



Remediation Strategy

Residential Development Area, Worton Grange, Reading

July 2016

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This document has been prepared and checked in accordance with Waterman Group's IMS (BS EN ISO 9001: 2008, BS EN ISO 14001: 2004 and BS OHSAS 18001:2007)

Issue	Date	Prepared by	Checked and Approved by
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A handwritten signature in blue ink, appearing to read 'R. Stockwell'.

Comments

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Remediation Strategy

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1. Introduction

1.1 Project Brief

Waterman Infrastructure & Environment Limited ("Waterman") was instructed by Bewley Homes Plc to undertake a Remediation Strategy for the residential development area at Worton Grange, Reading.

Following completion of Waterman's Geo-Environmental Assessment October 2015, Document Reference: WIB14723-100-R-1-5-1-GH which was submitted as part of the site wide planning application, additional ground investigation was undertaken by Waterman on behalf of Bewley Homes Plc. The findings of this ground investigation were reported in Updated Geo-Environmental Assessment (Area Designated for Residential Development at Worton Grange, Imperial Way, Reading) July 2016, Document Reference: WIB14723-102-R-1-3-1-MA.

This report describes the overall strategy that will be used to manage and minimise the environmental impact of the remediation works, which also relate to the initial enabling works. The main objectives of this report are to:

- Assist in discharging Planning Condition 25 "Contamination" (ref: 151944).

Condition 25 "Contamination" states:

25. Contamination

a) Implementation of Approved Remediation Scheme

The remediation scheme for within the Outline Element shall be implemented in accordance with the approved timetable of works. A validation report (that demonstrates the effectiveness of the remediation carried out) must be submitted to and approved by the Local Planning Authority prior to construction of the development.

b) Reporting of Unexpected Contamination

In the event that contamination is found at any time when carrying out the Outline Element of the development not previously identified, development must be halted on that part of the site and it must be reported in writing to the Local Planning Authority. Following that an assessment of the nature and extent of contamination must be undertaken and where remediation is necessary a remediation scheme, together with a timetable for its implementation, must be submitted to and approved in writing by the Local Planning Authority. The measures in the approved remediation scheme must then be implemented in accordance with the approved timetable. Following completion of measures identified in the approved remediation scheme a validation report must be submitted to and approved in writing by the Local Planning Authority.

The information contained within this report is based upon the Waterman's Geo-Environmental Assessment October 2015, Document Reference: WIB14723-100-R-1-5-1-GH and Updated Geo-Environmental Assessment (Area Designated for Residential Development at Worton Grange, Imperial Way, Reading) July 2016, Document Reference: WIB14723-102-R-1-3-1-MA, which should be read in conjunction with this report.

1.2 The Proposed Development

The proposed development is located at the Worton Grange Site, located in Reading, as shown in Figure A1, Appendix A.

The proposed development layout (Master Plan) is illustrated in Figure A4 in Appendix A. The development is for approximately 175 new homes including affordable housing, with areas of public open space.

1.3 Limitations

This assessment has been undertaken in general accordance with the Model Procedures for the Management of Land Contamination (Contaminated Land Report 11 – Environment Agency, September 2004) and forms a decision record in relation to the assessment of the Site.

The ground conditions reported relate only to the point of excavation and do not necessarily guarantee a continuation of the ground conditions throughout the non-inspected area of the Site. Whilst such exploratory holes would usually provide a reasonable indication as to the general ground conditions, these cannot be determined with complete certainty.

Waterman has endeavoured to assess all information provided to them during this assessment, but makes no guarantees or warranties as to the accuracy or completeness of this information.

The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the Site.

2. Environmental Setting

The full environmental setting and Conceptual Site Model are reported in Waterman's Geo-environmental Assessment Reports and a summary of the key points is given below.

2.1 Site Setting and Description

The Site currently comprises extensive areas of hardstanding, soft landscaping (including a perimeter landscaped bund) and a number of stockpiles of crushed aggregates. Redundant fuel and water tanks and associated pipework remains on-site. As well as a gas governor located within the landscaped bund close to the main site entrance.

2.2 Geology

Site:

The soil profile across the Site comprises made ground consisting of concrete or tarmac underlain by a yellow sand and gravel sub-base, including brick, concrete, flint, granite limestone and sandstone. Thicknesses ranged from 0.4m to 1.0m. London Clay soils were encountered between 0.5m and 1.0mbgl to a maximum encountered depth of 15.0m bgl and comprised soft yellow brown very sandy Clay, underlain by firm to stiff sandy gravelly clay, becoming stiff to very stiff with depth, with occasional sand and shell bands.

Landscaped Bunds:

The soil profile within the landscaped bunds comprises made ground consisting of grass over dark brown clayey topsoil, underlain by sandy gravelly clay with occasional brick, metal, timber, concrete, tile, flint and quartzite. Thicknesses ranged from 0.4m to 3.3m. Natural Clay soils were present beneath the made ground soils, consisting of grey brown silty Clay, becoming stiff at depth. Natural soils were encountered from 0.6m to 3.0m to a maximum depth of 3.95m bgl.

3. Conceptual Site Model

The Conceptual Site Model has been developed during the desk-based and ground investigation phases of the Site environmental assessment and is summarised below.

3.1 Pollution Linkages

The pollutant linkages identified and evaluated are detailed within Waterman's Geo-Environmental Assessment October 2015, Document Reference: WIB14723-100-R-1-5-1-GH and Updated Geo-Environmental Assessment (Area Designated for Residential Development at Worton Grange, Imperial Way, Reading) July 2016, Document Reference: WIB14723-102-R-1-3-1-MA. The following actions were recommended to address the potentially unacceptable risks that remained following the risk assessment:

- The investigations identified elevated concentrations of arsenic within the shallow Made Ground within localised areas of the Site below former car park and building slab areas when compared to residential criteria. These exceedances are classified as 'hot spots' and are not consistent across the entire Site. The exceedances were observed predominantly in gravel sub-base material found within the top 1.0m. Therefore it is likely that this material will be excavated during groundwork preparation, and if deemed geo-technically suitable, re-used on site below building footprint or roads infrastructure and therefore would not be considered a risk to future Site users and construction workers.
- Excavations into the landscaped bunds identified elevated concentrations of lead and beryllium at two locations therefore these soils would not be suitable for use within landscaped or garden areas as part of the future development. If there is a requirement to re-use these soils on site they could be used below areas of hardstanding or roads.
- Construction workers should ensure good working practices during construction, including the damping down of soils, to minimise the potential for dust generation and associated offsite migration. In addition, appropriate PPE/RPE should be worn at all times by construction workers, commensurate with the contaminants present and the activities being undertaken. This information should be made available to all Site personnel during any Site inductions.
- Asbestos fibres and a piece of lagging were encountered within soils that make up the landscaped bunds, located around the northern and eastern site perimeter. Where these contaminants are found the impacted soils should be excavated and segregated following appropriate mitigation measures to reduce the risk of asbestos fibre release. If there is a requirement to re-use this material on site, visible pieces of asbestos should be removed under controlled conditions by a specialist contractor and disposed of appropriately at a licensed facility.
- Following confirmation of the asbestos quantification analysis, only one sample contained asbestos at a quantifiable concentration of 0.065%. If the material is to be reused on site, further risk assessment will be required to determine site specific assessment criteria. Subject to geotechnical performance criteria and a need for the material, there is potential for the material to be re-used on site below areas of hardstanding using the CL:AIRE waste protocol.
- Where vinyl floor tiles were noted that could contain asbestos it is recommended that samples of this material are taken and screened for asbestos by a specialist contractor.
- No requirement for radon protection measures has been identified; however current guidance indicates that basic radon protection measures should be incorporated as standard into all new properties. Typical basic radon protection measures require that all gaps within building floors, such as joins or service penetrations, are sealed either with a PE sheet or suitable plastic based sealant material. It is therefore

recommended that the requirements for radon protection and the absence of ground gas (carbon dioxide) protection measures are confirmed with the Local Authority.

- It is recommended that the condition of the former fuel tank and associated pipework is investigated. Upon investigation the tank, pipework and potential contents should be removed from site and validation testing completed on underlying soils to confirm the absence of ground contamination.
- Earthworks requirements, including materials permitted for use in the works, should be detailed within an Earthworks Specification document. It is recommended this be prepared in accordance with Series 600 of the Specification for Highway Works and should outline requirements for preparation of sub-grade, compaction of fills and the frequency of acceptability testing to be undertaken on Site won and imported materials.
- Consideration should be given to the re-use of arisings from foundation trenches / drainage runs etc. Where contamination has been encountered, it may be possible to reuse foundation arisings subject to risk assessment; however, certainty of use and volume should be confirmed in accordance with the requirements of the CL:AIRE waste protocol.

4. Further Generic Quantitative Risk Assessment

Soil samples obtained during the Waterman 2014 intrusive ground investigation were originally compared to Waterman Generic Assessment Criteria (GAC) available at the time. Since the issue of the report (Waterman's Geo-Environmental Assessment October 2015, Document Reference: WIB14723-100-R-1-5-1-GH) the GAC has been updated therefore all historic soil data has now been compared to the most recent criteria. Table 1 below provides a summary of the results that exceeded the assessment criteria.

Table 1: Summary of 2014 generic quantitative risk assessment for human health

Stratum	Contaminant	Location	Conc. (mg/kg)	Generic Assessment Criteria (mg/kg)	Number of Exceedances
Made ground	Arsenic	TP11 (0.8m)	70.60	37	1

Table 2 below provides a summary of the results from the 2016 ground investigation that exceeded the assessment criteria.

Table 2: Summary of 2016 generic quantitative risk assessment for human health

Stratum	Contaminant	Location	Conc. (mg/kg)	Generic Assessment Criteria (mg/kg)	Number of Exceedances
Made ground	Arsenic	TP301 (0.3m) TP305 (0.3m) TP307 (0.4m)	37.96 - 65.45	37	3
Made ground	Beryllium	TP222 (1.5m) within landscaped bund	2.79	1.70	1
Made ground	Lead	TP213 (3.0m) within landscaped bund	289.10	200	1

Asbestos was indicated to be present in seven out of forty-five samples tested during the 2016 ground investigation (no asbestos was detected during the 2014 ground investigation). Asbestos was encountered within the landscaped bunds especially within the south eastern site boundary, along Basingstoke Road. Fibres were encountered at consistent depths and are considered likely to have originated from lagging identified in location TP206 at 0.5m. One location (TP301 0.3m) within tarmac hardstanding also identified asbestos fibres within subbase material.

Quantification analysis completed on all samples identified as containing asbestos fibres and /or asbestos containing material, confirms that only one sample from TP205 at 0.75m depth contained asbestos of a minimum volume that could be quantified. A piece of asbestos cement was confirmed with an asbestos

concentration of 0.065%. The other samples where asbestos had been identified previously did not contain asbestos in a sufficient volume to quantify therefore it can be assumed that the asbestos in these soils was only trace fibres. The details are presented in Table 3 below.

Table 3: Summary of 2016 generic quantitative risk assessment for human health - Asbestos

Stratum	Contaminant	Location	Component	Quantification Analysis Conc. (%)
Made ground	Asbestos (Chrysotile)	TP203 (1.0m) TP204 (1.0m) TP221 (1.5m) TP224 (2.0m)	Loose fibres	No asbestos detected enough to quantify
Made ground	Asbestos (Chrysotile)	TP206 (0.5m)	Lagging	No asbestos detected enough to quantify
Made ground	Asbestos (Chrysotile)	TP205 (0.75m)	Cement	0.065%
Made ground	Asbestos (Amosite)	TP301 (0.3m)	Loose fibres	No asbestos detected enough to quantify

Figure A2 within Appendix A illustrates the combined 2014 and 2016 Ground Investigation locations.

In order to better conceptualise the overall spread of shallow soil contamination across the Site, where shallow soils are shown to exceed residential assessment criteria, the locations have been plotted onto the Proposed Master Plan, so that the intended end use at the exceedance location can be more accurately assessed. This output is illustrated in Figure A3 'Proposed Master Plan showing Soil Exceedance Locations' contained within Appendix A.

4.1 Generic Assessment Criteria (Public Open Space – Residential)

Waterman has further assessed the residential soil exceedances against a more accurate end use assessment criteria, in order to establish the residual risk of shallow soil contamination across the Site.

The Proposed Master Plan identifies the following sample locations as being within areas designed as Public Open Space, therefore the Waterman Generic Assessment Criteria (GAC) for Public Open Space (POS) within a residential scheme has been selected as the most appropriate assessment criteria.

A summary of the revised assessment is presented in Table 4 below.

Table 4: Summary of previous identified soil exceedances compared to a revised public open space GAC

Final Development End Use	Contaminant	Location	Conc. (mg/kg)	Number of Exceedances	Generic Assessment Criteria (mg/kg)
	Arsenic	TP307 (0.4m);	37.96	0	79

Final Development End Use	Contaminant	Location	Conc. (mg/kg)	Number of Exceedances	Generic Assessment Criteria (mg/kg)
Public Open Space (Residential)	Lead	TP213 (3.0m)	289.10	0	630

When compared against Waterman's Generic Assessment Criteria (GAC) for Public Open Space (POS) within a residential scheme, the shallow soils at the above locations do not present a risk to human health.

4.2 Generic Assessment Criteria (below hardstanding)

The Proposed Master Plan identifies the following sample locations as being within areas below structures or hardstanding (roads and pavements) as part of the future development, therefore the Waterman Generic Assessment Criteria for a commercial end use has been selected as the most appropriate assessment criteria.

A summary of the revised assessment is presented in Table 5 below.

Table 5: Summary of previous identified soil exceedances compared to a revised commercial GAC

Final Development End Use	Contaminant	Location	Conc. (mg/kg)	Number of Exceedances	Generic Assessment Criteria (mg/kg)
Commercial (below hardstanding)	Arsenic	TP11 (0.8m); TP301 (0.3m); TP305 (0.3m)	38.64 - 70.60	0	640
	Beryllium	TP222 (1.5m)	2.79	0	12

When compared against Waterman's Generic Assessment Criteria (GAC) for below structures or hardstanding within a residential scheme, the shallow soils at the above locations do not present a risk to human health.

4.3 Conclusions

Based on this revised assessment only asbestos impacted soils at locations as detailed in Table 3 would present a risk to future site users. Asbestos impacted soils would require segregation on site for further assessment to determine their suitability to be retained for use within the future development, or disposed of off-site.

4.4 Site Specific Chemical Acceptance Criteria

Chemical acceptance criteria for the Site have been derived based on the requirements for re-use of site won soils within the development areas. It is envisaged that current ground investigation analysis can pre-classify site won soils to be used below hardstanding only.

Three sets of criteria have been formulated based on the sensitivity of the end use:

- one set of criteria is to be adopted for soils intended for re-use in residential areas (private gardens);
- one set of criteria is to be adopted for soils intended for re-use in landscaped areas (public open space);
and
- the other is to be adopted for soils to be used under structures or areas of hardstanding.

The full set of Chemical Acceptance Criteria can be found in Appendix B, Table B1.

5. Decommissioning and Removal of Fuel Tank within the Landscaped Bund

5.1 Background

Existing infrastructure is still present within the Site. This includes a fuel tank set within a landscaped bund located in the northwest boundary of the Site. The fuel tank is known to have fed emergency generators via underground pipework as part of the Sites previous use. Previous phases of ground investigation have not specifically targeted the area of the fuel tank, however, surrounding soils within the landscaped bund and to the south of the tank have been investigated and sampled. Currently it is not known whether the tank and associated pipework contain any residual fuel.

A plan of the fuel tank is illustrated in Appendix C.

5.2 Historic Contamination

5.2.1 Soil

During previous phases of ground investigation at the Site, soil samples have been taken from shallow Made Ground and natural soils within the landscaped bund immediately to the north of the tank and south and east of the tank, below existing hardstanding. No olfactory evidence of petroleum related contamination was observed in the majority of these locations and no elevated concentrations of contaminants were observed within chemical analysis. Only one location (Trial Pit TP11) located to the east of the fuel tank had a slight hydrocarbon odour when soils were disturbed between 0.7m and 1.3mbgl. Samples of soil taken at 0.8m and 1.3m depth did not contain elevated poly-cyclic aromatic hydrocarbons or total petroleum hydrocarbon concentrations when compared to a residential assessment criteria.

It is clear therefore that these surrounding soils are not impacted with hydrocarbon contamination that could be linked to spillages or leakages from the tank overtime.

5.2.2 Groundwater

Groundwater samples were also collected from two boreholes (BH1 and BH6) north and south east of the tank. No elevated concentrations of contaminants were observed in the groundwater and no olfactory evidence was observed during monitoring rounds.

5.3 Required Further Works

The fuel tank will need to be appropriately decommissioned to allow for its safe removal. A required scope of works and method statement should be sought from a specialist contractor, however a suggested course of action is detailed below:

- Extent and setting of the fuel tank, including any corresponding process pipework, should be established by a specialist survey company;
- The structure of the fuel tank should be sensitively exposed by removing of the surrounding soils in a controlled manor;

- The surrounding soils should be segregated for appropriate environmental testing to confirm the suitability of the soils to be retained on site or the likely waste classification should off-site disposal be required;
- The fuel tank and pipework should be appropriately decommissioned, cleaned and any residual contents removed off site to a licensed waste facility; and
- Once removed, the soils immediately below and at the sides of the tank and any process pipework should be tested to confirm the absence of possible residual contamination and to suitably validate the soils to be left in-situ.

6. Remedial Options Appraisal and Strategy

The various phases of ground investigation indicated that in general very little ground contamination has been encountered and that much of the Site comprises shallow Made Ground overlying natural uncontaminated natural clay geology.

The subsequent revised risk assessment presented above indicates that, while a few potential pollutant linkages have been identified at the Site, these pollutant linkages can be broken, through the use of standard mitigation measures.

The potential pollutant linkages can be summarised as follows:

- The risk to future site users within areas of private gardens as a result of direct contact, ingestion and inhalation of the limited contaminated soils present at shallow depth within the site boundary;
- The risk to construction personnel associated with direct contact, ingestion and inhalation of contaminated soils;
- The risk to buried water supply pipes associated with direct contact with made ground containing elevated concentrations of potentially degrading substances; and
- The risk to vegetation within private garden areas as a result of contact with potentially contaminated soils.

6.1 Remedial Options

The limited elevated concentrations of contaminants identified at the Site are considered to be isolated hotspots representative of imported materials used during the previous site construction and not as a result of any past contaminative land uses.

It is recommended that the remedial measures undertaken at the Site should take into account the potential for further contamination within the Masterplan area and the measures adopted should ensure that no significant environmental risks associated with sources of contamination are likely to impact on the Site on completion of the development.

The remedial options considered viable for this development are discussed below.

Source Removal

Removal of sources of ground contamination at the Site would remove the immediate risks to future site users. Source removal could be considered as a suitable option, as only isolated shallow soils contained elevated concentrations.

Where asbestos impacted soils have been identified, these soils would need to be segregated under controlled conditions in line with Control of Asbestos Regulations (CAR) 2012.

Based on current analysis it is possible that the majority of asbestos impacted soils would be classified as non-hazardous waste, however should any visible pieces of asbestos be found during the segregation exercise then these soils would potentially need to be disposed of as hazardous waste, however finalised waste classification would need to be sought from the receiving landfill or waste transfer station. A classification of hazardous waste would add significantly to disposal costs.

On-site Treatment of Metal Impacted Contaminated Soils

Only limited elevated concentrations of metals have been identified at the Site. For this reason, the relatively high costs associated with the mobilisation and treatment of any contaminated soils using immobilisation or chemical treatment methods is considered to be uneconomical in scale.

6.1.1 On-site Treatment of Asbestos Impacted Soils

One isolated area below existing hardstanding and a small section of the landscaped bunds surrounding the site are impacted with asbestos. Soils are mainly impacted with loose fibres however one piece of lagging and one piece of cement board were observed in soil samples. At such low concentrations, on-site treatment such as screening and handpicking to reduce waste classification or to allow the soils to be re-used on site is considered to be uneconomical in scale.

Break of Pollutant Linkages

As concluded in Section 4, the introduction of hardstanding (car parking, pavements, access roads and houses) to be constructed at the Site will act as a barrier to prevent future site users from coming into contact with underlying contaminated soils.

Isolated 'hotspots' where elevated concentrations of metals were encountered within shallow sub-base materials can either be incorporated within landscaped areas (areas of public open space) or be incorporated below hardstanding as part of the future development.

Similarly, the use of validated clean site won soils and imported topsoil, within areas of residential (private gardens) would act as a barrier to end users.

Soils tested were generally not found to contain leachable fractions of potential contaminants.

Soils found to contain elevated results of contaminants were located within the shallow Made Ground only, no natural soils tested were found to contain elevated contaminants.

The bedrock geology across the majority of the Site of London Clay is classified as an unproductive aquifer and therefore not a sensitive environmental receptor.

It is considered that this represents a cost effective and sustainable method of handling potentially contaminated soils and minimises the need for material to be exported and imported onto Site.

In addition, the use of barrier or wrapped ductile iron pipes will protect buried potable water supply pipes. However, it is recommended that this standard practice should be confirmed with the utility supplier.

6.1.2 Remedial Measures Conclusion

Based on the Remedial options outlined above the majority of identified contamination hotspots could be managed effectively by incorporating below areas of hardstanding, or within areas of public open space thereby breaking the pollutant linkage.

6.2 Remedial Methodology

Based on the above options appraisal the following Remedial Methodology is recommended to mitigate against the potential risk of soil contamination at the site.

6.2.1 Asbestos Impacted Soils Segregation

Where asbestos impacted soils have been identified these should be segregated under controlled conditions following the CAR 2012 Regulations. Asbestos was only identified within the top 2.0m of soils where identified in areas of the landscaped bunds and only at one location within shallow gravel sub-base (0.3m) below existing hardstanding, therefore only soils at these impacted depths should be removed. Ground investigation analysis suggests the asbestos impacted soils could be disposed of off-site as non-hazardous waste. However this should be confirmed with the waste receiver.

Figure A5 Remediation Action Plan highlights the locations of asbestos impacted soils.

Water Supply Pipes

The Site has been identified as a brownfield site and, as such, elevated concentrations of potentially degrading substances may be present within the made ground.

Based on the UKWIR guidance, it is recommended that barrier pipes should be used for all potable water supply pipes.

This is now considered standard practice by Water Companies and should not be considered a development abnormal.

Re-use of Site Won Material

Site won material is proposed for use across the Site to create founding levels and to be laid beneath structures, areas of hardstanding and to create new landscaped areas.

This material is considered to be chemically suitable for re-use within the future development provided that suitable remedial measures, such as removal of asbestos impacted soils off-site and placement of impacted sub-base materials below hardstanding, are utilised to break the identified pollutant linkage.

The use of a Materials Management Plan is recommended, detailing the nature of the materials used, together with a record of material origin, movement and deposition, should be adopted during the construction works.

All material reuse should be undertaken in line with the CL:AIRE Code of Practice. Definition of Waste: Development Industry Code of Practice Version 2 March 2011. CL:AIRE.

The material proposed for re-use at the Site does meet all of these criteria, providing it is managed in accordance with the recommendations given above i.e. deposited beneath hardstanding.

This approach should be agreed with the Local Authority, however.

Validation of Remedial Measures

It will be necessary to demonstrate within a Validation Report that the recommended remedial measures have been undertaken correctly.

This validation report should be prepared by the Contractor and reviewed by a suitably qualified environmental consultant and submitted to the local authority to support discharge of the associated planning condition.

The validation report should confirm:

- Chemical validation analysis on all site won and imported material used within the top 600mm of landscaped or garden areas;
- Detail on the removal of all asbestos impacted soils and suitable validation of surrounding areas;
- The type of potable water supply pipes used; and
- Details of all material movements both on-site and off-site.

A copy of the validation report should be retained on site as part of the Health and Safety File for the completed development.

6.3 Environmental Recommendations

The following further actions are recommended:

- A copy of this report should be provided to the Local Authority for review and agreement in support of the development planning process and prior to site works commencing;
- Asbestos impacted soils within landscaped bunds and one area below existing hardstanding should be segregated for off-site disposal following CAR 2012 guidance;
- The majority of soil results indicate that Site soils are chemically suitable for reuse at the Site either beneath buildings and other areas of hardstanding or within landscaped and residential (private gardens);
- In accordance with the CL:AIRE Code of Practice, a Materials Management Plan should be prepared for the site demonstrating how excavated materials will be reused and providing a detailed record of material movement around the Site and, if necessary, off-site. This should be reviewed by an appropriate independent CL:AIRE Qualified Person and a declaration sent to the Environment Agency in advance of earthworks starting;
- The scope of protection measures for buried potable water supply pipes should be confirmed with the utilities provider; and
- A copy of the future validation report should also be provided to the local authority to demonstrate successful implementation of all of the identified remedial measures.

7. Main Remediation activities

7.1 Material Management

Material management of earthworks will be a significant aspect during the project to minimise environmental risk and nuisance. The following section details the routine processes that should be followed with respect to materials generated during the work.

It is recommended that materials management will be governed under the CL:AIRE Code of Practice depending on the type of material encountered. Materials expected to be encountered during the works are listed below:

- Asphalt/Bitumen – recovered from Site roads and paved areas;
- All recycled aggregate – brick and concrete recovered from demolition of buildings paved areas and buried structures;
- Soil including Made Ground and granular sub-base – recovered during re-levelling of the Site.

Asphalt

Areas of asphalt may be planed and crushed.

Asphalt will be stockpiled separately.

Once chemically tested and confirmed to contain no coal tar, it can be re-used on Site in accordance with Environment Agency Waste exemption: U1 use of waste in construction.

Where deemed suitable for reuse such that it does not pose a risk to the wider environment it can be placed, subject to correct geotechnical properties, as granular sub base under areas of paving, roads and car parks (up to a limit of 1,000 tonnes).

The road should be constructed to a specific engineering standard and have a sealed surface in order to qualify for this larger limit.

Concrete

Concrete will likely be crushed to 6F2, or to other specification, as required.

The resulting recycled aggregate will be subject to visual and olfactory testing only and will be reused as backfill in excavations, sub-base under roads, paving and hardstanding.

Recycled aggregates not reused at this point in the redevelopment can be temporarily stockpiled and used in later phases of the redevelopment, subject to waste management regulations that relate to volumes and timescales of storage. Environment Agency Waste exemption: S2 storing waste in a secure place stipulates road planing's can be stored up to 500 tonnes for a period of up to 12 months.

Asbestos Impacted Soils

Asbestos impacted soils should be segregated following CAR 2012 Regulations, excavations should be subject to visual assessment by a competent person at the point of excavation. Asbestos soils should be excavated to depths as per the detail provided in Figure A5 Remediation Action Plan and as detailed below.

TP203 – 1.5mbgl

TP204 – 1.5mbgl

TP205 – 1.0mbgl

TP206 – 1.0mbgl

TP224 – 2.5mbgl

TP221 – 1.5mbgl

TP301 – 0.5mbgl

Surrounding soils are not required to be validated as previous ground investigation data is deemed adequate to pre-validate soils to safely remain on site.

Removal of Fuel Tank

Following the removal of the fuel tank within the landscaped bund (See Figure A5 Remediation Action Plan and Appendix C) and any associated process pipework by a specialist contractor, surrounding soils should be validated with a minimum of one soil validation sample per five metre squared. Samples should also be obtained every 5m along process pipe runs. Results should be compared to the assessment criteria contained in Appendix B. Based on this assessment further chemical and geotechnical testing may be required should soils be retained on site.

Reuse of validated clean soils will be covered by the CL:AIRE Code of Practice.

Topsoil recovered from areas of soft landscaping

Topsoil recovered from the Site will be stockpiled separately, and if re-used on site within landscaped or private garden areas, subject to chemical testing at the rate of one test per 250m³ and any further requirements of the Landscape Architect.

Topsoil should meet the criteria as stipulated in BS3882:2015.

Reuse of topsoil and sub-soils will be covered by the CL:AIRE Code of Practice.

Stockpiling

Any soils that are stockpiled on Site shall be appropriately managed to prevent impact to the surrounding environment.

Mitigation measures should be employed to minimise wind whip from stockpiled materials.

Stockpiles of contaminated or suspected contaminated material should be placed on an impermeable membrane incorporating a surrounding bund wall to prevent contaminated water runoff or leachate impacting underlying soil and/or groundwater.

Stockpiles of asbestos contaminated material should be placed on an impermeable membrane and covered with protective sheeting to prevent wind whip and exposure to site workers. Stockpile surfaces should be wetted down on occasions during particularly dry periods.

Stockpiles containing confirmed uncontaminated material can be placed on areas of hardstanding. However drainage in areas close to stockpiles should be protected from receiving runoff from the stockpiles.

Different material types should be segregated and clearly labelled with a unique identifier to avoid cross contamination.

A stockpile tracking register as detailed in the CL:AIRE Material Management Plan should be maintained during the works this shall include but not be limited to the following:

A unique identification number for each stockpile from the creation to the end of the stockpile;

Details relating to the date of creation, material type, contamination status, volume, proposed endues/destination and information of chemical and/or geotechnical testing;

A schematic diagram showing the location, size, movement and ultimate destination of each stockpile, to be updated as required, daily if necessary; and

Number of samples taken per stockpile and results of analysis.

Each stockpile should be clearly labelled to allow plant drivers and other Site staff and operatives to easily identify them.

Off Site Disposal

Where off-site licensed disposal is required, appropriate waste classification testing should be undertaken to allow an accurate disposal route to be determined.

A record of the quantities of materials disposed off-Site should be kept, along with consignment notes for the materials.

Imported Materials

All materials imported onto Site need to be suitable for the proposed use in accordance with the relevant legislation and subject to agreement with regulators.

Imported material shall be from a known source and shall be validated to ensure physical and chemical compliance with site criteria.

It is recommended that imported topsoil shall be a natural 'as dug' material and not from a recycled source. This shall be completed by provision of appropriate physical or chemical certification from the supplier or by on site testing.

As a minimum imported material shall be tested at the rate of one sample per 500m³ (minimum 3 recent representative sample results per source) to meet the requirements of chemical criteria within Appendix B.

Imported topsoil and subsoil will also be required to meet the relevant British Standards as detailed in Section 7.1.5.

Geotechnical performance specifications of imported material will be specified in other documents.

Duty of Care certification shall be provided for all imported materials.

7.1.1 Soils for Landscaping and Garden Areas

Site won soils to be used in landscaping or private garden areas, within the top 600mm, should be tested at a rate of one sample per 250 m³ for landscaping soils in areas of public open space and at a rate equivalent to one sample per private garden for residential soils.

7.1.2 Unforeseen Contamination

Whilst there has been a significant amount of ground contamination investigation, which has not identified widespread ground contamination, there is potential for previously un-investigated areas of contaminated ground to be encountered across the Site during the progression of the ground works.

Should suspected contaminated material be encountered, either visually or olfactory, the following procedures should be implemented:

Localised groundworks should be halted and the material identified to site workers to prevent potential cross contamination/ material dispersion;

The Environmental Consultant shall be contacted to inspect the area of concern;

Photographs of the area should be taken and appropriate plans and method statements for dealing with the issue shall be drafted by the Contractor and forwarded to the Environmental Consultant;

If necessary, an Addendum Remediation Method Statement shall be prepared by the Contractor and evaluated by the Environmental Consultant prior to being issued to the Statutory Authorities for approval and subsequent implementation.

8. Reporting

8.1 Validation Reporting

On completion of the remediation works the Contractor will provide a factual Validation Report detailing the works carried out.

The Validation Report will include, amongst other items, 'as-built' scale drawings showing areas of the Site cut and fill earthworks and all other excavations, updated Materials Management Plan to record any variations of soil movement; all validation chemical test results at the appropriate test frequency (together with sample locations and depths), the appropriate chain of custody and proof of disposal records for materials disposed off-Site and similar details of imported materials.

It is recommended that the Client's Environmental Consultant will also provide a Completion Statement independently confirming that the works carried out by the Contractor have met the objectives and requirements of the agreed remediation strategy.

The Statement will record the update environmental risk rating associated with Site ground conditions.

The Completion Statement will be based on a review of the Contractors as built information, together with on-site evidence gathered from site attendance during the groundworks.

Both the Validation Report and the Completion Statement will be submitted to the Regulatory Authorities (Environmental Health Officer and Environment Agency) for approval in order to allow construction to commence.

The approved reports will be added to the Site Health and Safety File for future use.



APPENDICES

Appendices

Remediation Strategy

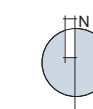
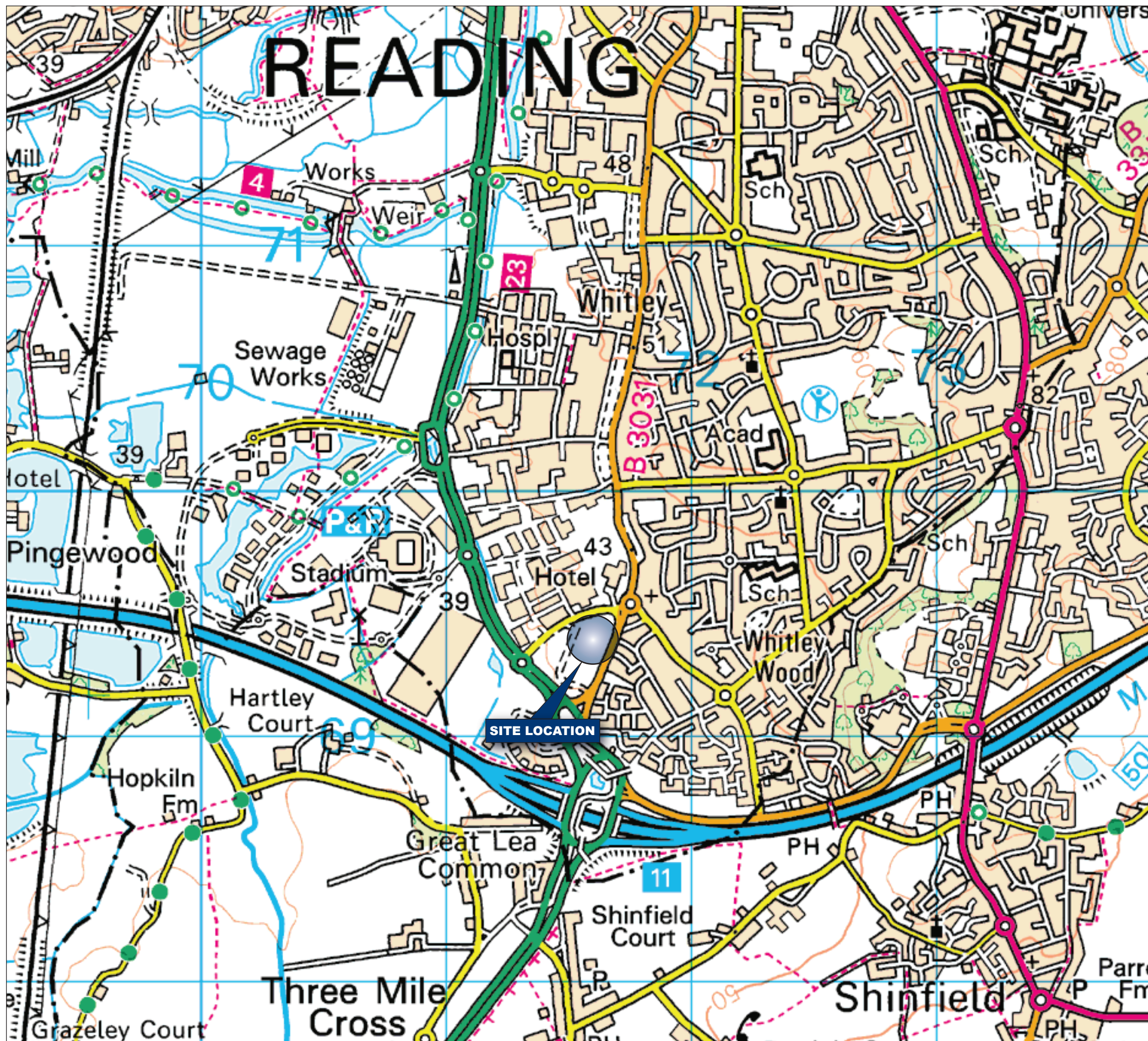
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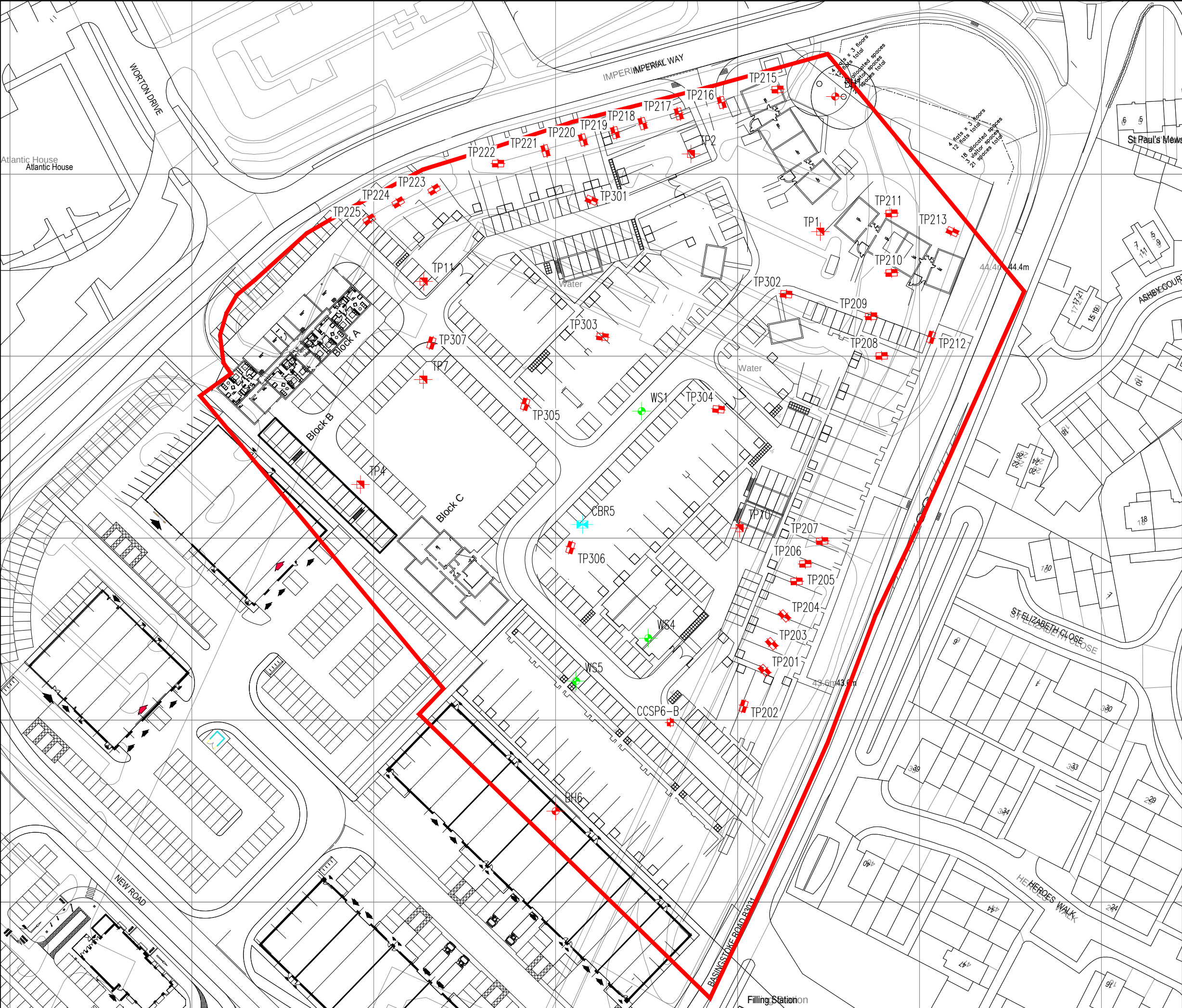
Appendix A

Site Plans

- **Site Location Plan (Fig. A1)**
- **Combined 2014 and 2016 Ground Investigation Locations (Fig. A2)**
- **Proposed Master Plan showing Soil Exceedance Locations (Fig. A3)**
- **Proposed Master Plan (Fig. A4)**
- **Remediation Action Plan (Fig. A5)**



Project Details	WIB14723-100: Worton Grange, Imperial Way, Reading
Figure Title	Figure A1: Site Location Plan
Figure Ref	WIB14723-100_GR_PERA_A1B
Date	July 2016
File Location	\\nt-incs\weed\projects\leed14723\100\graphics\pera\issued figures



- BHX BOREHOLE LOCATIONS
- TPX TRIAL PIT LOCATIONS
- WSX WINDOW SAMPLE LOCATIONS
- CBRX CBR LOCATIONS

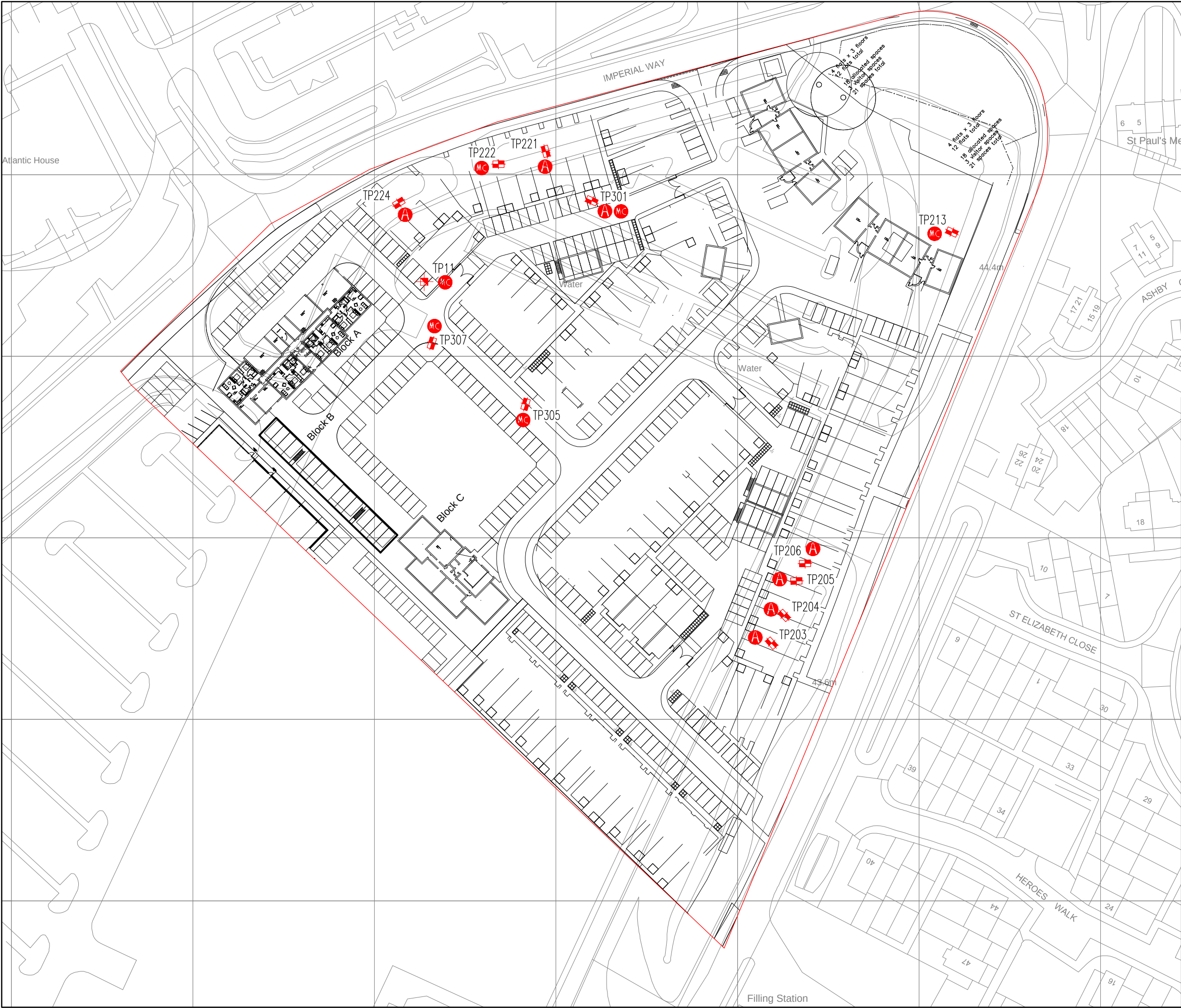
A01	17:07:16	PRELIMINARY ISSUE	RSM
Rev	Date	Description	By

Amendments	
Project	READING
Title	FIGURE A2 COMBINED 2014 & 2016 GI LOCATIONS
Client	



Pickfords Wharf Clink Street London SE1 9DG
t 020 7928 7888 f 03333 444 501
mail@watermangroup.com www.watermangroup.com

Drawing Status				
PRELIMINARY				
Designed by	MA	Checked by	MA	Project No
Drawn by	RSM	Date	JULY 16	WIB14723-110
Scales @ A3		1:1000 @ A3		Work Order No
work to figured dimensions only				110
Publisher	Zone	Category	Number	Revision
WIB	110	80	002	A01



- KEY
- A

ASBESTOS CONTAMINATION

MC

METAL CONTAMINATION

BHX

BOREHOLE LOCATIONS

TPX

TRIAL PIT LOCATIONS

WSX

WINDOW SAMPLE LOCATIONS

CBRX

CBR LOCATIONS

A01	17:07:16	PRELIMINARY ISSUE	RSM
Rev	Date	Description	By
Amendments			
Project		READING	
Title		FIGURE A3	
PROPOSED MASTER PLAN SHOWING SOIL EXCEEDANCE LOCATIONS			
Client			
waterman			
Pickfords Wharf Clink Street London SE1 9DG t 020 7928 7888 f 03333 444 501 mail@watermangroup.com www.watermangroup.com			
Drawing Status		PRELIMINARY	
Designed by	MA	Checked by	MA
Drawn by	RSM	Date	JULY 16
Scales @ A3		1:1000 @ A3	
work to figured dimensions only		110	
Publisher	Zone	Category	Number
WIB	110	80	003
			Revision
			A01



A01

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PRELIMINARY ISSUE

RSM

Rev

Date

Description

By

Amendments

Project

READING

Title

FIGURE A4

PROPOSED SITE MASTERPLAN

Client

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Drawing Status

PRELIMINARY

Designed by

MA

Checked by

MA

Project No

WIB14723-110

Drawn by

RSM

Date

JULY 16

Work Order No

110

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work to figured dimensions only

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Publisher

Zone

Category

Number

Revision

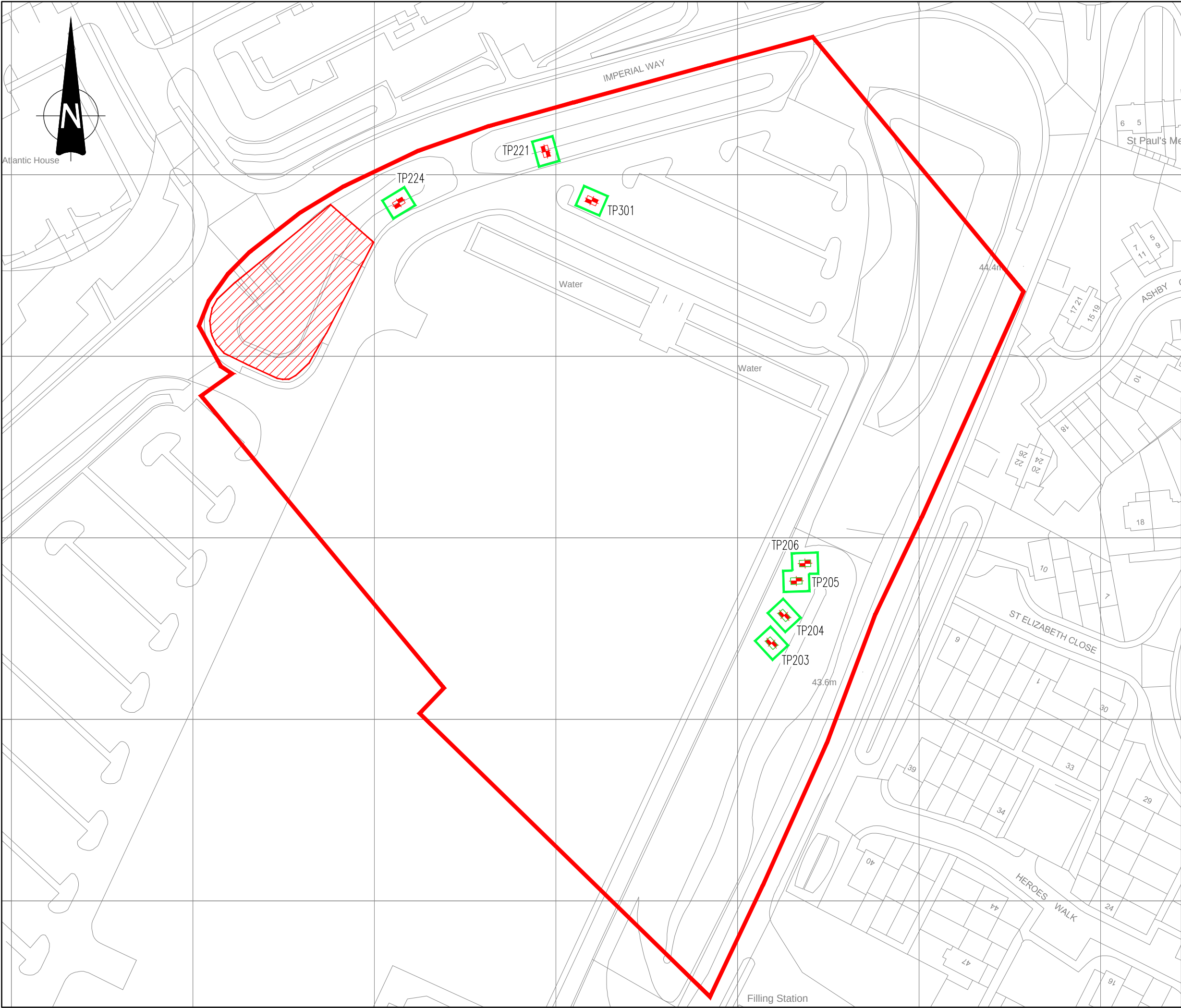
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004

A01



KEY

TPXXX

TRIAL PIT LOCATION

TRIAL PIT EXCAVATIONS

FUEL TANK AREA

- ASBESTOS EXCAVATIONS
- TP301 EXCAVATE TO 0.5m
 - TP203/204 EXCAVATE TO 1.5m
 - TP205/206 EXCAVATE TO 1.0m
 - TP224 EXCAVATE TO 2.5m
 - TP221 EXCAVATE TO 1.5m

A01	22:07:16	PRELIMINARY ISSUE	RSM
Rev	Date	Description	By
Amendments			
Project	READING		
Title	FIGURE A5		
	REMEDIAL ACTION PLAN		
Client			
 Pickfords Wharf Clink Street London SE1 9DG t 020 7928 7888 f 03333 444 501 mail@watermangroup.com www.watermangroup.com			
Drawing Status	PRELIMINARY		
Designed by	MA	Checked by	MA
Drawn by	RSM	Date	JULY 16
Scales @ A3	1:1000 @ A3		110
work to figured dimensions only			
Publisher	Zone	Category	Number
WIB	110	80	005
			Revision
			A01



Appendix B

Site Remediation Criteria

- **Criteria for Hardstanding, Landscaping and Private Garden Soils**

Appendices

Remediation Strategy

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Table B1 : Import Criteria for Hardstanding, Landscaping and Private Garden Soils

Determinant	Hardstanding Criteria, mg/kg	Landscaping Criteria, mg/kg	Residential Garden Soils Criteria, mg/kg	Source of Value
Arsenic	640	79	37	DEFRA C4SLs
Beryllium	12	2.2	1.7	LQM S4ULs 2015
Cadmium	410	220	22	DEFRA C4SLs
Chromium (Total)	8,600	1,500	910	LQM S4ULs 2015
Copper	68,000	1,200	2,400	LQM S4ULs 2015
Lead	2,330	630	200	LQM S4ULs 2015
Mercury	58	16	1.2	LQM S4ULs 2015
Nickel	980	230	180	LQM S4ULs 2015
Selenium	12,000	1,100	250	LQM S4ULs 2015
Zinc	730,000	81,000	3,700	LQM S4ULs 2015
Free Cyanide	16,000	na	26	Waterman GAC- CLEA v1.06
Aliphatic EC ₅ -EC ₆	3,200	3,200	78	LQM S4ULs 2015
Aliphatic EC ₆ -EC ₈	7,800	7,800	230	LQM S4ULs 2015
Aliphatic EC ₈ -EC ₁₀	2,000	2,000	230	LQM S4ULs 2015
Aliphatic EC ₁₀ -EC ₁₂	9,700	13,000	330	LQM S4ULs 2015
Aliphatic EC ₁₂ -EC ₁₆	59,000	13,000	2,400	LQM S4ULs 2015

Appendices

Remediation Strategy

WIB14723-103

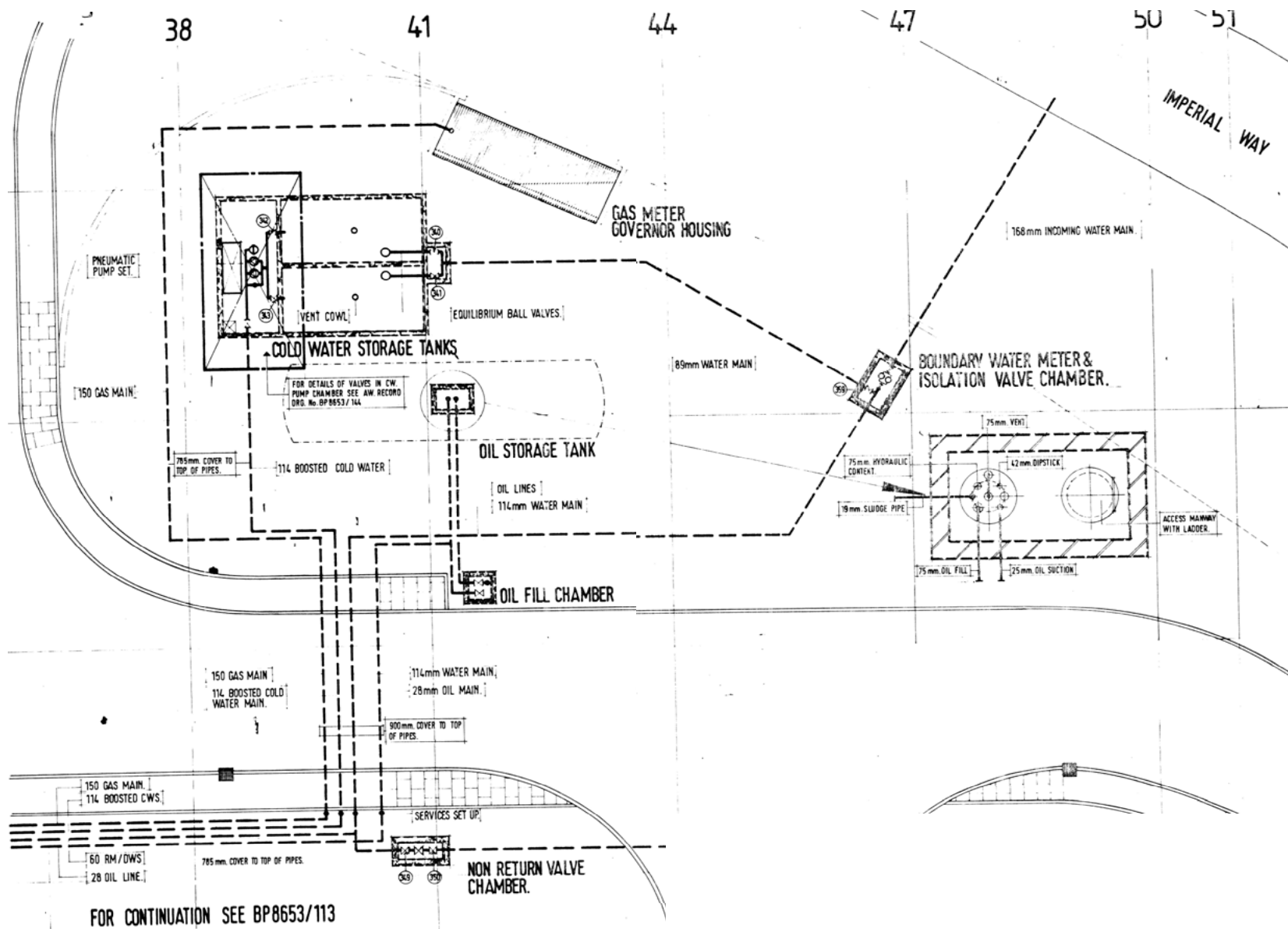
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Determinant	Hardstanding Criteria, mg/kg	Landscaping Criteria, mg/kg	Residential Garden Soils Criteria, mg/kg	Source of Value
Aliphatic EC ₁₆ -EC ₃₅	450,000	250,000	92,000	LQM S4ULs 2015
Aromatic EC ₅ -EC ₇	26,000	26,000	140	LQM S4ULs 2015
Aromatic EC ₇ -EC ₈ (Toluene)	56,000	56,000	290	LQM S4ULs 2015
Aromatic EC ₈ -EC ₁₀	3,500	5,000	83	LQM S4ULs 2015
Aromatic EC ₁₀ -EC ₁₂	16,000	5,000	180	LQM S4ULs 2015
Aromatic EC ₁₂ -EC ₁₆	36,000	5,100	330	LQM S4ULs 2015
Aromatic EC ₁₆ -EC ₂₁	28,000	3,800	540	LQM S4ULs 2015
Aromatic EC ₂₁ -EC ₃₅	28,000	3,800	1500	LQM S4ULs 2015
Benzene	27	72	0.17	LQM S4ULs 2015
Benzo (a) pyrene	35	5.7	2.7	LQM S4ULs 2015
Asbestos	No visible asbestos containing materials (ACMs) and <0.001% fibres	No visible asbestos containing materials (ACMs) and <0.001% fibres	No visible asbestos containing materials (ACMs) and <0.001% fibres	

Note: Assume a Soil Organic Matter content (SOM) of 1.0%



Appendix C Fuel Tank Drawing



UK and Ireland Office Locations

