

Remediation Strategy

At:

Former St John's Ambulance Station
Armoury Drive,
Gravesend,
Kent,
DA12 1CT

Ref: 4551 22 04 29 RPT 02 REV A BD SP

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Association of Geotechnical & Geoenvironmental Specialists



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Introduction

1.1 REASON FOR THE REPORT

Sevenoaks Environmental Consultancy Ltd (SEC) was appointed by the Longley Group Ltd to prepare a Remediation Strategy in support of proposed re-development of the site known as Former St John's Ambulance Station, Armoury Drive, Gravesend, DA12 1CT.

The site was previously developed with a St John's Ambulance Station garage and a Water Tower, which at the time of writing had been partially demolished. It is proposed to redevelop the site with 1 No. 2 storey block of flats to the western end of the site and 2 No. detached bungalows to the eastern end of the site with gardens (see Appendix A Figure 1 for Proposed Development Layout Plan). Two previous reports have been produced for the site including a Geo-Environmental Desk Study by Soils Ltd (Ref: 17753/PIR_R26) dated August 2019 and a Preliminary Geo-Environmental Site Investigation Report by SEC (Ref: 4551 22 04 21 Rpt 06 Rev B EH CW) dated April 2022. The findings from these previous assessment reports are summarised in more detail later in Section 2.0.

The previous reports and this Remediation Strategy have been produced in support of Planning Condition 5 associated with the proposed development of the site under Planning Permission 2020/0561. Additionally this Remediation Strategy aims to inform the redevelopment Contractor of the remedial strategy / processes to be employed during the proposed development such that potential contaminated land risks to receptors are managed appropriately during the site's redevelopment and that any remedial work undertaken is adequately validated and documented to the satisfaction of the LPA.

1.2 SCOPE OF REPORT

In order to help discharge contaminated land planning conditions, this report references and discusses earlier contaminated land assessment reports, which have been written previously to help determine the ground contamination status of the site. This report provides details on the strategy for inspecting and remediating ground contamination identified at the site as well as other site specific operational details required to help mitigate potential risks to receptors associated with the proposed development including construction workers, future site users, neighbouring sites and controlled waters.

1.3 SITE DESCRIPTION

The site is located at NGR 565110 173560 and covers an area of ~0.114 hectares. It is an approximately 'L' shaped plot which was previously occupied by a former St Johns Ambulance garage building, 1 No. Water Tower Structure and a long tarmac access drive trending through the site in an east to west orientation. Some areas of soft landscaping were also present across the site. SEC note that at the time of writing, the Client had carried out the partial demolition of the former St Johns Ambulance garage which included breaking out the garage ground slab and removal of some of the walls. The site is understood to have previously formed part of Gravesend barracks.

The site is bounded by residential houses on all sides and Albert Murray Close to the north.

1.4 PREVIOUS REPORTS

The following reports are relevant to the geo-environmental assessment of the site and should be considered with this document:

- Phase 1 Geo-Environmental Desk Study Report (Ref: 17753/PIR_R26) Dated August 2019 by Soils Ltd;
- Preliminary Geo-Environmental Site Investigation Report (Ref: 4551 22 04 21 Rpt 06 Rev B EH CT) dated April 2022 by SEC;

This current report should be read in conjunction with these previous documents.

It is noted that the site is potentially archaeologically sensitive and as such archaeological constraints should be considered in parallel with any intrusive groundwork on site associated with the proposed development. Potential UXO risks should also be considered prior to intrusive groundwork.

2 Summary of Contamination Assessment

2.1 INTRODUCTION

Previous contaminated land assessment reports for the site have been carried out by Soils Ltd and SEC. Whilst the following provides a brief summary of the geo-environmental findings recorded by the previous reports reference should be made to the aforementioned documents for a more comprehensive view of the results and their implications.

2.2 REVIEW OF PREVIOUS REPORTS

Phase 1 Geo-Environmental Desk Study Report by Soils Ltd (Ref: 17753/PIR R26) Dated August 2019:

The previous Desk Study Report was written as part of a pre-planning exercise based on a proposed end use for the site consisting of four different possible residential redevelopment options. It was understood that the preferred development was based on 2No. bungalows and 1No. block of 2-storey flat which is the same scheme that is proposed currently.

The site layout and usage noted in the previous Desk Study Report was generally consistent with the existing layout at the time of writing this current document except for the commencement of demolition of the St Johns Ambulance garage building.

Historically the Desk Study reported that the site comprised an undeveloped plot until 1874 when the water tower and garage were built. The site then remained unchanged until present day. Off site, between 1866 to 1874 a chalk pit was identified ~200m to the north of the site and a rail line ~140m north, with several tanks noted between 1954 to 1981 ~76m northeast.

The published geology locally to the site was recorded to be Thanet Formation bedrock over Lewes Nodular Chalk Formation with no overlying superficial deposits. The Thanet Formation was classified as a Secondary A Aquifer and the Lewes Chalk was noted to be a Principal Aquifer.

Potential on site sources identified included an electrical substation from 1951 [although it was noted that based on the site area for the current redevelopment scheme, the substation is located outside of the site footprint and is therefore actually off site], site use as Gravesend Barracks with a garage between 1874 and 1981 and an above ground storage water tank since 1936.

Many potential off-site sources were listed in the desk study and these have been summarised to include; an infilled chalk pit ~167m north east of the site between 1866 and 1897, tanks identified ~48m and 76m east and north east between 1954 and 1993 respectively and a garage identified ~142m north west between 1954 and 1999.

Preliminary Geo-Environmental Site Investigation Report (Ref: 4551 22 04 21 Rpt 06 Rev B EH CT) dated April 2022 by SEC

Further to the findings of the desk study report a preliminary intrusive site investigation was conducted by SEC. The site layout during the site investigation was noted to be generally consistent with that described in the earlier Desk Study with the exception of the recent demolition work. The site investigation was based upon the same residential end use as the previous desk study. It is noted however that a gas leak had occurred locally to the site prior to the site investigation which had reportedly been repaired by Southern Gas Networks although the manhole in Albery Murray Close to the north of the site was noted to still exhibit a methane odour.

The scope of the site investigation included the conduct of 5 No. mini boreholes up to 4m bgl (WS01 – WS05) using a Continuous Dynamic Sampler drill rig. Environmental ground gas and groundwater monitoring wells were installed within the boreholes to facilitate ground gas and groundwater monitoring. Soil samples recovered from the boreholes were sent for laboratory analysis for a range of contaminants including metals, asbestos (presence / absence and quantification), speciated PAHs, TPH, phenols, VOCs and WAC. 3 No. groundwater monitoring visits were conducted as part of the assessment. Ground gas monitoring to inform a ground gas risk assessment was conducted however is on going at the current time of writing.

The ground conditions identified on site generally comprised Made Ground up to between 0.25m bgl (WS04) and 1.35m bgl (WS05) which was relatively homogenous and consisted of gravelly Clay with flint, brick, concrete, tile and tarmac fragments. Underlying the Made Ground natural Sand deposits were encountered and proven up to 4.45m bgl.

Visual and olfactory observations indicative of potential ground contamination included VOC headspace test results up to 40.8ppm (WS2 at 3.5m bgl) and a hydrocarbon odour. Slightly elevated VOCs were identified within a sample recovered from WS02 at 3.50m bgl. Additionally potential cement bonded asbestos sheeting fragments were identified within TP01 (0.2m bgl) and TP03 (0.5m bgl).

Based upon the findings of the assessment the following sources of contamination were identified;

- Potentially coal tar rich tarmac surfacing associated with the existing site access road up to 0.15m bgl (WS01) which exhibited elevated concentrations of PAHs including benzo(a)pyrene up to 48.8mg/kg and TPH up to 2780mg/kg;
- Made Ground identified across the site up to 1.35m bgl (WS05) generally comprising gravelly Sand / sandy Gravel with varying frequencies of flint, brick and concrete inclusions, fragments of cement bonded asbestos sheeting (TP01 and TP03) and elevated concentrations of lead (up to 797mg/kg TP02 at 0.3m bgl) and PAHs including benzo(a)pyrene (up to 17.6mg/kg TP02 at 0.3m bgl);
- Former site use as a garage, with an above ground tank and as part of a barracks; and
- Potentially elevated concentrations of ground gases (to be considered separately within a follow on Ground Gas Risk Assessment Addendum which is currently on going at the time of writing this Remediation Strategy)

Potential off-site sources of contamination identified included;

- An infilled Chalk Pit identified ~167m northeast of the site between 1954 - 1981;
- Milton Barracks identified ~140m east of the site between 1947 – 1992;
- A Tank identified ~76m northeast of the site between 1954 – 1993;
- Gravesend Barracks identified ~23m northeast of the site between 1909 – 1981;
- A Tank identified ~49m southeast of the site between 1954 – 1978; and
- An Electrical Substation ~25m north of the site since 1951.

To help mitigate potential risks to receptors associated with sources of contamination the following recommendations were provided;

- That the remaining ground gas monitoring be completed in order to inform the Ground Gas Risk Assessment Addendum to supplement the findings of this assessment and to inform the requirement for any protective measures within the building design;
- That prior to the proposed development, all general rubbish and drums of fuel should be appropriately removed from site and disposed of at suitably licensed facilities (all waste disposal documents to be retained);
- That the existing potentially coal tar rich tarmac surfacing be disposed of from site to suitably licensed waste management facilities as hazardous waste under waste code 17 03 01. All waste disposal documentation should be retained for inclusion within a future Validation Report. To help facilitate appropriate waste disposal from site, the tarmac surfacing should be carefully excavated and segregated from the underlying material under the supervision of an Environmental Consultant;
- That a watching brief be maintained by an Environmental Consultant during the removal of the hardstanding across the site and in particular the ground slab of the former buildings. Confirmatory validation samples should be recovered for analysis to confirm an absence of impact associated with contaminants of concern including metals, PAHs, hydrocarbons and asbestos;
- That remedial excavation be conducted to remove the lead and asbestos impacted Made Ground identified on site for appropriate disposal to suitably licensed facilities. Remedial excavation should be overseen by an Environmental Consultant and be certified by soil validation sample analysis from the sides and base of the remedial excavation. Any imported backfill material (e.g. engineered fill / aggregate, subsoil or topsoil) should be chemically validated in relation to suitability for use on site as part of the proposed development, including the review of the supplier's chemical batch data prior to import and chemical analysis of validation samples following importation to site;

- That an asbestos picking exercise be conducted during the excavation of asbestos impacted material locally to TP01 and TP03, to remove fragments of cement bonded asbestos sheeting for separate disposal. Asbestos picking should be conducted by Category A & B Asbestos Awareness trained operatives and to help mitigate potential Health and Safety risks appropriate PPE / RPE should be worn by operatives during the remedial excavation and asbestos picking, including disposable suits and FFP3 masks;
- That all waste arisings should be disposed of from site appropriately in accordance with EA WM3 guidance. The impacted Made Ground should be disposed of as Non-Hazardous waste under waste code 17 05 04 and picked asbestos containing material fragments as Hazardous waste under waste code 17 06 05. All arisings should be segregated based on waste stream types and according to waste classification. All waste disposal tickets should be retained;
- That a “clean” cover system be provided to a minimum thickness of 475mm across landscaped / garden areas. The cover system should comprise the provision of a high visibility marker layer (permeable geotextile or similar) overlain by imported certified “clean” topsoil to the required minimum thickness. Subject to existing and proposed site levels it may be necessary to remove some existing soils to facilitate the cover system. Prior to delivery of any imported topsoil to site, the supplier’s chemical batch data should be provided to an Environmental Consultant for review and following provision of the cover system to landscaped areas it should be validated by an Environmental Consultant. This should include chemical analysis of a representative number of imported cover system validation samples based on a minimum frequency of 1 validation sample per garden / landscaped area as a minimum or 1 sample per 50m³ per material source for larger areas. In addition the thickness of cover system should be certified;
- That the water supply pipework included within the design of the proposed development should be chemically resistant barrier pipe. Alternatively the water supplier should be contacted to confirm chemically resistant barrier pipe is not required;
- That groundworkers should wear appropriate PPE/RPE, work in well ventilated areas, avoid confined spaces, avoid contact with soil and groundwater, not smoke, adopt high standards of personal hygiene, and operate with due care;
- That a Discovery Strategy should be implemented on site during the redevelopment work which should include for the immediate reporting of any potential indicators of ground or water contamination e.g. asbestos fragments, ash / clinker or hydrocarbon odours for separate assessment by an Environmental Consultant;
- That prior to the conduct of any remedial work, a Remedial Method Statement should be approved by the Regulators; and
- That any remedial work conducted on site as part of the proposed development should be certified and documented within a Validation Report produced by an Environmental Consultant.

3 Remedial Strategy

3.1.0 SPECIFIC REMEDIATION STRATEGY REQUIREMENTS

This section provides further details to specific issues or areas of the proposed development where the remediation strategy should be applied. It is designed to be used as an aid to understanding the remediation specifics for the proposed development and should not be considered in isolation.

3.1.1 SITE WORKS AND OPERATIONAL MATTERS

During the proposed remedial works the site will be well managed, kept secure from public access and the contractor should ensure as a minimum that all works are conducted in accordance with the following;

- Environmental Protection Act, 1990 Part 111 Sections 79-85;
- Environmental Permitting Regulations 2016
- Control of Substances Hazardous to Health Regulations 2002 (COSHH);
- Control of Pollution Act 1974;
- Waste Regulations and Controlled Waste Regulations (WM3 2021);
- Clean Air Act 1993;
- Health and Safety at Work Act 1974;
- The Control of Asbestos in the Air Regulations (SI 556) 1990;
- Control of Asbestos Regulations 2012;
- Construction Design Management Regulations 2015;

The contractor shall achieve compliance with the above by means of the following (which is not intended to be an exhaustive list but rather for indicative purposes):

- Regular damping down / dust suppression especially during warm and sunny weather;
- Deployment of dust screens adjacent to sensitive areas as necessary;
- Conduct of dust monitoring;
- Use of plant exhaust ventilation with filters;
- Employment of odour control measures as necessary;
- Limit vehicle speeds and employ road sweepers as necessary (no dry sweeping);
- Wheel washing prior to vehicles leaving site;
- Sheeting of vehicles carrying waste material away from site;

3.1.2 SITE CLEARANCE

Prior to the completion of demolition of existing structures on site all general waste should be removed and appropriately disposed of from site to suitably licensed waste management facilities. Any associated waste disposal tickets should be retained. In addition given that the ground gas monitoring and subsequent ground gas risk assessment is yet to be concluded, all existing borehole monitoring installations should be afforded careful protection during the demolition of the site. Lost or damaged monitoring installations will need to be replaced.

3.1.3 DISCOVERY STRATEGY

In order to provide a protocol to follow in the event that previously unidentified contamination is encountered on site during the proposed remedial work and preparatory groundwork ahead of construction, a Discovery Strategy should be implemented throughout the work, such as that provided in Appendix B. This should include for the immediate reporting of any suspected contaminated material based on visual and olfactory observations, to an Environmental Consultant for additional separate assessment. Additionally the Regulators should be informed of any such discoveries as works progress.

3.1.4 GROUNDWATER AND THE CONTROL OF SURFACE WATER RUN OFF

Based on the available data the groundwater beneath the site is in excess of 4.45m bgl and has not been encountered during the previous site investigation. As such no groundwater contamination has been identified on site and potential risks of groundwater contamination associated with the near surface sources of soil contamination identified were also considered to be low. No groundwater remediation was considered necessary and since groundworks (both in relation to soil remediation and foundations) are understood to be shallow it is not considered likely that the groundwater will be encountered during the proposed redevelopment of the site. If however any localised perched groundwater is encountered during the groundwork dewatering may be required. Any dewatering (including surface water management) required should either be discharged to foul sewer under an approved Discharge Consent or to a suitably licensed disposal facility by lorry tanker (disposal documentation to be retained). Chemical testing of water to be removed from site will be required to facilitate a permitted discharge consent or off site disposal.

During the proposed development no unauthorised releases from site are to occur. Therefore effective surface water management should be maintained especially during any heavy rainfall events. To help prevent unauthorised releases from site, surface water runoff management considerations should include;

- Provision of temporary bunds as may be necessary to help prevent runoff from site;
- Use of drip trays / spill kits associated with plant to prevent contamination of surface water: and
- Appropriate off site disposal of any ponded surface water via either foul sewer under an approved discharge consent or by lorry tanker to suitably licensed waste management facilities.

Should soakaways be proposed as part of the drainage solution for the proposed development then they should be appropriately consented by the Environment Agency.

3.1.5 EXISTING TARMAC SURFACING & AREAS OF HARDSTANDING

The existing tarmacked access driveway orientated east to west through the site is potentially coal tar rich given concentrations of Total PAHs and TPH identified within the tarmac. It is to be excavated and removed from site as part of the proposed development. Excavation of the tarmac should be conducted carefully in order to segregate it and any sub-base containing tarmac fragments from other underlying material, for disposal off site to a suitably licensed waste disposal facility. Accordingly the tarmac surfacing and sub-base material should be peeled back to help minimise cross contamination with underlying soils which would increase the volume of material to be removed. To help facilitate waste segregation and validate the ground beneath the access drive following removal of the tarmac rich Made Ground, the removal of the tarmac should be conducted under the watching brief of an Environmental Consultant.

The tarmac and any tarmac containing sub-base material should be disposed of from site as Hazardous Waste under waste code 17 03 01. All waste disposal duty of care documentation should be retained for inclusion within a Validation Report for the site.

In relation to other areas of hardstanding (eg beneath the footprint of former buildings), a watching brief by an Environmental Consultant should also be maintained during the removal of these areas to help confirm an absence of potential previously unidentified contamination. Representative confirmatory validation samples should be collected from the newly exposed ground following the removal of the tarmac drive and any associated sub-base containing tarmac and beneath areas of hardstanding for chemical laboratory analysis to confirm an absence of contaminants of concern including PAHs, hydrocarbons, metals and asbestos. The validation sample results should be compared to LQM/CIEH (Land Quality Management / Chartered Institution of Environmental Health) Suitable Use Levels (S4ULs) for Human Health Risk Assessment 2015 guidance, based on a residential end use with homegrown produce (see Appendix C). In relation to asbestos this should be absent. Should soil validation result failures be identified then further remedial excavation and validation analysis will be required.

If any areas of soil contamination are identified beneath the access drive and / or previous buildings then these should be considered in accordance with the Discovery Strategy to determine whether any remedial action is required to mitigate possible risks.

3.1.6 REMEDIATION OF LEAD & ASBESTOS IMPACTED MADE GROUND HOTSPOTS

The Made Ground identified to be impacted with elevated lead concentrations and cement bonded asbestos sheeting fragments is required to be removed from the site. Subject to the contractors preferred method of working this material could either be removed prior to or following the removal of the tarmac access drive and areas of hardstanding. The extent of the lead and asbestos impacted Made Ground which requires remediation is indicated in the Contamination Layout Plan provided in Appendix A Figure 2.

Remedial excavation to remove the lead and asbestos impacted Made Ground to the western end of the site may be required up to 1.35m bgl based on the depth of impacted material identified at WS05 however the average depth of excavation is approximately 1.0m bgl subject to Made Ground variation. The asbestos

impacted Made Ground hotspot to the eastern end of the site associated with TP01 appears to be shallower, up to 0.45m bgl.

Remedial excavation should be delineated and conducted under a Watching Brief by an Environmental Consultant. All impacted Made Ground should be removed from site for disposal at a suitably licensed waste disposal facility. Subject to the contractor's preferred method of working, it may be prudent to conduct an asbestos picking exercise to remove fragments of asbestos containing material before the bulk of the digging is conducted. Any asbestos picking exercise should be conducted by operatives who are appropriately trained with Category A & B Asbestos Awareness Training. Asbestos impacted material should be excavated carefully and in a controlled manner to help prevent cross contamination with other materials.

Any recovered fragments of asbestos containing material should be segregated for separate disposal as Hazardous Waste under waste code 17 06 05. Assuming all fragments of asbestos containing material are removed from the Made Ground prior to disposal from site, then the lead contaminated Made Ground should be classified as Non-Hazardous Waste under waste code 17 05 04. All waste disposal from site should be documented by an Environmental Consultant to help manage waste disposal requirements in accordance with EA WM3 guidance.

In order to manage site operatives Health & Safety during an asbestos picking exercise, all personnel should wear appropriate PPE and RPE including disposable overalls and FFP3 face masks, employ high standards of personal hygiene (i.e. washing hands, working in well ventilated areas, avoid confined spaces, avoiding contact with the soil and not smoking). For remaining groundworks involving soils that are not impacted by asbestos all measures are required except RPE and disposable overalls.

It may also be prudent to undertake some initial reassurance asbestos air monitoring to help confirm absence of asbestos containing dust during excavation / picking. This would also lend confidence that site activity was not causing a risk to neighbouring properties in relation to asbestos contamination remediation. An onsite provisional action threshold of 0.015f/ml should be adopted for the purposes of interpreting any asbestos air monitoring results (subject to Regulatory approval). Should results be recorded in excess of this threshold then activity should immediately be ceased and dust suppression efforts be redoubled until concentrations are recorded at levels below this threshold.

In general however, dust suppression measures should be implemented during excavation to help prevent dust generation and any material stockpiles should be kept to a maximum height of 3m.

In order to certify that the unsuitable Made Ground has successfully been removed from site, soil validation samples should be recovered from the sides and base of the remedial excavations for chemical laboratory analysis for the contaminants of concern (namely lead, PAHs and asbestos).

Subject to existing and proposed site levels, if it is necessary to backfill remedial excavations then imported material should be certified "clean" engineered fill (unless backfilling is required in areas of proposed soft landscaping / gardens which are discussed specifically below under 3.1.9). Prior to importation to site the supplier's chemical batch data should be provided to an Environmental Consultant for approval and following provision to site validation samples should be recovered for laboratory analysis for a suite of determinands including asbestos, metals, speciated PAHs, organic matter, TPH, phenols and pH. The validation sample results should be compared to the LQM/CIEH Suitable 4 Use Levels (S4ULs) 2015 as referenced above. All

imported material delivery tickets should be retained. Validation samples should be tested based on a frequency of 1 test per source, per material type and every 50m³.

In accordance with the Joint Industry Working Group (JIWG) risk assessment (see Appendix D) any excavation work relating to the asbestos impacted Made Ground should be completed as Non-Notifiable Non-Licensable Work.

Subject to site conditions at the time of the works wheel washing may be required to prevent lorries from tracking site material onto local roads. Should it be necessary to conduct any road sweeping then dry sweeping is to be prohibited. Any wheel wash water should be appropriately managed to prevent unauthorised release from site.

3.1.7 APPROPRIATE DISPOSAL OF WASTE ARISING

Impacted Made Ground that requires remedial excavation is not considered suitable for re-use on site. Additionally general waste soil arisings generated to facilitate the construction of the proposed development should be disposed of from site to suitably licensed waste disposal facilities. Whilst general soil arisings could potentially be considered for re-use, given the relatively small volume of arisings likely to be generated and the nature of the proposed development it is considered unlikely to be feasible to re-use waste arisings given that it would require either an EA approved Environmental Permit or implementation of the CL:AIRE CoP. It is unlikely to be cost effective to pursue re-use of relatively small volumes of material given that specific criteria for re-use would have to be satisfied we cannot be guaranteed to be successful. In addition given the small size of the site re-use of arisings may not be practical.

Waste arisings generated during the construction of the proposed development are to be disposed of from site in compliance with the Environment Agency's Technical Guidance WM3 Version 1.1 dated 2018 titled 'Guidance on the classification and assessment of waste' describes wastes in the List of Wastes Directive (LoWD 2014/955/EU).

Specialist waste classification software (HazWaste™) has been used to help determine waste classification codes for the material encountered on site. Details of the waste classification for the Made Ground and Natural material encountered on site are provided the Waste Classification Report which is appended to the Sevenoaks Environmental Consultancy site investigation report. However, a brief summary of the assessment has been provided below:

Made Ground on site has been classified under two separate waste codes 17 05 04 (Non-Hazardous) and 17 03 01* (Hazardous) subject to the concentrations of given contaminants within the Made Ground. Natural material across the site was classified as Non-Hazardous under waste code 17 05 04.

Waste arisings should be segregated and disposed of in accordance with the waste classification table provided below. The watching brief by an Environmental Consultant during remedial groundwork should help support the appropriate segregation and disposal of impacted waste arisings correctly. Should previously unidentified arisings be encountered then chemical characterisation (including WAC testing) should be carried out prior to disposal to ensure that materials are disposed of appropriately.

Material Type for Reference	Depth Range (bgl)	Landfill Acceptance (WAC Classification)	Waste Classification	Waste Code
Bituminous Surfacing	0.00~0.15m	-	Hazardous	17 03 01
Made Ground impacted with lead and PAHs	0.00~1.35m	Non-Hazardous (due to elevated lead and / or asbestos)	Non-Hazardous	17 05 04
Made Ground impacted with Asbestos Fragments (assuming asbestos containing material fragments are removed prior to disposal from site)	0.45 - ~1.25m	Non-Hazardous (due to elevated metals and / or asbestos)	Non-Hazardous	17 05 04
Cement Bonded Asbestos Fragments	-	-	Hazardous	17 06 05
General Made Ground	0.00-1.35 m	Non-Hazardous	Non-Hazardous	17 05 04
Natural Material	0.25~4.45m	Non-Hazardous	Non-Hazardous	17 05 04

Should the emission of odours relating to the work present an unacceptable nuisance to site workers, site users or neighbours, appropriate control measures should be implemented.

3.1.8 SITE TRAFFIC

Consideration of wheel cleaning facilities should be given throughout the duration of the redevelopment work to prevent debris / mud being tracked off site onto local roads. It may also be necessary to dampen down site soils to prevent dust generation by vehicles accessing the site. All wheelwash runoff should be appropriately managed such that unauthorised releases do not occur. Should conditions necessitate a road sweeper will be employed to supplement the jet washing of vehicles wheels in order to keep the local roads free from mud debris. No dry sweeping is permitted.

Any contaminated water produced as a consequence of these operations will be disposed of in accordance with current best practice and statutory guidance either to foul sewer under a discharge consent and following pre-treatment via a silt buster or via a licensed suction tanker to an approved disposal facility (any waste water disposal tickets should be retained for inclusion within the Validation Report).

3.1.9 AREAS OF PROPOSED COMMUNAL SOFT LANDSCAPING & GARDENS

Areas of proposed soft landscaping and gardens should be provided a “clean” cover system comprising the provision of a minimum thickness of 475mm imported topsoil laid over a high visibility marker layer.

Imported topsoil that is provided to site should be certified chemically “clean”. The supplier’s chemical batch data should be provided to an Environmental Consultant for approval prior to delivery to site and the cover system should be validated by an Environmental Consultant by means of trial pits to confirm the thickness of imported topsoil and analysis of representative validation samples to corroborate the initial batch supplier data. Soil validation samples should be analysed at a frequency of at least 1 sample per landscaped / garden area as a minimum or 1 sample per 50m³ per source for larger areas. Validation analysis results should be compliant with S4UL guidance values based on a residential end use with home grown produce (see Appendix C Remedial Target Values).

Subject to existing and proposed site levels it may be necessary to remove existing soils in areas of proposed soft landscaping to afford room for the required thickness of “clean” cover required. As discussed above, all waste arisings are to be disposed of appropriately to licensed facilities (all disposal tickets to be retained). All imported material delivery tickets should be retained for inclusion within the final Validation Report.

SEC is unaware of general material import requirements for the purposes for the redevelopment however any imported material should be chemically certified as suitable for use on site in the same way as imported topsoil / subsoil.

3.1.10 GROUND GAS RISK MITIGATION

The remedial strategy with respect to ground gas risk mitigation is subject to the findings of the Ground Gas Risk Assessment Addendum to the recent Preliminary Geo-Environmental Site Investigation, which is currently on going. Should any ground gas protective measures be required within the design of the proposed development then a Technical Addendum should be produced to supplement this remedial strategy.

As referred to above, the existing ground gas monitoring boreholes should be afforded protection until the ground gas risk assessment is completed to the Regulators approval.

3.1.11 WATER SUPPLY PIPE

Potential risks to the potable water supply provided to the new development should be mitigated by the provision of chemically resistant water supply pipe (also known as barrier pipe) within the design of the proposed development. Prior to the installation of chemically resistant water supply pipe on site, the specification for the proposed pipework should be provided to an Environmental Consultant for approval. The installation of the chemically resistant water supply pipework should be documented by an Environmental Consultant and detailed within the future Validation Report for the site. Alternatively the water supplier should

be contacted to clarify their requirements regarding the water supply pipe in light of the site investigation findings, should the possibility of standard pipework use be explored.

3.1.12 HEALTH AND SAFETY FOR SITE OPERATIVES

The groundworks contractor will prepare site specific risk assessment and method statements (RAMS) for approval prior to the commencement of earth works.

All site operatives will be required to wear appropriate PPE including a hard hat, reflective vests, gloves and hard toe footwear. Additionally workers should employ high standards of personal hygiene (including washing hands before eating) and avoid direct contact with soils (and waters if encountered). Workers should work in well ventilated areas and avoid confined spaces.

In addition to the above, ground contamination risks to workers should be managed during excavation work by the use of appropriate RPE / PPE including disposable suits and FFP3 face masks when working with asbestos impacted Made Ground.

Suitable welfare facilities should be provided on site for the duration of the redevelopment work.

3.1.13 VARIATIONS

As work progresses on site, subject to findings or conditions the remedial strategy may have to adapt to manage unforeseen issues (e.g. in the event that buried infrastructure is encountered which may give rise to previously unidentified contamination and /or previously unidentified contamination is identified). Any such findings should be assessed in accordance with the Discovery Strategy and any subsequent variations to the remedial strategy should be documented within a Technical Addendum produced by an Environmental Consultant for Regulatory approval.

3.1.14 VALIDATION REPORT

All remedial measures and remedial work implemented on site during the site's redevelopment should be adequately documented within a Validation Report for the site written by an Environmental Consultant, to demonstrate compliance with the remedial strategy for Regulatory approval.

The Validation Report should include information such as a commentary of the works conducted, photos record of work undertaken, validation sample analysis data, details of materials imported to and disposed of from site, and plans indicating remedial work undertaken. Following completion the Validation Report should be submitted to the Local Authority for approval and discharge of contaminated land conditions.

4.0 General Limitations and Exceptions

1. The advice given in this report with respect to contaminated land / pollution is based on the guidelines available at the time of writing.
2. The Client is advised that the conditions observed on site by SEC at the time of the investigation or assessment are subject to change. Certain indicators of the presence of hazardous substances may have been latent at the time of the most recent site reconnaissance or investigation and they may subsequently have become observable.
3. Comments made relating to land gas or groundwater conditions are based on observations made at the time of the investigation unless otherwise stated. The normal rate of conduct of an exploratory hole does not usually permit the recording of an equilibrium groundwater level for any one strike. Land gas and / or groundwater conditions may vary as a result of seasonal or other effects.
4. Ground contamination often exists as small discrete areas of contamination and there can be no certainty that any or all such areas have been located, sampled and / or identified.
5. The opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between or beyond borehole positions, these are only for guidance only and no liability can be accepted for their accuracy.
6. Whilst commonly regarded as one of the most reliable drilling techniques, cable percussive drilling may result in a certain amount of soil mixing.
7. This assessment may be subject to amendment in light of additional information becoming available.
8. The findings and opinions conveyed in this report are based on information obtained from a variety of sources, including that from 1) previous site investigations and 2) chemical testing laboratories, and which SEC has assumed are correct. Nevertheless, SEC cannot and does not guarantee the authenticity or reliability of the information it has relied upon. SEC can accept no responsibility for inaccuracies within the data supplied by other parties.
9. This report is written in the context of an agreed scope of work between SEC and the Client and should not be used in a different context. In light of additional information becoming available, improved practices and changes in legislation amendment or re-interpretation of the assessment or report in whole or part may be necessary after its original submission.
10. This report is provided for sole use by the Client and is confidential to them. No responsibility whatsoever for the contents of the report will be accepted to anyone other than the Client.
11. SEC believes that providing information about limitations is essential to help the Client identify and thereby manage risks.
12. The copyright of written materials supplied shall remain the property of SEC but with a royalty free perpetual licence, granted to the Client on payment in full of any outstanding monies.
13. SEC does not provide legal advice and the advice of the Clients legal advisors may also be required.
14. SEC notes that this assessment is subject to regulatory review and approval.

15. This report represents a stage in an iterative process of investigation and assessment and as such it is possible that further work may be recommended.
16. The use of data generated by this site investigation for the design of foundations or geo-technical assessment was outside the scope of this report.
17. An arboricultural survey, an ecological survey, an asbestos survey, a geotechnical assessment, a topographical survey, and a flood risk assessment for the site were beyond the scope of this report.
18. This report is subject to the limitations of the original investigations, as reported in the references above.

Appendix A

Figures

Gravesend Borough Council



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 This map is not to be relied upon for accuracy and is for identification purposes only

SITE: Armoury Drive, Gravesend

SCALE: NTS

JOB NO: 4551

FIGURE TITLE: Proposed Development Layout Plan

REV: 01

FIGURE NO: 01

SEVENOAKS
ENVIRONMENTAL
CONSULTANCY

Appendix B

Discovery Strategy

Gravesend Borough Council

DISCOVERY STRATEGY CONTAMINATED MATERIALS

SITE: Former St John's Ambulance Station, Armoury Drive, Gravesend

INTRODUCTION

We understand that the site previously comprised part of Gravesend Barracks and was used by St Johns Ambulance as a garage to park their vehicles. In addition a water tower occupied the site. The proposed redevelopment of the site involves the clearance of existing structures and hardstanding to make way for the construction of a 2 No. storey block of flats and 2 No. detached bungalows with communal and private gardens. The site will be undergoing some ground contamination remedial work associated with Made Ground containing cement bonded asbestos sheeting fragments and elevated concentrations of PAHs and lead as discussed within the Remedial Strategy document. A Discovery Strategy is to be implemented on site to provide a protocol to follow in the event that previously unidentified potential ground contamination is encountered during works.

Its purpose is to define the process to be undertaken on site in the event that previously unidentified ground or water contamination or suspicious objects (e.g. cement bonded asbestos sheeting fragments) are discovered during the redevelopment of the site. Should suspected evidence of contamination be identified then work should cease until additional separate assessment has been conducted by an Environmental Consultant. It is intended to be understood and followed by all on-site workers and for all new site workers to be made aware of the procedure.

HOW TO IDENTIFY POTENTIALLY CONTAMINATED MATERIAL

- Looks / colours – e.g black, purple, pink, grey oily or has an iridescent sheen
- Odours / smells – e.g. has an oil, fuel or solvent type of odour
- Man made fragments – e.g. paint or oil tins, cans or drums, car parts, bottles, glass, metal, rubber or rubbish fragments
- Ground contains foreign fragments of cement bonded (potential asbestos) sheeting, coal/coke, clinker, ash
- Subsurface structures / vessels, concrete or metal e.g. oil or asbestos filled pits or tanks, walls, metal pipes and sandbags

(N.B. These are examples only – This list is not exhaustive. If in any doubt then ask)

PROCEDURE

If during the redevelopment work, any visibly contaminated or odourous material is found to be present at the site, it must be investigated further, the Local Planning Authority must be informed immediately of the nature and degree of contamination present and a method statement detailing how the unsuspected contamination shall be dealt with must be prepared and submitted to the Local Planning Authority for approval in writing before being implemented.

On the discovery of any suspicious material or buried structures during the redevelopment of the site, the following procedure should be followed:

- Site Personnel to immediately inform Client / Site Manager. Do not investigate it yourself.
- Client / Site Manager to inspect and confirm the observations of potentially contaminated material and will inform Sevenoaks Environmental Consultancy Ltd. The area will be cordoned off and work will cease in the vicinity.
- Sevenoaks Environmental Consultancy Limited will attend site to inspect and sample the material in question for laboratory testing to evaluate if the material in question has been reported on previously and will attempt to quantify the extent and volume of any potential contamination if not.
- The Environmental Health Officer at the Council will then be notified if the material has not been reported on previously that potentially contaminated material has been discovered and will be forwarded the relevant laboratory data and a remedial strategy for their approval in the event that the material is to be classified as contaminated.

CONTACT DETAILS

Environmental Consultant:

Sevenoaks Environmental Consultancy Ltd.
145a Hastings Road
Pembury
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Contact: Damian Jones
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Email: d.jones@sevenoaksenvironmental.co.uk

Regulator:

Gravesham Borough Council
Civic Centre,
Windmill Street,
Gravesend,
DA12 1AU

Tel: 01474 337000

Client

Longley Group
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Blakeney Rd,
Beckenham,
Kent,
BR3 1HG

Contact: Samuel Parry / Chris Ward

Tel: 0203 846 8793
Email: Samuel.parry@longleygroup.co.uk / christopher.ward@longleygroup.co.uk

DECLARATION

[illegible]

Appendix C

Remedial Target Values

Gravesend Borough Council

Contaminant	Remedial Target Value (mg/kg)	Data Source
PAH (Polycyclic Aromatic Hydrocarbons)		
Acenaphthene	210	LQM/CIEH S4ULS
Acenaphthylene	170	LQM/CIEH S4ULS
Anthracene	2400	LQM/CIEH S4ULS
Benz(a)anthracene	7.2	LQM/CIEH S4ULS
Benzo(a)pyrene (only)	2.2	LQM/CIEH S4ULS
Benzo(b)fluoranthene	2.6	LQM/CIEH S4ULS
Benzo(ghi)perylene	320	LQM/CIEH S4ULS
Benzo(k)fluoranthene	77	LQM/CIEH S4ULS
Chrysene	15	LQM/CIEH S4ULS
Dibenz(ah)anthracene	0.24	LQM/CIEH S4ULS
Fluoranthene	280	LQM/CIEH S4ULS
Fluorene	170	LQM/CIEH S4ULS
Indeno(123-cd)pyrene	27	LQM/CIEH S4ULS
Naphthalene	2.3f	LQM/CIEH S4ULS
Phenanthrene	95	LQM/CIEH S4ULS
Pyrene	620	LQM/CIEH S4ULS
TPH (Total Petroleum Hydrocarbons)		
Aliphatic EC > 5-6	42	LQM/CIEH S4ULS
Aliphatic EC > 6-8	100	LQM/CIEH S4ULS
Aliphatic EC > 8-10	27	LQM/CIEH S4ULS
Aliphatic EC > 10-12	130 (48) ^{vap}	LQM/CIEH S4ULS
Aliphatic EC > 12-16	1100 (24) ^{sol}	LQM/CIEH S4ULS
Aliphatic EC > 16-35	65000 (8.48) ^{f, sol}	LQM/CIEH S4ULS
Aliphatic EC > 35-44	65000 (8.48) ^{f, sol}	LQM/CIEH S4ULS
Aromatic EC > 5-7	370	LQM/CIEH S4ULS
Aromatic EC > 7-8	860	LQM/CIEH S4ULS
Aromatic EC > 8-10	47	LQM/CIEH S4ULS
Aromatic EC > 10-12	250	LQM/CIEH S4ULS
Aromatic EC > 12-16	1800	LQM/CIEH S4ULS
Aromatic EC > 16-21	1900 ^f	LQM/CIEH S4ULS
Aromatic EC > 21-35	1900 ^f	LQM/CIEH S4ULS
Aromatic EC > 35-44	1900 ^f	LQM/CIEH S4ULS
Aliphatic + Aromatic EC > 44-70	1900 ^f	LQM/CIEH S4ULS
Metals		
Arsenic	37	LQM/CIEH S4ULS
Beryllium	1.7	LQM/CIEH S4ULS
Boron	290	LQM/CIEH S4ULS
Cadmium	11	LQM/CIEH S4ULS
Chromium (III)	910	LQM/CIEH S4ULS
Chromium (IV)	6	LQM/CIEH S4ULS
Copper	2400	LQM/CIEH S4ULS
Mercury (elemental)	1.2	LQM/CIEH S4ULS
Mercury (inorganic)	40	LQM/CIEH S4ULS
Nickel	180	LQM/CIEH S4ULS
Phenol (1% OM)	280	LQM/CIEH S4ULS
Phenol (2.5% OM)	550	LQM/CIEH S4ULS
Phenol (6% OM)	1100	LQM/CIEH S4ULS
Selenium	250	LQM/CIEH S4ULS
Zinc	3700	LQM/CIEH S4ULS
Lead	190	C4SL

Appendix D

Joint Industry Working Group Asbestos Risk Assessment

Gravesend Borough Council



Joint Industry Working Group
Asbestos in Soil and Construction & Demolition Materials

Project Reference	4551
Site Name	Former St Johns Ambulance, Armoury Drive
Client	The Longley Group
Run by	BD
Date	05-May-22
Scenario details	Cement bonded asbestos sheeting fragments within Made Ground

Decision Support Tool for CAR2012 Work Categories

Stage 1

Hazard Factors

Select ACM type (run model for each type to generate 'Worst Case' output)
Extent of degradation of ACMs at outset of work
Friability and degree of bonding by matrix (ACM matrix, not ground materials)
Distribution of Visible Asbestos Across Affected Area
Amount of asbestos fibre in selected ACM/fibre type as % of host material

Bonded ACMs: cement, vinyl, composites, textured decorative coatings, bitumen products	1
Intact (Very good condition ACM/ACM fragments	1
Non-friable ACM or ACM with fibres firmly linked in a matrix	0
Occasional/random occurrences of visible contamination by ACMs	1
Low quantities - >0.01 to <0.05 %wt/wt	2

Score

Sub-total

5

Note: the asbestos licensing regime is unaffected by the type of asbestos fibre present in ACMs

Hazard ranking

Very low

No warranty, expressed or implied, or reliance, is provided in relation to the use of this tool.

It is contingent on users to satisfy themselves that the output from the tool is relevant and appropriate to the assessment being made.

Stage 2		
Exposure Factors	Score	
Anticipated airborne fibre concentration - Control Limit or SALI?	<0.001 fibres/ml	0
Anticipated duration of exposure to asbestos	> 2 hours in a 7 day period and Up to 10 hours in a day (e.g. full time occupational exposure)	4
Activity type and effect on deterioration of ACMs during work	Maintenance tasks, no deterioration expected	0
Best description of primary host material matrix (soil/made ground)	Fine Silt and/or Clay	1
Respirable fibre index for ACM - RIVM report 711701034 (2003)	Very low	1
Sub-total		6
Exposure ranking		Low
Combined hazard and exposure ranking	11	Low

Stage 3

Risk Assessment Outputs

Probable Licensing Status	Non-Licensed Work
RPE*	EN149 type FFP3 disposable
Dust Suppression**	Manual/localised dust suppression
Hygiene/Decontamination***	Localised and basic personal decontamination facilities

*Where RPE has to be worn continuously for long periods (e.g. more than 1-hour), then powered RPE may be necessary.

**Reduction in control measures possible if natural mitigation factors are present (e.g. raining, wet ground)

***Guide only; suitability of selected personal hygiene measures may be reviewed on a site/contamination-specific basis