



Reading Borough Council

GEORGE STREET, READING

Detailed Remediation Scheme



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DRAFT (VERSION 1.0)

PROJECT NO. 70044279

OUR REF. NO. 70044279-007

DATE: SEPTEMBER 2019

Reading Borough Council

GEORGE STREET, READING

Detailed Remediation Scheme

WSP

Kings Orchard

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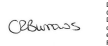
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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Version 1.0			
Date	5 September 2019			
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Project number	70044279			
Report number	70044279_REM			

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70044279/101	Exploratory Holes to be Decommissioned
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1 INTRODUCTION

1.1 TERMS OF REFERENCE

- 1.1.1. WSP UK Ltd. (WSP) was instructed by Saunders Architects on behalf of Reading Borough Council (RBC) to prepare a detailed remediation scheme for the proposed development at George Street, Reading ('the Site'). The work was undertaken in accordance with WSP's proposal dated 31 October 2018.

1.2 CONTEXT

- 1.2.1. WSP understands that RBC is intending to redevelop the Site for a residential end-use, for which planning permission has been granted (ref. 180798). The proposed development comprises a two-storey building which includes four residential units in the east of the Site, bin and cycle storage in the northern part of the Site, and a shared garden space in the west of the Site.
- 1.2.2. Following preparation of a Phase 1 Assessment¹, WSP undertook an intrusive ground investigation and risk assessment². The assessment identified several potentially unacceptable risks to future Site users from asbestos and elevated concentrations of TPH, PAHs and metals within Made Ground soils, groundwater and from ground gases. Potential risks to human health from future drinking water supply pipes, and risks to property (risks to pipes from hydrocarbons within soils), were also identified.
- 1.2.3. A remediation scheme is required to be devised and implemented to mitigate the identified risks and ensure the Site is suitable for the intended future use. The scheme is also required to support the discharge of planning condition No. 11 which states:

No development shall take place until a detailed remediation scheme to bring the site to a condition suitable for the intended use by removing unacceptable risks to human health, buildings and other property and the natural and historical environment has been submitted to and approved in writing by the Local Planning Authority. The scheme must include all works to be undertaken, proposed remediation objectives and remediation criteria, an appraisal of remedial options, and proposal of the preferred option(s), and a timetable of works and site management procedures. The scheme must ensure that the site will not qualify as contaminated land under Part 2A of the Environmental Protection Act 1990 in relation to the intended use of the land after the remediation.

1.3 SCOPE & OBJECTIVES

- 1.3.1. The objective of this work is to prepare a detailed remediation scheme to address the identified risks. The scheme comprises:

¹ George Street, Reading, Phase 1 Contaminated Land Assessment. WSP. March 2018. Ref. 70012984.

² George Street, Reading, Geoenvironmental Risk Assessment. WSP. August 2019. Ref. 70044279-002.

- Remediation Options Appraisal – which evaluates feasible remediation options to remove, reduce or control unacceptable risks and determines the most appropriate remediation option or combination of options for remediation of the identified relevant contaminant linkages;
- Remediation Strategy - which specifies the strategy to address all the relevant contaminant linkages and associated remediation criteria; and
- Outline Implementation Plan – which provides details of how the works will be scheduled and managed, implemented and verified, and how health and safety and environmental impacts will be managed.

1.3.2. This work has been undertaken in accordance with current United Kingdom best practice including government document 'Land Contamination: Risk Management' (LCRM) and UK Environment Agency document CLR11 'Model Procedures for the Management of Land Contamination' (due to be withdrawn in December 2019; forms basis of LCRM).

1.4 LIMITATIONS

1.4.1. This report is addressed to and may be relied upon by Reading Borough Council. It may not be relied upon or transferred to any other parties without the express written agreement of WSP. The report should be read and used in full. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party. WSP cannot be held liable for third party information.

2 SITE DETAILS

2.1 SITE DETAILS

- 2.1.1. The Site is located adjacent to No. 94 George Street, which is situated to the northwest of Reading town centre, approximately 0.5 km to the west of Reading Railway Station. The Site location is showing on Figure 1.
- 2.1.2. A summary of Site details is provided below in Table 2-1. Further details are provided within the reports listed in section 2.3

Table 2-1 - Summary of Site Details

Detail	Comment
Name and Address of Site	Land adjacent to No. 94 George Street Reading RG1 7NT
National Grid reference	SU70550,73742
Site Description and Current Use	The Site is currently disused, with no buildings present. A concrete slab of a former building is present across the eastern portion of the Site.
Area	Approximately 0.034 Ha
Site Setting and Surrounding Area	A community centre, (including an open field and playground) is present to the east of the Site. Residential terraced housing is present to the south and a narrow area of landscaping lies to the north and west. A railway line (the Newbury and Hungerford branch of the Great Western Railway), is present on an embankment (between circa 5-8 m in height) close to the northern and north-western boundaries of the Site. A narrow strip of land which permits pedestrian access to an area of allotments runs along the north-western boundary.
Topography and Ground Cover	The Site is relatively flat with ground levels typically around 38.5 mAOD.
Geology	The Site is underlain by Made Ground and superficial deposits of alluvium (clay, silt, sand and gravel), which overlie the Taplow Gravel (sand and gravel) and the solid geology of Seaford Chalk and Newhaven Chalk Formation (undifferentiated).
Hydrogeology	The superficial deposits are designated by the Environment Agency as Secondary A Aquifers, and the chalk is designated as a Principal Aquifer. The Site does not lie within a groundwater Source Protection Zone. However, there is a groundwater abstraction licence for potable water supply recorded 460 m northeast of the Site from the Chalk aquifer. None of the groundwater abstractions are related to the superficial aquifer.
Hydrology	Drainage ditches are present to the north of the Site, at the base of the railway embankment. There are no surface water abstraction licenses recorded within 500 m of the Site. The closest rivers to the Site are the River Kennet and the River Thames which are both over 1 km from the Site to the southeast and northeast respectively. No surface water abstractions are located within 1 km of the Site.

2.2 SITE HISTORY

- 2.2.1. The Site is historically associated with residential land use, comprising two dwellings from circa 1932 to pre-1988. A single building is present on-site post 1988 to pre-2016; due to its size and shape, this may have been a commercial property or light industrial unit.
- 2.2.2. Since the late 19th Century railway land has occupied land to the north of the Site, comprising two tracks lying along an embankment. Residential land use predominantly occupied the surrounding land to the south, east and west since the late 19th century.

2.3 PREVIOUS REPORTS

- 2.3.1. The following reports have been prepared for the Site:
 - George Street, Reading, Phase 1 Contaminated Land Assessment. WSP. March 2018. Ref: 70012984 Issue 2.
 - George Street, Reading. Geo-environmental Risk Assessment. Version 2. WSP. September 2019. Ref. 70044279-002.

3 SITE ASSESSMENT

3.1 KEY FINDINGS OF SITE INVESTIGATIONS AND MONITORING EXERCISES

- 3.1.1. An intrusive ground investigation was carried out by WSP between March and April 2019, which comprised: seven hand-dug pits; two rotary boreholes; four window sample boreholes; and three surface soil samples. In-situ testing geotechnical testing and photo-ionisation detector (PID) testing was undertaken. Following the intrusive works, two rounds of groundwater monitoring and six rounds of ground gas / vapour monitoring were undertaken.
- 3.1.2. Soil and groundwater samples from the works were submitted for laboratory analysis, for a suite of determinands which were based on the preliminary conceptual site model (CSM). Soil samples for laboratory geotechnical testing were also collected and tested.
- 3.1.3. Made Ground was identified in all the exploratory hole locations to a maximum thickness of 1.7 m, which overlies alluvium and then Taplow Gravels. Bedrock comprising the Seaford Chalk Formation and Newhaven Chalk Formation at depths between 4.1 mbgl and 7.0 mbgl.
- 3.1.4. Visual and olfactory evidence of contamination as recorded in several locations, including hydrocarbon odours and staining, in both the Made Ground and alluvium. Suspected asbestos containing materials (ACMs) were identified at surface level and at shallow depths within the hand pit excavations.
- 3.1.5. During monitoring, groundwater levels were recorded in the alluvium between 1.8 mbgl and 2.1 mbgl (36.4 mAOD and 36.5 mAOD), and in the chalk between 2.0 mbgl and 2.3 mbgl (36.4 m AOD and 36.6 mAOD). A slight sheen and hydrocarbon odour was recorded on groundwater in WS005, elsewhere there was no visual or olfactory evidence of contamination.

3.2 CONCEPTUAL SITE MODEL

- 3.2.1. The CSM is based on a future residential use (without homegrown produce), which assumes that existing topographic levels are to be maintained. The primary receptors associated with this end-use are as follows:
- Human health - future Site users (residential);
 - Controlled waters - groundwater resource underlying the Site;
 - Property – in the form of future buildings, structures and associated infrastructure.
- 3.2.2. Any potential risks to construction workers during redevelopment will be mitigated by adoption of appropriate working methods as defined by risk assessment, and therefore such risks are not considered further.

3.3 HUMAN HEALTH RISK ASSESSMENT

- 3.3.1. A human health Generic Quantitative Risk Assessment (GQRA) was undertaken to assess the potential risks to human health receptors. The purpose of the GQRA was to evaluate the suitability of the Site for a future residential end-use, in accordance with Planning Policy.

- 3.3.2. Soil data was screened against appropriate Generic Assessment Criteria (GAC) which were derived by WSP using the CLEA Workbook v1.071 modelling tool, based on a residential end-use (without home-grown produce) and using a soil organic matter (SOM) content of 1%.
- 3.3.3. Concentrations of various metals, PAHs and TPH were recorded in excess of the GAC. These exceedances were generally recorded within the Made Ground, although some exceedances for TPH were recorded within the alluvium. In addition, asbestos fibres (chrysotile) were identified in two out of 15 No. soil samples collected from Made Ground. ACM in the form of fragments of cement sheeting were recorded on the ground surface and in shallow soils.
- 3.3.4. Concentrations of contaminants recorded in groundwater were screened against the relevant vapour screening criteria derived for a residential exposure scenario. There were no recorded exceedances of human health criteria for vapours derived from groundwater.
- 3.3.5. In summary, the human health risk assessment concluded that there are potentially unacceptable risks to human health from asbestos, TPH, PAHs and metals within Made Ground.

3.4 GROUND GAS ASSESSMENT

- 3.4.1. Potential risks posed by hazardous ground gases at the Site have been assessed following the guidance contained within CIRIA C665 Report. This method requires use of both gas concentrations (carbon dioxide and methane) and standpipe flow rates to calculate a gas screening value (GSV). The dataset included six rounds of ground gas monitoring, which were undertaken on a total of four ground gas installations. Based on the calculated GSV, the Site has been characterised as Characteristic Situation 2 (low risk) in line with CIRIA 665 (NHBC equivalent classification of Green/Amber 1), whereby all new development requires gas protection measures to be installed, which would typically comprise the following protective measures:
 - a) Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft) with at least 1,200g DPM2 and underfloor venting.
 - b) Beam and block or pre-cast concrete slab and minimum 2,000 g DPM/reinforced gas membrane.
 - All joints and penetrations sealed.

3.5 CONTROLLED WATERS RISK ASSESSMENT

- 3.5.1. A controlled waters risk assessment was undertaken to assess the potential risks to the identified receptors (groundwater and surface waters) in accordance with the principles detailed in 'Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination' (EA 2006), the 'prevent and limit' approach of the Water Framework Directive (2000/60/EC) and the 'Groundwater protection guides covering: requirements, permissions, risk assessments and controls (previously covered in GP3)'.
- 3.5.2. Recorded concentrations of contaminants within soils and groundwater were screened against appropriate assessment limits, which were selected based on the identified receptors. These included Freshwater Environmental Quality Standards (EQS), UK Drinking Water Standards (UK DWS) and World Health Organisation standards (WHO).
- 3.5.3. The screening exercise identified soil and groundwater concentrations (of various metals, PAHs and ammoniacal nitrogen) in exceedance of assessment limits for the protection of surface water and groundwater. The exceedances of the assessment limits for the protection of surface waters are very

conservative given that the adjacent surface water feature (drainage ditch to the north of the Site) is not likely to be a receptor.

- 3.5.4. Exceedances of the assessment limits for the protection of groundwater (for benzo(a)pyrene and ammoniacal nitrogen) are not considered to represent potentially unacceptable risks to groundwater (Secondary A Aquifer and Principal Aquifer).

3.6 ASSESSMENT OF POTENTIAL RISKS TO PROPERTY

- 3.6.1. One sample of alluvium, four samples of the Taplow Gravels and three samples of the Upper Chalk were tested for buried concrete according to BRE Special Digest 1. The results of the testing indicated for each stratum buried concrete should be designed for Design Class 1 (DS-1), Aggressive Chemical Classification 1 (AC1). Identified sulphate concentrations within soils and groundwater would not pose a risk of chemical attack to concrete foundations
- 3.6.2. A potential risk to drinking water supply pipes was identified from direct contact with contaminated Made Ground soils. Where Made Ground remains in-situ below the proposed development footprint, the use of chemically resistant materials for supply pipes may be required. This may also be required where hydrocarbon impact is present (i.e. from 1.6 mbgl) in the natural ground.

3.7 RELEVANT CONTAMINANT LINKAGES

- 3.7.1. The relevant contaminant linkages identified following the Site assessment are detailed below in Table 3-1, with risks qualitatively evaluated in accordance with the methodology set out within CIRIA C552.

Table 3-1 - Relevant Contaminant Linkages

Ref	Source	Pathway(s)	Receptor(s)	Consequence	Probability	Risk Classification
RCL1	Made Ground containing asbestos	Inhalation of asbestos fibres	Human health: future Site residents	Medium	Likely	Moderate Risk
RCL2	Made Ground containing TPH, PAHs and metals	Ingestion, inhalation and dermal contact of soils and dust	Human health: future Site residents	Medium	Likely	Moderate Risk
RCL3*	Made Ground / natural ground	Inhalation of ground gases	Human health: future Site residents	Minor	Likely	Low Risk
RCL4*	Made Ground / natural ground	Diffusion through drinking water pipes	Human health: future Site residents	Medium	Likely	Moderate Risk
RCL5*	Made Ground / natural ground	Direct contact	Property in the form of buried concrete and water supply pipes	Medium	Likely	Moderate Risk

* Any potential risks to the relevant receptors associated with these linkages will be inherently mitigated by measures incorporated into the design of the development (with cognisance of the potential risks identified within the risk assessment and associated recommendations). These linkages are therefore not taken forward for further assessment as part of the remediation options appraisal as detailed in Section 4.

4 REMEDIATION OPTIONS APPRAISAL

4.1 CONTEXT AND OBJECTIVES OF THE OPTIONS APPRAISAL

- 4.1.1. The remediation options appraisal identifies and evaluates potential options to remove, reduce or control the identified risks, and evaluates feasible remediation techniques to determine the most appropriate technique or combination of techniques, which will achieve the remediation objectives.

4.2 REMEDIATION OBJECTIVES

- 4.2.1. The principal objective of the remediation, is to take reasonable practicable measures to reduce or remove the risks associated with the identified relevant contaminant linkages such that the Site is suitable for a future residential use (without homegrown produce), assuming existing Site levels are maintained. In line with statutory guidance, this will be achieved by the most effective and sustainable remediation option, or combination of options, considering the Site's constraints, without disproportionately costly measures.

4.3 NATURE AND EXTENT OF CONTAMINANT SOURCES

- 4.3.1. The relevant contaminant linkages are defined in Table 3-1 in the previous section. Details of the nature and extent of the corresponding sources are provided below:
- RCL 1: the source comprises shallow Made Ground soils containing asbestos fibres and ACM.
 - RCL 2: the source comprises shallow Made Ground soils containing TPH, PAHs and metals.
- 4.3.2. Given that there is no lateral or vertical distinction between those Made Ground soils containing asbestos fibres / ACM, and those containing TPH, PAHs and metals, Made Ground can be considered as a single source. Potential risks associated with this source are only applicable to future soft-cover areas, as the remainder of the development will comprise hardstanding or buildings / structures whereby no potential exposure pathway will be present. The total area of future soft-cover areas is approximately 92 m².

4.4 SITE CHARACTERISTICS AND CONSTRAINTS

- 4.4.1. Prior to the assessment of potential techniques, Site-specific characteristics and constraints that could affect the selection of feasible options have been considered. These are identified below in Table 4-1.

Table 4-1 - Site Characteristics and Constraints

Site setting	Sensitive land uses are in close proximity to the Site including residential properties, a recreation ground and Network Rail land. The Site does not lie within a groundwater Source Protection Zone. However, there is a groundwater abstraction licence for potable water supply recorded 460 m northeast of the Site from the Chalk aquifer. The Site is located within a Nitrate Vulnerable Zone, although there are no other sensitive land use designations such as Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPAs) located on Site or within the immediate vicinity.
Use and condition	The Site is disused and therefore, no constraints are posed by any on-going activities.

Working areas	The Site is relatively small and there is limited space available for storage of materials and plant / equipment.
Access	The Site can be accessed from George Street; however, access is restricted on all other sides of the Site.
Network Rail Land	The Site is situated to the south Network Rail land. The access way to the allotments to the north of the Site separates the Site with the Network Rail land. Consultations with Network Rail are ongoing with regard to the proposed development and foundation solutions.
Surface water features / flooding	The Environment Agency indicates that the Site is located within the boundary of a 'Flood Zone 2' designation which is associated with a 'medium' risk of flooding. There are no significant surface water features within the vicinity of the Site, however a drainage ditch is present to the north of the Site which sits at the base of the railway embankment.
Ground conditions	Buried foundations and remnant pipework may pose a constraint to excavation works.
Ecology	There are no known ecological constraints present on Site.
Tree preservation orders	There are no known Tree Preservation Orders (TPOs) pertaining to the Site.
Heritage	With reference to the Historic England website there are no listed buildings within 250 m of the Site.
Unexploded Ordnance	An unexploded ordnance (UXO) preliminary assessment has been undertaken which indicates that the Site is likely to have a low UXO hazard level and that further works, such as a detailed desk study, would likely confirm this hazard level.
Services	A foul sewer runs roughly northwest-southeast through the centre of the Site. Live services are known to be present in the pavement and highway adjacent to the Site. There remains the potential for other unidentified services to present within the Site.

4.5 IDENTIFICATION OF FEASIBLE REMEDIATION OPTIONS

- 4.5.1. To identify feasible remediation options, the general applicability of commonly used remediation techniques to deal with the identified RCLs is initially considered, with cognisance of the remediation objectives and the nature of the contaminant sources. This initial assessment is detailed below in Table 4-2.

Table 4-2 - Initial Evaluation of Remediation Techniques – RCL Specific

Remediation Option		Applicability of Technique		Comments
	RCL:	RCL 1	RCL 2	
	Source:	Shallow Made Ground Soils	Shallow Made Ground Soils	
	Receptor:	Human Health	Human Health	
	Contaminant Group(s):	Asbestos fibres / ACM	Metals, TPH, PAHs	
	Applicable Media:	Soils	Soils	
In-situ Treatment Techniques				
Stabilisation / solidification methods	×	✓	Potentially feasible option to mitigate risks associated with source material containing metals, PAHs and TPH. Technique is not likely to be feasible for treating asbestos fibres or ACM.	
Civil Engineering Methods				
Source removal by excavation	✓	✓	Potentially feasible means to achieve source removal of soils to mitigate risks to human health. Would require coupling with an ex-situ on-site treatment approach or off-site disposal / treatment to deal with the recovered source soils.	
Containment – cover systems	✓	✓	Feasible technique to mitigate risks from shallow soil to human health receptors via pathway break and applicable all the identified contaminants. Would require coupling with source removal technique if existing levels are to be maintained.	
Ex-situ Treatment Techniques (For Treating Recovered Source Soils by Excavation)				
Stabilisation / solidification methods	×	✓	Potentially feasible option to mitigate risks associated with source material containing metals, PAHs and TPH. Technique is not likely to be feasible for treating asbestos fibres or ACM.	
Thermal techniques – desorption / thermopiles	×	✓ / ×	Potentially feasible option to mitigate risks associated with source material containing PAHs and TPH. Technique is not likely to be feasible for treating asbestos fibres / ACM or metals.	
Soil washing	×	✓	Potentially feasible option to mitigate risks associated with source material containing metals, PAHs and TPH. Technique is not likely to be feasible for treating asbestos fibres or ACM.	
Biological Techniques	×	✓ / ×	Potentially feasible option to mitigate risks associated with source material containing PAHs and TPH. Technique is not likely to be feasible for treating asbestos fibres / ACM or metals.	
Off-site Disposal or Treatment Options (For Removal of Recovered Source Soils)				
Off-site disposal (landfill)	✓	✓	Off-site disposal to licensed landfill is a feasible approach for source soils; however, soils would require pre-treatment and waste classification. Possibly some level of treatment may be required to meet waste acceptance criteria.	
Off-site treatment (treatment centre / plant)	✓ / ×	✓	Soil treatment facilities may be a feasible option for source soils, although acceptance may be limited by the presence of asbestos. Treatment centre options for treatment of soils containing asbestos may be few.	

✓ = generally applicable
x = generally not applicable
✓ / x = limited applicability

4.6 SHORTLIST OF FEASIBLE REMEDIATION OPTIONS

4.6.1. The preliminary assessment of remediation options has identified feasible options that are generally suitable to remove reduce or control risks associated with the relevant contaminant linkages. These shortlisted techniques have been initially evaluated against the Site-specific objectives, constraints and likely source quantities, as detailed in Table 4-3.

Table 4-3 - Initial Evaluation of Short-listed Feasible Techniques

Category	Technique	Comment	Taken Forward?
In-situ techniques	Stabilisation / solidification methods	Technique is not applicable to both RCLs and would therefore require coupling with another technique. Would require removal of the near surface soils to facilitate placement of subsoil / topsoil for landscaped areas. Very unlikely to be economic for the relatively small source volume.	x
Civil Engineering	Source removal by excavation	Feasible means of achieving source removal for both identified RCLs, achievable in a short timeframe and suitable to implement on a Site with a small working area.	✓
	Containment – cover systems, including a geomembrane and hard dig layer	Feasible means of achieving a pathway break (between source soils and future receptors) for both identified RCLs, achievable in a short timeframe and suitable to implement on a Site with a small working area.	✓
Ex-situ Treatment Techniques	Stabilisation / solidification methods	Technique is not applicable to both RCLs, has limited applicability to some contaminants and would therefore require coupling with another technique. Not practicable to implement given the small working area. Would require removal of the near surface soils to facilitate placement of subsoil / topsoil for landscaped areas. Very unlikely to be economic for the relatively small source volume.	x
	Thermal techniques – desorption / thermopiles	Technique is not applicable to both RCLs, has limited applicability to some contaminants and would therefore require coupling with another technique. Not practicable to implement given the small working area. Very unlikely to be economic for the relatively small source volume.	x
	Soil washing	Technique is not applicable to both RCLs, has limited applicability to some contaminants and would therefore require coupling with another technique. Not practicable to implement given the small working area. Very unlikely to be economic for the relatively small source volume.	x
	Biological Techniques	Technique is not applicable to both RCLs, has limited applicability to some contaminants and would therefore require coupling with another technique. Not practicable to implement given the small working area. Very unlikely to be economic for the relatively small source volume.	x
Off-site Disposal or Treatment Options*	Off-site disposal (landfill)	Feasible means of dealing with any source material generated.	✓
	Off-site treatment (treatment centre / plant)	Feasible means of dealing with any source material generated.	✓

* These are secondary options to deal with any source material which is generated by implementation of a primary remediation option.

4.7 DETAILED EVALUATION OF FEASIBLE REMEDIATION OPTIONS

- 4.7.1. The initial evaluation of short-listed remediation options has identified feasible options / combination of options that are suitable to mitigate the potential risks associated with the identified contaminant source. Given the relatively small source volume, the relatively small working area and the nature of the contaminants present, feasible options are limited to source removal by excavation, or placement of a cover system.
- 4.7.2. Both these approaches would entail some excavation and removal of source soils. Whilst a cover system could theoretically be constructed over the source material from ground level, it is assumed that Site levels are to be maintained. Excavation to a risk-based depth of 0.7 m would be required before clean imported material is placed to form the cover layer. The advantage of a cover system over a full source removal approach is that the quantity requiring removal would be minimised i.e. the whole source volume would not require removal, which would be beneficial economically.
- 4.7.3. Should the design of the development allow levels to be raised, the excavation volume could be reduced accordingly, however, regardless of the final ground levels, the approach would require placement of a minimum of 0.6 m of clean cover.
- 4.7.4. For both approaches, the excavation of source soils would generate waste requiring removal from the Site. Both landfill and off-site treatment facilities are feasible, the latter being more economic but it is uncertain whether the resultant soil waste would be acceptable. The presence of both bulk ACM and asbestos fibres may restrict treatment and disposal options. Engagement with treatment facility operators at an early stage is recommended. Should a suitable receiving treatment facility not be located, waste classification testing would be required to determine a suitable disposal location.
- 4.7.5. Alternatively, should sufficient void space be available on Site, the excavated source material could be re-used, provided that the material is placed beneath hardcover or structures. Any re-use of soils or hard materials would require a Materials Management Plan (MMP) in accordance with The Definition of Waste: Development Industry Code of Practice.

4.8 RECOMMENDED REMEDIATION APPROACH

- 4.8.1. The assessment of remediation options identifies placement of a cover system coupled with either off-site disposal / treatment of excavated source soils, as the recommended remediation approach. Alternatively, the excavated soils could be re-used on Site should sufficient void space be available.
- 4.8.2. The recommended remediation approach, as outlined above, is reasonable considering the risk context of the Site, the practicability and timeframe of implementing the scheme, the durability and cost.

5 REMEDIATION STRATEGY

5.1 BASIS OF THE STRATEGY

- 5.1.1. The remediation strategy is risk-based and has been developed in line with best practice procedures for the assessment of land contamination. The strategy has been prepared following a detailed review of existing Site information, utilising reasonable assumptions and previous experience.
- 5.1.2. The overriding objective of the remediation work is to render the Site safe to a standard at which it is suitable for a future residential end-use. This will require appropriate reduction or removal of risks associated with the identified RCLs.

5.2 COMPONENTS OF THE STRATEGY

- 5.2.1. The most appropriate strategy to achieve the remediation objectives, given the Site's characteristics and constraints, comprises installation of a cover system to provide a pathway-break between source soils and receptors (future Site users). The strategy comprises the following principal elements:
- Removal of source soils within future soft-cover (landscaped / garden areas) to a minimum risk-based depth of 0.7 m (below final ground levels);
 - Placement of a geomembrane at the bases and sides of the excavations to act as a warning / separation layer;
 - Placement of 0.1 m hard to dig layer;
 - Placement of suitable imported sub soil and top soil materials; and
 - Off-site disposal of excavated materials to a suitably licensed landfill or waste treatment centre (or re-use of soils on Site subject to the requirements of The Definition of Waste: Development Industry Code of Practice.

5.3 REMOVAL OF SOURCE SOILS & PLACEMENT OF COVER SYSTEM

- 5.3.1. Source soils impacted will be excavated to a minimum risk-based depth of 0.7 m below final ground level, which is assumed will be broadly coincident with existing ground level. The objective is to achieve full removal of soils to the stated risk-based depth.

5.4 PLACEMENT OF GEOMEMBRANE

- 5.4.1. Prior to reinstatement a geomembrane (e.g. Terram T1000 orange, or similar approved) will be placed over the bases of the excavations and lapped against the excavation sides. The membrane will also require lapping against the bases and sides of any tree pits excavated within future soft-cover areas.

5.5 PLACEMENT OF IMPORTED MATERIALS

- 5.5.1. A minimum thickness of 0.7 m of imported materials shall be placed above the geomembrane to final ground level. A 100mm hard to dig layer will be placed on top of the geomembrane for added protection against ACMs. The soft-cover areas will require placement of topsoil / subsoil as part of the landscaping design. Where the specified thicknesses of topsoil / subsoil in the landscaping design are less than the specified excavation depth, the difference shall be made-up by increasing the thickness of sub-soil. Testing of topsoil / subsoil shall be in accordance with the landscaping design (based on the relevant British Standards).

5.6 OFF-SITE DISPOSAL / TREATMENT

- 5.6.1. Excavated materials will require removal from Site to appropriately licensed recycling / disposal facilities. Where necessary, materials will be tested and characterised prior to removal from Site. Alternatively, soils may be re-used on Site, subject to the requirements of The Definition of Waste: Development Industry Code of Practice.

5.7 ANTICIPATED REMEDIATION EXTENTS AND QUANTITIES

- 5.7.1. Remediation areas are shown on Drawing No. 70044279/102, and cover approximately 92 m². Excavation quantities are estimated at approximately 64 m³. It should be noted that the remediation extents have been based on the design proposals available at the time of writing. Should the extents of the future soft-cover areas change then the remediation areas will require adjustment accordingly.

5.8 REMEDIATION CRITERIA

- 5.8.1. The remediation criteria are based on achieving full removal of source soils to the stated risk-based depth, and achieving the same minimum thickness of replacement clean cover.

5.9 REMEDIATION DURABILITY

- 5.9.1. The selected strategy is based on the creation of a pathway-break which will be a durable solution, but require Site levels to be maintained in the future.

5.10 DISCOVERY STRATEGY

- 5.10.1. Changes to the remediation strategy may be required during the course of the works, as a result of unexpected contamination / impacts being encountered. This is defined as any contamination source which is distinct in its chemical or physical composition from the type of source material considered within the CSM. Should unexpected contamination be encountered, then further characterisation and risk assessment will be undertaken as required. An addendum to the strategy will be prepared detailing how this contamination will be dealt with. Written agreement will be sought from RBC prior to implementation any amendments to the agreed strategy. Any such amendments will be fully documented within the Verification Report.

6 OUTLINE IMPLEMENTATION PLAN

6.1 INTRODUCTION

- 6.1.1. The Implementation Plan provides details of the management, preparation, implementation, verification, and details of any long-term monitoring and maintenance, of the remediation works. The Implementation Plan is provided in outline at this stage, and is to be developed prior to commencement of the works following tender and appointment of the remediation contract.

6.2 CONTRACTUAL ARRANGEMENTS

- 6.2.1. Contractual details are to be confirmed, including roles and responsibilities prior to, during and post-completion of the remediation works.

6.3 LEAD-IN WORKS

- 6.3.1. Discharge of the relevant pre-commencement conditions of the Planning Permission granted by RBC will be required.
- 6.3.2. Liaison with service owners and Network Rail will be undertaken in advance of the remediation works to agree working methodologies and protection measures.
- 6.3.3. Engagement with a licenced ACM contractor, an Asbestos Management Plan and asbestos mitigation measures will be required (eg dust suppression measures) prior to works commencing on Site.
- 6.3.4. Preparation of a Materials Management Plan will be required should it be intended to re-use excavated soils on Site (including any excavated soils / processed hard materials which are not directly generated by the remediation works).

6.4 PREPARATORY WORK

- 6.4.1. Areas for the temporary storage of storage of excavated materials will be prepared prior to disposal / re-use.
- 6.4.2. The Site boundaries will be made secure prior to the works commencing. Site security will be maintained for the duration of the works to protect on-site plant and equipment.
- 6.4.3. Existing features will require protection, such as live services. Intrusive service location, via hand digging or vacuum excavation techniques, will be undertaken to locate services which may present a constraint to the remediation.
- 6.4.4. Baseline environmental monitoring for airborne asbestos fibres may be required.
- 6.4.5. All existing monitoring well installations (as shown on Drawing No. 70044279/101) will be decommissioned prior to the commencement of the remediation works. These will be decommissioned in accordance with the requirements of the relevant British Standards and Environment Agency guidance.

6.5 REMEDIATION WORKS

- 6.5.1. The remediation works will be compliant with the requirements of the Remediation Strategy. Remediation areas are shown on Drawing No. 70044279/101.

- 6.5.2. The remediation will be phased as determined by the appointed contractor. The remediation works are anticipated to be completed within two weeks of commencement.

6.6 MONITORING AND MAINTENANCE OBLIGATIONS

- 6.6.1. No monitoring is required following completion of the remediation works.

6.7 ENVIRONMENTAL IMPACTS AND MITIGATION

- 6.7.1. The remediation works have the potential to impact a number of sensitive receptors including air, surface water, groundwater and neighbouring properties. Emphasis will be placed on preventing or controlling emissions at source, and the following hierarchy will be adopted:

- Prevention;
- Suppression; and
- Containment.

- 6.7.2. An Environmental Management Plan (EMP) will be prepared for the remediation works and implemented by the appointed contractor. The EMP will incorporate an appropriate risk assessment and details of mitigation measures required to be implemented to reduce potential risks to sensitive receptors, including:

- Control measures to minimise noise, air emissions (including dust/fibres), odour and vibration;
- Control and protection measures from surface water run-off;
- Storage of plant, equipment and materials;
- Monitoring programme;
- An asbestos management plan (AMP); and
- Waste management controls

- 6.7.3. General Site operations will be confined to the working hours stated in condition No. 15 of the planning permission.

6.8 HEALTH & SAFETY RISKS AND PRECAUTIONS

- 6.8.1. A full construction phase health and safety plan will be prepared for the works, included detailed risk assessments and method statements for all relevant activities. The following potential hazards are highlighted (non-exhaustive), and safe working methods will be adopted to minimise risks to Site workers, visitors and the public:

- There is the potential for exposure to contaminated soils and dusts during the remediation works. Of particular note is the presence of asbestos materials, control / mitigation measures will be determined as part of the development of the asbestos management plan.
- There is a risk of physical harm to Site staff resulting from the use of plant and equipment.
- There is a risk of physical harm resulting from unauthorised access to the Site. Security fencing and clear signage shall be implemented to minimise this risk.

6.9 VERIFICATION PLAN

INTRODUCTION

- 6.9.1. This Verification Plan sets out the data gathering requirements in order to demonstrate that the remediation criteria and objectives are met, and how the works are to be documented and reported. Any changes to the Verification Plan, particularly where they lead to a change to the objectives, will be documented and, where necessary, agreed with relevant parties.
- 6.9.2. The Verification Plan will be supplemented following design and appointment of a contractor to confirm details such as: roles and responsibilities (including qualification and experience of personnel) and qualification; accreditation and experience of parties involved in the verification process including appointed testing laboratories; and quality management procedures.

VERIFICATION APPROACH

- 6.9.3. Verification will be based on gathering several different lines of evidence. The excavation levels (formation levels) and geomembrane layer shall be topographically surveyed and photographed prior to reinstatement. A topographical survey shall then be undertaken post-reinstatement (final ground levels) to demonstrate that sufficient thickness of clean cover has been placed. Certification of imported top soil / sub-soil will be provided.

RECORDS

- 6.9.4. The following records will be provided for inclusion in the Verification Report:
- Specification of selected geomembrane;
 - Excavation quantities;
 - Waste classification testing data;
 - Waste disposal records, including tickets and consignment notes, details of waste disposal facilities;
 - Details of imported materials used in reinstatement;
 - Photographic record; and
 - Topographic survey information, including excavation levels and final ground levels.

VERIFICATION REPORT

- 6.9.5. Complete and accurate records of the works will be prepared and maintained throughout the remediation project for inclusion within the verification report to demonstrate completion of the works in accordance with the strategy.
- 6.9.6. The following will be incorporated within the report as a minimum:

BACKGROUND INFORMATION

- Relevant Site location / identifying information;
- Summary of the reasons and objectives of the remediation and any items out of scope;
- Key contacts, roles and responsibilities.

REMEDIATION PROJECT

- Full description of the works undertaken, including: methodology and programme; and any approved changes to the remediation strategy;
- Summary of the programme - start / completion dates;

- Details regarding classification of excavated materials for disposal;
- Quantities of material: excavated and imported;
- Any relevant analytical reports;
- Data on the quality and provenance of the imported fill materials;
- Details regarding management of waste, including details of carrier and waste disposal /treatment sites;
- Details of methodology for monitoring well decommissioning;
- Details of quality control procedures adopted;
- Details of any monitoring activities;
- Photographic record;
- As-built drawings, to include: original ground level surveys; locations of decommissioned monitoring wells; excavation extents; geomembrane extents; test locations; removed and remaining obstructions; and finished ground levels;
- Details of any third-party consultation, licencing, permits, consents, Site visits or communications;

6.9.7. The verification report will be incorporated into the health & safety file for the Site, and relevant details included in the future maintenance plan.

Figures & Drawings

wsp



Key
 Site Boundary



TITLE:

70044279 - George Street,
Reading

FIGURE No:

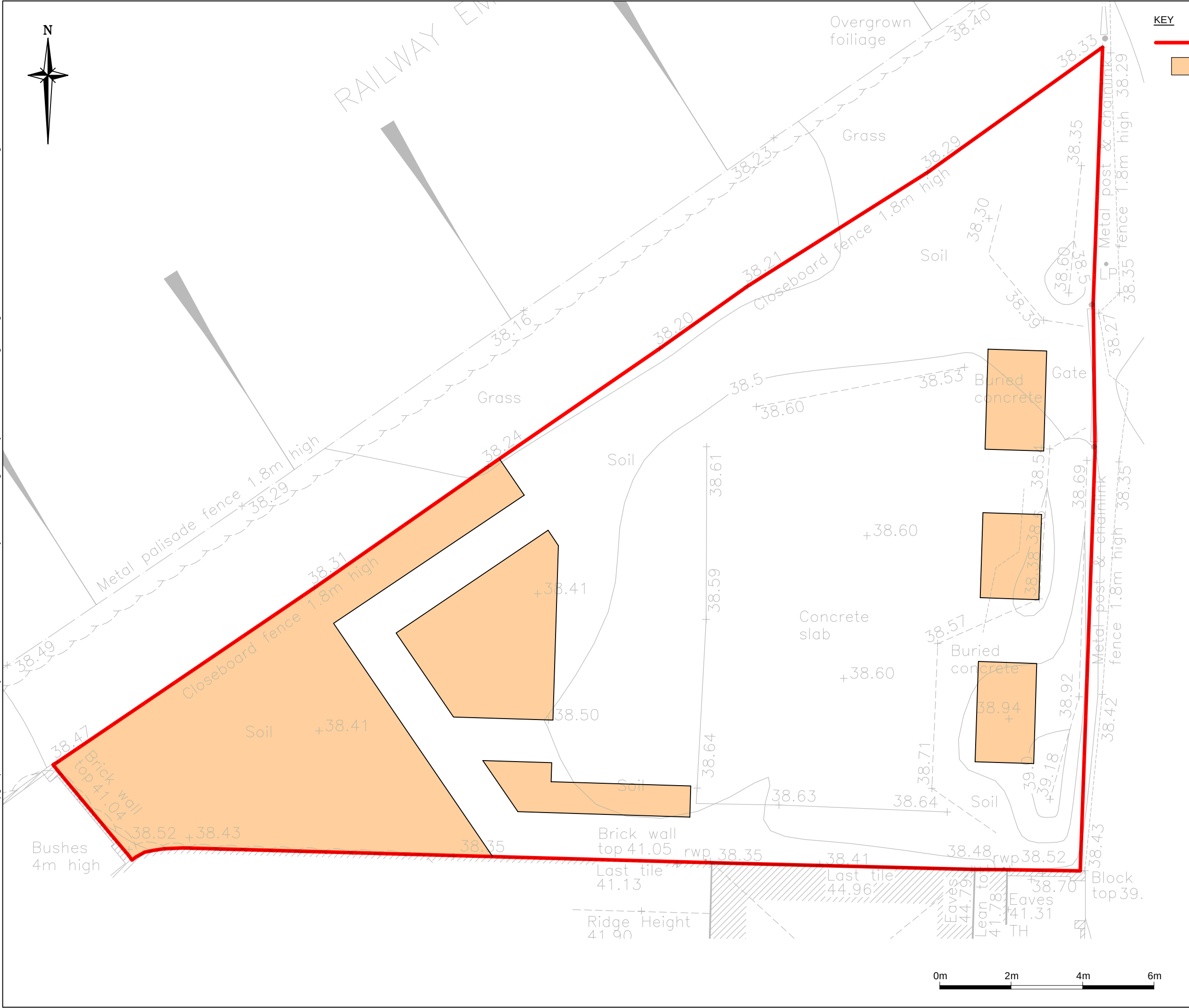
Figure 1 - Site Location



wsp

TITLE:
70044279 - George Street,
Reading

FIGURE No:
Figure 2 - Site Layout



KEY

SITE BOUNDARY

REMEDIATION AREA - COVER SYSTEM

Rev	Date	Description	By	Chk	App
wsp Kings Orchard 1 Queen Street Bristol BS2 0HQ Tel: 44-(0)1179-306200					
Client: READING BOROUGH COUNCIL					
Site/Project: GEORGE STREET READING					
Title: REMEDIATION AREAS					
Drawn: CEW		Checked: JW			
Designed: JW		Approved: PD			
Date: 14/06/2019	Scale: 1:100	A3	Sheet:		
Project Number: 70044279		Drawing Number: 102		Revision:	
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