REMEDIATION AND ENABLING WORKS VALIDATION REPORT

Castlefield House
29 Ellesmere Street
Manchester
M15 4LZ

Prepared for:

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Consulting Engineers

Report Ref: 10-745-R4
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EXECUTIVE SUMMARY	
Site Address	Castlefield House, 29 Ellesmere Street, Manchester M15 4LZ
Grid Reference	E 382550, N 397100
Site Area	0.45 Ha
Stated Objective	The primary purpose of this report is to document the implementation and subsequent validation of land remediation and enabling works completed as part of the construction of a residential development on land located off Ellesmere Street, Manchester. This document also defines the 'Build Phase' mitigation measures that are required in the construction of the proposed apartment complex to ensure all potential pollutant linkages are addressed.
Site Remediation and Enabling Works	All works at the site have been conducted in accordance with the agreed Remediation Strategy. The main outputs from the works are: • Implement all works in strict accordance with UK Environmental Permitting and Local Planning Authority Requirements. • General site clearance and legislatively compliant disposal of all surface vegetation, breaking out, excavation and removal of all slabs, hard-standing and buried structures to the base of the Made Ground; • Removal and treatment of all invasive plans species (if required); • Removal of all relict foundations and buried features in their entirety; • Excavation and processing of Made Ground material in order to achieve proposed development level; • Ensure that all works are completed in a manner so as not to create any structural risk to the adjacent infrastructure; • Delineation and excavation of Mercury hotspots; • Management of ACM impacted soils in a legislatively compliant manner; • Validation sampling and testing (by Chartrange and verified by E3P) to confirm material imported to site pose no unacceptable risk to the residential end users, controlled waters or wider environ; • Inspection of all works by a Geo-Environmental Engineer to confirm the suitability of material for re-use and to confirm the findings of the Contamination Conceptual Site Model (CSM); • Provide suitable development platform to facilitate the construction of the proposed roadways, drainage infrastructure, pavements and areas of hard-standing; to be delivered in accordance with the Engineer's Specification; and, • Confirm the absence of any previously unidentified contamination sources.
Materials Management Plan & Legislative Waste Compliance	All waste transfer notes and duty of care certification is held by the Remediation Contractor in the site completion file. The works did not require the treatment of any materials and therefore no Environmental Permit was registered for the site. Recycling of demolition material was completed using LAPC licensed crushing plant operated by Chartrange.

EXECUTIVE SUMMARY	
Regulatory Authority Compliance	Local Planning Authority – Human Health The previous Phase I & Phase II ground investigation reports completed by E3P have previously been submitted to MCC (acting as the statutory Human Health regulator). Following approval of the site characterisation and risk assessments, E3P produced a Remediation and Enabling Works Strategy which was submitted (by the client) to MCC. Environment Agency – Controlled Waters & Wider Environ The E3P Risk assessment didn't identify any potential risk to controlled waters and as such no specific remediation works have been specified or implemented. However, the site watching brief was completed to ensure that if any previously unidentified potentially soluble phase source was identified, the appropriate risk assessment and remediation works could be implemented to demonstrate regulatory compliance. Furthermore, the historic Made Ground (potential source of unidentified mobile contaminants) has been removed across the majority of the site for allow construction of the undercroft parking; and as such the site is deemed to pose no risk to controlled waters.
Ground Gas	Ground gas monitoring thus far has indicated the site would be classed as Characteristic Situation 1 in accordance with CIRIA 665 which states that ground gas protection measures are not required. Furthermore, given the proposal to remove the Made Ground underlying the proposed structures enable the construction of the undercroft car parking; any potential for ground gas risk to the structures is considered to be fully mitigated.
Geotechnical Engineering Performance	The residential apartment footprints have been remediated and prepared in a manner that will allow the installation of deep piled foundations. All adopted highways (road box) have been engineered in a controlled manner with soils to the underside of formation (sub-grade) compacted in accordance with a Method Compaction Specification as defined within the Highways Design Manual Series 600 to ensure a CBR>5% at the underside of road formation.
Build Phase Development Works	Post remediation constraints for the site will include: - Topsoil and subsoil to be imported by Graham Construction with appropriate validation testing to demonstrate suitability for use on-site; - Placement of clean sub-soil (150mm) and topsoil (150mm) in all areas of soft landscaped to ensure a minimum cover of 300mm. Once the cover system has been placed, independent depth validation will be required to demonstrate regulatory compliance.

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1. INTRODUCTION

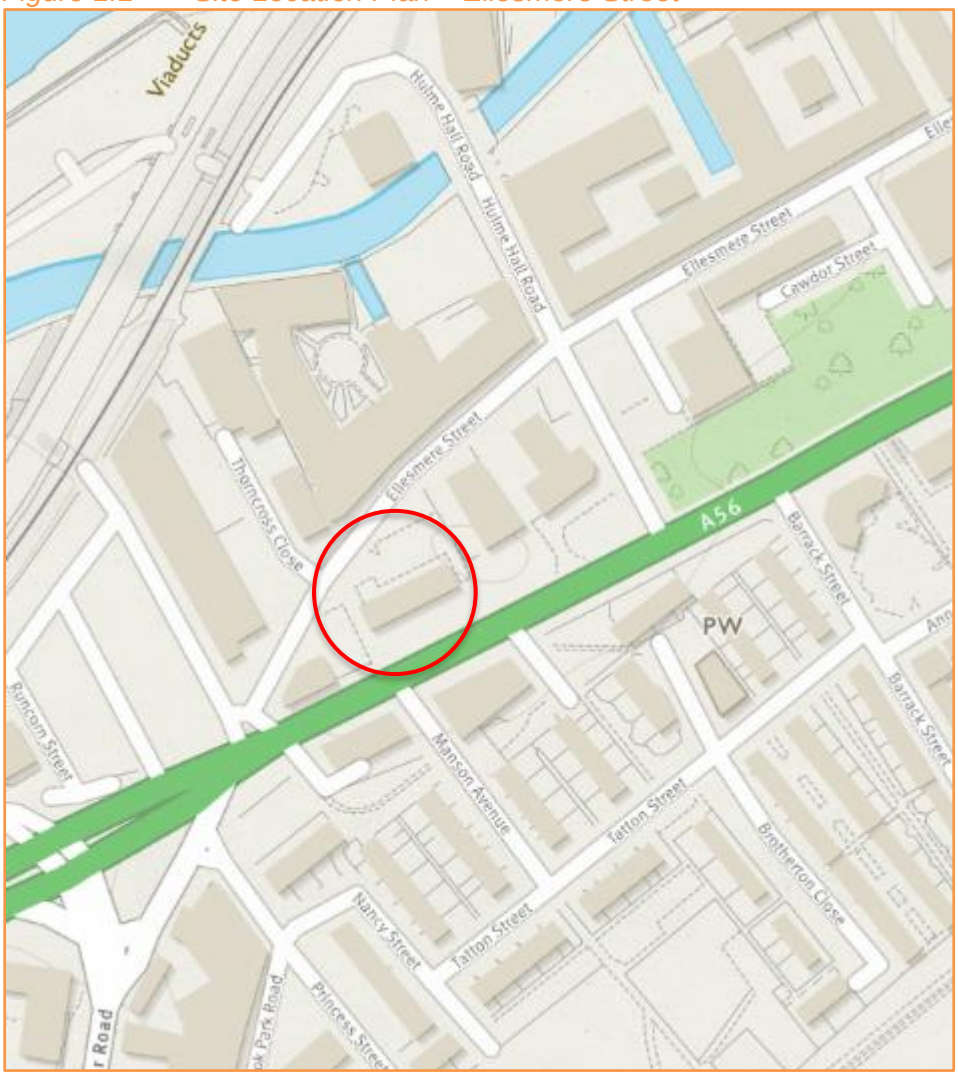
Background

This report details the remediation and enabling works operations that were undertaken by Chartrange under the supervision of E3P to facilitate the preparation of two residential apartment blocks on a parcel of land located off Ellesmere Street, Manchester; herein referred to as ***the site***.

E3P was appointed by SGI Consulting Engineers as independent Geo-Environmental Consultant for the site remediation, preparation / enabling and validation works; including the preparation of this Validation Report. This report is required to satisfy the relevant planning conditions and geotechnical engineering requirements for Building Control, warranty providers and the future adoption of infrastructure by the Highways Authority and statutory service providers.

For the avoidance of doubt, E3P can confirm that the parcel of land refers to the red-line boundary as indicated in Figure 1.1 below:

Figure 1.1 Site Location Plan – Ellesmere Street



1.3 Site Location / Setting

Site Address	Castlefield House, 29 Ellesmere Street, Manchester M15 4LZ
National Grid Reference	E 382550, N 397100
Area	0.45 Ha

Site History

The land was undeveloped until the 1890s at which time the site was developed with terraced residential properties, a small works and a brewery.

The historic features had been cleared by the 1980s and by 1992 had been redeveloped with Castlefield House. Castlefield House was demolished in 2016.

Proposed Development

E3P understands that SGI Ltd (acting on behalf of their client) are acting as structural engineers for a residential development comprising the construction of two multi-storey apartment blocks with undercroft parking and associated adopted utility infrastructure as detailed in excerpt Figure 1.2 (below)

Figure 1.1 Site Location Plan – Ellesmere Street



Summary of Parties Involved

FUNCTION / INTEREST	NAME OF PARTY
Local Planning Authority	Manchester City Council
Developer	Glenbrook Property
Clients Geo-Environmental Consultant	E3P
Main Contractor	TBC
Remediation / Enabling Works Contractor	TBC
Human Health Regulator	Manchester City Council
Building Control Officer	NHBC
Warranty Provider	NHBC
Highways Authority	Manchester City Council
Controlled Waters & Waste Regulator	Environment Agency

Limitations

The limitations of this report are presented in Appendix I.

Confidentiality

E3P has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from E3P; a charge may be levied against such approval.

2. CONTAMINATION, REMEDIATION & ENABLING WORKS REQUIREMENTS

Summary of Contamination Issues

E3P has completed a Tier 1 Qualitative and Tier 2 Quantitative Contaminated Land Risk Assessment to determine the potential risk to human health, controlled waters and the wider environ. These assessments are documented in full within the E3P Geo-Environmental Site Investigation Reports and for clarity are summarised below.

2.1.1 Human Health

The Tier I risk assessment determined that concentrations of the following determinants exceed guideline values for a residential end use:

Heavy Metals and PAHs

For the elevated concentrations of heavy metal and PAHs the viable exposure pathway is directly related to soil ingestion and/or dermal contact. The exceedances were identified in the upper horizons (<2.50m bgl) of Made Ground.

These risks can be mitigated through careful management of earthworks so as to prevent impacted soils being exposed to constructions workers through the use of appropriate Personal Protective Equipment (PPE) and provision of welfare facilities.

When considered within the context of the proposed development the external areas will be predominantly hard-standing capping or a chemically suitable cover system will be required in any landscaped areas thereby removing the exposure pathway and ensuring no unacceptable degree of risk is posed to future residential site users.

Mercury

Elevated concentrations of mercury were encountered at two locations (TP01 & TP103).

Theoretically, this material poses an unacceptable degree of risk to human health through volatilisation to indoor air.

Vertical delineation in TP103 bgl did not record concentrations above the Tier I GAC residential screening values indicating localised impact with limited lateral and/or vertical migration.

However, the reduced level dig to construct the undercroft car parking will remove the mercury impact at TP103.

Further investigation and chemical analysis of the mercury at TP101 confirmed the that elemental and methyl mercury were below the laboratory limit of detection (LOD) and as such there it has been determined to pose no unacceptable degree of risk posed to future site users through valour inhalation.

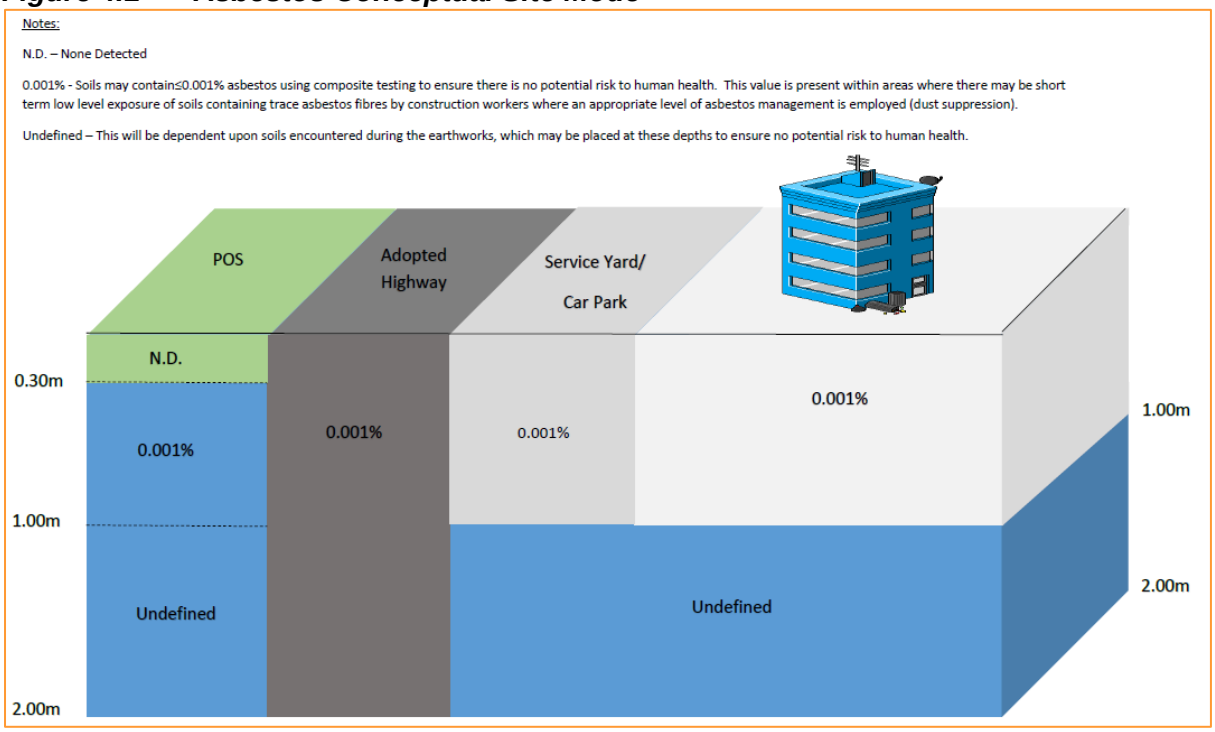
The impacted soils at TP101 will need to be excavated and removed as part of the Remediation & Enabling Works.

Asbestos

Asbestos (chrysotile / amosite fibres) was identified at three location within the shallow Made Ground (0.35-1.45m bgl) across the site.
ACM quantification indicates the impacted Made Ground soils are <0.001% by volume/weight.

E3P has produced an asbestos specific CSM which identifies the locations that asbestos impacted soils may be placed in a residential setting to ensure there is no unacceptable level of risk to the future site users, included as Figure 4.1 below:

Figure 4.1 Asbestos Conceptual Site Mode



Chemical analysis confirms that the natural underlying drift strata is suitable for use within the development, therefore any drift deposits cut within the enabling works (albeit unlikely), pending chemical validation, may be utilised as subsoil within any proposed landscaped areas.

The shallow Made Ground will not be suitable for use as Topsoil or subsoil element within any proposed landscaped areas due to the aforementioned impacted soils.

2.1.2 Controlled Waters

The Bridgewater Canal is located 80m north of the site. However, the risk to this watercourse is remote as the canal is likely to be isolated from groundwater by the presence of dock wall structures.

The site is underlain by a Principal Aquifer in the solid geology, however, the overall risk to this receptor is reduced given the lack of any true groundwater at shallow depth underlying the site, no potable groundwater abstractions within the locality (<1km) and presence of continuous low permeability glacial clay soils directly overlying the solid geology which will effectively reduce any downward migration and thus the potential for the creation of a complete pollutant linkage.

Furthermore, no sources of potential pollutants were noted or potentially soluble contaminants of concern identified within the soil and given the absence of a viable exposure pathway (due to underlying low permeability natural CLAY strata), it is concluded that the site poses no unacceptable degree of risk to controlled waters or the wider environ.

2.1.3 Ground Gas

Ground gas monitoring thus far has indicated the site would be classed as Characteristic Situation 1 in accordance with CIRIA 665 which states that ground gas protection measures are not required.

Furthermore, given the proposal to remove the Made Ground underlying the proposed structures enable the construction of the undercroft car parking; any potential for ground gas risk to the structures is considered to be fully mitigated.

2.1.4 Potable Water Supply Infrastructure

Poly-Ethylene Pipe (PE) will not be suitable for the proposed development in its current condition.

A full UKWIR assessment will be required upon completion of remediation works.

Correspondence with Regulatory Authorities

2.2.1 Local Planning Authority – Human Health

The previous Phase I & Phase II ground investigation reports completed by E3P have previously been submitted to MCC (acting as the statutory Human Health regulator).

Following approval of the site characterisation and risk assessments, E3P produced a Remediation and Enabling Works Strategy which was submitted (by the client) to MCC.

2.2.2 Environment Agency – Controlled Water & Wider Environ

The E3P Risk assessment didn't identify any potential risk to controlled waters and as such no specific remediation works have been specified or implemented.

However, the site watching brief was completed to ensure that if any previously unidentified potentially soluble phase source was identified, the appropriate risk assessment and remediation works could be implemented to demonstrate regulatory compliance.

Furthermore, the historic Made Ground (potential source of unidentified mobile contaminants) has been removed across the majority of the site for allow construction of the undercroft parking; and as such the site is deemed to pose no risk to controlled waters.

Environmental Permit & Approvals

2.3.2 Local Authority Pollution Control – LAPC Part B Licensing

The demolition materials were processed using dedicated 'crushing plant' mobilised to site by the Remediation Contractor.

Prior to mobilisation the appropriate deployment notification was submitted by the operator to the Local Authority to ensure due notification of the intended arrival and operation of the Part B LAPC process.

2.3.2 Standard Rules Permit.

In this instance all the Made Ground and demolition material was processed in order to backfill the excavation and re-engineer the development platform and as such there was a requirement for the notification of works under a U1 or T5 standard rules permit.

Copies of the standard deployment notification are available from the operator directly.

Summary of Remediation & Enabling Works Objectives

The proposed remediation activities were detailed within the E3P Remediation Strategy and Enabling Works Plan (10-745-R3; dated May 2016) and supplementary supporting documents provided by E3P.

This report has been prepared to document the completion of all necessary land remediation and enabling works and to record the presence of any variation in ground conditions or previously unidentified sources of potential contamination, environmental impact or potential nuisance to the wider environ.

ENABLING WORKS NO.	GENERAL OVERVIEW OF OBJECTIVES
EW1	Pre-Commencement Regulatory Compliance
EW2	Environment & Nuisance Control
EW-3	Removal of Perched Water
EW-4	Site Clearance Operations
EW-5	Identification, Isolation and Treatment of Invasive Plants
EW-6	Delineation, Excavation and Treatment of Identified Asbestos Impact
EW-7	Excavation, Breaking and Processing of All Above & Below Ground Structures
EW-8	Excavation, Delineation & Validation of Mercury Hotspot
EW-9	Importation of Bulk Fill
EW-10	Off-Site Disposal
EW-11	Preparation of Landscaped Areas & Public Open Space for Cover System
EW-12	Provision of Subsoil
EW-13	Provision of Topsoil

Second Phase Remediation & Enabling Works – Build Phase

A second post Remediation & Enabling phase of works will be required to ensure the proposed development is constructed in a manner that incorporates the required mitigation measures to ensure the development is compliant with UK Building Regulations and the Local Authority Planning requirements.

Once the ground has been stabilised and rendered suitable for development, the builder will be required to undertake a second phase of remediation works to mitigate the identified theoretical risk to human health.

- *Provision of 300mm certified cover system to all areas of soft landscaping and POS using certified material with appropriate validation;*
- *Provision of appropriately assessed water supply pipes;*

3. DETAILED REMEDIATION & EARTHWORKS ACTIVITIES

The focus of the remediation and enabling works are to address the contaminant issues previously identified within the site investigations that presented an unacceptable risk to human health following the redevelopment of the site.

Furthermore given the access limitations (the former office had not been demolished) during the initial Site Investigation by E3P, the scope of the Validation was extended to include a watching brief during all earthworks to ensure the appropriate assessment previously unidentified contamination.

For completeness, each of these activities has been discussed below within the context of the actual remediation works that were undertaken on site.

The Remediation & Site Enabling works was undertaken between September 2016 and October 2016.

3.1 Excavation of all Below Ground Structures & Removal of Made Ground

Date of Works Undertaken
September 2016

Photographs
Plates 1-4, 8

Overview of Works
The subject site was historically occupied by terraced residential properties, a works and brewery.

A limited number of large concrete and brick sub-structures associated with the historical use of the site were encountered during the Ground Investigation and removal of Made Ground across the site.

These were believed to be mainly associated with the former basement structures of the residential properties and brewery and generally extended to a depth ranging between 1.0 – 2.0m bgl.

All sub-structures were excavated using controlled mechanical techniques under the strict control of the Chart Range Site Manager with E3P in part time supervision.

The turnover of Made Ground in this manner allowed for the removal of any oversize materials, stripping of all vegetated organic near surface soils and separation of any cohesive and granular soil matrices, in addition to the identification of any previously unidentified areas of contamination.

The oversize materials were excavated and stockpiled prior to being processed on-site. The majority of the Made Ground was granular with brick and concrete. Any material containing waste in the form of wood, tyres, plastic or metal were placed into separate stockpiles and further transported to allocated skips for subsequent disposal.

E3P maintained a part time watching brief during the turnover of the Made Ground to audit and validate the site enabling works in addition to inspecting all materials and identifying any previously unidentified contamination hotspots, including Asbestos Containing Materials (ACMs).

No shallow groundwater was observed within the reduced level dig to remove the below ground obstructions.

Photographs of the site remediation and enabling works through to completion are included within Appendix IV of this report.

3.2 Delineation, Excavation and Treatment of Identified Asbestos Impact

Date of Works Undertaken
September 2016 - October 2016

Photographs
Plates 1-5, 8

Overview of Works
Chemical analysis identified the presence of ACM within the Made Ground at three at locations at depth of between 0.35-1.45m bgl. The asbestos content was recorded at <0.001% volume / weight; with the exception of HP101 at 0.30m bgl which recorded 0.003%.

The Made Ground at HP101 was excavated for off-site disposal. The Made Ground across the wider site was processed and re-engineered and will underlie either one of the two proposed structures, an area of hardstanding or an 300mm cover system in the landscaped areas thereby mitigating any exposure risk to future site users.

The presence of ACM within the wider Made Ground could not be discounted; therefore, to protect constructions works and third party property, during the groundworks all excavations were dampened in order to mitigate the potential dispersal of fibres from the Made Ground.

E3P maintained a part time watching brief during the processing of the Made Ground to confirm the required mitigation measured were undertaken by Chartrange in order to protect construction staff and ensure the Made Ground soils were re-engineered in a manner that will encapsulate the ACM.

Photographs of the site mitigation measures are included within Appendix IV of this report.

3.3 Excavation, Delineation & Validation of Mercury Hotspot

Overview of Works
Mercury was identified at two locations (TP101 & TP103) within the Made Ground. The material at both TP101 & TP103 was excavated by Chartrange under the supervision of E3P and subject to chemical analysis in order to confirm the soils were suitable for off-site disposal to landfill.

The Chemical analysis results / WAC analysis are available from Chartrange upon request.

3.4 Removal of Invasive Plant Species

Overview of Works
No invasive plant species were identified within the site boundary and no special precautions were required.

3.5 Importation of Bulk Fill

Overview of Works
There was no net shortfall of material and, as such, no imported aggregates for bulk fill were required.

The results of the analysis (by both Chartrange) confirm that the 6F2 (crush) was suitable for re-use as general fill material within the context of the proposed residential end use.

Transfer tickets, Duty of Care Information and chemical analysis results are available on request from Chartrange. Chartrange chemical analysis results are attached in Appendix V.

3.6 Replacement of Materials Geotechnical Engineering Requirements

Overview of Works
All materials were backfilled in strict compliance with the E3P Geotechnical Engineering Specification.

3.7 Remediation of Previously Unidentified Contamination

Overview of Works

A suitably qualified E3P engineer was in part-time attendance during the turnover of the wider Made Ground and underlying historic building footprint.

All soils were screened with a Photo Ionisation Detector (PID), showing no elevated readings (hydrocarbons and/or SVOC or VOCs) and there was no visual or olfactory evidence of contamination identified within the soils.

3.8 Provision of Subsoil and Topsoil Materials

Overview of Works

The testing, importation, placement and validation of Subsoil and Topsoil will be addressed as a Build Phase item.

3.9 Waste Management

Overview of Works

All of the soils encountered during the remediation and site enabling works (except for mercury) were chemically and geotechnically suitable for use to be incorporated into the earthworks.

However, due to the excess of material produced from both the demolition and excavation works a large volume of material was removed off-site to waste transfer stations or landfill.

A total of 24,440 tonnes of waste was produced between July 2016 and March 2017; of which 17,330 tonnes was sent to landfill.

A copy of the Site Waste Management data sheets are presented in Appendix V.

A copy of any Waste Transfer Notes can be provided by Chartrange upon request.

4. POST REMEDIATION BUILD PHASE REQUIREMENTS

4.1 Overview of Build Phase Requirements

This document details the construction works that are required to ensure full compliance with the remediation Strategy, Regulatory Authorities, Building Control & Warranty Providers;

The following should be implemented during the build phase of the development:

- Laboratory testing of any imported topsoil;
- Chemical validation of any additional subsoil imported for use within landscaped areas;
- Placement and chemical validation of imported topsoil and subsoil within all landscaped areas and POS ; and
- Provision of suitable potable water supply infrastructure.

4.2 Requirements for Further Works Prior to Substructure Construction

The following items remain to be addressed prior to construction of the development:

ITEM	DISCUSSION
United Utilities Risk Assessment	Pending (awaiting instruction)
Submission of Validation Report to Regulators	N/A

4.3 Water Pipeline Risk Assessment

Chemical analysis would suggest that barrier pipe will be required for potable water supplies; however, Polyethylene (PE) pipeline may be suitable for the proposed residential development following a phase remediation works. Chemical analysis of the remediated ground is required.

A UKWIR Risk Assessment is required to confirm the suitable pipeline selection.

4.4 Chemical Analysis of Clean Cover System

The Remediation Strategy for the site, with respect to human health of the future site users includes the provision of a chemically suitable clean material to be installed in all POS and landscaped areas; the construction of the clean cover / placement of clean material shall consist of:

- 150mm subsoil; and,
- 150mm topsoil.

In accordance with the current requirements of the regulatory authorities, validation samples will be collected from all materials that are to be imported or re-used on site to confirm the proposed development will pose no unacceptable risk to human health or the wider environ. Subsoil and topsoil shall be free of any deleterious materials, such as buildings materials, timber, plastics etc and conform to the requirements of BS 3882:2007.

The testing of all sub-soil will be completed as part of the remediation works undertaken. Therefore, the only requirement for further analysis of sub-soil or topsoil would be in the event of importation of additional material during construction.

The agreed sampling frequency for these materials is presented in Table 4.1 below.

Table 4.1 - Specification of Materials Validation Laboratory Analysis

Material Use	Testing Frequency	Suite of Analysis
Site generated Sub-Soil (150mm garden cover)	1 Sample Per 250m³	A / B / C / D
Imported Topsoil (150mm garden cover)	1 sample per 50m³	A / B / C / D

Notes – Table 4.1
Suites of Analysis
A) Speciated PAH
B) Banded TPH (C5-C35)
C) Asbestos (ID)
D) CLEA Inorganic

All analysis prescribed above to be completed by UKAS accredited laboratory.

Source testing certificates and validation testing of the imported materials shall be provided and is required to comply with the criteria set out in Table 4.2 overleaf.

Table 4.2 Remediation Targets-Low Rise Residential End Use

Determinand	Units	Under Hard Standing	Under Public Open Space <300mmCover	Under Public Open Space >300mm	Pathway
Arsenic [vii]	mg/kg	40[4]	79	170[4]	1[5]
Cadmium [vii]	mg/kg	85[4]	120	532	1[5]
Chromium (Hexavalent)	mg/kg	6[4]	7.7	220	1[5]
Lead [vii]	mg/kg	200[4]	200	200[4]	1[5]
Elemental Mercury [ii]	mg/kg	1.2[4]	16	160	2
Nickel	mg/kg	180[4]	230	3400	1[5]
Selenium (New SGV)	mg/kg	430[4]	1100	1800	1[5]
Copper	mg/kg	7100[4]	12000	44000	1[5]
Zinc	mg/kg	40000[4]	81000	170000	1[5]
Cyanide	mg/kg	791[4]	791	791[4]	1[5]
Phenol	mg/kg	210[4]	210	210	2
Naphthalene	mg/kg	2.3	4900	1200	2
Acenaphthylene	mg/kg	2900[1,2]	15000	29000	3[5]
Acenaphthene	mg/kg	3000[1,2]	15000	29000	1[5]
Fluorene	mg/kg	2800[1,2]	9900	20000	1[5]
Phenanthrene	mg/kg	1300[1,2]	3100	6200	3[5]
Anthracene	mg/kg	31000[1,2]	74000	150000	3[5]
Fluoranthene	mg/kg	1500[1,2]	3100	6300	3[5]
Pyrene	mg/kg	3700[1,2]	7400	15000	3[5]
Benzo(a)Anthracene[	mg/kg	11[1,2]	29	49	3[5]
Chrysene	mg/kg	30[1,2]	57	93	3[5]
Benzo(b)Fluoranthene [iii]	mg/kg	3.9[1,2]	7.1	13	3[5]
Benzo(k)Fluoranthene [iii	mg/kg	110	190	370	3[5]
Benzo(a)Pyrene [vii]	mg/kg	3.2[1,2]	5.7	11	3[5]
Indeno(123-cd)Pyrene	mg/kg	45[1,2]	82	150	3[5]
Dibenzo(a,h)Anthracene	mg/kg	0.31[1,2]	0.57	1.1	3[5]
Benzo(ghi)Perylene	mg/kg	360[1,2]	640	1400	3[5]
TPH C_5-C_6 (aliphatic)	mg/kg	42	570000	95000	2
TPH C_6-C_8 (aliphatic)	mg/kg	100	600000	150000	2
TPH C_8-C_{10} (aliphatic)	mg/kg	27	13000	14000	2
TPH C_{10}-C_{12} (aliphatic)	mg/kg	130	13000	21000	2
TPH C_{12}-C_{16} (aliphatic)	mg/kg	1100	13000	25000	1[5]
TPH C_{16}-C_{21} (aliphatic)	mg/kg	65000	250000	450000	1[5]
TPH C_{21}-C_{35} (aliphatic)	mg/kg				1[5]
TPH C_5-C_7 (aromatic)	mg/kg	370	56000	76000	2
TPH C_7-C_8 (aromatic)	mg/kg	860	56000	87000	2
TPH C_8-C_{10} (aromatic)	mg/kg	47	5000	7200	2
TPH C_{10}-C_{12} (aromatic)	mg/kg	250	5000	9200	2
TPH C_{12}-C_{16} (aromatic)	mg/kg	1800	5100	10000	1[5]
TPH C_{16}-C_{21} (aromatic)	mg/kg	1900	3800	7600	1[5]
TPH C_{21}-C_{35} (aromatic)	mg/kg	1900	3800	7800	1[5]
PCE	mg/kg	0.18	1400	14000	2
TCE	mg/kg	0.017	120	1200	2

4.5 Placement of Chemically Suitable Cover System

Proposed landscaped areas and POS within the residential development require a chemically suitable cover system in order to break the exposure pathway between the end user and the contaminants.

Procedure for Placement:

- *If proposed utilities are to be placed within the cover system, the clean cover should be placed prior to installation of these utilities;*
- *If natural drift deposits are encountered, excavation can cease here;*
- *Landscaped areas need to be backfilled with 150mm chemically validated subsoil, with 150mm topsoil overlaying this.* ***Topsoil is required to be confirmed as chemically suitable prior to placement.***

Landscaped / POS Validation Procedure

The placement of 300mm of clean material will be undertaken during the build phase works of the project.

The placement of subsoil and corresponding validation will be documented within the Garden Validation Letters (to be issued on completion of the contractor's works).

Where subsoil is not placed during Remediation & Enabling works, E3P will be required to return to site and undertake independent validation of the correct placement of subsoil.

E3P will collect photographic evidence of the placement of 150mm of certified topsoil and 150mm of subsoil on completion of construction works. This element will also be checked by the Building Control Officer as part of the site completion prior to issuing of a CML certificate.

PROCEDURE	METHOD
Chemical Validation	Imported sub-soils and topsoil will need to be chemically analysed to confirm suitability for use with the proposed cover system prior to installation and completion of the garden systems. E3P will issue an email to the SGI Consulting Development Engineer with an assessment of the chemical suitability of both sub soils and top soils. If acceptable the materials can be installed to the required depth at which time the plot will be deemed complete following a validation procedure by a suitability qualified E3P engineer.
Trial Holes	Trial holes are deemed necessary for the all landscaped areas and POS given that the 300mm cover system will need to be placed within each sector during the build phase.
Validation	Photographic evidence will be taken (by E3P or Graham Construction) of the topsoil placement demonstrating the depth of topsoil and practical completion of works are required for each and every plot. For areas where subsoil depths requires validation by E3P during the build phase, photographs will be taken and collated by E3P.

Validation Certificate	Once the photographs of the placement of topsoil (over the clean material) have been provided, E3P will issue a validation certificate to demonstrate that the required subsoil and topsoil has been placed in the required areas along with the chemical analysis.
Completion Report	Upon completion of all landscaped areas and POS within the development, a Completion Report will be issued providing the confirmation that all remediation requirements have been achieved.



Photographs 1 and 2: Examples of validation photographs demonstrating clean cover.

4.6 Notes

If any of the procedures as outlined within the Build Phase Development Requirements Plan are not completed, this may result in a delay in obtaining a Warranty and Council for Mortgage Lenders and a Certificate of Completion.

Post Remediation Constraints for the site will include:

- Topsoil to be supplied by the developer, with appropriate quality checks if any further topsoil is required;
- Placement of clean subsoil and topsoil in soft landscaped areas must be a minimum of 300mm or natural ground (whichever is the shallower). The placement of this material will require independent validation by a suitably qualified professional;
- Foundation strategies should take into account the properties of the strata left in-situ; and,
- Consultations will have to be completed with the Local Authority to enable the satisfactory discharge of planning conditions associated with the planning consent for the site.

5. CONCLUSION AND RECOMMENDATIONS

E3P has completed the validation of the agreed land remediation and enabling works completed as part of the regeneration for a parcel of land at Ellesmere Street, Manchester.

E3P can confirm that the works have been implemented in accordance with the agreed Remediation Strategy with all materials managed in such a way as to ensure that the completed works posed no risk to construction operatives or the wider environ.

E3P can also confirm that all materials that remain in-situ pose no unacceptable degree of potential risk to the identified receptors within the context of the developed Conceptual Site Model (CSM) and as such the site is deemed suitable for use subject to the installation, validation and testing of the build phase mitigation works.

As part of the on-going construction works the developer will be required to construct and validate the items listed below in strict accordance with the requirements of the regulatory authorities as documented in detail within this report.

- Placement of clean subsoil and topsoil in all soft landscaped areas must be a minimum of 300mm or natural ground (whichever is the shallower); and
- Independent validation of the cover system by a suitably qualified E3P engineer.

END OF REPORT

APPENDIX I
LIMITATIONS



1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the Client as indicated in Section 1.2.

2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.

3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.

4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not be made known or accessible.

5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.

6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.

7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.

8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.

10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

APPENDIX II
GLOSSARY

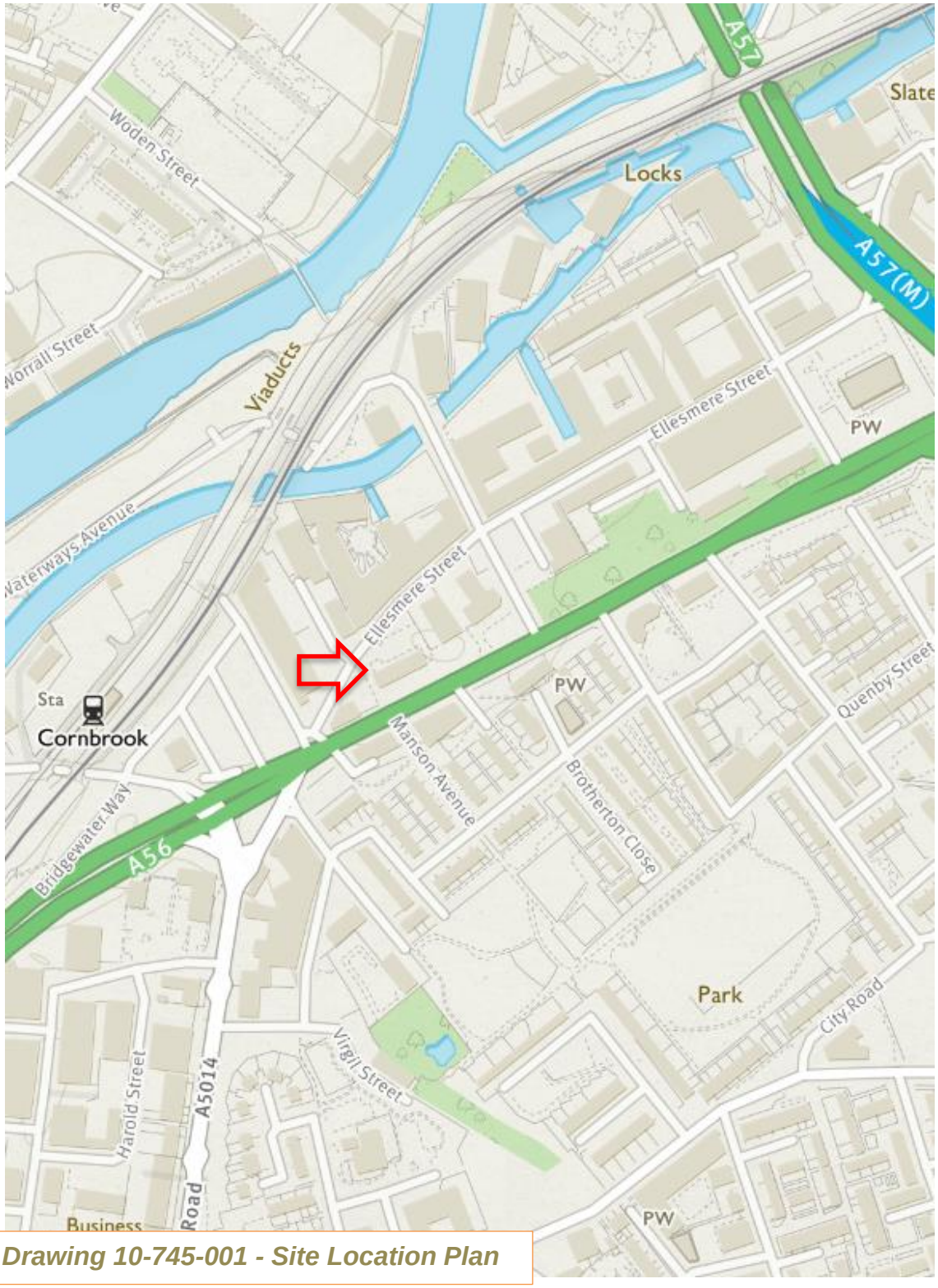


TERMS

AST	Above Ground Storage Tank	**SGV**	Soil Guideline Value
BGS	British Geological Survey	**SPH**	Separate Phase Hydrocarbon
BSI	British Standards Institute	**TPH CWG**	Total Petroleum Hydrocarbon (Criteria Working Group)
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes	**SPT**	Standard Penetration Test
CIEH	Chartered Institute of Environmental Health	**SVOC**	Semi Volatile Organic Compound
CIRIA	Construction Industry Research Association	**UST**	Underground Storage Tank
CLEA	Contaminated Land Exposure Assessment	**VCCs**	Vibro Concrete Columns
CSM	Conceptual Site Model	**VOC**	Volatile Organic Compound
DNAPL	Dense Non-Aqueous Phase Liquid (chlorinated solvents, PCB)	**WTE**	Water Table Elevation
DWS	Drinking Water Standard	**m**	Metres
EA	Environment Agency	**km**	Kilometres
EQS	Environmental Quality Standard	**%**	Percent
GAC	General Assessment Criteria	**%v/v**	Percent volume in air
GL	Ground Level	**mb**	Milli Bars (atmospheric pressure)
GSV	Gas Screening Value	**l/hr**	Litres per hour
HCV	Health Criteria Value	**µg/l**	Micrograms per Litre (parts per billion)
ICSM	Initial Conceptual Site Model	**ppb**	Parts Per Billion
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene)	**mg/kg**	Milligrams per kilogram (parts per million)
ND	Not Detected	**ppm**	Parts Per Million
LMRL	Lower Method Reporting Limit	**mg/m^3**	Milligram per metre cubed
NR	Not Recorded	**m bgl**	Metres Below Ground Level
PAH	Polycyclic Aromatic Hydrocarbon	**m bcl**	Metre Below Cover Level
PCB	Poly-Chlorinated Biphenyl	**mAOD**	Metres Above Ordnance Datum (sea level)
PID	Photo Ionisation Detector	**kN/m^2**	Kilo Newtons per metre squared
QA	Quality Assurance	**µm**	Micro metre
SGV	Soil Guideline Value		

APPENDIX III
DRAWINGS





Drawing 10-745-001 - Site Location Plan

Hotspot Excavated and segregated on site. Metals-9 and WAC-E tests carried out (CR369/003-1,2,4). Results came back as fine.





ate Window Sample Probehole Location

ate Trial Pit Location

ate Hand Dug Pit Location

ate Cable Percussive Borehole Location

WAC-E and metals-9 CR369/001-2 was taken from this locaton. Test results came back as fine. Asbestos ID CR369/003-2 was taken from here. No asbestos detected.

Holdings area for WS105 Hotspot arisings



Sample CR369/003-3, was taken from the arisings. Sample failed loss of ignition test but metals-9 was fine.

Hotspot excavated and taken off site. WAC-E and Metals-9 tests HS 1,2 and 3 were taken from the excavated pit. All results came back as fine.

Metals-9 and WAC-E CR369/001-1 was taken from this location. test came back fine. Asbestos ID CR369/003-1 was taken from here. No asbestos was detected

Holdings area for 6f2. Sample CR369/000 was taken from the pile. Metals-9, and WAC-E tests came back as fine. Asbestos ID 369/003-4 was taken from the pile, no asbestos was detected.

Metals-9 and WAC-E CR369/001-3 was taken from this location. Results came back as fine. Asbestos ID CR369/003-3 was also taken from here. No asbestos was detected.

P1	-	24.02.2016	DRAFT	RW	MD
Phase	Revision	Date	Issue	Drawn	Authorised

Client: Shepard Gilmour

Job No.: 10-745

Date: 24-02-2016

Drawing No.: 002

Scale: NTS

Job Title: Castlefield House, Ellesmere Streeet

Drawing Title: Exploratory Hole Location Plan

e3p

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APPENDIX IV
PHOTOGRAPHS





PLATE 1 – EXCAVATION & PROCESSING OF RELICT FOUNDATIONS



PLATE 2 – EXCAVATION OF SUB STRUCTURES & TURNOVER OF MADE GROUND



PLATE 3 – STOCKPILE OF TIMBER FROM MADE GROUND TURNOVER



PLATE 4 – EXCAVATION OF SUB STRUCTURES & TURNOVER OF MADE GROUND



PLATE 5 –WATER CANNON TO DAMPEN EXCAVTION & PROCESSING WORKS



PLATE 6 – STOCKPILE OF PROCESSED AGGREGTAE TO BACKFILL EXCAVATION



PLATE 7 – SHEET PILES TO FORM UNDERCROFT CAR PARKING



PLATE 8 – EXCAVATION OF SUB STRUCTURES & TURNOVER OF MADE GROUND

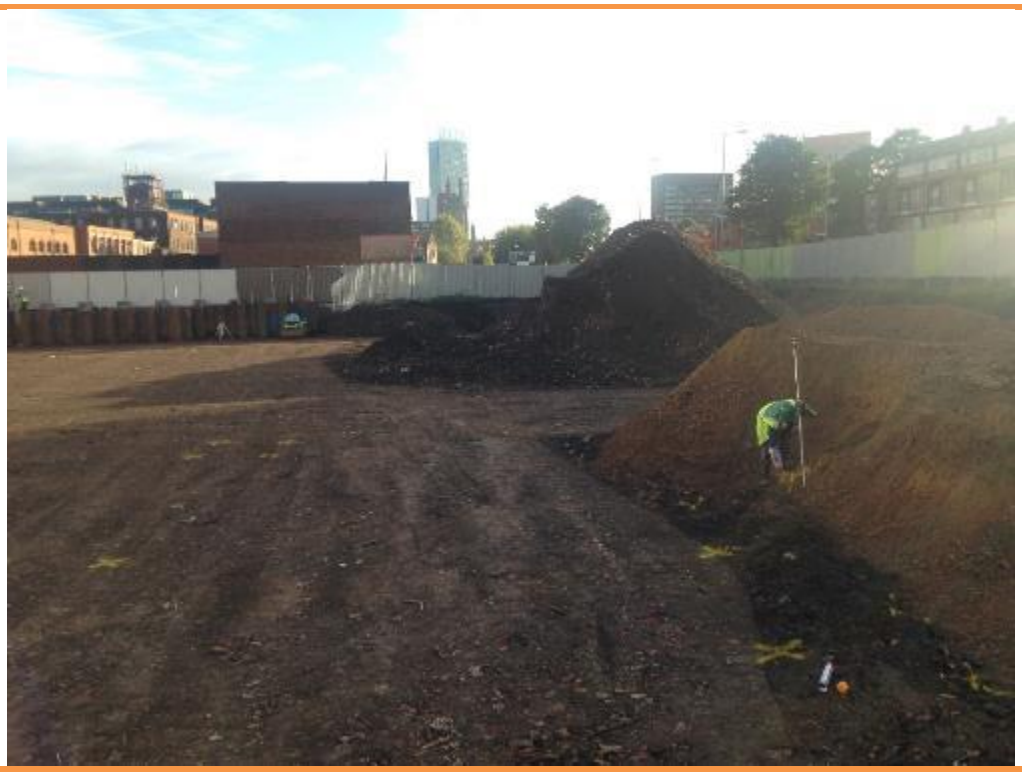


PLATE 9 – RE-ENGINEERED FILL / DEVELOMENT PLATFORM



PLATE 10 – ENGINEERED DEVELOPMENT PLATFORM NEARING COMPLETION



PLATE 11 – ENGINEERED DEVELOPMENT PLATFORM NEARING COMPLETION



PLATE 12 – ENGINEERED DEVELOPMENT PLATFORM NEARING COMPLETION



PLATE 13 – ENGINEERED PLATFORM AWAITING FINAL FILL FOR COMPLETION

APPENDIX V
SITE WASTE MANAGEMENT PLAN

SITE WASTE MANAGEMENT PLAN - DATA SHEET

PF10-PR10-44-F004

PROJECT / SITE:	PROJECT VALUE	DISCIPLINE	REPORTING PERIOD	LOCATION
IR-16 Ellesmere Street	27m	Building	July - Sept	England

TOTAL WASTE GENERATED 17095.09 tonnes

TOTAL WASTE TO LANDFILL 16290.17 tonnes

Waste source	Waste Material Code	Destination	Quantity sent (in tonnes)	Recovery rate (%)	Quantity recovered (in Tonnes	Name of waste carrier	Carriers registration number	Expiry date of carriers licence	Licence/ exemption number for receiving site	Have checks been carried out to check receiving site
Excavation	17 05 04 - soil and stones other than those mentioned in 17 05 03	Disposal to landfill	16000.00	0%	0.00	Chartrange Ltd	CBDU91551	25/03/2019	EPR/ZP3433AQ	Yes
Excavation	17 01 01 - concrete	Sent to waste transfer station	500.00	75%	375.00	Chartrange Ltd	CBDU91551	25/03/2019	EPR/AB3939RT	Yes
Excavation	17 05 03 - soil and stones containing dangerous substances	Disposal to landfill	40.00	0%	0.00	Chartrange Ltd	CBDU91551	25/03/2019	DP3639LM	Yes
Excavation	17 05 04 - soil and stones other than those mentioned in 17 05 03	Sent to waste transfer station	500.00	75%	375.00	Chartrange Ltd	CBDU91551	25/03/2019	EAWML50052	Yes
Construction	20 03 01 - mixed municipal waste	Recycled off site	8.34	100%	8.17	JWS Recycling Services Ltd	CBDU50919	43316	EAWML/50186	Yes
Demolition	20 03 01 - mixed municipal waste	Sent to waste transfer station	36.79	100%	36.79	Chartrange Ltd	CBDU91551	25/03/2019	EAWML/50186	Yes
Demolition	17 04 05 - iron and steel	Sent to waste transfer station	9.96	100%	9.96	Chartrange Ltd	CBDU91551	25/03/2019	EAWML/50065	Yes
					0.00					
					0.00					
					0.00				

SITE WASTE MANAGEMENT PLAN - DATA SHEET

PROJECT / SITE:	PROJECT VALUE	DISCIPLINE	REPORTING PERIOD	LOCATION
Ellesmere St IR-16	27m	Building	Oct - Dec	England

TOTAL WASTE GENERATED 4924.50 tonnes

TOTAL WASTE TO LANDFILL 0.00 tonnes

Waste source	Waste Material Code	Destination	Quantity sent (in tonnes)	Recovery rate (%)	Quantity recovered (in Tonnes	Name of waste carrier	Carriers registration number	Expiry date of carriers licence	Licence/ exemption number for receiving site	Have checks been carried out to check receiving site
Construction	17 05 04 - soil and stones other than those mentioned in 17 05 03	Disposal to landfill	4924.50	100%	4924.50	Chartrange Ltd	CBDU91551	25/03/2019	EPR/ZP3433AQ	Yes
					0.00					
					0.00					
					0.00				

SITE WASTE MANAGEMENT PLAN - DATA SHEET

PROJECT / SITE:	PROJECT VALUE	DISCIPLINE	REPORTING PERIOD	LOCATION
			Jan - Mar	

TOTAL WASTE GENERATED 2420.00 tonnes

TOTAL WASTE TO LANDFILL 0.00 tonnes

Waste source	Waste Material Code	Destination	Quantity sent (in tonnes)	Recovery rate (%)	Quantity recovered (in Tonnes	Name of waste carrier	Carriers registration number	Expiry date of carriers licence	Licence/ exemption number for receiving site	Have checks been carried out to check receiving site
	17 05 04 - soil and stones other than those mentioned in 17 05 03	Disposal to landfill	1040.00	100%	1040.00	Chartrange Ltd	CBDU91551	25/03/2019	EPR/ZP3433AQ	Yes
	17 05 04 - soil and stones other than those mentioned in 17 05 03	Sent to waste transfer station	1180.00	100%	1180.00	Chartrange Ltd	CBDU91551	25/03/2019	EPR/EB3903LV	Yes
	17 05 04 - soil and stones other than those mentioned in 17 05 03	Sent to waste transfer station	80.00	100%	80.00	Chartrange Ltd	CBDU91551	25/03/2019	EAWML50052	Yes
	17 01 01/17 01 02	Sent to waste transfer station	120.00	100%	120.00	Chartrange Ltd	CBDU91551	25/03/2019	EPR/EB3903LV	Yes
					0.00					
					0.00					
					0.00				