

1st October 2018

MF-BHE-XX-XX-RP-CG-0002

Factory, Water Street, Manchester.
Land Contamination Summary and Outline Remediation Strategy

To whom it may concern,

1. Introduction

This letter is in respect of the proposed development at The Factory, Water Street, Manchester (National Grid Reference ³82990 E, ³97960 N), hereafter referred to as 'the Site'. The proposed end use will comprise a new cultural venue comprising flexible auditorium spaces and associated facilities including retail, restaurant, office and educational uses with areas of external public realm (hard and soft landscaping). A Site location plan and architect's impression of the proposed development and associated layout are included as Enclosures 1 & 2 respectively.

This letter summarises the work undertaken to date in relation to ground contamination (Section 2) and sets out the proposed outline remedial strategy for the Site (Section 3).

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2. Summary of Site Assessment Work

This section aims to provide sufficient information to the Local Planning Authority and associated statutory consultees in relation to the Site's condition. Table 1 below lists the contamination related assessment and Site investigation works previously undertaken at the Site to date.

Table 1 - Summary timeline of ground contamination works relating to the Site

Report Reference	Description of works undertaken	Contamination Ground Investigation	Date
Report 0	ROC Consulting Phase 1 Desk Study	Preliminary Conceptual Site Model	July 2015
Report 1 (MF-BHE-XX-XX-RP-CG-0001-PO1)	BuroHappold Ground Engineering Desk Study Report	Preliminary Conceptual Site Model	6 th September 2016
Report 2 (Factual Report A6053-16)	BuroHappold/ESG – Site Specific Ground Investigation (East of Water Street)	3 No. boreholes, 11 No. window samples, 8 No. hand dug trial pits and 5 No. machine excavated trial pits.	October 2016 (Site work between 23 June 2016 – 12 July 2016)
Report 3 (Factual Report A6131-16)	BuroHappold/ESG – Site Specific Ground Investigation (West of Water Street)	2 No. boreholes, 1 No. machine excavated trial pit.	May 2017 (Site work between 9-23 January)
Report 4 (Factual Letter A7064-17)	BuroHappold/SOCOTEC (formerly ESG) – Site Specific Ground Investigation (Starlight Theatre)	4 No. machine excavated trial pits	12 March 2018 (Site work between 19-20 December 2017)

The following sections summarise pertinent parts the above assessments.

Report 1: BuroHappold Ground Engineering Desk Study Report

The Site is located at the former Granada TV Studio on Water Street, Manchester and is approximately 550 m northwest of Deansgate Railway Station.

The Site is approximately 0.73 hectares in area and is currently occupied by surface car parking, a Grade II Listed Colonnaded Railway Viaduct, the Starlight Theatre (overlying the railway arches), and a number of structures and buildings associated with former Granada TV filming and events. The railway viaduct comprises two sets of railway arches, namely the St. John's arches (on Site) and the Museum of Science and Industry (MoSI) arches (off Site), which approximately form the southern Site boundary. Water Street (orientated SW-NE) runs centrally through the Site.

The Site has had a variety of historical industrial land uses including warehouses, wharfs, and railway sidings. Historically off Site industrial uses have included a timber yard ~20-30 m to the east and an engineering works adjacent to the north of the Site.

No contamination related risks above Low were identified at Desk Study stage.

A copy of the BuroHappold Ground Engineering Desk Study Report has previously been submitted to the Local Planning Authority as part of the original planning submission.

Reports 2, 3 and 4: Three phases of ground investigation

Due to access restrictions (primarily associated with Network Rail occupying the Site to the west of Water Street), three phased ground investigations were undertaken across the Site by ESG supervised by BuroHappold.

Report 2: ESG undertook the first phase of ground investigation at the Site, east of Water Street during June – July 2016. This phase comprised 3 No. cable percussive boreholes with rotary follow-on, 11 No. window samples, 8 No. hand dug trial pits, 5 No. machine dug trial pits, geotechnical and chemical laboratory testing, installation of gas and groundwater monitoring wells and a programme of gas and groundwater monitoring.

Report 3: ESG undertook the second phase of ground investigation (west of Water Street, after Network Rail allowed access) during January 2017. This comprised 2 No. boreholes using combined dynamic sampling and rotary drilling, 1 No. machine excavated trial pit, geotechnical and chemical laboratory testing, installation of gas and groundwater monitoring wells and a programme of gas and groundwater monitoring.

Report 4: SOCOTEC UK Ltd. (formerly ESG) were commissioned to undertake the third phase of ground investigation during December 2017, which comprised 4 No. machine dug trial pits to inspect the material located above the crown of the arches of the Colonnaded Railway Viaduct, along with chemical laboratory testing.

A copy of each of the above Factual Reports have previously been submitted to the Local Planning Authority as part of the original Planning Submission.

Exploratory hole location plans detailing the works undertaken across the three phases of GI are included as Enclosure 3.

The Site ground conditions were assessed on the basis of the Site specific available information. The general sequence of strata encountered beneath the proposed development (summarised in Table 2) comprises Made Ground (MG) which is underlain by superficial deposits: Alluvium (both cohesive and granular), and Glaciofluvial Deposits (granular material – recorded in BH02 only). The cohesive Alluvium was encountered sporadically, within 10 No. exploratory holes out of 28. The Chester Formation bedrock underlies the superficial deposits. Rockhead was recorded between 21.60 and 23.10 m AOD during the GI.

During the ground investigations, groundwater was struck between 2.20 and 3.10 m BGL within several exploratory holes within the granular Alluvium.

Post fieldwork groundwater levels within the Chester Formation bedrock were recorded between 23.13 and 23.51 m AOD (~2.80 to 3.30 m BGL) within the granular Alluvium, and between 22.87 and 23.63 m AOD (~2.80 to 3.80 m BGL). It is therefore considered that the two strata are in hydraulic continuity. Perched water was recorded in 2 No. of the 4 No. wells installed within the Made Ground, between 1.80 and 3.05 m BGL.

Table 2 - Summary of the ground conditions encountered at the Site.

Depth to Top of Strata (m BGL)	Typical Thickness (m)	Generalized Description
0.00	0.80 – 2.50 (3.75 in BH05)	MACADAM or CONCRETE OVER Grey, yellow, brown and black sandy/very sandy gravel and very gravelly sand of sandstone, limestone, mudstone, coal, slate, brick, concrete clinker and glass, with occasional cobble content of sandstone and brick AND Soft to firm brown and black, sandy, gravelly, clay with localised silt and sand of ash. Gravel of fine to coarse brick, coal, quartzite, limestone, mudstone, slate and timber with occasional cobbles of brick. [MADE GROUND]
1.60 – 1.80 (HTP09 & HTP10)	0.10 – 0.60	Soft yellowish brown and brown slightly sandy, slightly gravelly CLAY. Gravel of sandstone and mudstone. [POSSIBLE MADE GROUND]
0.80 – 2.50 (Sporadic)	0.50 – 1.30	Soft to firm brownish yellow mottled grey, slightly sandy, slightly gravelly CLAY. Gravel of sandstone and mudstone. [ALLUVIUM – COHESIVE]
1.50 – 2.50	1.40 – 3.10	Medium dense to very dense dark brown, orange brown and occasionally grey slightly gravelly to gravelly SAND and sandy, silty GRAVEL. Gravel of sandstone and mudstone with occasional limestone, quartzite and siltstone. [ALLUVIUM – GRANULAR]
3.20 (Encountered in BH02 only)	1.20	Brownish grey, becoming yellowish grey, gravelly SAND and sandy GRAVEL. Gravel of sandstone, quartzite and siltstone. [GLACIOFLUVIAL DEPOSITS]
3.40 – 4.60	>25.60	Reddish brown slightly gravelly silty SAND. AND Extremely weak to weak reddish brown to greenish grey medium grained SANDSTONE. Discontinuities are: 1. Subhorizontal, closely to medium spaced, rough, planar, undulating, smooth. 2. Subvertical, widely spaced, tight, planar, smooth with sand smearing and local clay smearing. [CHESTER FORMATION – SHERWOOD SANDSTONE GROUP]

3. Chemical Testing Results

As part of the three phases of ground investigation, chemical testing was undertaken within both Made Ground and natural material and assessed against the relevant thresholds. A brief summary is presented below.

Soil Results and Risk to Human Health

In total, 20 No. soil samples (Made Ground: 17 No. and natural material: 3 No.) were tested and assessed against the relevant CLEA model thresholds (commercial / industrial, S4SLs and C4SLs derived for 1% SOM).

Commercial criteria are considered suitable for the proposed end use as a theatre / public realm space due to the following reasons:

- End users will be transient;
- The vast majority of the proposed development area will be covered by the building, with the remainder covered by hard or soft landscaping; and
- Floor slabs and landscaped areas will be underlain by a clean capping layer.

No exceedances of the CLEA model commercial / industrial thresholds for the analysed determinands were recorded. No Asbestos Containing Material (ACM) was identified in the 20 No. samples analysed.

Several chemical exceedances were recorded above the more sensitive CLEA model residential without plant uptake thresholds, including TPH, lead, arsenic and PAHs. The results are included as Enclosure 4.

Visual / olfactory evidence of contamination was recorded during the first phase of the ground investigation in 2 No. exploratory holes, namely WS09, 3.30 to >3.85 m BGL (maximum depth drilled with a 'strong diesel odour – hydrocarbon') and MTP05, 0.30 to >3.10 m BGL (maximum depth drilled; 'slight hydrocarbon odour').

Samples of these materials were sent to a laboratory to be analysed for a suite of potential contaminants. Soil analysis results recorded concentrations of TPH, lead and PAH above residential without plant uptake thresholds. The highest TPH value recorded on Site was within HTP11 at 1.00 m BGL (192 0mg/kg TPH), despite no visual / olfactory evidence of contamination being noted; this material represents historic backfilling on top of the St John's arches.

Leachate and Groundwater Results: Risks to Environmental Receptors

Leachate and groundwater testing were undertaken in order to assess indicative current levels of contamination within the groundwater, and to assess the risk of future contamination to nearby controlled water receptors (Chester Formation Principal Aquifer and River Irwell). The results are included as Enclosure 5.

Leachate

Eleven leachate tests undertaken as part of the ground investigation recorded sporadic minor exceedances of the UK DWS of antimony, barium, benzo[a]pyrene and fluoride, and minor exceedances of the Freshwater EQS of pH and sulphate (Note: PAHs and TPH only tested in two of the eleven samples). Several other determinands (lead, copper, zinc and chromium) recorded concentrations between the two assessment criteria used (above the Freshwater EQS but below the UK DWS).

Based on the minor exceedances of the Freshwater EQS and UK DWS, the potential for leaching of contaminants from Site soils into controlled waters is considered to be low. Furthermore, the groundwater concentrations are also low (see next section) giving a further line of evidence to the low leachability of soils.

Groundwater

Two groundwater samples were collected on one occasion by bailer during post-fieldwork monitoring and tested in the laboratory. The two samples were taken from different wells (BH01 and BH05), both with response zones within the Chester Formation bedrock (i.e. deeper groundwater). One exceedance was recorded in BH01: benzo[a]pyrene exceeding the UK DWS by 17 times. In BH05, a substantial concentration of TPH was recorded (14,000 µg/m³); however, no visual or olfactory signs of contamination were reported during groundwater sampling.

The monitoring undertaken suggests some hydrocarbon impact to groundwater within the Chester Formation aquifer; however, there is no evidence to suggest that this impact originates from the Site:

- On-Site processes unlikely to have resulted in such contamination;
- The origin of the TPH impacts recorded at BH05 is unclear and may be from an off-Site source (engineering works and timber yard are recorded off Site on historical maps);
- Chemical analysis of soils in the location of BH05 recorded low TPH concentrations (58 and 40 mg/kg at 1 and 3 m BGL respectively).
- Within the upper strata of both BH01 and BH05, no visual / olfactory evidence of contamination was noted, and no elevated TPH was recorded during soil chemical testing. This suggests migration of contamination within the groundwater;
- No CLEA commercial threshold exceedances were recorded in the Site soils; and
- Soil leachability tests reported low leachability.

4. Ground Gas

6 No. ground gas monitoring events were undertaken on the 8 No. monitoring wells as part of the post fieldwork monitoring visits between 28 July and 20 October 2016. The findings of the monitoring events undertaken are outlined below and a summary of the monitoring results obtained is included in Enclosure 6:

- The maximum concentration of carbon dioxide recorded during the monitoring events was 3.7% in 1 No. installation, namely BH04 on the 22.03.2017 (response zone 1.00 to 3.00 m BGL in Glaciofluvial Deposits);
- The maximum concentration of methane was recorded to be <0.1% for the installations; and
- The maximum flow rate was recorded to be 0.1%.

On the basis of this information, the Site is classified as Characteristic Situation 1 (CS1).

Conclusion

Concentrations in soil were recorded below the relevant CLEA commercial thresholds and are therefore considered suitable for use for the proposed development. The soils data indicates that some contaminants are present within Site Made Ground; however, the maximum concentrations recorded do not indicate that the Site is substantially impacted by contamination. Impacts within the Made Ground are therefore not considered to pose a risk either to future end users of the development or environmental receptors.

Suitable and appropriate health and safety measures / procedures will need to be implemented to protect the construction workforce from an associated risk. The procedure for dealing with unexpected contamination 'hotspots' is outlined in the Remediation Strategy (Section 3) and the BuroHappold Excavation and Filling Specification (MF-BHE-XX-XX-SP-CG-00-0001; herein referred to as the E&F Spec).

The evidence from leachate and groundwater results suggests that there is a low potential for impacts to controlled waters originating from the Site.

The future development will introduce impermeable surfaces over the proposed development and sealed drainage discharging to the River Irwell. This will substantially reduce infiltration through Site Made Ground and so will further reduce potential impacts to controlled waters.

The Site is classified as Characteristic Situation 1 (CS1), suggesting that "no special precautions" are required, in accordance with CIRIA C665 and the British Standard BS8485:2015.

3. Outline Remediation Strategy / Works Methodology

This section provides details of the remediation strategy and works methodology for managing the contaminated land aspects of the construction works that is to be managed and implemented by the Site team during the enabling works package/construction phase of works.

This strategy is also presented in the relevant sections of the E&F Spec. These have been compiled into a specific contaminated land document (REM Clauses) which is provided in Enclosure 7.

It should also be noted that as part of the proposed Remediation Strategy, further acceptability testing will be carried out in accordance with the E&F Spec.

The following should be noted:

- Chemical concentrations in soils are not anticipated to pose a risk to future Site users as:
 - Contaminant concentrations of in-situ soils at the Site were reported below CLEA commercial / industrial values;
 - No imported material exceeding the CLEA residential without plant uptake values will be accepted on to the Site from off site sources;
 - Only topsoil with concentrations lower than the CLEA residential with plant uptake values will be used in landscaped areas; and
 - Building and hardstanding is proposed across the Site with only limited soft landscaping.
- No asbestos containing materials were recorded in Site soils during three phases of GI.

The outline remediation strategy is as follows:

- The works for the construction of the proposed development comprise a bulk earthworks exercise to rationalise levels across the Site using Site won material and some cutting and filling of existing levels. Recycled and / or quarried 6F2 will be imported to be utilised for the piling mat laid on a geotextile;
- Earthworks will be completed in accordance with the Buro Happold E&F Spec REM Clauses document (Enclosure 7). Excess material, as well as geotechnically or chemically unsuitable material (as defined in the E&F Spec) encountered during the works will be removed from Site;
- Fill material, either Site won arisings or imported material including topsoil, will be tested for the list of determinands specified in Clauses 510 and 850 of the E&F Spec (Enclosure 7);
- The top ~400 mm of material used within the piling mat will be removed from Site after piling is complete, leaving the lower portion (i.e. ~250 mm envisaged) of the piling mat on Site in the permanent case. This material will double up as the sub-base to the ground bearing slab. This material will be tested as it is placed to ensure it complies geotechnically and chemically with the E&F Spec;
- Imported material used on Site will be tested to ensure that it complies with the CLEA residential without plant uptake thresholds within the E&F Spec (Enclosure 7);
- If asbestos not currently identified in site soils is encountered during construction works, the contractor is to manage residual risk posed to site workers and off Site receptors within arisings generated from excavations on Site. This will be undertaken by employing dust control measures such as damping down and management of on Site vehicle speeds. If encountered, significant asbestos contamination will be removed from Site as part of construction works. Construction works will place sufficient barriers at the Site surface to be protective of future Site users should residual asbestos be encountered in Site soils during the works;
- Imported and Site-won material that is considered non-compliant in terms of geotechnical properties will not be accepted and will be removed from Site;
- The Main Contractor will be required to control the permeation of water through the ground during construction and surface runoff to the River Irwell;

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- Construction Site staff will be vigilant for visual or olfactory evidence of contamination, as well as asbestos, during earthworks. Should unexpected contamination be encountered, work will be stopped in that area of the Site, the material location recorded and covered over and an appropriate strategy agreed with the Local Authority. The full procedure is outlined in the E&F Spec (Enclosure 7);
- As detailed above, a ground gas assessment has classified the site as CS1. As such, and in accordance with CIRIA C665 guidance, no special ground gas precautions are required on the Site.

BuroHappold are seeking comment on and approval of this proposed strategy and on the Excavation and Filling Specification provided in Enclosure 7.

Yours sincerely
on behalf of BuroHappold Limited



George Mitchell
Ground Engineer
email george.mitchell@burohappold.com

Reviewed by

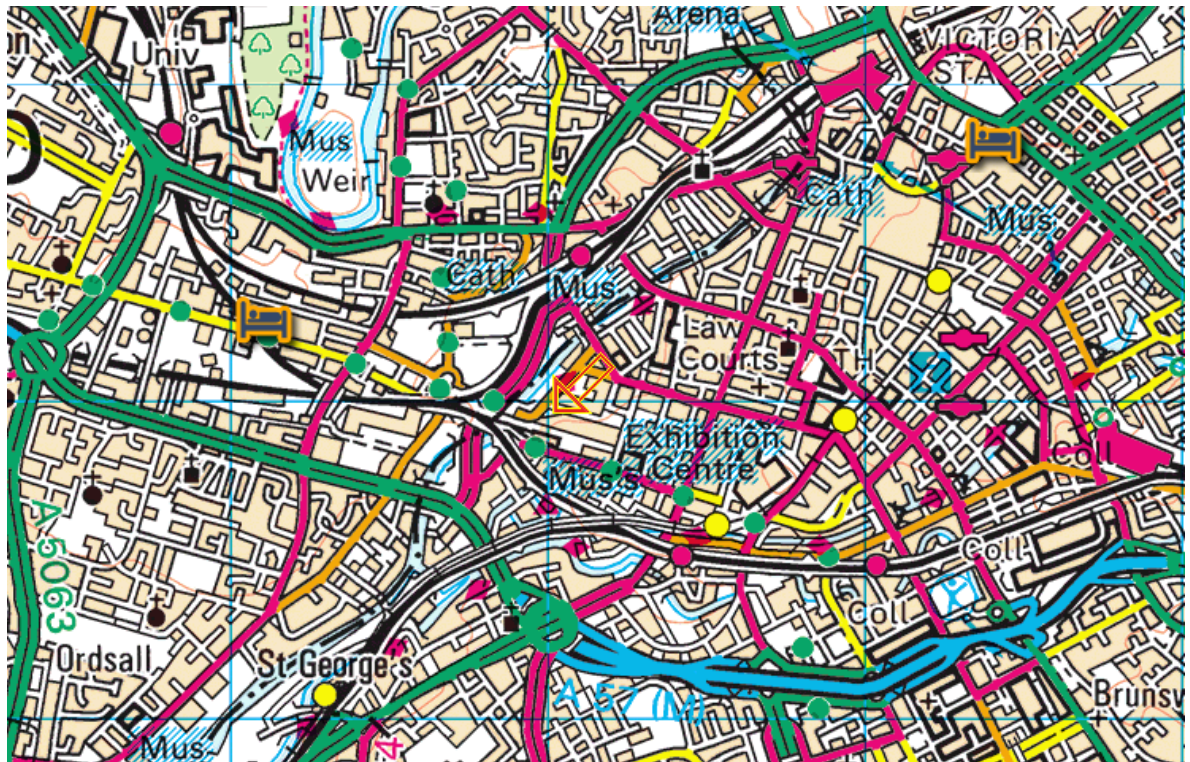


Rob Frost
Associate Director – Geoenvironmental Consultant

Encs	1.	Site Location Plan
	2.	Development Details – Architectural Plans
	3.	GI Exploratory Hole Location Plan
	4.	Chemical Assessment Summary Spreadsheets: Soil
	5.	Chemical Assessment Summary Spreadsheets: Leachate and Groundwater
	6.	Ground Gas Summary Spreadsheet
	7.	BuroHappold Excavation & Filling Specification REM Clauses

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Enclosure 1



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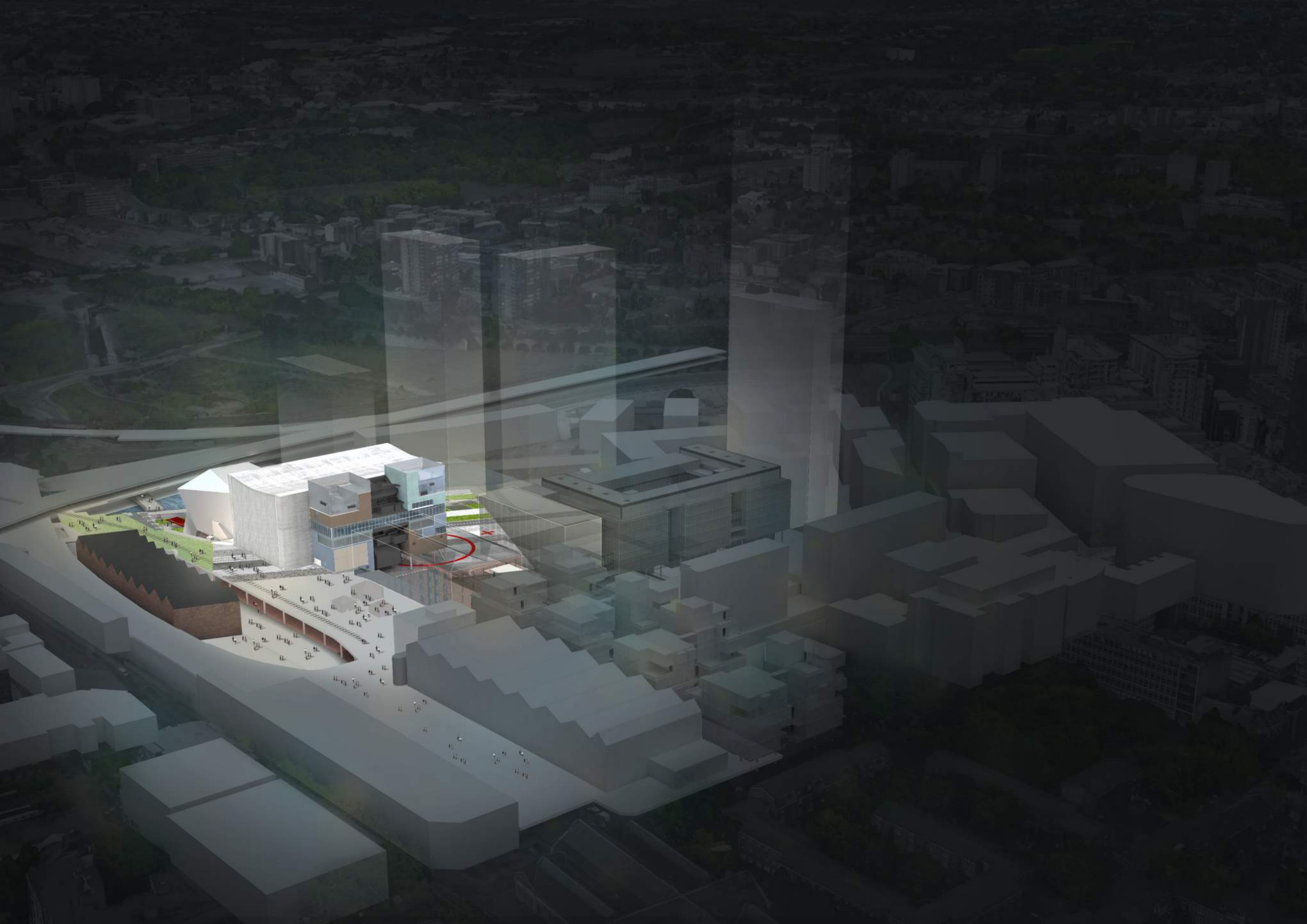


Project Name : Factory Theatre				BUROHAPPOLD ENGINEERING
Report Title : Land Contamination Summary and Outline Remediation Strategy				
Figure Title : Site Location Plan				
Scale: NTS	Date: Oct 2018	Job No: 034933	Enclosure: 1	

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Enclosure 2







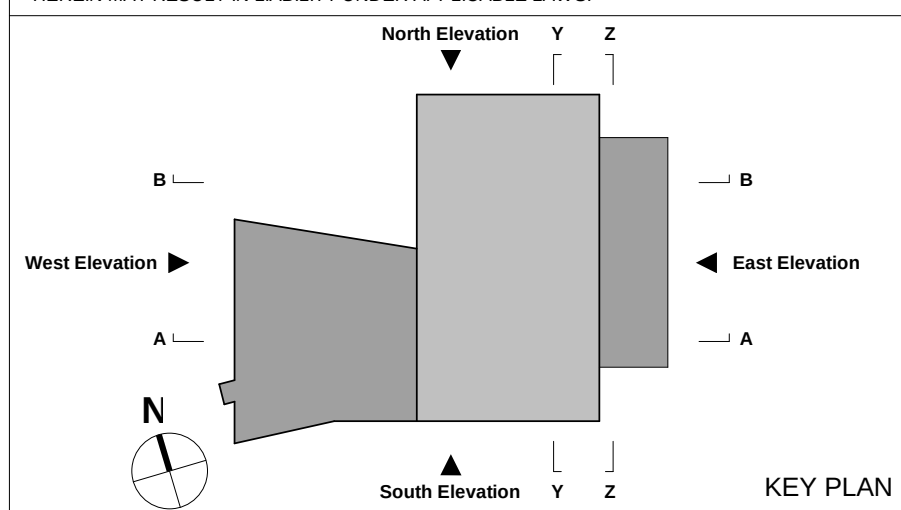
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N 398030031 E 353033229	NORTHING COORDINATE EASTING COORDINATE
+26.720	SPOT HEIGHT
GF	LEVEL
+26.720	LEVEL HEIGHT
FF/SSL +26.720	LEVEL HEIGHT (IF SAME AS SSL)
+26.720	FINISHED FLOOR LEVEL
+26.670	STRUCTURAL SLAB LEVEL
0	GRID LINE
1 TL 101	CALLOUT DETAIL NUMBER DRAWING REFERENCE
1 TL 101	ELEVATION DETAIL NUMBER DRAWING REFERENCE
1 TL 101	SECTION DETAIL NUMBER DRAWING REFERENCE
1 Ref 1 Ref	INTERNAL ELEVATION DETAIL NUMBERS DRAWING REFERENCE
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EW5522	WALL TAG EXTERNAL WALL TYPE
ST-02	MULTI CATEGORY TAG TYPE NUMBER
12 Risers 170 / 250	STAIR TAG NUMBER OF RISERS RISER HEIGHT TREAD DEPTH
	FLOOR BOX
	NOT IN CONTRACT
P8 S2 23 Mar 2018 ISSUED FOR PLANNING	
P7 S3 16 Mar 2018 INTERIM DESIGN RELEASE	
P6 S0 21 Dec 2017 WIP INTERIM GA SUBMISSION	
P5 S2 29 Sep 2017 PLANNING APPLICATION	
P4 S3 11 Aug 2017 RIBA STAGE 3 SUBMISSION	
REV	STAT DATE DESCRIPTION

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PROPOSED GROUND FLOOR PLAN

DRAWING NAME: P8 REVISION

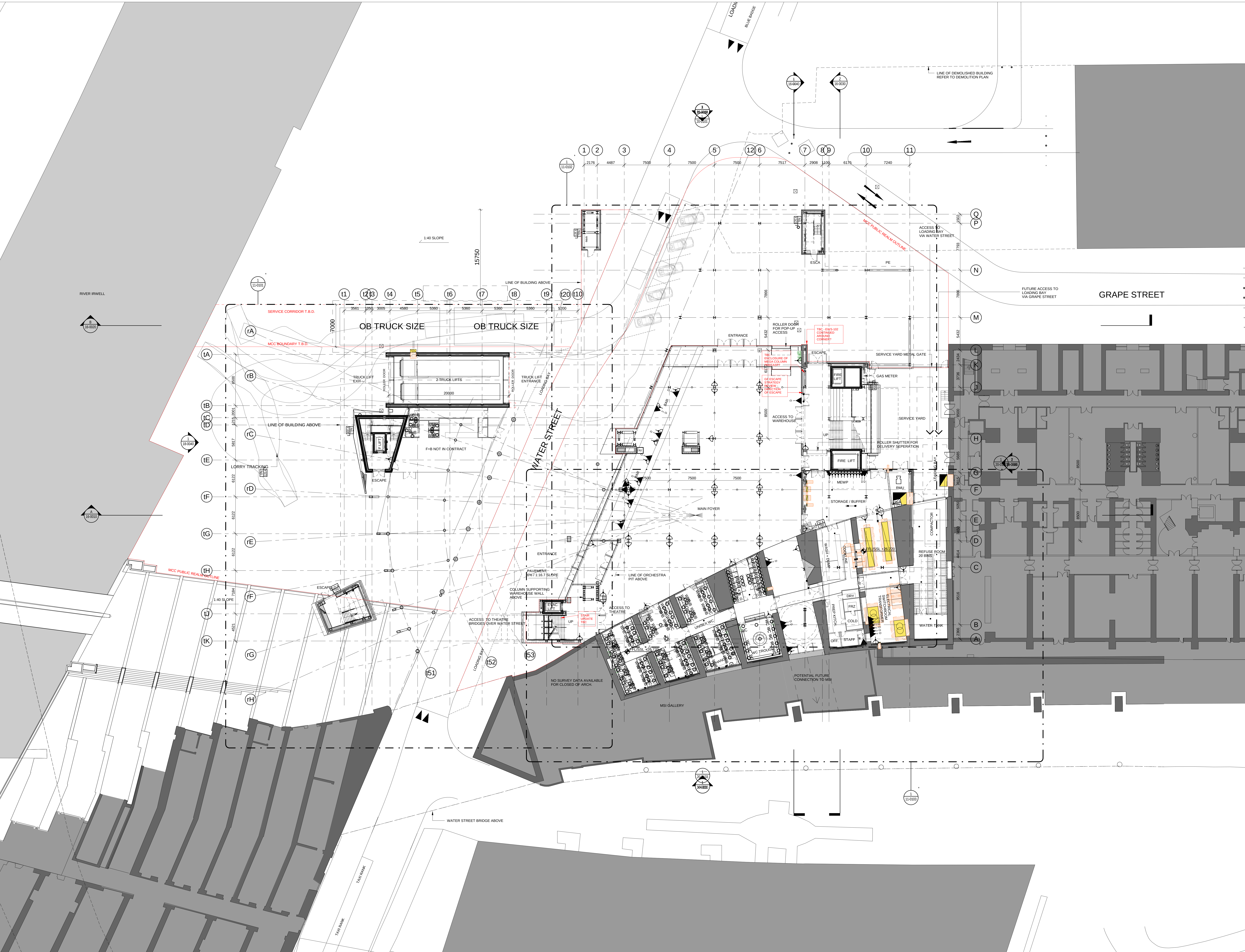
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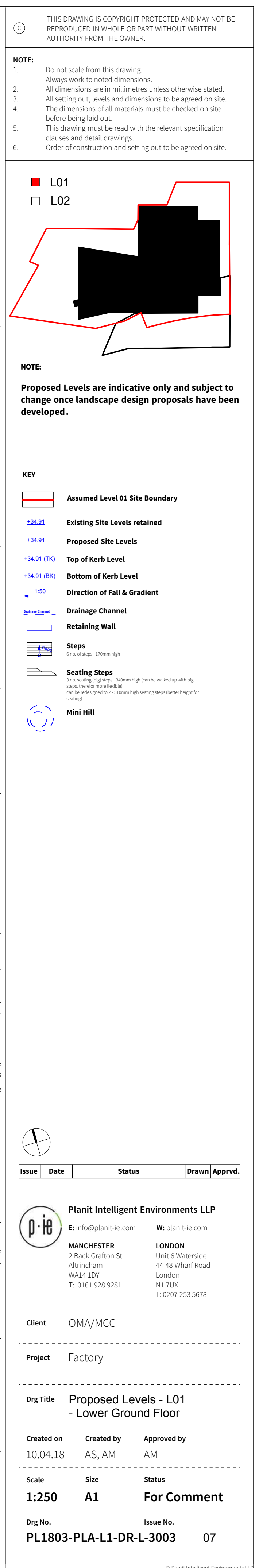
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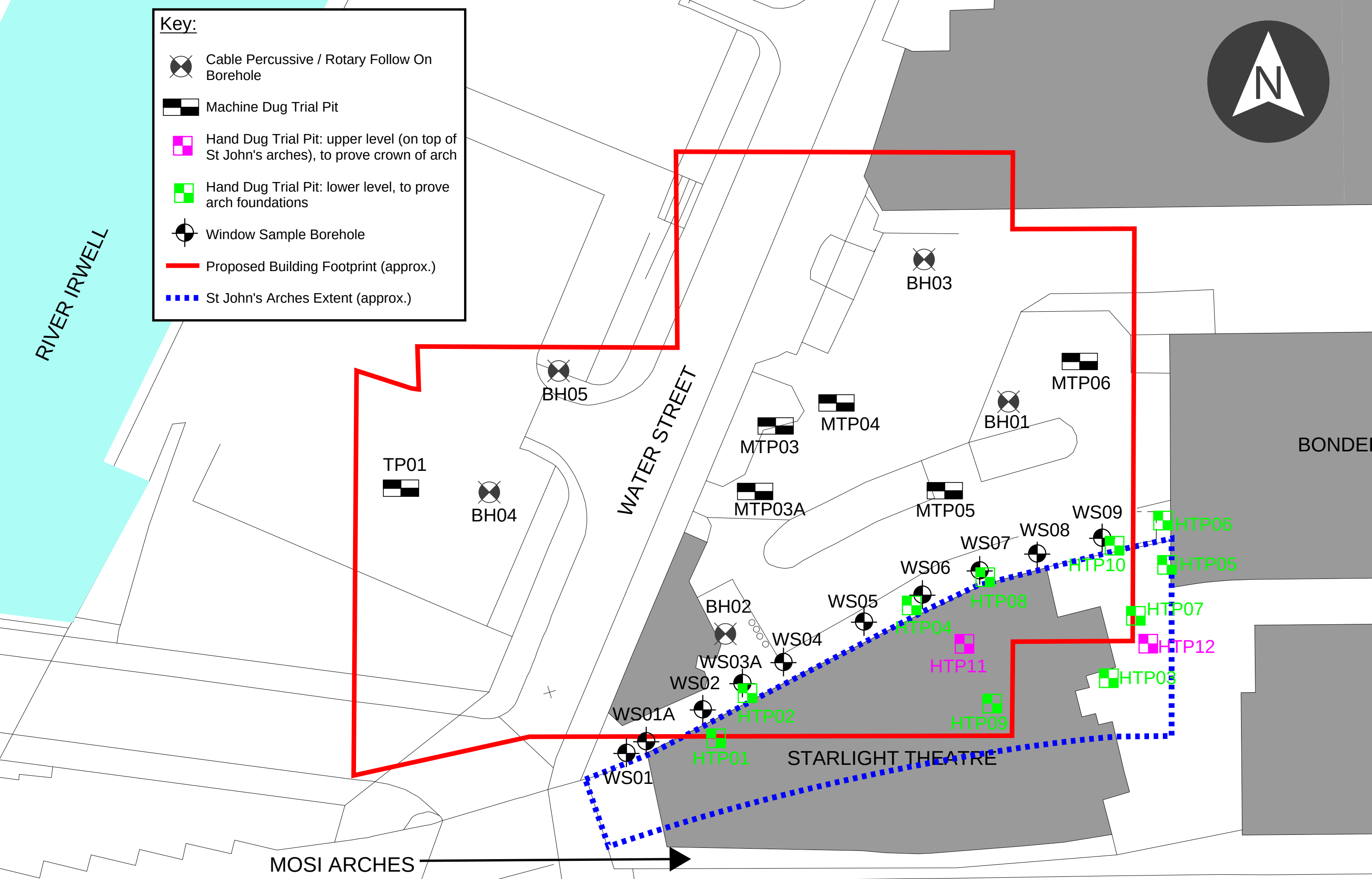


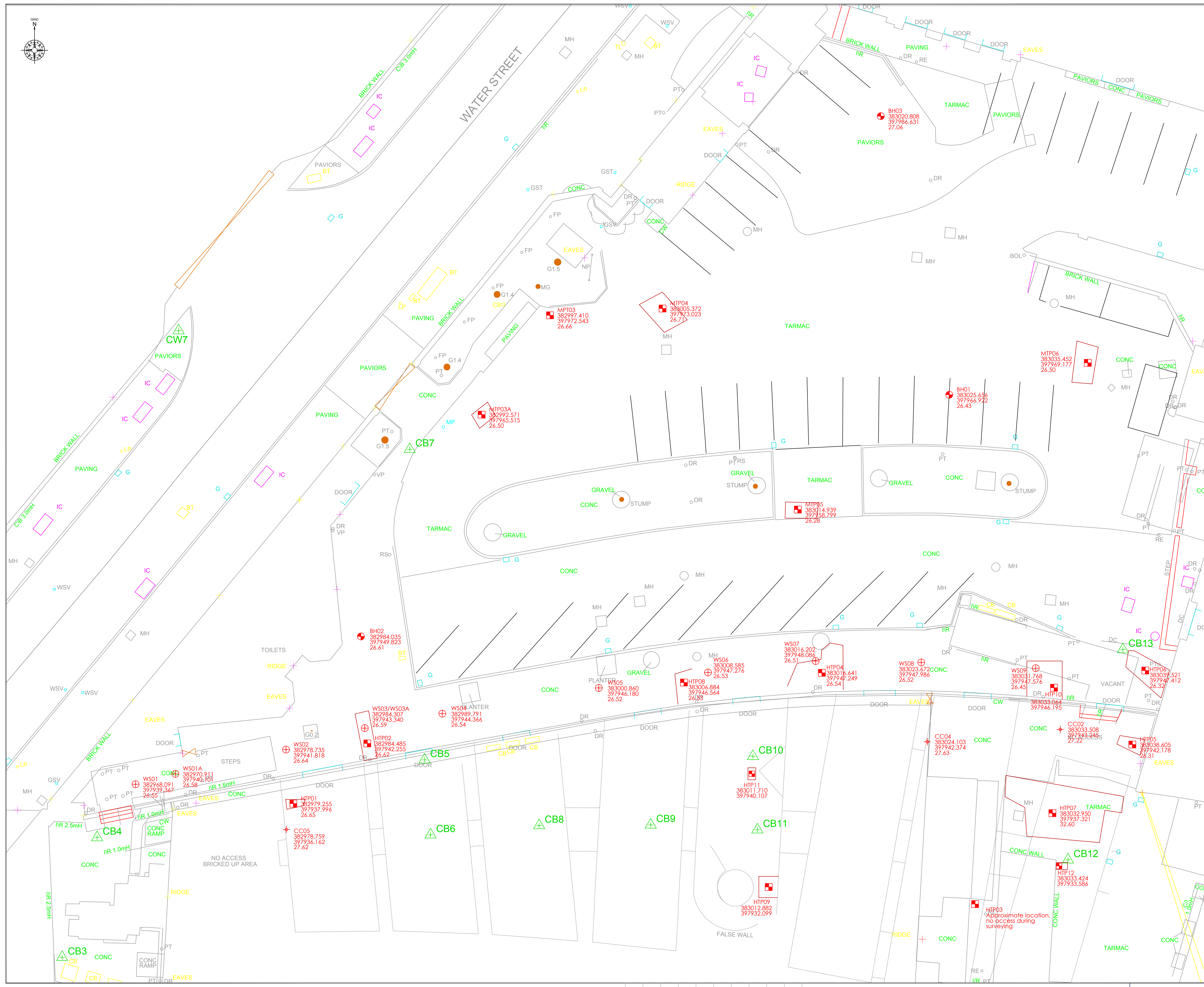
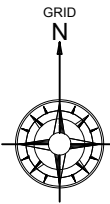
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Enclosure 3

Key:

-  Cable Percussive / Rotary Follow On Borehole
-  Machine Dug Trial Pit
-  Hand Dug Trial Pit: upper level (on top of St John's arches), to prove crown of arch
-  Hand Dug Trial Pit: lower level, to prove arch foundations
-  Window Sample Borehole
-  Proposed Building Footprint (approx.)
-  St John's Arches Extent (approx.)





CONTROL & DATUM INFORMATION

Co-ordinates and levels are based upon OSGB 1936 National Grid (OSGB36) and Ordnance Survey Datum Newlyn (ODN).

They are derived using realtime on site GPS survey, that utilises the National Grid Transformation OSTN15GB and the National Geoid Model OSGM15GB.

The data obtained for use in this drawing involved the use of realtime GPS survey and total station survey.

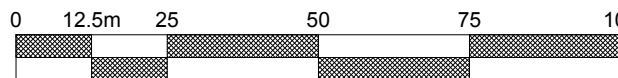
COORDINATES

Ground Investigation Co-ordinates (OSGM15GB-OSTN15GB)				
Reference	East	North	Elevation	Description
BH01	383025.656	397946.922	26.43	Borehole
BH02	382984.035	397949.823	26.61	Borehole
BH03	383026.868	397946.631	27.06	Borehole
CC02	383033.508	397943.245	27.22	Wall Core
CC04	383024.103	397942.374	27.63	Wall Core
CC05	382978.759	397936.162	27.62	Wall Core
HTP01	382979.255	397937.994	26.65	Trial Pit
HTP02	382984.485	397942.255	26.62	Trial Pit
HTP03	Undrains to survey			
HTP04	383006.864	397946.564	26.53	Trial Pit
HTP05	383038.605	397942.178	26.31	Trial Pit
HTP06	383030.521	397947.472	26.32	Trial Pit
HTP07	383032.950	397937.321	32.60	Trial Pit
HTP08	383016.641	397947.249	26.54	Trial Pit
HTP09	383012.882	397932.099		
HTP10	383033.064	397946.195		
HTP11	383011.710	397940.107		
HTP12	383033.424	397933.586		
MTP03	382997.410	397972.543	26.66	Trial Pit
MTP04	382992.371	397945.515	26.50	Trial Pit
MTP05	383005.372	397973.023	26.71	Trial Pit
MTP06	383014.939	397958.799	26.28	Trial Pit
MTP09	383035.452	397949.177	26.50	Trial Pit
WS01	382968.091	397939.367	26.55	Window Sample
WS01A	382970.911	397940.100	26.58	Window Sample
WS02	382978.735	397941.818	26.64	Window Sample
WS03/WS03A	382984.307	397943.340	26.59	Window Sample
WS04	382989.791	397944.366	26.54	Window Sample
WS05	383000.860	397946.180	26.52	Window Sample
WS06	383006.884	397946.564	26.53	Window Sample
WS07	383016.202	397948.086	26.51	Window Sample
WS08	383023.672	397947.186	26.52	Window Sample
WS09	383031.768	397947.516	26.45	Window Sample

LEGEND TO SYMBOLS

- Denotes Borehole Location
- Denotes Trial Pit Location
- Denotes Wall Core Location
- Denotes Window Sample Location

Scale: 1:125



Rev.	Drawn	Date	Checked	Approved	Details
R1	BS	JAN 2018	MS	MS	Issued

Survey Date:	-	Surveyor:	SOCOTEC	Drawn By:	BS
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Client:

MANCHESTER CITY COUNCIL

Contractor:

Infrastructure & Energy
Askern Road, Carrcroft
Doncaster DN6 8DQ
United Kingdom
www.socotec.co.uk
Tel: +44(0)1302 723456

Contract:

THE FACTORY MANCHESTER

DWG:

SITE PLAN
A7064-17

Original Sheet Size:	Scale:	Rev.:
A1	Horiz. 1:125 Vert.:	R1

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Enclosure 4

Soil Results Summary

Number of samples exceeding	Residential with Uptake	12
	Residential without Uptake	11
	Commercial	0

No. samples exceeding

Residential with uptake	Residential without Uptake	Commercial
1	1	
6	3	
1	1	
7	7	
2	2	
2	2	
1		
6	5	
6	5	
6	6	
1	1	
7	7	

No Tests	No <LOD	Min	Max	Location of Maximum
20	13	0.50	1.50	HTP12 0.8mbgl
20		1.90	49.00	HTP11 1mbgl
20	2	0.50	2.00	MTP03 0.9mbgl
20	3	0.21	1.15	HTP11 1mbgl
20		7.96	45.00	MTP04 0.5mbgl
14		0.30	0.30	MTP05 2.5mbgl
20		8.00	735.10	HTP11 1mbgl
20		17.30	577.20	HTP12 0.8mbgl
14	9	0.33	1.92	HTP12 0.8mbgl
6		0.50	0.52	BH05 1mbgl
20		7.05	52.20	MTP04 0.5mbgl
20	3	0.50	1.10	MTP03 0.5mbgl
20		38.61	358.10	WS9 2mbgl
20		15.00	1920.00	HTP11 1mbgl
19	19			
19	19			
19	18	0.01	0.01	MTP05 2.5mbgl
19	18	0.06	0.06	MTP05 2.5mbgl
19	19			
17	17			
20	20			
20	7	0.09	3.78	WS9 2mbgl
20	10	0.08	1.43	MTP03 0.5mbgl
20	6	0.09	6.20	HTP11 1mbgl
20	7	0.09	4.06	MTP03 0.5mbgl
20	3	0.10	33.50	HTP11 1mbgl
20	3	0.09	8.57	HTP11 1mbgl
20	2	0.10	52.60	HTP11 1mbgl
20	2	0.10	45.90	HTP11 1mbgl
20	6	0.09	27.70	HTP11 1mbgl
20	6	0.09	22.90	HTP11 1mbgl
20	4	0.10	25.70	HTP11 1mbgl
20	5	0.09	8.57	HTP11 1mbgl
20	5	0.09	23.00	HTP11 1mbgl
20	5	0.09	16.60	HTP11 1mbgl
20	7	0.09	3.10	HTP11 1mbgl
20	5	0.09	10.80	HTP11 1mbgl
20	10	1.57	287.82	HTP11 1mbgl
2	2			
2	2			
14	6	1.20	29.20	WS9 3.3mbgl
14	7	2.00	67.20	WS9 3.3mbgl
14	4	2.00	199.00	WS9 3.3mbgl
14	3	2.49	108.80	WS9 3.3mbgl
14	2	11.20	396.00	BH04 0.2mbgl
8	3	102.00	496.00	WS9 3.3mbgl
8	8			
8	7	5.74	5.74	WS9 2mbgl
8	3	7.90	23.40	WS9 3.3mbgl
8	3	13.00	136.00	MTP05 1mbgl
8	3	25.00	286.00	MTP05 1mbgl
8	3	89.50	443.00	MTP05 1mbgl
20		15.00	1920.00	HTP11 1mbgl

calculated SOM

8.178 Project: Factory Theatre

SOM used for threshold

1% Project Number034933

Date:

Oct-2018

N/A = no screening criteria available

Screening criteria: C4SL/S4UL				
		Residential with	Residential with	Commercial
Cyanide	mg/kg	4.6	760	16000
Arsenic	mg/kg	37	40	640
Barium	mg/kg	N/A	N/A	N/A
Beryllium	mg/kg	1.7	1.7	12
Boron	mg/kg	290	11000	240000
Cadmium	mg/kg	26	149	410
Chromium	mg/kg	910	910	8600
Chromium VI	mg/kg	21	21	49
Copper	mg/kg	2400	7100	68000
Lead	mg/kg	200	310	2330
Mercury (elemental)	mg/kg	1.2	1.2	58
Mercury (inorganic)	mg/kg	40	56	58
Nickel	mg/kg	130	180	980
Selenium	mg/kg	250	430	12000
Vanadium	mg/kg	410	1200	9000
Zinc	mg/kg	3700	40000	730000
TPH	mg/kg	490	490	38000
Benzene	mg/kg	0.087	0.38	27
Toluene	mg/kg	130	869	869
Ethyl Benzene	mg/kg	47	83	518
m/p Xylenes	mg/kg	56	79	576
o Xylenes	mg/kg	60	88	478
Xylenes	mg/kg	56	79	576
MTBE	mg/kg	N/A	N/A	N/A
Naphthalene	mg/kg	2.3	2.3	190
Acenaphthylene	mg/kg	170	2900	83000
Acenaphthene	mg/kg	210	3000	84000
Fluorene	mg/kg	170	2800	63000
Phenanthrene	mg/kg	95	1300	22000
Anthracene	mg/kg	2400	31000	520000
Fluoranthene	mg/kg	280	1500	23000
Pyrene	mg/kg	620	3700	54000
Benzo[a]anthracene	mg/kg	7.2	11	170
Chrysene	mg/kg	15	30	350
Benzo[b]fluoranthene	mg/kg	2.6	3.9	44
Benzo[k]fluoranthene	mg/kg	77	110	1200
Benzo[a]pyrene	mg/kg	2.2	3.2	35
Indeno[123-cd]pyrene	mg/kg	27	45	500
Dibenzo[ah]anthracene	mg/kg	0.24	0.31	3.5
Benzo[ghi]perylene	mg/kg	320	360	3900
Total USEPA 16 PAHs	mg/kg	N/A	N/A	N/A
Aliphatic C5 - C7	mg/kg	42	42	3200
Aliphatic C7 - C8	mg/kg	100	100	7800
Aliphatic C8 - C10	mg/kg	27	27	2000
Aliphatic C10 - C12	mg/kg	130	130	9700
Aliphatic C12 - C16	mg/kg	1100	1100	59000
Aliphatic C16 - C21	mg/kg	65000	65000	1600000
Aliphatic C21 - C35	mg/kg	65000	64000	1600000
Total Aliphatic	mg/kg	N/A	N/A	N/A
Aromatic C5 - C7	mg/kg	70	370	26000
Aromatic C7 - C8	mg/kg	130	860	56000
Aromatic C8 - C10	mg/kg	34	47	3500
Aromatic C10 - C12	mg/kg	74	250	16000
Aromatic C12 - C16	mg/kg	140	1800	36000
Aromatic C16 - C21	mg/kg	260	1900	28000
Aromatic C21 - C35	mg/kg	1100	1900	28000
Total Aromatic	mg/kg	1100	1900	28000
Total Aliphatic and Aromatic	mg/kg	490	490	38000

	MG / NG	MG	NG	MG	MG	MG	MG	MG	MG	MG	NG	MG	NG	MG	MG	MG	MG	MG	MG	MG	MG
	Sample ID	MTP05	MTP05	MTP03	MTP03	MTP04	BH01	WS1	WS6	WS7	WS8	WS9	WS9	HTP12	HTP11	BH04	BH04	BH05	BH05	TP01	TP01
	Depth	L	2.5	3.5	3.9	3.5	2.1	3.5	3.5	1.1	1.2	2	3.3	3.8	L	3.2	L	L	3	3	3.8
	Units																				
pH	pH units	7.6	7.6	8.6	8.5	8.7	8.5	11.8	11.1	9.3	8.3	7.7	7.8	8.5	8.1	8.8	8.4	8.6	8.6	9.8	8.8
SOM	%	8.59	1.24	21.8	14.9	17	25.9	0.72	0.31	2.44	2.58	4	0.9	25.9	25.2	1.75	1.41	5.41	0.64	2.2	0.67
Moisture	%	23.3	15.6	9.4	17.9	22.8	16.1	15.4	9.9	3.1	22.5	24.8	8.3	21.9	12.8	5.6	19	22.1	12.1	6.2	22
TOC	%	4.98	0.72	12.7	8.7	9.8	15	0.42	0.18	1.41	1.5	2.32	0.53	15	14.6	1.01	0.82	3.14	0.37	1.28	0.39
Asbestos Screen	D/ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Asbestos Quantification	%																				
Cyanide	mg/kg	<0.7	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.5	<0.6	<0.7	<0.6	1.5	<0.5	0.53	0.6	0.6	0.57	0.5	0.6
Arsenic	mg/kg	13	8.1	24.4	28.5	29.8	15	2.5	1.9	6.3	9.7	12.5	9.8	31.8	49	3	6.8	14.8	4.72	4.3	11.6
Barium	mg/kg																				
Beryllium	mg/kg																				
Boron	mg/kg	1.4	1.2	0.8	2	0.9	1.4	0.5	<0.5	<0.5	0.8	1	0.6	1.5	1.4	0.51	0.5	0.5	0.51	0.5	0.5
Cadmium	mg/kg	<0.21	<0.2	0.84	0.24	0.48	0.77	0.74	0.44	0.53	<0.2	0.89	0.22	0.42	1.15	0.582	0.21	0.4	0.205	0.54	0.25
Chromium	mg/kg	19.4	19.2	18	19.4	45	14.8	20.4	22.1	11.8	24.4	28.1	22.3	18.2	18.2	7.96	16	13	19.1	12.6	16.3
Chromium VI	mg/kg	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1						
Copper	mg/kg	124.8	27	133.4	68.4	108.4	69	10.1	8	38.9	29	130.4	24.7	249	735.1	15	16.9	44	15.81	26.1	18.1
Lead	mg/kg	127	24.9	253.8	169.1	267.7	178.1	39	21.3	99	318	359.7	32.4	577.2	235.1	187.59	39.7	140.4	20	40.4	17.3
Mercury (elemental)	mg/kg	<0.53	<0.53	0.65	0.64	0.73	<0.50	<0.5	<0.5	<0.5	<0.5	<0.53	<0.5	1.92	0.33						
Mercury (inorganic)	mg/kg															0.51	0.5	0.52	0.51	0.5	0.5
Nickel	mg/kg	23.9	15.4	42.1	33	52.2	32.5	16.7	18.3	9.6	15.3	23.5	25.3	36.4	46	7.05	10.9	17.5	19.1	12.4	16
Selenium	mg/kg	0.8	1	1.1	1	1	1.1	<0.5	<0.5	0.7	0.8	0.8	<0.5	0.6	1	0.51	0.5	0.6	0.51	0.5	0.7
Vanadium	mg/kg																				
Zinc	mg/kg	80	43	219.6	89.4	167.5	293.7	57	41.9	160.5	77.9	358.1	61.7	177	340.4	42.38	46.9	72.4	38.61	43.8	77.6
TPH	mg/kg	915	704	1140	74	109	411	22	16	513	15	315	561	387	1920	576	20	58	40	339	17
Benzene	mg/kg	<0.013	<0.013	<0.011	<0.012	<0.013	<0.012	<0.012	<0.011	<0.01	<0.013	<0.013		<10	<10	<0.011	<0.012	<0.013	<0.011	<0.011	<0.013
Toluene	mg/kg	<0.013	<0.013	<0.011	<0.012	<0.013	<0.012	<0.012	<0.011	<0.01	<0.013	<0.013		<10	<10	<0.011	<0.012	<0.013	<0.011	<0.011	<0.013
Ethyl Benzene	mg/kg	<0.013	0.01	<0.011	<0.012	<0.013	<0.012	<0.012	<0.011	<0.01	<0.013	<0.013		<10	<10	<0.011	<0.012	<0.013	<0.011	<0.011	<0.013
m/p Xylenes	mg/kg	<0.013	0.057	<0.023	<0.024	<0.026	<0.024	<0.022	<0.021	<0.026	<0.027		<20	<20	<0.021	<0.025	<0.026	<0.023	<0.021	<0.026	
o Xylenes	mg/kg	<0.013	<0.013	<0.011	<0.012	<0.013	<0.012	<0.012	<0.011	<0.01	<0.013	<0.013		<10	<10	<0.011	<0.012	<0.013	<0.011	<0.011	<0.013
Xylenes	mg/kg			<0.034	<0.037	<0.039	<0.036	<0.035	<0.033	<0.031	<0.039	<0.04		<30	<30	<0.032	<0.037	<0.039	<0.034	<0.032	<0.038
MTBE	mg/kg	<0.026	<0.025	<0.023	<0.024	<0.026	<0.024	<0.022	<0.021	<0.026	<0.027	<0.022	<20	<20	<0.021	<0.025	<0.026	<0.023	<0.021	<0.026	
Naphthalene	mg/kg	0.22	<0.10	2.81	<0.10	<0.10	<0.10	<0.09	<0.09	0.7	<0.10	3.78	0.36	1.11	0.87	1.29	0.1	0.1	0.09	1.51	0.1
Acenaphthylene	mg/kg	<0.10	<0.10	1.43	<0.10	<0.10	<0.10	<0.09	<0.09	0.12	<0.10	<0.11	<0.09	0.43	0.32	0.08	0.1	0.1	0.09	0.09	0.1
Acenaphthene	mg/kg	1.51	1.4	2.59	<0.10	<0.10	<0.10	<0.09	<0.09	1.31	<0.10	0.15	1.62	0.74	6.2	1.37	0.1	0.1	0.09	1.34	0.1
Fluorene	mg/kg	1.92	1	4.06	<0.10	<0.10	<0.10	<0.09	<0.09	1.5	<0.10	<0.11	0.41	0.82	3.58	1.21	0.1	0.1	0.09	1.06	0.1
Phenanthrene	mg/kg	10.9	5.38	29.6	0.3	0.58	1.11	<0.09	<0.09	11.2	<0.10	1.81	0.53	8.29	33.5	7.87	0.1	0.19	0.13	7.47	0.1
Anthracene	mg/kg	0.8	0.68	7.21	0.11	0.19	0.3	<0.09	<0.09	2.78	<0.10	0.43	0.38	2.01	8.57	2.55	0.1	0.1	0.09	1.74	0.1
Fluoranthene	mg/kg	4.26	2.75	24.2	0.76	0.87	1.13	<0.09	<0.09	9.93	0.1	1.22	1.81	9.44	52.6	8.39	0.1	0.3	0.13	6.71	0.1
Pyrene	mg/kg	2.82	2.08	24.5	1.01	1.05	1.3	<0.09	<0.09	9.55	0.1	1.14	3.16	9.68	45.9	7.87	0.1	0.28	0.13	6.2	0.1
Benzo[a]anthracene	mg/kg	<0.10	0.37	12.7	0.6	0.8	<0.10	<0.09	<0.09	5.31	<0.10	0.65	<0.09	5.68	27.7	3.67	0.1	0.17	0.09	2.91	0.1
Chrysene	mg/kg	<0.10	0.28	9.9	0.54	0.71	<0.10	<0.09	<0.09	4.53	<0.10	0.6	<0.09	4.4	22.9	4.05	0.1	0.18	0.09	3.25	0.1
Benzo[b]fluoranthene	mg/kg	0.12	<0.10	12.3	0.82	1.2	1.13	<0.09	<0.09	4.94	<0.10	0.9	0.26	5.1	25.7	4.06	0.1	0.21	0.1	3.06	0.1
Benzo[k]fluoranthene	mg/kg	<0.10	<0.10	3.62	0.35	0.49	0.43	<0.09	<0.09	1.52	<0.10	0.36	0.1	1.76	8.57	1.61	0.1	0.1	0.09	1.11	0.1
Benzo[a]pyrene	mg/kg	<0.10	<0.10	10.4	0.76	1.05	0.97	<0.09	<0.09	4.5	<0.10	0.85	0.21	5.35	23	3.65	0.1	0.17	0.09	2.62	0.1
Indeno[123-cd]pyrene	mg/kg	<0.10	<0.10	7.1	0.6	0.9	0.77	<0.09	<0.09	3.04	<0.10	0.92	0.1	2.98	16.6	2.57	0.1	0.1	0.09	1.73	0.1
Dibenzo[ah]anthracene	mg/kg	<0.10	<0.10	1.68	<0.10	0.16	0.17	<0.09	<0.09	0.73	<0.10	0.15	<0.09	0.64	3.1	0.58	0.1	0.1	0.09	0.41	0.1
Benzo[ghi]perylene	mg/kg	<0.10	<0.10	5.58	0.52	0.88	0.7	<0.09	<0.09	2.4	<0.10	0.92	0.1	2.15	10.8	2.2	0.1	0.12	0.09	1.57	0.1
Total USEPA 16 PAHs	mg/kg	<23.38	<14.76	159.67	<6.86	<9.27	<8.59	<1.51	<1.42	64.12	<1.70	<14.08	<9.42	60.15	287.82	53.05	1.58	2.41	1.57	42.8	1.64
Aliphatic C5 - C7	mg/kg	<0.3	<0.3																		
Aliphatic C7 - C8	mg/kg	<0.3	<0.3																		
Aliphatic C8 - C10	mg/kg	<5	1.2					<5	<4	<4	<5.21	<5	29.2			2	2	3	2	2	3
Aliphatic C10 - C12	mg/kg	<5	<5					<5	<4	<4	<5.21	<5	67.2			3.13	2	3	2	3.25	3
Aliphatic C12 - C16	mg/kg	27.2	29					<5	<4	10	<5.21	<5	199			21	2	4.44	2	17.5	3
Aliphatic C16 - C21	mg/kg	104.7	107.5					<5	<4	23	<5.21	31	108.8			77.1	2.49	14	5.42	66	3
Aliphatic C21 - C35	mg/kg	233	157					11.2	<9.72	88.2	<11.42	68.4	88.9			396	14.6	35.7	30.4	232	11.8
Total Aliphatic	mg/kg	369	297					<24	<22	128	<26.1	102	496								
Aromatic C5 - C7	mg/kg																				
Aromatic C7 - C8	mg/kg																				
Aromatic C8 - C10	mg/kg	<5	<5					<5	<4	<4	<5	<5	<4								
Aromatic C10 - C12	mg/kg	<5	<5					<5	<4	<4	<5	5.74	<4								
Aromatic C12 - C16	mg/kg	15.4	15.7																		

Enclosure 5

The Factory, Manchester : Groundwater contamination testing results assessment

		Sample Identity		Minimum values	Maximum values	UK Drinking Water Standards (The Water Supply (Water Quality) Regulations 2000	Other Thresholds
		Depth					
		Sample Type					
		Sampling Date					
Determinand	Method	Units					
Metals							
Arsenic		µg/l	<1	1	1	10	50 ⁽¹⁾
Cadmium		µg/l	0.1	<0.1	0.1	5	-
Chromium		µg/l	<1	9	9	50	5 ⁽¹⁾
Copper		µg/l	9	3	3	2000	1 ⁽¹⁾
Lead		µg/l	4	<1	4	25	4 ⁽¹⁾
Mercury		µg/l	<0.1	0.6	0.6	1	1 ⁽¹⁾
Nickel		µg/l	3	12	3	20	50 ⁽¹⁾
Selenium		µg/l	<1	2	2	10	-
Zinc		µg/l	22	3	3	3000 **	8 ⁽¹⁾
Barium		µg/l				100 **	-
Antimony		µg/l	<1	1	1	5	-
Molybdenum		µg/l				-	-
Boron (w)		µg/l	20	20	20	1000	2000 ⁽¹⁾
Other Determinands							
Sulphate as SO4		µg/l	23100	56000	23100	250000	400000 *
Phenol Index		µg/l	<0.5	0.9	0.9	1 **	30 *
pH (pH Units)		pH units	7.2	7.4	7.2	-	6<pH<9 ⁽¹⁾
Cyanide (total) (w)		µg/l	<20	<20		50	-
Sulphide (w)		µg/l	<20	<0.02		-	-
Petroleum Hydrocarbons							
TPH (C10-C40)		µg/l	590	14000	590	-	-
Polycyclic Aromatic Hydrocarbons							
Naphthalene		µg/l	<0.02	<0.400	0	-	10 ⁽¹⁾
Acenaphthylene		µg/l	<0.01	<0.200	0	-	-
Acenaphthene		µg/l	0.057	<0.200	0.057	-	-
Fluorene		µg/l	0.019	<0.200	0.019	-	-
Phenanthrene		µg/l	0.155	<0.200	0.155	-	-
Anthracene		µg/l	0.032	<0.200	0.032	-	-
Fluoranthene		µg/l	0.334	<0.200	0.334	-	-
Pyrene		µg/l	0.326	<0.200	0.326	-	-
Benzo [a] anthracene		µg/l	0.164	<0.200	0.164	-	-
Chrysene		µg/l	0.225	<0.200	0.225	-	-
Benzo [a] pyrene		µg/l	0.178	<0.200	0.178	0.01	-
Dibenzo [ah] anthracene		µg/l	0.033	<0.200	0.033	-	-
Benzo [b] fluoranthene		µg/l	0.243	<0.200	0.243	-	-
Benzo [k] fluoranthene		µg/l	0.086	<0.200	0.086	-	-
Indeno [123-cd] pyrene		µg/l	0.137	<0.200	0.137	-	-
Benzo [ghi] perylene		µg/l	0.13	<0.200	0.13	-	-
Total PAH		µg/l	<2.149	<3.400	0	-	10 ⁽¹⁾
Classification Tests							
Total Dissolved Solids		mg/l			0	-	400000 ⁽²⁾
Dissolved Organic Carbon		mg/l	11	65	11	-	50000 ⁽²⁾
Conductivity (µS/cm)		µS/cm	249	500	249	2500	-
Chloride		mg/l	10	42	10	250	-
Fluoride		mg/l	0.1	0.4	0.1	1.5	-

Between criteria - No further consideration

GENERAL NOTES:
(1) Freshwater Environmental Quality Standard. For hardness-related determinands, worse-case hardness band adopted 0 - 50 mg/l CaCO3
(2) Based on Environment Agency 'Guidance on Sampling and Testing of Wastes to meet Landfill Acceptance Procedures' (2005, version 1) Inert waste criteria.
*EA non-statutory (operational)
**From The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996 (DW-1)

Project name	The Factory, Manchester
Report title	Land Contamination Summary and Outline Remediation Strategy
Table title	Contamination End Use Assessment - Groundwater results
Date: October 2018	Job No: 034933

The Factory, Manchester : Leachate contamination testing results assessment

		Sample Identity	MTP03	MTP05	WS09	HTP 12	HTP11	BH04	BH04	BH05	BH05	TP01	TP01	Minimum values	Maximum values	UK Drinking Water Standards (The Water Supply (Water Quality) Regulations 2000	Other Thresholds
		Depth	0.50	1.00	3.30	0.80	1.00	0.20	1.00	1.00	3.00	0.00	0.80				
		Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL				
		Material	MG	MG	SAND	MG	MG	MG	MG	MG	MG	MG	MG				
Determinand	Method	Units															
Metals																	
Arsenic		µg/l	5	3	<1	4	2	1	1	1	1	1	1	1	5	10	50 ⁽¹⁾
Cadmium		µg/l	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	5	-
Chromium		µg/l	12	1	<1	<1	<1	6	1	1	1	9	1	1	12	50	5 ⁽¹⁾
Copper		µg/l	7	15	30	13	3	15	5	2	3	8	2	2	30	2000	1 ⁽¹⁾
Lead		µg/l	1	11	<1	18	<1	1	3	2	1	1	1	1	18	25	4 ⁽¹⁾
Mercury		µg/l	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1	1 ⁽¹⁾
Nickel		µg/l	<1	1	<1	1	1	1	1	1	1	2	1	1	5	20	50 ⁽¹⁾
Selenium		µg/l	1	1	<1	1	<1	2	1	1	1	2	1	1	2	10	-
Zinc		µg/l	34	107	66	12	4	4	61	43	24	9	90	4	107	3000 **	8 ⁽¹⁾
Barium		µg/l	130	170	130	20	20	50	70	70	60	60	<10	20	170	100 **	-
Antimony		µg/l	13	2	1	1	4	<1	<1	<1	<1	<1	<1	1	13	5	-
Molybdenum		µg/l	70	6	4	16	11	60	1	38	29	65	1	1	70	-	-
Boron (w)		µg/l														1000	2000 ⁽¹⁾
Other Determinands																	
Sulphate as SO4		mg/l	77.3	78.9	542	73	134	62	34	14	12	67	16	12	542	250	400 *
Phenol Index		mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.28	<0.05	0.28	0.28	1 **	30 *
pH (pH Units)		pH units	7.8	7.7	7.6	7.5	7.4	9.3	7.8	7.6	7.6	10.4	7.9	7.4	10.4	-	6<pH<9 ⁽¹⁾
Cyanide (total) (w)		µg/l														50	-
Sulphide (w)		µg/l														-	-
Petroluem Hydrocarbons																	
TPH (C10-C40)		µg/l	30	250										30	250	-	-
Polycyclic Aromatic Hydrocarbons																	
Naphthalene		µg/l	0.051	<0.02										0.051	0.051	-	10 ⁽¹⁾
Acenaphthylene		µg/l	<0.01	0.127										0.127	0.127	-	-
Acenaphthene		µg/l	0.036	0.322										0.036	0.322	-	-
Fluorene		µg/l	<0.01	0.027										0.027	0.027	-	-
Phenanthrene		µg/l	0.035	0.062										0.035	0.062	-	-
Anthracene		µg/l	<0.01	0.06										0.06	0.06	-	-
Fluoranthene		µg/l	0.024	0.273										0.024	0.273	-	-
Pyrene		µg/l	0.018	0.16										0.018	0.16	-	-
Benzo [a] anthracene		µg/l	0.017	0.055										0.017	0.055	-	-
Chrysene		µg/l	<0.01	0.045										0.045	0.045	-	-
Benzo [a] pyrene		µg/l	0.01	0.014										0.01	0.014	0.01	-
Dibenzo [ah] anthracene		µg/l	0.01	<0.01										0.01	0.01	-	-
Benzo [b] fluoranthene		µg/l	0.015	0.025										0.015	0.025	-	-
Benzo [k] fluoranthene		µg/l	<0.01	<0.01										0	0	-	-
Indeno [123-cd] pyrene		µg/l	0.01	<0.01										0.01	0.01	-	-
Benzo [ghi] perylene		µg/l	0.014	<0.01										0.014	0.014	-	-
Total PAH		µg/l	<0.29	<1.23										0	0	-	10 ⁽¹⁾
Classification Tests																	
Total Dissolved Solids		mg/l	306	367	787	308	415	200	300	300	300	300	200	200	787	-	400000 ⁽²⁾
Dissolved Organic Carbon		mg/l	9.9	22	10	2.5	2.8	12	20	4.9	4.8	6.7	6.4	2.5	22	-	50000 ⁽²⁾
Conductivity (µS/cm)		µS/cm	392	471	1010	395	532	300	400	300	300	400	300	300	1010	2500	-
Chloride		mg/l	8	32	26	5	6	14	9	32	33	40	5	5	40	250	-
Fluoride		mg/l	2	0.4	0.5	0.5	0.7	0.4	0.1	0.7	0.7	0.3	0.1	0.1	2	1.5	-

Between criteria - No further consideration

GENERAL NOTES:

(1) Freshwater Environmental Quality Standard. For hardness-related determinands, worse-case hardness band adopted 0 - 50 mg/l CaCO3

(2) Based on Environment Agency 'Guidance on Sampling and Testing of Wastes to meet Landfill Acceptance Procedures' (2005, version 1) Inert waste criteria.

*EA non-statutory

(operational)

**From The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996 (DW-1)

2:1 Leachate results used

Project name	The Factory, Manchester
Report title	Land Contamination Summary and Outline Remediation Strategy
Table title	Contamination End Use Assessment - Leachate results
Date: October 2018	Job No: 034933

Enclosure 6

GUIDANCE:

Assessment based on guidance published in CIRIA C665 (2007) 'Assessing risks posed by hazardous ground gases to buildings.'

Information from Table 8.5 of CIRIA C665

Characteristic Situation 1 conditions

Gas screening value (CH4 or CO2) < 0.07 l/h

Typically methane < 1 % by volume

Typically carbon dioxide < 5% by volume

Characteristic Situation 2 conditions

Gas screening value (CH4 or CO2) < 0.7 l/h

Borehole air flow rate < 70 l/h

Characteristic Situation 3 conditions

Gas screening value (CH4 or CO2) < 3.5 l/h

Key for shading

	CO ₂ > 5% in air
	CH ₄ > 1 % in air
	Gas screening value > or = 0.07 l/h
	Gas screening value > or = 0.7 l/h

NOTES:

Maximum concentration and flow values are assessed below, using peak values for CO2 % (minimum values for oxygen).

Where no detectable flow is recorded the limit of detection of the instrument is used, following Note 5 of Table 8.5. CIRIA C665

Exploratory Hole	Location	Installation response zone stratum	Depth range (m BGL)	Monitored by	Date	Gas measurements						CO ₂ analysis		CH ₄ analysis		Characteristic
						Flow Rate (l/hr)	Atmos Pres (mb)	O ₂ (%) air	CO ₂ (%) air	CH ₄ (%) air	H ₂ S (ppm)	CO ₂ as fraction	Gas screening value CO ₂ (l/hr)	CH ₄ as fraction	Gas screening value CH ₄ (l/hr)	Situation
BH01 (50 mm)		SAND	2.00 - 4.00	ESG	28.7.16	No Data - damage to installation						No Data - damage to installation				
					11.8.16											
					25.8.16											
					22.9.16	No Access (parked vehicles)						No Access (parked vehicles)				
					27.9.16	0.1	1008	20.9	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					20.10.16	0.0	1021	20.1	0.2	0.0	0.0	0.002	0.000	0.000	0.000	1
BH02 (50 mm)		MG	1.00 - 1.50	ESG	28.7.16	0.0	1008	20.8	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					11.8.16	0.0	1017	20.9	0.2	0.0	0.0	0.002	0.000	0.000	0.000	1
					25.8.16	0.0	1014	20.8	0.1	0.0	0.0	0.001	0.000	0.000	0.000	1
					22.9.16	No Access (parked vehicles)						No Access (parked vehicles)				
					27.9.16	0.0	1008	20.2	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					20.10.16	0.0	1020	20.7	0.1	0.0	0.0	0.001	0.000	0.000	0.000	1
BH03 (50 mm)		MG	1.50 - 3.00	ESG	28.7.16	0.0	1008	21.2	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					11.8.16	No Data						No Data				
					25.8.16	0.0	1014	21.0	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					22.9.16	0.0	1015	20.6	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					27.9.16	0.0	1008	20.6	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					20.10.16	0.0	1021	20.5	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
BH04	NR Investigation	Sand / Gravel / Clay	1.00 - 3.00	ESG	2.2.17	No Data						No Data				
					8.3.17	0	1011	21.1	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					14.3.17	0.0	1030	21.4	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					22.3.17	0.0	1004	6.1	3.7	0.0	0.0	0.037	0.004	0.000	0.000	1
					30.3.17	0.0	1014	19.0	0.1	0.0	0.0	0.001	0.000	0.000	0.000	1
BH05	NR Investigation	Sandstone	4.00 - 10.00	ESG	2.2.17	0.1	985	21.4	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					8.3.17	0	1011	21.1	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					14.3.17	0	1030	21.3	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					22.3.17	0.0	1004	21.6	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					30.3.17	0.0	1014	21.2	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
												0.000	0.000	0.000	0.000	1
WS02		MG	1.00 - 2.00	ESG	28.7.16	0.1	1008	20.0	0.3	0.0	0.0	0.003	0.000	0.000	0.000	1
					11.8.16	0.0	1017	21.2	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					25.8.16	0.0	1014	21.1	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					22.9.16	No Access (parked vehicles)						No Access (parked vehicles)				
					27.9.16	-0.1	1008	20.8	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
WS06		MG	1.00 - 2.00	ESG	20.10.16	0.0	1020	20.7	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					28.7.16	0.1	1008	19.7	0.6	0.0	0.0	0.006	0.001	0.000	0.000	1
					11.8.16	0.0	1017	20.9	0.1	0.0	0.0	0.001	0.000	0.000	0.000	1
					25.8.16	0.1	1014	19.7	0.8	0.0	0.0	0.008	0.001	0.000	0.000	1
					22.9.16	0.0	1015	19.6	1.1	0.0	0.0	0.011	0.001	0.000	0.000	1
					27.9.16	0.0	1008	20.9	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
WS08		SAND	2.00 - 3.50	ESG	20.10.16	0.0	10212	20.2	0.2	0.0	0.0	0.002	0.000	0.000	0.000	1
					28.7.16	0.0	1008	20.7	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					11.8.16	0.0	1017	21.1	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					25.8.16	0.0	1014	21.2	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					22.9.16	0.0	1015	20.7	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					27.9.16	0.0	1008	20.8	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					20.10.16	0.0	1021	20.6	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1
					Max reading	0.1	10212	21.6	3.7	0.0	0.0	0.037	0.004	0.000	0.000	1
					Min reading	-0.1	985	6.1	0.0	0.0	0.0	0.000	0.000	0.000	0.000	1

BUROHAPPOLD
ENGINEERING

Enclosure 7

Factory Theatre

Excavation and Filling Specification – REM Clauses

034933

1 October 2018

Revision 00 Draft – Subject to Local Authority Approval

Revision	Description	Issued by	Date	Checked
00	REM Clauses Draft – Subject to Local Authority Approval	GM	01/10/18	COH

O:\034933 The Factory, Manchester\F9 Ground Engineering - Site Investigation\05 Specifications\Earthworks\S181001_REM Clauses.docx

This report has been prepared for the sole benefit, use and information of **Manchester City Council** for the purposes set out in the report or instructions commissioning it. The liability of Buro Happold Limited in respect of the information contained in the report will not extend to any third party.

It should be noted that at the time of issue this document is Preliminary and those clauses related to contaminated land detailed in this specification are subject to Local Authority approval.

author **George Mitchell**

date **1st October 2018**

approved **Chris O'Hara**

signature



date **1st October 2018**

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BH D20 EXCAVATING AND FILLING

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100 General Requirements/Information

TO BE READ WITH THE PRELIMINARIES/GENERAL CONDITIONS

100* General

- The Main Contractors (MC) attention is drawn to the nature and extent of material on site. It is anticipated that some proportion of the materials excavated may be suitable for re-use as part of the permanent works construction. The MC shall be responsible for the selection, separation and processing as appropriate for re-use in the permanent works or temporary works as appropriate. The MC is also responsible for the disposal of all unsuitable materials.
- The MC is responsible for the inspection and acceptance of materials, contract drawings and workmanship.
- The works to be executed as specified and in accordance with good practice. No changes are permitted without written approval.
- The MC is to review the detail of this specification and consider the times required for testing, preparation of samples and production of fabrication drawings. This information to be included in the contract programme.
- The MC to include in the price as necessary, the costs for all necessary test pieces, testing, trials and attendance to demonstrate compliance with the requirements of this Specification.
- All publications referred to hereafter are to be the issues current at the date of invitation to tender.
- The following materials are specifically precluded from all specifications pertaining to works carried out under this contract:-
 - a) High alumina cement or concrete.
 - b) Woodwool slabs as permanent shuttering.
 - c) Calcium chloride in admixtures for use in reinforced concrete.
 - d) Asbestos in any form.
 - e) Sea dredged aggregates for use in reinforced concrete unless otherwise instructed by the client.
 - f) Calcium silicate bricks.
 - g) Urea formaldehyde.

The MC is required to ensure that all efforts be made, and using the best information available to him, that these substances are not incorporated into the Works. In the event that he is unwilling or unable to comply with these requirements he is to submit in writing in sufficient time for consultations to be held and alternatives to be considered.

110 The Site

181* Japanese Knotweed: None envisaged.

Japanese Knotweed is an invasive, non-native plant species. The Wildlife and Countryside Act (1981) made it illegal to spread Japanese Knotweed and guidance on the management of Japanese Knotweed on development sites is given in the Environment Agency's (EA) code of practice, 2001.

The MC is responsible for ensuring that Japanese Knotweed is not spread across the site. There are a variety of methods available for treating infested areas including spraying with herbicides or digging, spraying and removal to landfill. The Client is responsible for selecting a method of treatment and obtaining approval for the selected method from the Local Authority.

205 Excavating

208* Excavation of Chemically Contaminated Materials: Where contaminated materials are to be excavated the MC shall be responsible for all Health and Safety precautions required to protect the site personnel and the local environment and shall provide method statements covering these issues.

It is worthy of note that no asbestos or fibres were recorded in the material recorded during the ESG 2016 and 2017 investigations. However, due to the historical site uses, the presence of such material within the Made Ground cannot be ruled out and vigilance during site works will be required.

225* Handling Topsoil: The following requirements shall be complied with:

- Where aggressive weeds as included in the Weeds Act – Section 2 or the Wildlife and Countryside Act – Schedule 9 – Part 2 are encountered, instructions should be obtained prior to moving topsoil.
- Earthmoving equipment shall be selected and used to minimize disturbance, trafficking and compaction of topsoil.
- On no account should topsoil be mixed with:
 - a) Subsoil, stone, hardcore, rubbish or material from demolition work.
 - b) Oil, fuel, cement or other substances harmful to plant growth.
 - c) Other grades of topsoil.
- Multiple handling should be kept to a minimum. Where practicable topsoil should be used immediately after stripping.
- Topsoil handling should be undertaken in the driest condition possible. It should not be handled during or after heavy rainfall or when it is wetter than the plastic limit defined by BS 3882 Annex N2.

320* Recorded Features: Break out old foundations, beds, drains, etc. where and to the extent stated on the drawings. Seal off drain ends, remove contaminated earth and disinfect as required by local authority. Backfill as specified on the drawings.

Due to the site having a rich industrial history, a number of obstructions are likely to be present within the ground. It is worthy of note that during the ESG 2016 ground investigation, a number of obstructions were encountered.

It is worthy of note that no asbestos or fibres were recorded in the material recorded during the ESG 2016 and 2017 investigations. However, due to the historical site uses, the presence of such material within the Made Ground cannot be ruled out and vigilance will be required.

330* Unrecorded Features: Where old foundations, beds, basements, filling, tanks, service pipes, drains, hotspots of soil contamination etc. not shown on the drawings are encountered, obtain instructions before proceeding. See also Clause 406.

400 Disposal of Materials

400* General: 'Suitable material' comprises all that which is acceptable to the MC in accordance with this specification. "Unsuitable material" is defined in Clause 510.

- No excavated suitable material to be removed from the site unless this suits the MC's operational procedure and then the MC is to make good any subsequent deficit at his own expense.
- Where the excavation reveals a combination of suitable and unsuitable materials the MC is to propose the methods by which suitable material may be excavated without contamination by unsuitable materials.

405* Contaminated Soils: Where surplus soils for disposal are chemically contaminated, the MC shall be responsible for disposal of these materials at a suitably licensed landfill and all associated issues such as consignment notes and Environmental Protection Act Section 34 Duty of Care documentation. The MC shall be deemed the producer and holder of the waste and shall be responsible for classifying the materials for disposal to landfill. The MC shall be responsible for carrying out any further soil contaminant testing and Waste Acceptance Criteria testing to enable classification of the waste in accordance with current regulatory guidance and the requirements of the receiving landfill.

The MC shall prepare an earthworks spoil management strategy which shall take account of the range of waste types expected to be encountered and set out any proposed sampling and testing regime for waste classification. The strategy shall include consideration of stockpile management, measures and working methods to protect site worker health and safety and the environment, and working methods to minimize the degree of intermixing of wastes of different classes and to minimize disposal costs.

406* Unrecorded Contaminated Soils: Where materials that appear to be contaminated (either visually or on the basis of odour) are encountered during the excavation works the MC shall be responsible for carrying out laboratory testing to enable the materials to be classified for hazard assessment and waste disposal purposes, for disposal to suitably licensed tip as appropriate, and all associated issues such as consignment notes and Environmental Protection Act Section 34 Duty of Care documentation.

500 Filling

510* Unsuitable Materials:

- Do not import or use fill materials which would, either in themselves or in combination with other materials or ground water, give rise to a health hazard, damage to building structures or instability in the filling.
- **Site won** Fill materials must not contain any contaminant in the suite listed below that is in excess of its Specified Trigger Concentration:

Determinand	Soil Concentration	Soil Leachate Concentration
Arsenic	640 mg/kg	-
Cadmium	410 mg/kg	-
Chromium (total)	8,600 mg/kg	-
Chromium (VI)	49 mg/kg	-
Lead	2,330 mg/kg	-
Mercury (inorganic)	58 mg/kg	-
Selenium	12,000 mg/kg	-
Copper	68,000 mg/kg	-
Nickel	980 mg/kg	-
Zinc	730,000 mg/kg	-
TPH	See Table A1	-
Polycyclic Aromatic Hydrocarbons (USEPA 16)	See Table A2	-
Phenol Index	1,300 mg/kg	-
Cyanide	16,000 mg/kg	-
pH	5<pH<9	-
Asbestos	<0.1%	-

Note 1: Values used are all C4SL's or S4UL's (Commercial) with the exception of cyanide (BH Generic Assessment Criteria - GAC).

- **Imported fill** materials must not contain any contaminant in the suite listed below that is in excess of its Specified Trigger Concentration:

Determinand	Soil Concentration	Soil Leachate Concentration
Arsenic	40 mg/kg	-
Cadmium	149 mg/kg	-
Chromium (total)	910 mg/kg	-
Chromium (VI)	21 mg/kg	-
Lead	310 mg/kg	-
Mercury (inorganic)	56 mg/kg	-
Selenium	430 mg/kg	-
Copper	7,100 mg/kg	-
Nickel	180 mg/kg	-
Zinc	40,000 mg/kg	-
TPH [See Note 1]	See Table A1	-
Polycyclic Aromatic Hydrocarbons (USEPA 16)	See Table A2	-
Phenol Index	1,200 mg/kg	-
Cyanide	760 mg/kg	-
pH	5 < pH < 9	-
Asbestos	<0.001%	-

Note 1: Values used are all C4SL's or S4UL's (residential without plant uptake) with the exception of cyanide (BH Generic Assessment Criteria - GAC).

- Any materials arising or imported that appear suspect in terms of contamination based on either appearance or smell shall be stockpiled separately and tested for the contaminant suite listed above in addition to any other appropriate contaminant as indicated by appearance or by smell and accepted into the Works or disposed of off site as appropriate.
- Soluble sulphate content (SO₄) of imported materials for filling under concrete slabs or within 1 m of substructures must not exceed 1.2 g/litre when tested BS 1377:Part 3, Clause 5 using a 2:1 water-soil extract.
- Other unsuitable materials include: material from marshes or bogs, peat, logs, stumps, slurry, mud and perishable material, material susceptible to spontaneous combustion, material in a frozen condition, clays of liquid limit exceeding 80% and/or plasticity index exceeding 55, material with excessive moisture content.
- See also Clause 100.

Table A1. Threshold concentrations for risk banded hydrocarbons and BTEX (SOM 1%).

Determinand		Site Won	Imported
Aliphatic	EC5 – EC7	3,200 mg/kg	42 mg/kg
	EC7 – EC8	7,800 mg/kg	100 mg/kg
	EC8 – EC10	2,000 mg/kg	27 mg/kg
	EC10 – EC12	9,700 mg/kg	130 mg/kg
	EC12 – EC16	59,000 mg/kg	1,100 mg/kg
	EC16 – EC35	1,600,000 mg/kg	1,900 mg/kg
Aromatic	EC5 – EC7	26,000 mg/kg	370 mg/kg
	EC7 – EC8	56,000 mg/kg	860 mg/kg
	EC8 – EC10	3,500 mg/kg	47 mg/kg
	EC10 – EC12	16,000 mg/kg	250 mg/kg
	EC12 – EC16	36,000 mg/kg	1,800 mg/kg
	EC16 – EC21	28,000 mg/kg	1,900 mg/kg
	EC21 – EC35	28,000 mg/kg	1,900 mg/kg
Benzene		27 mg/kg	0.38 mg/kg
Ethylbenzene		518 mg/kg	83 mg/kg
Toluene		869 mg/kg	880 mg/kg
Xylenes		576 mg/kg	79 mg/kg

Note 1: Site won - Values used are S4UL's (Commercial).

Note 2: Imported - Values used are S4UL's (Residential without Plant Uptake) with some reductions to TPH fractions.

Table A2. Threshold concentrations for Poly Aromatic Hydrocarbons (USEPA 16)

Determinand	Site Won	Imported
Naphthalene	190 mg/kg	2.3 mg/kg
Acenaphthylene	83,000 mg/kg	2,900 mg/kg
Acenaphthene	84,000 mg/kg	3,000 mg/kg
Fluorene	63,000 mg/kg	2,800 mg/kg
Phenanthrene	22,000 mg/kg	1,300 mg/kg
Anthracene	520,000 mg/kg	31,000 mg/kg
Fluoranthene	23,000 mg/kg	1,500 mg/kg
Pyrene	54,000 mg/kg	3,700 mg/kg
Benzo(a)anthracene	170 mg/kg	11 mg/kg
Chrysene	350 mg/kg	30 mg/kg
Benzo(b)fluoranthene	44 mg/kg	3.9 mg/kg
Benzo(k)fluoranthene	1,200 mg/kg	110 mg/kg
Benzo(a)pyrene	35 mg/kg	3.2 mg/kg
Indeno(123-cd)pyrene	500 mg/kg	45 mg/kg
Dibenzo(ah)anthracene	3.5 mg/kg	0.31 mg/kg
Benzo(ghi)perylene	3,900 mg/kg	360 mg/kg

Note 1: Site won - Values used are S4UL's (Commercial).

Note 2: Imported - Values used are S4UL's (Residential without Plant Uptake).

605 Acceptance of Suitable Fill

605 Acceptance of Suitable Fill

For all imported fill from an unknown, mixed or brownfield source, testing shall be carried out to demonstrate that no contaminant listed in the suite given in Clause 510 is in excess of its Trigger Concentration. This testing shall be carried out at a rate of 1 test per 50 m³ of placed fill material.

For all naturally site won derived as-dug soils or imported soils from a Greenfield source, testing shall be carried out to demonstrate that no contaminant listed in the suite given in Clause 510 is in excess of its Trigger Concentration. This testing shall be carried out at a rate of 1 test per 200 m³ of placed fill material.

In addition, any materials arising or imported that appear suspect in terms of contamination based on either appearance or smell shall be stockpiled separately and tested for the contaminant suite listed in Clause 510 in addition to any other appropriate contaminant as indicated by appearance or by smell and either accepted into the Works or disposed of off-site as appropriate.

During placement of **General Fill** the MC is also required to provide daily records of testing of the material placed to show compliance with the Specification. The minimum requirements are:

Grading (BS1377: Part 2, Method 9.2): At least once a day or one test for every 500 m³ placed.

Moisture Content and undrained remoulded shear strength (cohesive materials) (BS1377: Part 2, Method 3.2; and Part 7, Method 8): Three times a day or one test for every 200 m³ placed.

Plasticity Tests (BS1377: Part 2, Methods 4.3 and 5): One test per day for each source or for every 500 m³ placed.

During placement of **Structural Fill** the MC is also required to provide daily records of testing of the material placed to show compliance with the Specification. The minimum requirements are:

Grading (BS1377: Part 2, Method 9.2): At least once a day or one test for every 50 m³ placed.

Moisture Content and undrained remoulded shear strength (cohesive materials) (BS1377: Part 2, Method 3.2; and Part 7, Method 8): Three times a day or one test for every 20 m³ placed.

Plasticity Tests (BS1377: Part 2, Methods 4.3 and 5): One test per day for each source or for every 50 m³ placed.

Los Angeles Test (BS EN 1097-2): One test per source and for every 100 m³ placed.

End product (BS1377: Part 9, Method 2.2): One sand replacement density test for each compacted layer or each 20 m³ placed.

Note: For each element cited above the option giving the greatest number of tests shall apply.

610* General Landscape Filling:

Definition: Fill to soft landscape areas only (excluding sports pitches).

- Materials arising from the excavations or imported, but excluding unsuitable materials as defined in Clause 510, with a maximum particle size of 150 mm.
- Lay in layers not more than 200 mm thick and consolidate each layer with the earthmoving plant.

630 Compacted Structural Filling

660 Deterioration of Fill Materials:

If the material to be deposited as fill subsequently reaches a condition where it cannot be compacted to the requirements of this specification the MC shall:

- make good by removing the material from site until it is in a suitable condition for reuse and/or replace with suitable material, or
- make good the material by mechanical or chemical means, or
- cease work until the physical condition of the material is such that it can be compacted as described in this specification.

800 Topsoil Areas

850* Contamination:

Do not use topsoil contaminated with subsoil, rubbish, oil-based products or other materials toxic to plant life. Dispose of contaminated topsoil as instructed.

Imported topsoil for use as fill to the top metre (if required) on the site will be tested for the contaminant suite listed below to ensure that contaminant threshold levels are not exceeded.

Site won topsoil for use as fill to the top metre shall also be tested for the contaminant suite defined below to ensure that contaminant threshold levels are not exceeded.

Maximum permissible contaminant concentrations in **imported and site won topsoil** (soil concentrations only will be determined):

Determinand	Soil Concentration	Soil Leachate Concentration
Arsenic	37 mg/kg	Not required
Cadmium	26 mg/kg	Not required
Chromium (total)	910 mg/kg	Not required
Chromium (VI)	21 mg/kg	Not required
Lead	200 mg/kg	Not required
Mercury (inorganic)	40 mg/kg	Not required
Selenium	250 mg/kg	Not required
Copper	2,400 mg/kg	Not required
Nickel	130 mg/kg	Not required
Zinc	3,700 mg/kg	Not required
TPH {See Note 1}	100 mg/kg	Not required
Polycyclic Aromatic Hydrocarbons (USEPA 16) And BTEX	See Note 2	Not required
Phenol Index	380 mg/kg	Not required
Cyanide	4.6 mg/kg	Not required
pH	5<pH<9	Not required
Asbestos	<0.001%	-

Note 1: Materials exceeding this threshold shall be subject to speciated analysis and comparison with the below table:

Hydrocarbon band	Soil concentration mg/kg
Aliphatic C5 - C6	42
Aliphatic C6 - C8	100
Aliphatic C8 - C10	27
Aliphatic C10 - C12	130
Aliphatic C12 - C16	1100
Aliphatic C16 - C21	1100
Aliphatic C21 - C35	1100
Aromatic C5 - C7	70
Aromatic C7 - 8	130
Aromatic C8 - C10	34
Aromatic C10 - 12	74
Aromatic C12 - C16	140
Aromatic C16 - C21	260
Aromatic C21 - C35	1100

Note 2: PAH values and BTEX values:

Compound	Soil concentration mg/kg
Naphthalene	2.3
Acenaphthylene	170
Acenaphthene	210
Fluorene	170
Phenanthrene	95
Anthracene	2400
Fluoranthene	280
Pyrene	620
Benzo[a]anthracene	7.2
Chrysene	15
Benzo[b]fluoranthene	2.6
Benzo[k]fluoranthene	77
Benzo[a]pyrene	2.20
Indeno[123-cd]pyrene	27
Dibenzo[ah]anthracene	0.24
Benzo[ghi]perylene	320
Benzene	0.087
Toluene	130
Ethyl Benzene	47
m/p Xylenes	56
o Xylenes	60
Xylenes**	56

The rate of validation testing on **imported topsoil** will be 1 sample per 250 m³ of backfill.

The rate validation testing on **site won** topsoil will be 10 No. representative samples from stockpile.

Appendix A Contamination Procedures & Documentation

A1 Validation Strategy

As soon as practicable after the removal of any anticipated or unexpected 'hot spots' a **Validation Report** shall be prepared and submitted by the MC and agreed with the relevant Local Authority Planning Development Department.

The validation strategy shall be as follows:

- Anticipated areas of elevated concentrations or 'hot spots' shall be excavated and removed to at least 1.00 m beyond any visual or olfactory (odorous) indication of contamination.
- Samples of the surrounding soil will be taken from the excavation formed and tested for the suite of determinands listed in Clause 510 in addition to any other appropriate contaminant as indicated by appearance or by smell.
- If the chemical concentrations of the soil samples are less than the concentrations recorded in Clause 510 or other appropriate guidance in respect of other appropriate contaminant, the elevated concentrations or 'hot spot' can be considered to have been removed and no further remedial action is required.
- If the chemical concentrations of the soil samples are greater than the concentrations recorded in Clause 510, further excavation is required and the sequence of sampling and testing should be repeated. Incremental excavation and testing should continue until the chemical concentrations encountered are less than the concentrations recorded in Clause 510 or other appropriate guidance in respect of other appropriate contaminant.
- During this procedure, the following information should be collected and recorded:
 - The exact extent of each phase of excavation should be recorded using 3D topographical surveying techniques.
 - The exact position and depth of each sample taken should be recorded using 3D topographical surveying techniques.
 - The samples should be given a unique reference number.
 - The laboratory testing results for each unique sample shall be recorded.
 - A photographic record of each phase of excavation and sampling will be collected and recorded.
- A general photographic record of the works should also be collected and recorded to provide a general record of the nature and characteristics of the materials encountered and/or laid to form formations etc. Where practicable, the photographic record should be cross referenced with any chemical testing available for the material type.

A validation report should be prepared, comprising substantiating completion documentation to include type of documentation listed above and photographic records in addition to Environmental Protection Act 1990 Section 34 Duty of Care documentation relating to waste disposal of the material removed from site.

A2 Validation Documentation Requirements

The following documentation shall be prepared by the MC and submitted to the relevant Local Authority Planning Development Department.

- Plan or plans showing earthworks movement of materials on site (cut and fill) and imported if appropriate.
- Plan or plans showing the location of any 'hot spots' located, if any, or confirmation that none were encountered.
- Plan or plans showing location of chemical testing undertaken as appropriate plus supporting information.
- Plan or plans showing surface finishes and thickness of build-ups, topsoil or clean cover as appropriate.
- Plan or plans showing the location of any hotspots encountered during service trench excavation, if any, and plan sections of remedial measures undertaken for water pipe provision.
- Appropriate records of material removed from site including testing records.
- Appropriate records of material imported to site including testing records.
- Appropriate records of topsoil imported to site including testing records.
- Appropriate photographic records of the earthworks plus any specific areas of interest ('hotspots', tanks etc).
- Records of any water control of groundwater that may have been contaminated, if any, or confirmation that none were encountered.
- Other records, if appropriate, not included in above summary.
- A statement confirming the earthworks was undertaken in accordance with this specification.

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