imported topsoil/subsoil (thickness and nature of material will need to be confirmed with the landscape architect).

Any material used within the capping layer should meet the import criteria provided in Section 7 and be free from visible anthropogenic materials. The details provided in Section 5.6 should also be adhered to. Soil cover depth to be confirmed through verification inspection pits.

5.11 Previously Unforeseen Contamination

Due to the historical use of the site as an oil works, there may be other unknown contamination hotspots that may be present or not encountered during the ground investigation. If encountered, additional investigation, risk assessment and remediation may be required to adequately address the unexpected contamination and allow it to be verified appropriately.

In the event this occurs during the earthworks, the contingency plan outlined below will be implemented:

- All works to cease pending revision of the CSM, updating of the RMS (including details of action plan – dependent on the points below) as appropriate, submission of documents to the Contaminated Land Officer (CLO) – approval to be sought from the CLO.
- Implementation of delineation works, including appropriate sampling and laboratory analysis to further characterise the materials, and determine the extent of the contamination.
- The results of the delineation works will be passed to the CLO.
- Depending on the results of the testing, the following will be considered: (i) no further works will be required; (ii) further risk assessment will be required and/or (iii) localised specific remedial measures (including removal of impacted material to a quarantine area) may be necessary.
- Any additional remediation works will be included in the Verification Report.

5.12 Ground Gas / Vapour Protection

The results of ground gas monitoring and assessment provided in the Soils Limited Letter Report designated the site as a CS1. This means that the risk presented by ground gas is minimal and no protection measures are required.

There is, however, an indication that there may be isolated areas of gas generation associated with the former tank area that remain unquantified – given this area is set for excavation, it is assumed that this potential source will be removed.

Due to the presence of some volatile fractions within the hydrocarbons, it is prudent that vapour protection measures are included within the building design (this could be ruled out if supported by further risk assessment – the outcome of this can be detailed in the verification report).

5.13 Unexploded Ordnance

According to the ground investigation reports, the risk associated with Unexploded Ordnance (UXO) presence was considered unlikely as the site was a strategic oil producer during WWII, being high risk but a hard covered site.

As it was not clear how the above conclusion was reached (probably it was assumed by Soils Limited that there would have been records of strikes or damage, hence coming to their conclusion – this is speculation, however). Thus, Turnkey has sourced some preliminary information on the site from a UXO consultant (Zetica Ltd); this information provided in Appendix B. This will be considered by Henrys as part of their H&S management.

6. Additional Considerations

6.1 Licensing and Permitting

Henrys will need to apply for or arrange the following licences, consents and approvals as part of the earthworks:

- Foul sewer effluent discharge consent (if planning to discharge to sewer).
- MMP (as indicated in Section 5.7 above). Turnkey will be assisting with this.
- HSE notification, authorisation for asbestos works (where applicable).
- Site Waste Management Plan (SWMP).

6.2 Water Supply Pipes

As indicated in the provided Soils Limited ground investigation reports, the results of the investigation was compared to the threshold concentrations for Polyethylene (PE) and Polyvinyl Chloride (PVC) pipe specified in the UKWIR report⁴. The output indicates that PE and PVC water supply pipes would probably not be considered suitable and appropriate by the regulator/provider for use on the development site. This is unless appropriate remedial measures are implemented that mitigate this identified risk i.e. through emplacement in sealed service corridor.

On the basis of the above, water supply pipe materials should be agreed with the local utility provider before installation to prevent tainting of water supplies from residual contamination (where applicable). Having clean bedding materials may suffice, although this will need confirming. Evidence of the installation of suitable pipework will need to be provided as part of the Verification Report.

6.3 Utility Service Corridors

Only certified clean materials should be used to backfill service corridors through areas of Made Ground. As indicated in the Remediation Strategy, this should be lined with a geotextile membrane to provide a marker layer between clean service trench fill materials and Made Ground.

6.4 Waste Management

In the event contaminated site-won soils cannot be reused as general fill, this material will require off-site disposal to a suitably licenced treatment of waste disposal facility.

All waste sent to landfill or a waste treatment facility will be classified and pre-treated (where necessary). The form of pre-treatment should be documented in the Site Waste Management Plan (SWMP). The final decision whether to accept the waste is the responsibility of the landfill operator/waste treatment facility, but Henrys has the responsibility of undertaking laboratory testing (to classify the waste, including waste acceptance criteria (WAC) testing, where required).

Due to asbestos, when present, not being quantified, Henrys will need to undertake some of this analysis otherwise some soils may be classified as hazardous when actually they may be non-hazardous.

All waste will be removed from site with a completed Waste Transfer Note (WTN). All hazardous waste will be removed from site with complete hazardous waste consignment notes. All waste will be removed using a licensed waste transport provider and sent to a licensed waste accepting facility.

The source and volume of material should be stated on delivery tickets and these should be retained by Henrys.

⁴ UKWIR Report 10/WM/03/21 Guidance of the Selection of Water Supply Pipes to be used in Brownfield site (UKWIR,2010)

7. Verification Plan and Reporting

7.1 Introduction

Validation sampling will be undertaken in general accordance with BS10175:2011 The Investigation of Potentially Contaminated Sites and EA guidance on the Verification of Remediation Land Contamination, 2010, following the principles outlined below:

- minimise the risk for cross contamination of samples both during sampling and transit;
- every sample will have unique name/reference;
- store samples in clean, laboratory supplied vessels; and
- all samples should be labelled, stored appropriately (i.e. cool boxes with ice packs & padding) and transported under chain of custody to the laboratory.

Samples will be submitted to an analytical laboratory holding UKAS and MCERTS accreditation.

7.2 Soil Sampling Criteria and Frequencies

The collected samples will be analysed for a range of determinands set out in Appendix C. The results of the laboratory analysis will be compared against the verification criteria provided in Appendix C. Separate criteria have been provided for site-won materials (Appendix C1) and imported materials (Appendix C2). Both set of criteria are human health driven, however they are conscious of risk assessments that have signed off controlled waters.

When deriving the verification criteria targets, Turnkey have considered the following:

- for import criteria, consideration of the existing site soil contaminant concentrations has been undertaken to ensure imported soil are generally below the threshold concentrations derived for the site;
- the criteria presented are equal or below the Suitable for Use Level (S4UL) for Public Open Space – residential (POSresi), to prevent the materials posing a risk to site users. For imported materials, the more stringent S4UL for residential with homegrown produced has been considered where POSresi threshold values are considered too high (*especially considerate of hazardous waste thresholds and groundwater risk assessment at ground investigation stage*);
- the criteria is below current hazardous waste thresholds, this is in case the material is partially excavated during follow-on construction works and may require off-site disposal (if surplus to requirement); and
- the criteria will not increase the existing contaminant load on-site related in particular to imported material.

Soil validation sampling will be carried out at the frequencies outlined in Table 7.1 below and against the verification criteria provided in Appendix C.

It should be noted that the sampling frequencies set out in Table 7.1 are provided as a guide and the actual frequencies (particularly related to unforeseen contamination) could change following consultation with the CLO. Any amendments to the sampling frequency will be clearly documented with details provided in the Verification Report.

Table 7.1: Soil Validation Sampling Criteria and Frequencies

Material Type	Validation Sampling Frequency	Verification Criteria
Base of former oil storage tanks area in north-west of site (see Section 5.4)	1 sample per 10m x 10m square across the base and 1 sample every 15m along the face of the excavation. For smaller excavations, at least one sample per face and one sample per base should be collected.	Refer to Appendix C1
Excavation unforeseen contamination for	1 sample per 10m x 10m grid square across the base and 1 sample every 10m along the face of the excavation. For smaller excavations, at least one sample per face and one sample per base should be collected. The final sampling regime will be confirmed following assessment of the contamination.	To be confirmed following assessment of the unforeseen contamination and, where required, liaison with the CLO and other stakeholders.
Site-won material reused on-site	1 sample per 500m ³	Refer to Appendix C1
Imported topsoil or subsoil	1 sample per 100m ³ per source for the first 500m ³ , with a minimum of three samples per source. If results are consistent, this can be reduced to 1 sample per 500m ³ per source. Supplier certificates (including test certificates from source) must also be provided prior to the material being imported to site.	Refer to Appendix C2
Recycled aggregate or imported material for use as general fill on-site	Confirmation that the material has been produced under a quality protocol (WRAP) or permitted operation or if natural soils, imported under a DoWCoP MMP. Confirmatory sampling required and analysis for chemical quality, minimum of 1 sample per 500m ³ . In addition, chemical results for material must be provided by the supplier before importation of material commences.	Refer to Appendix C2
Imported quarried aggregate for use on-site	No sampling if material is naturally sourced/virgin material. Documentation from supplier must be provided to confirm that that material is naturally sourced.	Not Applicable

Samples will be considered acceptable for use if they are below or equal to the relevant verification criteria. Samples which exceed the verification targets will typically be unacceptable. There are some exceptions to this which will include marginal/localised exceedances of verification targets. In such cases, additional sampling may be carried out or qualitative or quantitative risk assessment implemented to determine if the results are acceptable.

7.3 Work Methods

The earthworks will incorporate a number of activities, the details of which are included in this section.

7.3.1 Watching Brief

Turnkey will undertake a part time watching brief during the earthworks. The watching brief will target removal of any redundant tanks in the former oil storage area and associated excavation works.

Attendance at the site by Turnkey will also be required during verification sampling of excavation subgrade and soils for placement, including landscaped soils.

Following incorporation of the cover system, Turnkey will also carry out verification of the thickness of the cover layer and presence of geotextile marker layer.

7.3.2 Environmental Monitoring

Environmental monitoring will be undertaken in accordance with the Construction Environmental Management Plan (CEMP) for the duration of the earthworks and appropriate records reported in the Verification Report.

7.4 Verification Reporting

The Verification Report will incorporate information collected during the earthworks demonstrating compliance with this RMS and Remediation Strategy. The Verification Report will comprise:

- The Remediation and Verification objectives.
- As-built plans.
- A photographic record of the works.
- Provision of justification on any areas where any varied methodology differing from the RMS has been implemented.
- A summary of the works completed including:
 - works methodology;
 - details of any outstanding/residual actions and constraints; and
 - description of final site conditions.
- Records of the watching brief and Discovery Strategy implemented during the works, where applicable.
- Confirmation on whether or not unforeseen contamination was encountered. If encountered, how it was handled.
- Chemical results of the soils reused on-site and/or imported onto the site.
- Details of any imported materials including transfer notes and chemical testing certification (where applicable).
- Verification of waste disposal including chain of custodies and consignment notes.
- Confirmation of use of the marker layer, where required.
- Confirmation of thickness of cover layer placed in soft landscape areas via inspection pits.
- Confirmation that appropriate protection has been afforded to water supply pipes as required by the utility company.
- Confirmation of use of vapour membrane within building design or risk assessment proving it is not required.
- Summary of piling, adhering to the PWRA (if one is actually required).
- Details of all relevant permits, licenses and consents.

Appendix A – Figures

- Master Plan
- Post-demolition survey markup

Appendix B – Supporting Documentation

Appendix B1 – Soils Limited Remediation Strategy

Appendix B2 - Unexploded Ordnance Assessment

Appendix C – Verification Criteria

Appendix C1 – Reuse of Site won Soils Criteria

Appendix C2 – Imported Material Criteria