Verification Report – Phase 1 Development

Lowry Park
Grimshaw Lane
Manchester
M40 2HJ

May 2024

602192.0000.0000

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1.0 Introduction

1.1 Purpose

TRC was commissioned by A&H Construction and Developments Plc (the 'Client') to provide a verification report following the remediation of a Site located at Lowry Park, Grimshaw Lane, Manchester, M40 2HJ (hereafter referred to as the 'Site').

A Site location plan is presented as Figure 1 in Annex A.

The purpose of the remediation is to address contamination sources previously identified on the Site. The works were designed to be carried out in accordance with the TRC Remediation Strategy (report ref. 423207.0001.0000, dated July 2022).

TRC was not engaged to provide direct oversight during the works or audit the works in progress. TRC has prepared this report based on Client and contractor provided information to support the discharge of Condition 7b of planning ref. 129444/FO/2021.

This report should be read in conjunction with the following documents:

- WYG Plot 3 (Plot 1), Newton Heath, Manchester, Geo-environmental Desk Study and Ground Investigation Report, report ref. A083215, dated January 2014
- WYG Plot 2 (Plot 2), Newton Heath, Manchester, Geo-environmental Desk Study and Ground Investigation Report, report ref. A083215, dated May 2014
- Curtains Consulting Limited, Mathers Foundry, Park Works, Newton Heath, Due Diligence Geo-Environmental Site Assessment, report ref. 070588-CUR-00-XX-RP-GE-001, dated February 2020
- TRC Companies Ltd, Phase II Geo-Environmental Site Assessment for Mathers Foundry, report ref. 385367.0000.0000, dates September 2020
- TRC Companies Ltd, Coal Mining Risk Assessment for Mathers Foundry and Grimshaw Lane Plots 1 and 2, report ref. 423207.0000.0000, dated January 2021
- TRC Companies Ltd, Phase I Environmental Site Assessment for Plots 1&2 Grimshaw Lane, report ref. 423207.0000.0000, dated April 2021
- TRC Companies Ltd, Phase II Geo-Environmental Site Assessment for Plots 1&2 Grimshaw Lane, report ref. 423207.0000.0001, dated April 2021
- TRC Companies Ltd, Plots 1&2 Grimshaw Lane – Gas Risk Assessment, report ref. 491210.0000.0001, dated July 2022
- TRC Companies Ltd, Remediation Strategy, Grimshaw Lane, report ref. 423207.0001.0000, dated July 2022

The remediation strategy considers the Site as a whole, but this report covers only the works undertaken as part of phase one of the development. A Site Layout Plan showing the phases of development is presented as Figure 2 in Annex A. A proposed development plan for the Phase One Development is presented as Figure 3 in Annex A.

1.2 Proposed Development

TRC understands that the Client has developed the Site for light industrial/commercial end use. The Site has historically been investigated as three separate plots – Plot 1 & 2 Grimshaw Lane, and Mathers Foundry. The new scheme combines all three plots into one development comprising six small units (A-F) between 5,050ft^2 and 11,500ft^2 in the far western section of the Site, four mid-sized units (1,2,3 and 6) between 26,800ft^2 and 47,800ft^2 in the centre of the Site, and two large units (4 and 5) between 123,600ft^2 and 153,700ft^2 along the north eastern boundary.

Each unit has associated vehicle parking, loading space and service yards. Soft landscaping is present along the north eastern, north western and western site boundaries. Minor soft landscaping is present within

vehicle parking areas close to the units. A small pond is located in the centre of the southern boundary behind Unit 6, and a pre-existing vegetated mound is present in the far south eastern corner of the Site. The six small and four mid-size units are part of development phase one, whilst the two large units, pond and vegetated mound area are part of development phase two. This verification report covers development phase one only.

A cut and fill earthworks scheme has been undertaken for development phase one. Current design proposals will complete a finished floor level at 69.5m above ordnance datum (AOD) for units A-F and between 71.25m and 71.45mAOD for units 1, 2 , 3 and 6. To achieve these levels, the Site has a total cut volume of 5,326m^3 and total fill volume of 16,320m^3. Therefore, the net volume is 10,994m^3 fill and materials will be imported to achieve this.

The proposed development plan for the Phase One Development is presented in Annex B (drawing no. 20066-1004).

1.3 Significant Assumptions

This report presents TRC's observations, findings, and conclusions as they existed on the date that this report was issued. This report is subject to modification if TRC becomes aware of additional information after the date of this report that is material to its findings and conclusions.

The reliability of information provided by others to TRC cannot be guaranteed to be accurate or complete. Performance of this Remediation Completion Report is intended to reduce, but not eliminate, uncertainty of environmental conditions associated with the subject Site; therefore, the findings and conclusions made in this report should not be construed to warrant or guarantee the subject Site, or express or imply, including without limitation, warranties as to its marketability for a particular use. TRC found no reason to question the validity of information received unless explicitly noted elsewhere in this report.

1.4 User Reliance

This report has been prepared for A&H Construction and Developments Plc. Reliance on the Report by any other third party is subject to requesting and fully executing a reliance letter between TRC and the third party that acknowledges the TRC Standard Terms and Conditions with the Client, to the same extent as if they were the Client thereunder.

TRC has been provided with information from third parties for information purposes only and without representation or warranty, express or implied as to its accuracy or completeness and without any liability on such third parties part to revise or update the information. Where reliance has been provided by third parties to potential purchasers this is noted in our report.

2.0 Site Summary

2.1 Site Details

Table 1: Summary of Site Details

Site Address	Grimshaw Lane, Manchester, M40 2BA
Grid Reference	387082, 400076
Approximate Size	The Site is approximately 10 ha in area.
Site Location	The Site is located approximately 4.5km east of Manchester city centre. The Site is located in an area of mixed commercial land use.

2.2 Summary of Adjacent Land Uses

The Site is located in an area of mixed industrial, residential and commercial use. Land uses in the immediate vicinity include the following principal features.

Table 2: Adjacent Land Uses

Direction	Land Use
North	The Site is bound to the north by a canal with a manufacturer, steel stockholder and supplier, and undeveloped land beyond.
East	The Site is bound to the east by Grimshaw Lane with commercial properties further east.
South	To the south of the Site is commercial properties (Fine Lady Bakery).
West	To the west of the Site is undeveloped agricultural fields and a residential properties.

2.3 Site Overview

The Site currently comprises undeveloped vacant land at the southern end of an industrial estate.

2.4 Summary of Previous Reports

The following reports have been completed for the Site:

Table 3: Summary of Previous Reports

Report Title	Summary of Findings
WYG Plot 3 (Plot 1), Newton Heath, Manchester, Geo-environmental Desk Study and Ground Investigation Report, report ref. A083215, dated January 2014	The desk study revealed that the Site was formerly occupied by clay pits followed by development as a sports pitch with possible landfilling. The geology was mapped as Glacial Till with Coal Measures / Newton Heath Sandstone at depth. The bedrock geology was classified as a Secondary (A) Aquifer overlain by an Unproductive Strata (Glacial Till). The Site was not in a Source Protection Zone. The nearest surface water feature was the Rochdale Canal which was immediately north of the Site. No elevated concentrations of contaminants in soil exceeded the assessment criteria for a commercial use. Asbestos fibres were identified in one soil sample. No testing of groundwater appears to have been undertaken as part of the Phase II.

Report Title	Summary of Findings
	Ground gas monitoring was undertaken to determine the risk from hazardous gases arising from Made Ground and natural soils and migrating into buildings and subsequent inhalation risk. The Site currently corresponds with a CS1 classification (Very Low Risk). Therefore, gas protection measures are unlikely to be required. There is a low risk from land contamination to future Site users. The Made Ground is too thick to allow shallow spread foundations to be adopted for the proposed development. Ground improvement utilising vibro-stone columns or concrete columns are likely to be a suitable foundation solution. The Coal Authority website suggests the Site is within an area at risk from coal mining. A development high risk area is present at the southwest of the Site. A historical landfill site is located 285m northeast of the Site. The landfill was operational between 1973 and 1984.
WYG Plot 2 (Plot 2), Newton Heath, Manchester, Geo-environmental Desk Study and Ground Investigation Report, report ref. A083215, dated May 2014	The desk study revealed that the Site was formerly occupied by ponds / clay pits followed by development as an engineering works including tanks and a substation. The Site was known to have remained derelict since 2007, but excavated soils and imported capping materials were deposited on the Site in conjunction with the development of the bakery immediately south of the Site between 2009 and 2011. The geology was classified as the Glacial Till with the Sherwood Sandstone at depth. The bedrock was classified as a Principal Aquifer overlain by an Unproductive Strata (Glacial Till). The Site was not located in a Groundwater Source Protection Zone. The nearest surface water feature was the Rochdale Canal located 200m northwest of the Site. Elevated concentrations of petroleum hydrocarbons were identified in soil and further site investigation was recommended to delineate and determine the risk to future Site users. No testing of groundwater appears to have been undertaken as part of the Phase II. Asbestos fibres were identified in all of the Made Ground samples. However, the concentration was <0.001% (less than the laboratories limit of detection). Ground gas monitoring was undertaken to determine the risk from hazardous gases arising from Made Ground and natural soils and migrating into buildings and subsequent inhalation risk. The Site currently corresponds with a CS1 classification (Very Low Risk). Therefore, gas protection measures are unlikely to be required. There is a low to moderate risk from land contamination to future Site users.
Curtains Consulting Limited, Mathers Foundry, Park Works, Newton Heath, Due Diligence Geo-Environmental Site Assessment, report ref. 070588-CUR-00-XX-RP-GE-001, dated February 2020	The Site remained undeveloped until the 1890s at which point football ground/pitches were recorded on the north of the Site. The football ground was no longer recorded by the early 1900s, a large excavation was present on the west of the Site which was later infilled and a mineral railway on the south associated with 'Park Engineering Works' which extended on the south of the Site. The excavation on the west was no longer recorded by the 1930s and Park Engineering Works/Mathers Foundry expanded across the Site throughout the 20th century and became disused in 2017. A slope was historically present along the north eastern side of the Site and significant reprofiling of the Site occurred during the development of the Site indicating that a variable thickness of Made Ground is likely to be present across the Site.

Report Title	Summary of Findings
	The superficial Glacial Till is classified as a Secondary Undifferentiated Aquifer, the bedrock Chester Formation and Newton Heath Sandstone Formation are both classified as Principal Aquifers, and the Pennine Middle Coal Measures is classified as a Secondary A Aquifer. Made Ground was encountered to a maximum depth of 8.0mbgl in one location associated with the area of infilled ground on the west of the Site. Outside of this area, Made Ground was encountered to a maximum depth of 4.30mbgl. Glacial Till was encountered underlying the Made Ground and was found to extend to a maximum proved depth of 12mbgl. It should be noted that the base of the Glacial Till was not encountered. The Glacial Till was typically cohesive with interbedded sand bands of variable thickness. Elevated concentrations of PAHs, hydrocarbon impacted soils and asbestos fibres/asbestos containing material (ACM) were identified on Site. Volatile contamination was encountered in groundwater. The interface probe recorded free phase LNAPL of up to 50mm thickness in WS08 on visit 5, visual verification revealed only a thin veneer of free phase separated liquid. Exceedances of GACs for arsenic, PAHs and TPHs were recorded in groundwater samples and visual hotspots of contamination identified in soils and groundwater. Rochdale Canal is located 3m north of the Site. Leachable contamination is considered a risk through vertical and horizontal migration due to exceedances of GACs for heavy metals, PAHs and TPHs recorded in groundwater samples. Visual hotspots of contamination identified in soils and groundwater particularly within WS08 in relatively close proximity to the canal. Ground gas arising from Made Ground and natural soils could migrate into buildings and subsequently be inhaled. The infilled land on the west of Site represents a significant source of ground gas with high methane concentrations. A historical landfill Site is located 185m northeast of the Site. The landfill was operational between 1973 and 1984 and was licensed to accept inert, industrial, commercial and household waste.
TRC Companies Ltd, Phase II Geo-Environmental Site Assessment for Mathers Foundry, report ref. 385367.0000.0000, dates September 2020	An intrusive investigation comprising three cable percussive boreholes, 15 window sample boreholes and 20 CPT tests was carried out at Mathers Foundry in August 2020. Made Ground was encountered between ground level and 4.5mbgl, recording a thickness range of 0.3m to 4.5m. Superficial deposits comprising Glacial Till were encountered underlying the Made Ground, recording a maximum unproven thickness of 11.0mbgl. Ice Contact Deposits (granular layers) were also encountered in localised areas of the Site, recording a maximum unproven thickness of 2.0m. Groundwater was encountered between 0.3m and 4.0mbgl. During subsequent monitoring rounds resting groundwater levels of 0.93m to 2.2mbgl were recorded. Asbestos fibres were identified in five samples of Made Ground. The samples contained both Amosite and Chrysotile asbestos. Asbestos quantification tests were undertaken and recorded at 0.078% fibres and debris in soil (WS213), 0.007% fibres in soil (WS214), and <0.001% fibres in soil in the remaining three samples.

Report Title	Summary of Findings
	Elevated concentrations of hydrocarbons were detected in soil samples (both Made Ground and natural soils). Several of the concentrations exceed the GACs. Slightly elevated concentrations of heavy metals were detected in soils at the Site. Only one exceedance of the GAC was identified for lead. The majority of the Site is proposed to be covered with hard surfacing, therefore, the risk of a pollutant linkage occurring from the source of contaminated soils is considered unlikely. Two areas of NAPL contamination have been identified at the Site, alongside separate contaminated groundwater zone between WS201 and WS202. These are associated with historic storage tanks. Groundwater samples exceeded the EQS for heavy metals, petroleum hydrocarbons and speciated hydrocarbons. SoBRA values were also exceeded for speciated PAHs and petroleum hydrocarbons. Exceedances of the EQS for heavy metals occurred at the majority of sampling locations within the Site. However, this is indicative of broader groundwater quality and background concentrations in the local area. Therefore, no further assessment of heavy metals in groundwater is considered necessary. Localised targeted remediation of the two areas of hydrocarbon contamination is recommended. Gas monitoring indicates that the Site would be classified as Characteristic Situation 2 (low risk). However, significant concentrations of carbon dioxide and methane have been detected in areas of deep Made Ground. Speciated PAH and petroleum hydrocarbons have been identified at levels above the Society of Brownfield Risk Assessment (SoBRA) vapour intrusion guidelines. It is possible that elevated levels of petroleum hydrocarbons are causing the elevated methane readings. The Site currently corresponds with a CS2 classification - requiring gas protection measures. However, due to the high concentrations of methane recorded, it is considered necessary to allow for CS3 gas protection measures where building footprints are within the backfilled pit. In order to achieve finished levels a programme of earthworks will be required. Initial indications are that Site levels will be cut from the northern and eastern Site areas, with localised cutting in the centre and southwestern section of the Site. It should be noted that resting groundwater levels have been recorded above the cut level. It should also be noted that asbestos has been encountered in WS213. The earthworks will need to be undertaken in accordance with the Control of Asbestos Regulations. While shallow foundations may be feasible for some of the buildings where there are areas of cut, shallow foundations will not be feasible across the entire Site. In these areas foundations will need to be extended to found on competent strata located beneath the Made Ground / fill material. It should also be noted that peat was recorded in WS202 between 3.3m and 3.7mbgl, and an SPT 'N' value of 1 was recorded in WS206. The peat and softened materials appeared to be of limited thickness and limited extent, but will need to be taken into consideration during foundation design. It is recommended that further probing is undertaken around this location to delineate the peat. Ground bearing floor slabs are likely to be feasible in areas where the floor is resting directly upon Glacial Till or where ground improvement has been undertaken. If this is not undertaken then a suspended floor slab will need to be utilised in areas where Made Ground or fill material is present.

Report Title	Summary of Findings
	TRC recommends that the developer adopts Design Sulphate Class DS-2 and ACEC class of AC-2 for foundations.
TRC Companies Ltd, Coal Mining Risk Assessment for Mathers Foundry and Grimshaw Lane Plots 1 and 2, report ref. 423207.0000.0000, dated January 2021	One coal seam was worked beneath the Site. The worked coal seam was located to the southwest of a northwest to southeast orientated fault and is only likely to be present beneath Plot 1. The coal mining assessment has indicated that there should be sufficient thickness of intact rock above this coal seam to minimize the risk of voids migrating to surface. The Coal Authority website indicates that the western edge of Plot 1 is located within a development high risk area and a coal seam is indicated to subcrop beneath the superficial deposits. The Coal Authority Consultants Report identifies this as the Doctor Coal. The Consultant's report indicates that the Doctor Coal was not workable and given the considerable thickness of overlying superficial deposits it is considered that this coal seam is unlikely to have been worked. The proposed redevelopment includes the construction of new buildings in the main part of the Site, located predominantly to the northeast of the fault line and to the northeast of the Doctor Coal Seam subcrop. The Doctor Coal subcrops at the western end of Plot 1 with the coal seam dipping away from the main part of the Site. As such while there remains a potential risk that the coal seam had been worked, the fact that this area of the Site unlikely to support new buildings it is considered that the risk to the proposed redevelopment will be low. If redevelopment includes the construction of new buildings in the southwestern part of the Site, it is recommended that the risk is reviewed. There is a potential risk to the proposed development from the fault line. Based upon the information collected by Curtins it is likely that this will be masked by the presence of significant thickness Glacial Till. However, should the Glacial Till be granular in nature this could act as a preferential pathway for mine gas. It is recommended that should granular deposits be encountered within the Glacial Till that monitoring wells are installed with the screened sections installed to coincide with the granular layers. Subsequent permanent ground gas monitoring should be undertaken to ensure that the granular layers do not provide a pathway through the Glacial Till for gas migration.
TRC Companies Ltd, Phase I Environmental Site Assessment for Plots 1&2 Grimshaw Lane, report ref. 423207.0000.0000, dated April 2021	Earliest available mapping (1893) shows that Plot 1 was undeveloped while Plot 2 was part of the wider Bricks Works centred further north. By 1908 Plot 1 contained markings indicating it was part of the Brick Works while Plot 2 had been converted into Park Engineering Works which included several building. Between 1923 and 1992 there was no change on Plot 1 apart from becoming a Sports Ground. Park Engineering Works on Plot 2 continued to grow and develop and by 1999 was demolished leaving both Plots vacant. Historically, the surrounding area has largely comprised industrial land use with several different works and factories in the area. The extensive brick works to the north gradually shrunk throughout the c20th while residential developments to the east expanded. To the south of the Site were many railway tracks which connected Manchester to further afield as well as connecting Plot 2 with a mineral railway loop. TRC consider that Site has a low to moderate environmental sensitivity. The published geology indicates that the Site is underlain by Till (Devensian) and then

Report Title	Summary of Findings
	Pennine Middle Coal Measures Formation, Newton Heath Sandstone, or Chester Formation. The EA has classified the Till (Devensian) as a Secondary (undifferentiated) Aquifer; the Pennine Middle Coal Measures Formation and the Newton Heath Sandstone as a Secondary A Aquifer; and the Chester Formation as a Principal Aquifer. Both plots an area affected by historical UXO risk. Both plots are within a coal mining reporting area. Plot 1 contains a coal mining development high risk area. The Made Ground and previous land use at the Site could be a source of asbestos fibres in soil, heavy metals, polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons and ground gases. The sources at the Site are considered to present a low-medium risk to future Site users. The historical brickfields located <250m from the Site are a potential source of asbestos fibres in soil, heavy metals, polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons, polychlorinated biphenyls and ground gases. The sources off Site are considered to pose a low-medium risk to the Site. Plausible geotechnical hazards identified at the site are: • Soft / loose compressible ground. • Shrink swell of the clay fraction of soils . • Obstructions associated with relic foundations and concrete slabs. • Differential settlement caused by relic foundations and concrete slabs. • High groundwater. • Changing groundwater conditions. • Risk from erosion or flooding. • Running sands or loose Made Ground • Differential settlement due to infilled land on both plots 1 and 2. • Earthworks – poor bearing capacity of new fill. • Earthworks – unsuitability of site won material to be reused as fill. • Possible cambered ground with gullies possibly present. • Relict slip surfaces. • Problematic soils. TRC recommends an intrusive ground investigation to appraise ground conditions for environmental and geotechnical purposes.
TRC Companies Ltd, Phase II Geo-Environmental Site Assessment for Plots 1&2 Grimshaw Lane, report ref. 423207.0000.0001, dated April 2021	An intrusive investigation was carried out at Plots 1 and 2 at Grimshaw Lane in February 2021. Two cable percussive boreholes, four rotary boreholes, four window sample boreholes and four trial pits were advanced in Plot 1. Two cable percussive boreholes, four window sample boreholes and five trial pits were advanced in Plot 2. The investigation identified that both plots were underlain by Made Ground varying from 2.2m to 4.0m on Plot 1 and from 3.0m to 4.95m on Plot 2. The Made Ground in both plots were underlain by Glacial Till. The deeper boreholes on Plot 1 identified that superficial deposits extended to depths of between 36.0m and 39.5mbgl beneath which the Pennine Middle Coal Measures Formation was encountered. Granular Ice Contact Deposits were encountered within superficial deposits. The Pennine Middle Coal Measures were found to comprise a weak weathered mudstone.

Report Title	Summary of Findings
	During the investigation groundwater was encountered in Plot 1 between 2.0mbgl and 3.0mbgl. During monitoring, groundwater was recorded between 1.11mbgl ang 2.90mbgl. During the investigation groundwater was encountered in Plot 2 between 2.0mbgl and 3.4mbgl. During monitoring, groundwater resting levels were recorded between 0.25mbgl and 3.62mbgl in Plot 2. Plot 1 – No soil exceedances were identified when screened against screening criteria for the proposed development; therefore no soil remediation is necessary for the proposed light industrial / commercial end use. The contaminants detected are unlikely to present a significant risk within a future development if placed beneath hardstanding, which will provide a physical barrier against contact with any contaminants. Plot 2 – Although no soil exceedances have been identified when screened against the relevant screening criteria for the proposed development, asbestos in soil (<0.001%) was identified in several sample locations across Plot 2. The contamination is unlikely to present a significant risk with a future development if placed beneath hardstanding, which will provide a physical barrier against contact with any contaminants. If these soils are to be removed from the Site as surplus to the development, TRC consider that the asbestos contamination would be classified as non-hazardous waste as the quantification is less than the 0.1% hazardous waste threshold. It is recommended that further waste assessment testing is undertaken to further classify the waste materials. Exceedances of heavy metals and hydrocarbons were identified in groundwater from both plots. No evidence of a significant contaminant sources was identified during the soil screening. In addition, the Site is underlain by an Unproductive Strata which is likely to preclude contaminant transfer to the deeper sensitive aquifer. On this basis, TRC considers that the concentrations are more indicative of the broader groundwater quality rather than contamination arising from Site sources and unlikely to pose a risk to controlled waters. Ground gas monitoring indicates that Plot 1 would be classified as Characteristic Situation 1 (very low risk). However, an anomaly was identified in RC02 during drilling. RC02 is located in the north-western section of Plot 1. RC02 was terminated at 22.0mbgl due to a carbon monoxide reading of 106ppm during drilling. This elevated carbon monoxide concentration may be as a result of gas originating from a deep coal mine. The fault line at the Site could be acting as preferential pathway in the transfer of hazardous gases. It is anticipated that the gas concentrations are likely to be accumulating within the Ice Contact Deposits underlying the Site. Therefore, it is recommended that gas protection measures are installed across Plot 1. This will likely comprise the installation of a gas protection membrane to mitigate the risks from ground gases. Ground gas monitoring indicates that Plot 2 would be classified as Characteristic Situation 4 (high risk). The data indicates that gas protection measures would be required for the proposed development at Plot 2, which will likely comprise the installation of a structural barrier, gas protection membranes and ventilation protection measures to mitigate the risks from ground gases. Due to the high-risk level TRC would recommend continuous monitoring within Plot 2, to further characterise the ground gas regime and assess risk.

Report Title	Summary of Findings
	Historical mapping indicated that there is likely to be a variable thickness of Made Ground on both plots (Plot 1 and 2) resulting from infilling of the former ponds and reworking of the near surface sites to create level building/sports pitch platforms. In addition, former foundations associated with the previous development of Plot 2 are likely to be present. The Coal Mining Risk Assessment (CMRA) prepared by TRC in January 2021 (385367.0000.0000) identified that there is a potential risk associated with the potential of shallow coal beneath Plot 1. Due to the presence of a fault line, Plot 2 was not considered to be at risk from shallow coal workings. The geotechnical assessment within this report found that either a ground improvement option or piled foundation solution will be suitable for the proposed development.
TRC Companies Ltd, Plots 1&2 Grimshaw Lane – Gas Risk Assessment, report ref. 491210.0000.0001, dated July 2022	Additional ground gas monitoring was undertaken at Plots 1 and 2 at Grimshaw Lane. Three gas pins were installed in Plot 1 and monitored on three occasions. Periodic and continuous ground gas monitoring was undertaken at Plot 2 over a period of three weeks, as well as flux box testing and a surface emissions survey. The gas assessment revealed very low concentrations of gas at the Site. Within Plot 1, further monitoring has been undertaken in close proximity to RC02. There is evidence to suggest that no pathway exists between the mine gases located within granular soils at depth and the Site surface. Gas monitoring suggests that Plot 1 could be assigned a CS1 risk rating. However, due to the presence of mine gases at depth some basic ground gas protection measures are recommended, in accordance with a CS2 risk rating. The flux box tests and surface emissions survey (undertaken in Plot 2) show that some upward methane migration towards the Site surface soils is occurring. However, GGS undertook a flux box survey in the vicinity of the peak reading and methane emissions remained within typical ambient background range during the survey. Gas sample analysis indicates that some petroleum hydrocarbons and VOCs are present within the unsaturated zone. However, where detected, the concentrations of petroleum hydrocarbons are relatively low and similarly the concentrations of VOCs are low. The continuous monitoring data obtained over a three-week period did not identify any flow within the boreholes. A maximum concentration of methane of 14.9% v/v was recorded. However, this is not considered representative of the gas regime in the unsaturated zone. An assessment has been undertaken by TRC using the GSV methods set out in CIRIA C665. The results of this assessment suggest that the gas risk rating should be classed as CS1 (Very Low Risk). However, due to the presence of contaminants in anthropogenic soils and the presence of mine gas on Plot 1 (recorded during drilling), the risk rating for both Plots 1 and 2 has been assigned as CS2. This is a conservative approach which ensures that robust mitigation measures will be put in place to protect future Site users from ground gas risk. Zones of gas mitigation across Plot 1, Plot 2 and Mathers Foundry have been developed. Mitigation measures will be required as per the zones. The monitoring

Report Title	Summary of Findings
	well network should be fully decommissioned to seal pathways and prevent migration of ground gases.
TRC Companies Ltd, Remediation Strategy, Grimshaw Lane, report ref. 423207.0001.0000, dated July 2022	Various contamination issues have been previously identified during the extensive Site Investigations that have taken place on Site: • Visual and olfactory evidence of contamination • Asbestos in soils • Contaminant concentrations in soil • Contaminant concentrations in groundwater • Ground gas TRC consider the following remediation drivers are valid for further action which will result in the betterment of the Sites environmental conditions: • Removal of any underground storage tanks, associated pipework and infrastructure and contaminated soils (if present) – to remove potential contaminant sources and potential for contamination that may impact soil and groundwater conditions • Removal and/or treatment of localised hydrocarbon impacted Made Ground soils within the two areas of gross contamination (areas of WS211 and WS202)- to remove contaminant source • Removal and/or treatment of localised hydrocarbon impacted groundwater within the two areas of gross contamination (areas of WS211 and WS202)- to remove contaminant source The remediation strategy also outlines: • Asbestos management • Stockpile management • Excavation of materials • Reuse of materials • Waste disposal Remediation works will be carried out with procedures in place for unforeseen contamination, obtaining relevant permits and consents, and additional environmental controls. A verification plan is required to document that remediation works have been completed in order to obtain planning approval to discharge of planning conditions. The plan covers the following verification actions: • UST and associated pipework removal • Soil hotspot removal • Groundwater remediation • Asbestos mitigation • Ground gas mitigation • Actions triggered by the discovery strategy • Buried services • Materials import • Materials disposal A verification report will be prepared to confirm all necessary remediation actions have been satisfactorily completed at the Site.

3.0 Summary of Remediation Scope of Work

3.1 Overview

The Client commissioned A&H Construction and Developments Plc (A&H) (Principal Contractor) to carry out remediation works at the Site.

A&H carried out the development led remediation including construction of hardstanding across the majority of the Site including building footprints, paved roadways and footpaths.

The existing wells at the Site were decommissioned during demolition by removing the well installation only. The presence of stabilised soils will reduce permeability when compared to natural soils and pre-construction unconsolidated Made Ground soils. Additionally, the presence of engineered hardstanding will mitigate risks of controlled drainage to the sub-surface. Ground gas risks to future building occupiers will be mitigated via the validated ground gas barrier as presented within subsequent sections .

The cut and fill drawing provided by the Principal Contractor is presented within Annex B (drawing no. 9762-PTA-SW-XX-DR-C-8021) for information. As shown within the drawing, there was a net import of 10,994m^3 imported to meet development requirements. These materials comprised 6F2 recycled aggregate supplied by Murray RIX from Wharf Street, Dukinfield, and 6F5 crushed sandstone from Scout Moor Quarry. Grading and moisture certificates provided by the contractor have been provided within Annex E.

Soft landscaped areas were capped with a geotextile membrane and 300mm of topsoil.

A discovery strategy and watching brief were also implemented during redevelopment works to identify any unforeseen contamination.

3.2 Soil Remediation

The remediation strategy states that removal of any underground storage tanks, associated pipework and infrastructure and contaminated soils (if present), and removal and/or treatment of localised hydrocarbon impacted Made Ground soils within the two areas of gross contamination should be undertaken at the Site.

This work has been carried out by Brownfield Solutions Ltd on behalf of the contractor. The Remediation Validation Report is presented in Annex C.

Asbestos in soil was encountered within samples obtained from Made Ground. Therefore, any Made Ground on Site would need to be reused under hardstanding or underneath a cover system if within soft landscaping areas.

3.3 Groundwater Remediation

The remediation strategy states that removal of grossly contaminated soil and/or treatment of localised hydrocarbon impacted groundwater within the two areas of gross contamination should be undertaken at the Site.

This work has been carried out by Brownfield Solutions Ltd on behalf of the contractor. The Remediation Validation Report is presented in Annex C.

3.4 Materials Re-Use

The cut and fill drawing is presented within Annex A. The contractor has confirmed that site derived materials were reused during redevelopment. No analytical sampling or testing was performed on materials excavated and relocated within the development.

3.5 Imported Materials

The cut and fill drawings show that 10,994m^3 of 6F2 and 6F5 material was imported for engineering purposes. Grading certificates have been provided for those materials. No further sampling and analysis was performed on these materials. However, it is noted that the materials were sourced from an aggregate supplier and comprised virgin aggregate and recycled aggreged products produced under environmental permits.

The remediation strategy required the placement of engineered clean capping across areas of proposed landscaping including a geotextile membrane and clean cover of 300mm (150mm topsoil and 150mm subsoil). The areas of landscaping are shown on the external works drawing presented in Annex B.

The geotextile membrane was placed between existing soils and clean capping layers within landscaped areas. The geotextile is an Alert woven polypropylene membrane, which is described as a bright orange, highly visible geotextile. It is designed to be used as a warning and separator layer in civil engineering and construction uses. The technical specification document is provided in Annex E.

The topsoil used included site derived materials removed and stockpiled prior to the earthworks. The contractor performed additional sampling and testing to confirm the quality of topsoil. A total of 15 samples were collected by the contractor and sent to their laboratory for environmental analysis. The analytical data is presented in Annex E and shows no contamination at concentrations that exceed the screening values agreed within the remediation strategy.

3.6 Materials Disposal

It is understood that no soils were removed and disposed of from the Site.

4.0 Soil Remediation

TRC identified the following remediation drivers requiring further action which will result in the betterment of the Site's environmental conditions:

- Removal of any underground storage tanks, associated pipework and infrastructure and contaminated soils (if present) – to remove potential contaminant sources and potential for contamination that may impact soil and groundwater conditions.
- Removal and/or treatment of localised hydrocarbon impacted Made Ground soils within the two areas of gross contamination – to remove contaminant source.

4.1 Summary of Ground Conditions

TRC understand that there were numerous underground fuel storage tanks (UST) located on Site which were removed during demolition works. Verification of the UST removals was not undertaken. Given the previous use of the Site there is uncertainty regarding the potential for previously unidentified UST and associated pipework and drainage runs that may present an ongoing contaminant source. It is outlined in the remediation strategy that if any USTs or associated infrastructure are identified during the construction phase, they should be appropriately removed and remediated.

Two areas of gross contamination were identified during intrusive investigations at the Site. TRC consider that these areas require remediation due to the presence of elevated hydrocarbon concentrations in soil and visible presence of hydrocarbon staining and free product.

4.2 Summary of Soil Remediation Works

The contractor instructed Brownfield Solutions Ltd (BSL) to undertake soil remediation works at the Site. Remediation works were carried out in September and October 2023.

BSL did not report discovery of any USTs or associated infrastructure during their remediation works.

BSL undertook excavation of additional confirmatory trial pits within the areas highlighted by TRC's remediation strategy to assess the presence of hydrocarbons in the areas. Whilst visual and olfactory evidence of contamination was observed, laboratory testing showed that hydrocarbon concentrations within the confirmatory trial pits did not exceed commercial screening levels. Therefore, BSL did not consider the soils 'grossly contaminated' and considered them suitable to remain in situ.

The BSL Remediation Validation Report is presented in Annex C.

4.3 Asbestos

Asbestos in soil was encountered within samples obtained from Made Ground. Quantification of asbestos was generally low, making soils suitable for reuse under hardstanding or underneath a cover system if within soft landscaping areas.

5.0 Groundwater Remediation

TRC identified the following remediation drivers requiring further action which will result in the betterment of the Site's environmental conditions:

- Removal and/or treatment of localised hydrocarbon impacted groundwater within the two areas of gross contamination – to remove contaminant source.

4.1 Summary of Groundwater Conditions

Two areas of groundwater contamination were identified during intrusive investigations at the Site. TRC consider that these areas require remediation due to elevated hydrocarbon concentrations in groundwater which exceed commercial screening criteria, and visible presence of hydrocarbon staining and free product.

4.2 Summary of Groundwater Remediation Works

The contractor instructed Brownfield Solutions Ltd (BSL) to undertake groundwater remediation works at the Site. Remediation works were carried out in September and October 2023.

BSL remediation works comprised of source removal and site betterment through excavation of sumps and subsequent pumping and removal of groundwater. Groundwater sumps were excavated within the area of hydrocarbon impacted groundwater and left to fill overnight. Once filled, groundwater was pumped out and removed from Site by a licenced carrier. Additional boreholes were installed downgradient of the hydrocarbon impacted area and a programme of groundwater testing was undertaken to assess the betterment of remedial measures. A watching brief was maintained by the contractor and no further contamination was observed during remediation and construction phases.

The BSL Remediation Validation Report is presented in Annex C.

6.0 Discovery Strategy

It has been confirmed that for the duration of remediation and development works, no contamination was identified and reported by A&H.

7.0 Buried Services

It is understood that barrier water pipes have been installed at the new development. Evidence of this is presented in Annex B (case no. 04196014).

8.0 Ground Gas

8.1 Summary of Ground Gas Conditions

A ground gas assessment was undertaken in 2022 and the majority of the Phase One Development was classified as Characteristic Situation (CS) 2 (low risk) with a small portion to the east classified as CS3 (moderate risk). This is a conservative approach due to the presence of mine gases at depth underlying the Site, and the presence of contaminants in anthropogenic soils. The monitoring and assessment were based upon guidance documented within CIRIA C665 and BS 8485:2015.

8.2 Summary of Mitigation Design

The design included the use of a protective gas membraned installed within the floor slab design. The gas membrane was a CS2 rated membrane designed to provide a barrier to methane, carbon dioxide and VOC ingress. The contractor has confirmed that the ground floor slab was constructed in accordance with the design presented within the remediation strategy.

8.3 Summary of Membrane Installation and Verification Works and Findings

A&H appointed UK Membranes to install the gas membrane at the development. TRC was not engaged to perform further on-site review and validation and is wholly reliant on the expert oversight and reporting provided by UK Membranes.

The membrane was a Juta GP5 gas barrier designed for use on this site condition. The manufacturers specification sheet is provided in Annex D.

The membrane was installed by a NVQ Level 2 qualified installers.

Following installation, UK Membranes engaged MEC Environmental Limited to provide independent verification of the membrane installation. These works were overseen and managed by Michael Corban. Evidence of qualification has been provided in Annex D.

The membrane installed was inspected to ensure there was appropriate sealing and that that any damage (if present) of the membrane was repaired. The inspection comprised visual, air lance and pick testing. The inspection identified that the sealing was done to the appropriate standard; however repairs were required in a number of areas which were completed and further inspection was undertaken to confirm that the repairs were undertaken satisfactorily.

The full ground gas verification report is presented in Annex D.

9.0 Soft Landscaped Areas

Soft landscaped areas at the proposed development were capped with a geotextile membrane and 300mm of reused topsoil. Full details have been provided within Section 3.5. The data indicates that capping layers have been installed correctly as per the remediation strategy and that topsoil materials are chemical suitable for use at the Site.

The topsoil used included site derived materials removed and stockpiled prior to the earthworks. The contractor performed additional sampling and testing to confirm the quality of topsoil. The analytical data is presented in Annex E and shows no contamination at concentrations that exceed the screening values agreed within the remediation strategy.

Photographs of the membrane and topsoil installation are presented in Annex F.

10.0 Revised Environmental Risk Assessment

The methodology of this risk assessment uses the source-pathway-receptor pollutant linkage to provide a qualitative appraisal of environmental risks and potential liabilities associated with soil and groundwater contamination at the Site.

The revised conceptual Site model (CSM) has been prepared on the basis of the current remediated Site and development, which is under construction. This CSM considers the following valid sources, pathways and receptors:

- **Sources** – Concentrations of asbestos in the soil within the samples analysed. Hydrocarbon contamination in soils and groundwater samples analysed. Ground gases present underlying the Site. Remediation of soils and groundwater was considered necessary. Development design (proposed development being covered in hardstanding) and suitable capping of soft landscaped areas would mitigate against asbestos and residual soil and groundwater contamination. Ground gases would be mitigated by installing ground gas membranes in building footprints.

- **Pathways** – Initial risk assessment considered risks to human health via inhalation, dermal contact and ingestion pathways. TRC considers that human health risk pathways are no longer valid due to the presence of hardstanding (building footprints and externally paved areas), engineered capping in landscaped areas, which will provide an engineer barrier for dermal contact, ingestion and inhalation pathways;

- **Receptors** – the on-site sensitive receptors are primarily the future site users, buried services, groundwater and surface waters.

10.1 Revised Conceptual Site Model

Table 3: Revised Conceptual Site Model – On-Site Sources

Source	Pathway	Receptor	Risk
On-site residual contamination	Dermal contact, ingestion, inhalation	Future Site users	**Low** Pollutant linkage mitigated via the presence of engineered segregation i.e. hardstanding and suitable capping in soft landscaped areas.
	Direct contact	Buried services	**Low** Protecta-Line water pipe has been installed at the new development.
	Leaching of Contaminants, vertical migration into groundwater and lateral migration to surface waters	Controlled waters	**Low** Contaminated groundwater identified at the Site has been remediated and the presence of significant thicknesses of impermeable Till

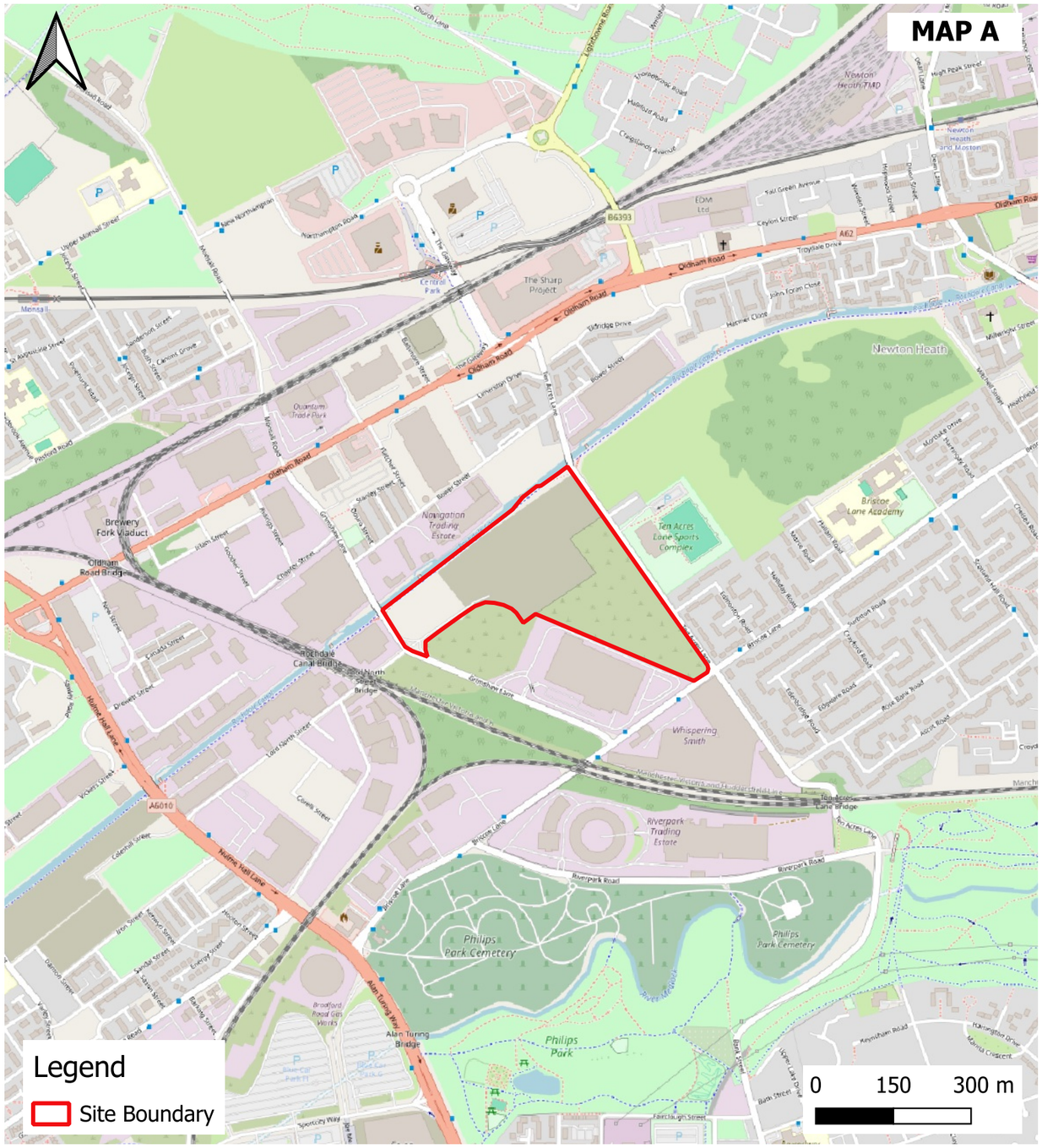
Source	Pathway	Receptor	Risk
			underlying the Site will prevent migration to bedrock aquifers.
	Migration and inhalation pathways	Future Site users	**Low** Ground gas membranes have been installed within new buildings at the Site which breaks the pathway between ground gas sources and future site users.

11.0 Conclusions

The following work has been satisfactorily completed at the Site:

- Installation of hardstanding;
- Capping of soft landscaped areas with clean cover and membrane installation;
- Soil remediation;
- Groundwater remediation;
- Material reuse and import associated with cut and fill;
- Barrier pipe used for water pipes; and,
- Installation and verification of ground gas membrane.

Annex A: Figures



NOTES	COPYRIGHT NOTES Google Imagery January 2024 © OpenStreetMap contributors - Data is available under the Open Database License. Cartography licensed as CC BY-SA.	REVISIONS				TITLE SITE LOCATION PLAN
					TRC Arkwright House Manchester M3 2LF	TRC PROJECT NO. 602192 / SCALE MAP A: 1:10,000 @ A3 MAP B: 1:3,500 @ A3
		P01	FIRST ISSUE		CLIENT A&H CONSTRUCTION AND DECVELOPMENTS PLC	PURPOSE OF ISSUE SUITABLE FOR INFORMATION / STATUS
			Initials: NJ	NJ 9/4/2024		
		REV.	REVISION NOTES/COMMENTS		PROJECT LOWRY PARK	DRAWING NO 602192.0000.FIG01 / REVISION PO1
			Initials			

NOTES	COPYRIGHT NOTES Google Imagery January 2024	REVISIONS P01 FIRST ISSUE — Initials: NJ / NJ / 9/4/2024 REV. REVISION NOTES/COMMENTS — Initials:	TRC Arkwright House Manchester M3 2LF

CLIENT A&H CONSTRUCTION AND DEVELOPMENTS PLC	TITLE SITE LAYOUT PLAN		
PROJECT LOWRY PARK	TRC PROJECT NO. 602192	SCALE 1;2,000 @ A3	
	PURPOSE OF ISSUE SUITABLE FOR INFORMATION	STATUS	
	DRAWING NO 602192.0000.FIG02	REVISION P01	

Annex B: Client Provided Figures

Disclaimer:
Subject to survey.
Based on topographical survey provided by Greenhatch Group, Drawing Quality ref: GH8075. Drawing no. 37505_T, Rev 1, dated 07.08.20

Notes:

0 5 10 15 20 25

N

Key

- Site Boundary (103,050m2/ 25.46 acres /10.31ha)
- Phase 1
- 2.4m proposed paladin fence
- Existing fence
- Indicative retaining wall, refer to engineer's drawings. Handrails to be allowed to comply with Building Regulations
- Existing trees
- Proposed trees within the car parking area. For all other proposed trees refer to the Landscape Architects drawings.
- Soft landscaping extent to be inline with Landscape Architects drawings.
- Block paving
- Concrete / asphalt extent to be in line engineer drawings
- Double height armco barrier
- Armco barrier with key clamp handrail
- (1) Refuse area
- (2) Bicycle stand / shelter
- (3) Motorbike parking bay
- (4) Vehicle gate
- (5) Pedestrian gate
- (6) Substation
- (7) Installed car charging points
- (8) Indicative DDA Compliant Access
- (9) External Stairs
- (10) Retractable bollards

Rev:	Notes:	Date:	Dwn:	Iss:
C8	Minor Updates.	25.03.24	BG	HA
C7	Unit 6 cycle shelter relocated.	21.03.24	BG	HA
C6	AC Units relocated to suit BC feedback.	20.03.24	BG	HA
C5	Armco barriers, tactile paving, retractable bollards, gas meters and external plants added. External ramp and stairs update.	01.02.24	BG	HA
C4	Footpaths in front of the entrances reduced to allow for cycle shelter & motorcycle spaces.	22.11.23	MP	HA
C3	Updated to site requirements.	12.10.23	BG	HA
C2	Attenuation pond, cycle shelters and footpaths updated. Substation relocation.	11.10.23	BG	HA
C1	First Issue	07.07.23	MP	HA

CONTRACTOR PROPOSAL

Client:

A.&H.

hale
ARCHITECTURE
22c Leathermarket Street, London, SE1 3HP

Project:
Lowry Park, Grimshaw Lane, Manchester

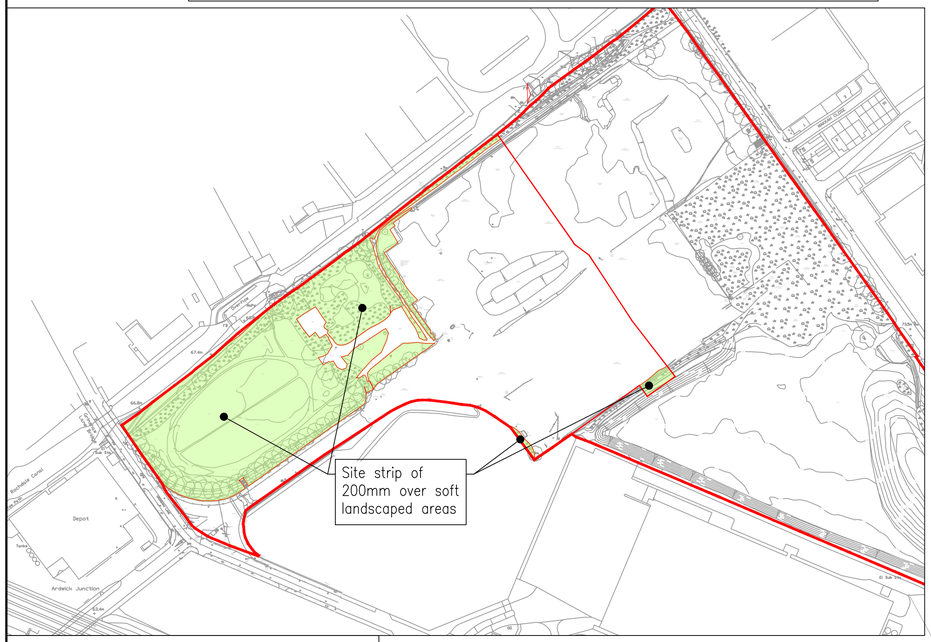
Drawing Title:
Proposed Site Plan

Project No:	Scale @ A1 @ A3	Revision:
20066	1:500 / 1:1000	C8

Drawing No:
20066-1004

CUT AND FILL APPRAISAL NOTES

1. The following earthwork volumetric exercise has been undertaken to demonstrate that the order of magnitude of the cut and fill volumes associated with the proposed development and must not be relied upon as exact values. Many assumptions have been made and it is not possible to account for material variability – Any clarification of this statement should be referred to PTA direct. The appointed contractor should undertake their own Cut and Fill analysis in order to price the works. The purpose of the appraisal provided here is to assist with assessing the contractor's analysis.
2. No allowance is made in these calculations for bulking of excavated material, since the bulking factors will vary depending upon whether the material is to be exported from site, or re-used on site as loosely compacted or engineered fill. Bulking factors will also vary depending upon the type of material. The Contractor should state the bulking factors assumed within their analysis.
3. No allowance has been made in this appraisal for excavations required to construct foundations, drainage runs, attenuation/infiltration tanks, manholes, lift pits, service trenches, etc.
4. It is possible that some of the made ground cut material may be suitable for re-use as an engineered fill. This is subject to testing of the material to establish geotechnical properties and for contamination.
5. If contamination is known to exist on the site – reference should be made to the relevant Geo-Environmental reports for the site in order to understand how the contaminated material is to be dealt with.
6. Cut and fill isopachytes shown are calculated from the post demolition Topographic Survey by Greenhatch Group ref 37505_T Rev 2 dated 10.05.2021 without stockpile of crushed material and with site strip of 200mm within softlandscaped areas to proposed underside of formation level.
7. An assumed 350mm deep construction has been considered across the external paved areas and a 500mm deep construction to the internal areas.

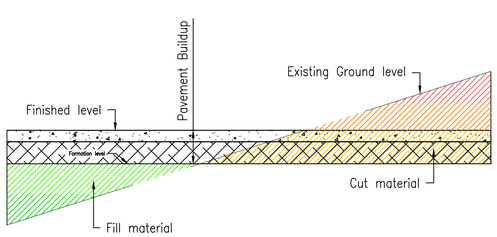


Site strip of existing soft landscaped areas included within this accessment	Area [m²]	Thickness [m]	Volume [m³]
Light Vegetated Areas	15801	0.2	3160

CUT & FILL VOLUMES
Topographic levels reduced by site strip vs Formation Levels

Band	Minimum Level [m]	Maximum Level [m]	Colour	Area [m2]	Volume [m3]	Cut/Fill	
1	−2.00	−1.50		21m2	2m3	Cut	Total Cut Volume 5,326m3
2	−1.50	−1.00		215m2	40m3	Cut	
3	−1.00	−0.50		4573m2	1261m3	Cut	
4	−0.50	0.00		7318m2	4023m3	Cut	
5	0.00	0.50		10563m2	11386m3	Fill	Total Fill Volume 16,320m3
6	0.50	1.00		13873m2	3739m3	Fill	
7	1.00	1.50		1923m2	804m3	Fill	
8	1.50	2.00		714m2	292m3	Fill	
9	2.00	2.50		252m2	95m3	Fill	
10	2.50	3.00		36m2	5m3	Fill	

Net Volume 10,994m3 (Fill)



Notes:

1. Do not scale from this drawing.
2. In case of any discrepancies in drawings, details or bills, refer to engineers for clarification: unilateral decisions by the Contractor will not be accepted.
3. This drawing is to be read in conjunction with all related Architects, Consultants & Sub-Contractors drawings and specifications.
4. The Contractor is advised that all design drawings and information are to be read concurrently and any discrepancies or omissions reported directly to PTA Civils' Department.
5. This drawing is based upon the Topographic Survey ref 37505_T Rev 2 dated 10.05.2021 by Greenhatch Group in digital format.

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DRAWING STATUS
FOR CONSTRUCTION

REV	DESCRIPTION	BY	DATE	CHK'D
C01	Site Layout & Proposed Levels Updated; Site Strip Included.	LB	04.07.23	SLW
P02	Phasing Boundary Revised; Stone House Entrance Added & Unit 1 Ramp Amended.	LB	27.06.23	
P01	First Issue.	LB	03.02.23	

PROJECT TITLE
Grimshaw Lane, Manchester

DRAWING TITLE
Phase 1 Cut & Fill Volumetric Analysis

DATE	October 2022	CHECKED DO	CHECKED ENG	PTA PROJ No 9762
DRAWN	LB	LB	SLW	
SCALE	1:1000			REVISION C01
DRG SIZE	A1			

DRAWING No
9762-PTA-SW-XX-DR-C-8021

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