

SBK

DRAINAGE STATEMENT Phase 1b

Phase 1b, Lime Kiln Cottage, Welshpool

KIM Properties Ltd

November 2023

SBK-23-118-C-502

Prepared by:	DG
Authorised by:	AH
Signed:	
Dated:	17.11.2023
Revision	P02



CONTENTS

- 1.00 INTRODUCTION
- 2.00 SITE LOCATION AND DESCRIPTION
- 3.00 DEVELOPMENT PROPOSALS
- 4.00 EXISTING GROUND CONDITIONS
- 5.00 EXISTING DRAINAGE
- 6.00 FLOOD RISK
- 7.00 STORM WATER DESIGN
- 8.00 DRAINAGE STRATEGY –FOUL WATER
- 9.00 PLANNING CONDITIONS

APPENDICES

- Appendix 1 –Location Plan
- Appendix 2 –Topographical Survey
- Appendix 3 –BEK Soakaway Report
- Appendix 4 –Masterplan
- Appendix 5 –Sewer Records
- Appendix 6 –Proposed Drainage Layout
- Appendix 7 –Hydraulic Calculations
- Appendix 8 –Land Registry Document

This document has been prepared by SBK for the exclusive use by the commissioning party in accordance with the terms and conditions of the contract between SBK and the commissioning party. No other party may use, make use or rely on the contents of this report without the prior written consent of SBK. No liability is accepted by SBK for any use of this report other than for the purpose for which it was originally prepared. This document may contain and rely on information provided by Third Parties; no verification of such information has been undertaken and SBK accept no responsibility for any inaccuracies within such information. No part of this report may be copied or reproduced by any means without written permission from SBK.



1.0 0 INTRODUCTION

- 1.01 SBK was commissioned by KIM Properties Ltd to prepare a Drainage Strategy Design to support the proposed development on the land at Lime Kiln Cottage, Welshpool.
- 1.02 The proposed development has obtained full planning approval (22/1137/FUL) from Powys Council for a phased development. However, this Drainage Statement relates to the Phase 1b scheme which involves the provision of a drive thru café with associated car parking.
- 1.03 This report will outline the philosophy of the proposed drainage design for the Phase 1b drive-thru café scheme. It is intended to support the discharge of Conditions 6, 7 and 21.



2.00 SITE LOCATION AND DESCRIPTION

2.01 The development site is located approximately 2km north of Welshpool at Buttington Cross Roundabout. The Ordnance Survey National Grid reference to the centre of the site is SJ241089.

2.02 The neighbouring land use is as follows:

- North Potential future Phase 2 of development
- East A483
- South Phase 1a of development
- West Montgomery Canal

2.03 A Google Map screenshot of the site location is shown below in Figure 1. A location plan can be found in Appendix 1.

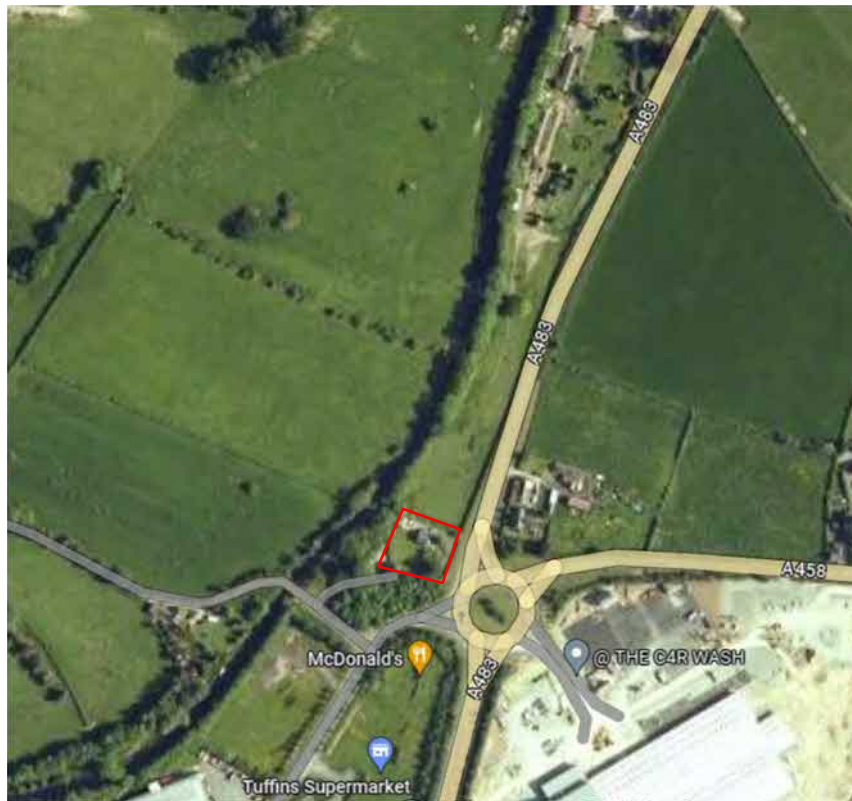


Figure 1 - Site location with approximate Phase 1b boundary (source Google Maps)

2.04 The site is currently occupied by a cottage, Lime Kiln Cottage, an access road, historic lime kilns and vegetation. The south-east corner of the site was formerly a copse.

2.05 The site slopes from the west to east from approximately 76.16m AOD to 73.89m AOD. A topographical survey of the site undertaken by Battlefield Land Surveys Ltd in May 2023 can be found in Appendix 2.



- 2.06 The nearest watercourse to the site is the Montgomery Canal which is located along the north-west boundary of the site at higher level. The River Severn is located approximately 400m east of the site.
- 2.07 The Phase 1b site totals an area of approximately 0.17ha which will be used within the drainage assessment.



3.00 DEVELOPMENT PROPOSALS

3.01 The development proposal will provide 1800 sq m of Class A3 floorspace with associated drive thru lane and car parking.

3.02 Figure 2 below shows an extract of the proposed masterplan. The full drawing can be found in Appendix 4.



Figure 2 - Proposed Masterplan (by Rev-A Associates)



4.00 EXISTING GROUND CONDITIONS

4.01 Site Geology and Hydrology

4.011 BEK Enviro Ltd has been commissioned to undertake a desk study and site investigation of the site at Lime Kiln Cottage, document reference BEK-23048-2.

4.02 Ground Conditions

4.02.1 Anticipated Ground Geology

Reference to the BGS Geological Map of Great Britain indicates the majority of the site is underlain by Bedrock Geology of the Forden Mudstone Formation.

The mapping indicates superficial deposits of Glaciofluvial Fan Deposits.

Borehole logs from the site investigation found made ground to depths of up to 0.4m. Below this stiff sandy silty clay was encountered to a depth of up to 1.60mBGL. Below this hard brown siltstone was encountered to the end of the boreholes at 2.5mBGL. The bedrock was not encountered by the boreholes.

4.02.2 Coal Mining

The Coal Authority Interactive Viewer indicates that the site is not located within a Coal Mining Reported Area.

4.02.3 Hydrogeology (subsurface water features)

MagicMap indicates that the Forden Mudstone Formation underlying the site is a Secondary B Aquifer.

The mapping also indicates that the Glaciofluvial Fan Deposits underlying the site are classified as a Secondary A Superficial Drift Aquifer.

There are no Source Protection Zones within circa 12km of the site boundary, with the nearest being to the north-east in Eyton.

4.02.4 Soakaway Design

Soakaway testing undertaken on the site as part of the site investigation determined that infiltration is not a suitable means of surface water disposal. A falling head test was undertaken within WS6 and provided an estimated infiltration rate of 8.90×10^{-9} m/s. The BEK report is contained within Appendix 3.



4.02.5 Hydrology (surface water features)

The nearest watercourse to the site is the Montgomery Canal which is situated along the north-western boundary of the site at higher level. The River Severn is located approximately 400m east of the site.

4.03 Existing Drainage on the Site

There are no records of any existing drainage on the site, although there is potential for some existing pipework to be located around the cottage.



5.00 EXISTING DRAINAGE

5.01 Severn Trent Water

5.011 Severn Trent Water (STW) has been contacted for information regarding existing public storm and foul water sewers in the vicinity of the site.

5.012 A copy of the STW sewer records can be found in Appendix 5.

5.013 The sewer records provided by STW identify a foul water sewer running in a southerly direction along the private road located to the south of the site. The mapping also highlights a private storm water sewer running parallel to the public foul water sewer.

5.014 Additional note:

Since 1st October 2011 many private sewers have been transferred into the ownership of the water authority as public sewers, where two or more properties in separate ownership are served by those sewers. Most of these former private sewers will not be shown on the public sewer records, therefore a full site survey should be carried out prior to any layout design or construction works to identify where these sewers may be and to avoid later delays and possible added costs.



6.00 FLOOD RISK

- 6.01 The Natural Resources Wales Flood Risk Map shows the site is not a risk of flooding from Rivers or Seas. The mapping does show a small area with a low to medium risk of flooding from surface water and small watercourses. This surface water flood risk area appears to be at the end of the existing access track which has a local depression compared to surrounding levels.
- 6.02 The risk of flooding from sewers is considered to be negligible as there are no public sewers within the site, and the only sewers which may be present on the site will be serving the existing cottage. These sewers will be decommissioned as part of the works and as such there will be a negligible risk.
- 6.03 The risk of flooding from groundwater is considered to be negligible as groundwater was not encountered within any of the boreholes up to a depth of 2.45m BGL. Additionally, no groundwater was encountered to a depth of 5.45m BGL within the Phase 1a testing.
- 6.04 The risk of flooding from artificial sources such as canals or reservoirs is considered to be low. The Montgomery Canal is located along the north-western boundary of the site. The canal is situated at a higher level than the site however, the topographical survey shows the water level within the canal to be circa 500mm below the towpath level, which would allow for any variances in level. In addition, the embankments of the canal are monitored and maintained by the Canal and River trust and as such it is considered that there is a low risk of the canal breaching into the site.
- 6.05 Sequential Test
- 6.05.1 The Sequential Test is intended to direct new development to area of lowest probability of flood risk, and ensure development is in the most appropriate flood zone.
- 6.05.2 As the development extents of the site are wholly within Flood Zone 1 and the proposed development is classed as less vulnerable, the development can be considered appropriate for the proposed use, and therefore passes the Sequential Test.
- 6.06 Exception Test
- 6.06.1 The Exception Test is not required as the site is located within Flood Zone 1 and passes the Sequential Test.



7.00 STORM WATER DESIGN

- 7.01 The Phase 1b development site has been designed to accommodate up to and including the 1 in 100 year plus 40% allowance for climate change storm event. Refer to drawing SBK-23-118-DR-C-532 for further information.
- 7.02 The Phase 1b development site totals approximately 0.17ha, with approximately 0.143ha impermeable area.
- 7.03 A greenfield runoff rate has been calculated using the UKSuds website and the IH124 methodology. Table 1 below shows the greenfield runoff rates for the site based on an area of 0.17ha.

Table 1 - Greenfield Runoff Rate

Return Period	Discharge Rate (l/s)
QBAR	0.92
Q1	0.77
Q30	1.85
Q100	2.37

- 7.04 However, it is considered that the lowest practicable discharge rate to reduce the risk of blockage is 2.0l/s. Therefore, it is proposed to restrict the discharge rate from the development site to 2.0l/s for all storm events up to and including the 1 in 100 year plus 40% allowance for climate change.
- 7.05 The discharge will be restricted to 2.0l/s via a hydro-brake flow control chamber. The hydro-brake has been sized to restrict the discharge rate to 2.0l/s at a head of 0.875m, which provides an orifice diameter of 69mm.
- 7.06 The surface water drainage discharge hierarchy is as follows. Discharge from developments should aim to discharge surface water as high up the hierarchy as possible.
 1. Surface water is collected for reuse;
 2. Into the ground (infiltration);
 3. To a surface water body;
 4. To a surface water sewer, highway drain, or another drainage system;
 5. To a combined sewer.
- 7.07 Priority Level 1 –Rainwater Collected for re-use. This has not been incorporated within the design as the proposed development class being a refreshment hub drive thru’ will not generate sufficient demand for re-use of greywater to justify the inclusion of Rainwater Harvesting.
- 7.08 Priority Level 2 –Surface water runoff is infiltrated to the ground. Infiltration testing undertaken on the site showed the underlying soil has insufficient permeability to drain the site via infiltration techniques. Refer to BEK Soakaway Report BEK/23048-2 for details of the infiltration testing. The report provides an infiltration rate of $8.90 \times 10^{-9} \text{m/s}$ based upon a falling head test. The report concluded that infiltration is not feasible for the site.
- 7.09 Priority Level 3 –The site is located adjacent to the Montgomery Canal. However, the canal is at a much higher level than the development site (circa



2m higher) therefore, a gravity connection cannot be made to the canal. An alternative watercourse would be the River Severn to the south-east. However, the River Severn is circa 400m from the site and the route to the river from the site crosses multiple third party land and as such this is not considered to be a feasible discharge location for the size of the development.

- 7.10 Therefore, it is proposed to discharge at Priority Level 4 to an existing private surface water sewer just south of Rhalt Lane. This private sewer in turn discharges to the Gungrog Brook circa 500m south of the site.
- 7.11 The proposed development site has rights to discharge into the private sewer as part of the sale agreement. Refer to the land register document CYM677940 for further details.
- 7.12 Permeable paving is proposed within the car park to provide a source control SuDS feature. Approximately 560m² permeable paving will be provided. The sub-base will be 300mm deep and will provide 30% voids for storage. Therefore, the permeable paving will provide 50m³ attenuation volume. The permeable paving will only drain its own area and as such it can be assumed to comply with interception of the first 5mm of rainfall as per CIRIA C753 Table 24.6.
- 7.13 Permeable paving is also proposed within the footpath area leading to the back-of-house area. The permeable paving will provide a source control SuDS feature. Approximately 95m² will be provided. The sub-base will be 250mm deep and will provide 30% voids for storage. Therefore, the permeable paving will only drain its own area and as such it can be assumed to comply with interception of the first 5mm of rainfall as per CIRIA C753 Table 24.6.
- 7.14 Baffles will be provided within the permeable paving to maximise the storage volume due to the slope of the car park. A 50mm opening within each baffle will be provided to hold back water within each section of sub-base.
- 7.15 Runoff from the western side of the drive-thru lane will be drained via a flush kerb which will allow rainwater to sheet over the kerb and over a filter strip to a dry swale. The dry swale will be 150mm deep and will be planted to the landscape architects specification. The dry swale will provide biodiversity benefits by providing a suitable habitat for invertebrates. The runoff will percolate through a 150mm filter medium and into the underlying granular drainage layer and perforated pipe before discharging into the piped network. The dry swale can be assumed to comply with interception of the first 5mm of rainfall as per CIRIA C753 Table 24.6 as the longitudinal gradient is less than 1:100.
- 7.16 Runoff from the eastern side of the drive-thru lane will be drained via a flush kerb which will allow rainwater to sheet over the kerb and over a filter strip and into the filter drain. The filter drain will be 600mm wide and a minimum of 600mm deep. The filter drain will convey water before discharging back to the piped network. Although the infiltration rate of the site is not suitable to discharge surface water, it is proposed for the filter drain to be unlined to allow the first 5mm of rainfall to be intercepted and discharged into the ground.



- 7.17 Three raised planters are proposed around the building. It is proposed to discharge the building roof area runoff directly into the raised planters to provide some treatment and reduce the peak flow of water from smaller return period storms. The raised planters will have a 300mm deep granular drainage layer at the bottom which will provide a small volume of attenuation before runoff enters the perforated pipe and discharges to a subsequent SuDS feature.
- 7.18 A vortex separator device is proposed prior to the cellular storage tank to provide water quality treatment to runoff from the drive-thru lane. A SDS Aqua Swirl Vortex Separator has SuDS mitigation index values of 0.8, 0.5, 0.7 for TSS, Metals and Hydrocarbons.
- 7.19 A cellular storage tank is proposed beneath the car park to provide sufficient volumetric storage to restrict the discharge rate from the development to the greenfield runoff rate. The cellular storage tank will be 36m² plan area and 0.8m deep. Cellular storage typically has a porosity of 95% so the tank will provide approximately 27m³ attenuation.
- 7.20 The cellular storage tank should have a minimum compressive strength of 400kPa to ensure it can take loading from occasional larger delivery vehicles as well as car traffic.
- 7.21 The proposed drainage layout is contained within Appendix 6.
- 7.22 The surface water drainage design has been modelled using Causeway's Flow software and calculations are contained within Appendix 7.
- 7.23 The hydraulic calculations show there will be no flooding up to and including the 1 in 100 year + 40% climate change event.
- 7.24 The drainage system has also been modelled for the 1 in 1000 year storm event as a sensitivity test to determine where the system would be exceeded. The model shows that the site would have circa 8m³ flooding in the 1 in 1000 year storm event and it would flood at the permeable paving manhole (as the lowest point on the site). The flooding would be contained within the kerb and it would drain away once the water levels in the system fall.
- 7.25 Sustainable Drainage Maintenance
- 7.25.1 The various SuDS features will remain privately owned and be maintained by the Development's Maintenance team. The exact details of this arrangement will be defined at a later stage and secured at outline stage by condition.
- 7.25.2 The SuDS operation and maintenance strategy will be in accordance with CIRIA C753 best practice, as tabled below:



Table 2 - SuDS Operation and Maintenance Requirements

Feature	Maintenance Requirement	Description
Gullies, drainage channels, manholes and flow control devices	Remove debris from catchment surface	Quarterly
	Inspect and record silt level within gullies and catchpits	Quarterly
	Inspect flow control chamber for evidence of poor performance	Monthly for 3 months then annually.
	Remove sediment from gullies, catchpits, flow control sumps.	Annually, or as required by inspection.
Filter Drain	Remove litter (including leaf litter) and debris from surface, access chambers and pre-treatment devices.	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment device:	Six monthly or as required from inspections
	Clear perforated pipework of blockage	As required. Min every 5 years.
	Remove surface geotextile and replace, and wash or replace overlying filter medium.	Every 5 years, or as required from inspections.
Cellular Storage Crates	Remove sediment from pre-treatment catchpit	Annually, or as required by inspection
	Inspect all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years
Permeable Paving	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Annually, after autumn leaf fall.
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	Annually or as-required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years, or as required.
	Inspect for evidence of poor operation or weed growth – if required, take remedial action	Quarterly, and 48 hours after large storm events.
Dry Swale	Remove litter and debris from swale and catchment surface	Quarterly
	Cut grass – to retain grass height within specified design range	Monthly (during growing season)
	Manage other vegetation and remove nuisance plants	Monthly for first year then as required
	Inspect inlets, outlets and perforated pipe for blockages and clear if required	Monthly



	Inspect vegetation coverage	Monthly for six months, quarterly for two years then half yearly
	Inspect filter medium surface for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hour	Monthly
	Inspect for silt accumulation, establish appropriate silt removal frequency	Half yearly
	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
	Repair erosion or other damage by reseeded	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil/filter medium layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	Every two years
	Clear perforated pipework of blockage	As required. Min every 5 years.
Raised Planter	Remove litter (including leaf litter) and debris from surface.	Monthly (or as required)
	Inspect infiltration surfaces for silting and ponding to determine if maintenance is necessary.	Quarterly
	Inspect operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc. and replace as necessary.	Quarterly
	Clear perforated pipework of blockage	As required. Min every 5 years.
	Inspect for scour within raised planter	Quarterly
	Replace any plants, to maintain planting density	As required
	Infill any holes or scour in the filter medium	As required
	Remove and replace filter medium and vegetation above	As required but likely to be >20 years
Repair minor accumulations of silt by raking away surface mulch, scarifying surface and replacing mulch	As required	
SDS Aqua Swirl Vortex Separator	Remove litter and debris and inspect for sediment, oil and grease accumulation.	Six monthly
	Change the filter media	Every two years
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections. Every two years as a minimum
	Replace malfunctioning parts or structure	As required
	Inspect for evidence of poor operation	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly for first 3 months, then six monthly.



7.26 Water Quality

7.26.1 CIRIA C753 provides the Simple Index Method which is an assessment to check the performance of the proposed SuDS design will provide sufficient water quality treatment in relation to three forms of pollution.

7.26.2 Table 3 below shows the minimum Target Index that the development site will need to achieve. The proposed site will need to meet or exceed the index values of the relevant land use shown below.

Table 3 - Minimum Target Index (CIRIA C753)

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roof	Very low	0.2	0.2	0.05
Other roofs (typically commercial / industrial)	Low	0.3	0.2	0.05
Individual property driveways; residential car parks, low traffic roads and non-residential car parking with infrequent change i.e. < 300 traffic movements / day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change, all roads except low traffic roads and trunk roads/motorway	Medium	0.7	0.6	0.7
Sites with heavy pollution, sites where chemicals and fuels are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

7.26.3 Where the mitigation index of an individual SuDS component is insufficient to meet the target Index, two components (or more) in series will be required where:

$$\text{Total SuDS mitigation index} = \text{mitigation index}_1 + 0.5 (\text{mitigation index}_2)$$

7.26.4 Tables 4, 5 and 6 below shows the proposed mitigation index values for the site based on runoff from various areas of the site going through the respective treatment train of SuDS features.



Table 4 - Proposed Water Quality Treatment Index (route from eastern drive thru lane)

Pollutant	SuDS Type			Target Index
	Filter Drain	SDS Aqua Swir (0.5 x Index Value)	Total	
TSS	0.4	(0.5) x 0.8	0.80	0.7
Metals	0.4	(0.5) x 0.5	0.65	0.6
Hydrocarbon:	0.4	(0.5) x 0.7	0.75	0.7

Table 5 - Proposed Water Quality Treatment Index (route from western drive thru lane)

Pollutant	SuDS Type			Target Index
	Filter Strip	Dry Swale (0.5 x Index Value)	Total	
TSS	0.4	(0.5) x 0.5	0.65	0.7
Metals	0.4	(0.5) x 0.6	0.70	0.6
Hydrocarbon:	0.5	(0.5) x 0.6	0.80	0.7

7.26.5 Tables 5 above shows runoff from the dry swale will exceed the target index values for Metals and Hydrocarbons, however, it does not meet the requirements for Total Suspended Solids. Therefore, it is proposed to provide a catchpit downstream of the dry swale to capture some remaining solids before runoff discharges from the site. This is anticipated to provide an additional mitigation index which will ensure that total suspended solids are adequately removed.

Table 6 - Proposed Water Quality Treatment Index (route from permeable paving)

Pollutant	SuDS Type			Target Index
	Permeable Paving	SDS Aqua Swirl (0.5 x Index Value)	Total	
TSS	0.7	(0.5) x 0.8	1.10	0.7
Metals	0.6	(0.5) x 0.5	0.85	0.6
Hydrocarbon:	0.7	(0.5) x 0.7	1.05	0.7

7.26.6 Tables 4 and 6 above show runoff from these parts of the site exceed the target index values.



8.00 DRAINAGE STRATEGY –FOUL WATER

- 8.01 The foul water drainage from the proposed Phase 1b development will convey water around the proposed building and to the south of the site where it will discharge into the existing Severn Trent Water public foul water sewer at MH ref 1800.
- 8.02 A S106 application will be submitted to Severn Trent Water to confirm it is acceptable prior to connecting to the sewer.
- 8.03 SBK have prepared a foul water strategy drawing which can be found in Appendix 6.



9.00 PLANNING CONDITIONS

Planning Condition 6

- 9.01 Planning Condition 6 states: *“Prior to the commencement of development, including groundworks and ground clearance, evidence shall be submitted to and approved in writing by the Local Planning Authority to demonstrate that any works required for management of surface waters on-site would not affect adversely the structural integrity of the canal embankment taking into account current groundwater levels at the embankment as well as predicted changes to surface water flows. The development shall be carried out in strict accordance with the approved details.”*
- 9.02 The canal is a minimum of 16m north-west of the Phase 1b site at its closest, with the nearest hardstanding to the canal being at least 19m away. In addition, the top of the canal bank level is 76.60m which is approximately 1.8m higher than the proposed building finished floor level of 74.83m.
- 9.03 The site investigation report did not find any groundwater up to a depth 2.5mBGL which equates to at least 4.5m below ground compared to the canal bank as the testing was undertaken at the Phase 1b site levels which are lower than the canal.
- 9.04 The proposed surface water drainage strategy for the site will be to discharge to a public sewer, therefore the site will be positively drained. The proposed drainage strategy will accommodate all water within the network up to and including the 1 in 100 year plus 40% climate change event. The proposed drainage strategy will be an improvement to the existing situation and will provide a more robust network which can accommodate much larger storm events than the current site. This will ensure surface water will not have an impact on the canal embankment.
- 9.05 Therefore, as the proposed site will be positively drained up to and including the 1 in 100 year plus 40% climate change event, coupled with the distance the canal is away from the Phase 1b development site and that the canal is at a higher level than the site. It is considered that the proposed development will not have an impact on the structural integrity of the canal embankment.

Planning Condition 21

- 9.06 Planning Condition 21 states: *“No surface water drainage from the site shall be allowed to discharge onto the county highway at any time during the approved development's lifetime.”*
- 9.07 The proposed drainage design positively drains the full site and will discharge the runoff to a private surface water sewer. The proposed drainage network will provide storage to accommodate storm events up to the 1 in 100 year plus 40% allowance for climate change event. The drainage network has been stress tested based on a 1 in 1000 year storm event, in this scenario the model shows the site would only have 8m³ flooding, which would be contained within the car park area of the site by the kerb upstands. Therefore, no surface water from the site will discharge onto the county highway.



Planning Condition 7

- 9.08 Planning Condition 7 states: *“No development shall commence until drainage plans for the disposal of foul and surface water flows (to include calculations) have been submitted to and approved in writing by the Local Planning Authority. The scheme shall be fully implemented in accordance with the approved details prior to the first beneficial use of any phase of the development hereby approved.”*
- 9.09 This report has been prepared along with the associated appendices to provide the required information for this planning condition to be discharged.



Appendix 1 –Location Plan





1. DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS STATED OTHERWISE.
3. THE CONTRACTOR IS TO CHECK DRAWINGS AND TO VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS. ANY DISCREPANCIES ARE TO BE NOTIFIED TO REV-A ASSOCIATES IMMEDIATELY.
4. THIS DRAWING IS THE PROPERTY OF REV-A ASSOCIATES. COPYRIGHT IS RESERVED BY THEM AND THE DRAWING IS ISSUED ON THE CONDITION THAT IT IS NOT COPIED, REPRODUCED, RETAINED OR DISCLOSED TO ANY UNAUTHORISED PERSON, EITHER WHOLLY OR IN PART, WITHOUT THE CONSENT IN WRITING OF REV-A ASSOCIATES.
5. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE CURRENT BUILDING REGULATIONS AND ALL ASSOCIATED BRITISH STANDARDS.

- Phase 1a
- Phase 1b
- Phase 2

P02	30/11/2022	AC	AA
Update to phasing			
P01	24/06/2022	AC	AA
Updates to layout			
Rev	Date	By	Checked



Client
 Stephen James Property Ltd

Project Title
 Moors Farm, Mixed Use Redevelopment

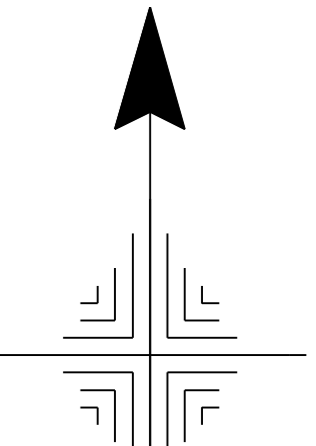
Date	Drawn By:	Checked By:
27/11/2020	AC	AA
Suitability	Scale	Revision
S0	1:500	P02

Drawing Name
 Construction Phase Plan

Drawing Number
 SHR17065-REVA-DR-A-014

Appendix 2 –Topographical Survey





- Legend**
- BL BOLLARD
 - BS BUS STOP
 - CATV CABLE TV COVER
 - CL COVER LEVEL
 - CPS CONCRETE PAVING SLAB
 - DP DRAIN PIPE
 - DK DROP KERB
 - EL ELECTRICITY COVER
 - EP ELECTRICITY POLE
 - ER EARTH ROD
 - EH FIRE HYDRANT
 - FL FLOOR LEVEL
 - FS FLAG STAFF
 - G GAS COVER
 - GL GULLY
 - GSV GAS STOP VALVE
 - IC INSPECTION COVER
 - IL INVERT LEVEL
 - LB LITTER BIN
 - LP LAMP POST
 - MKR MARKER
 - NB NOTICE BOARD
 - P POST
 - PH POST HOLE
 - PLP PEDESTRIAN LAMP POST
 - RE RODDING EYE
 - RS ROAD SIGN
 - STN SURVEY STATION
 - STY STAY WIRE
 - T TELECOMMUNICATIONS COVER
 - TL TRAFFIC LIGHT
 - TP TELEGRAPH POLE
 - TWk TOP OF WALL LEVEL
 - UTL UNABLE TO LIFT
 - UTM UNABLE TO MEASURE
 - VP VENT PIPE
 - WL WATER LEVEL
 - WP WASTE PIPE
 - WSW WATER STOP VALVES
- FENCE TYPES**
- B/W BARBED WIRE
 - C/B CLOSE BOARD
 - P/W POST AND WIRE
 - P/R POST AND RAIL
 - C/L CHAIN LINK
 - C/P CHESTNUT PALE
 - C/W CHICKEN WIRE
 - M/R METAL RAIL (SECURITY TYPE)
 - P/F PANEL FENCE
 - C/ CORRUGATED IRON
 - I/R IRON RAILING
 - RWL RETAINING WALL

Notes
 COPYRIGHT FOR DRAWING REMAINS WITH BATTLEFIELD LAND SURVEYS LTD, AND MAY NOT BE COPIED WITHOUT THEIR WRITTEN CONSENT.

ANY SERVICES SHOWN ARE AS LOCATED BY EITHER GROUND PENETRATING RADAR (GPR) OR BY RADIO DETECTION SCANNER IN EITHER ACTIVE (A) OR PASSIVE MODE (P). DUE TO SUBSOIL CONDITIONS AND OTHER FACTORS THE UNDERGROUND SERVICE INFORMATION SHOWN MAY NOT REPRESENT A COMPREHENSIVE RECORD AND ALL CONTRACTORS SHOULD PROCEED WITH CAUTION BEFORE EXCAVATION

--- DENOTES OVERHEAD CABLES
 - - - - DENOTES UNDERGROUND SERVICES

LEVELS AT ROAD KERBS ARE TAKEN AT CHANNEL LEVELS UNLESS OTHERWISE REQUESTED

STATION CO-ORDINATES

STN 1	E 324378.696	N 509270.881	H 69.591
STN 2	E 324281.885	N 509296.881	H 76.828
STN 3	E 324245.050	N 509185.299	H 76.636
STN 4	E 324226.287	N 509081.127	H 76.578
STN 5	E 324183.826	N 508989.476	H 76.611
STN 6	E 324141.806	N 508937.129	H 76.661
STN 7	E 324112.461	N 508893.518	H 78.345
STN 8	E 324104.959	N 508855.903	H 74.623
STN 9	E 324221.656	N 508912.220	H 74.338
STN 10	E 324292.709	N 509292.167	H 75.256
STN 11	E 324251.930	N 508865.946	H 72.958
STN 12	E 324158.479	N 508909.818	H 74.323
STN 13	E 324256.854	N 509139.257	H 73.656
STN 14	E 324268.311	N 509179.941	H 74.250
STN 15	E 324278.902	N 509206.261	H 74.338
STN 16	E 324303.462	N 509224.374	H 73.347
STN 17	E 324297.478	N 509246.264	H 73.645
STN 18	E 324302.972	N 509261.983	H 73.554
STN 19	E 324316.704	N 509296.143	H 72.279

BATTLEFIELD LAND SURVEYS LTD
 3 NEWBERRY ROAD
 BATTLEFIELD ENTERPRISE PARK
 SHREWSBURY
 SHROPSHIRE SY1 3EH
 TEL/FAX 01743 443358
 EMAIL MAILBOX@BLSURVEYS.CO.UK

Client	REV-A ASSOCIATES	Title	MOORS FARM OSWESTRY ROAD, WELSHPOOL
Scale	Date	Job No	Dwg No
1 : 200	05/05/23	13532	06
Surveyed by	Checked	Scanned	Levels are related to
RDL/SJ/HP CS/WE	RDL	NO	OS DATUM (VRS)

Appendix 3 –BEK Soakaway Report





GEO-ENVIRONMENTAL CONSULTING ENGINEERS

bEk Enviro Ltd

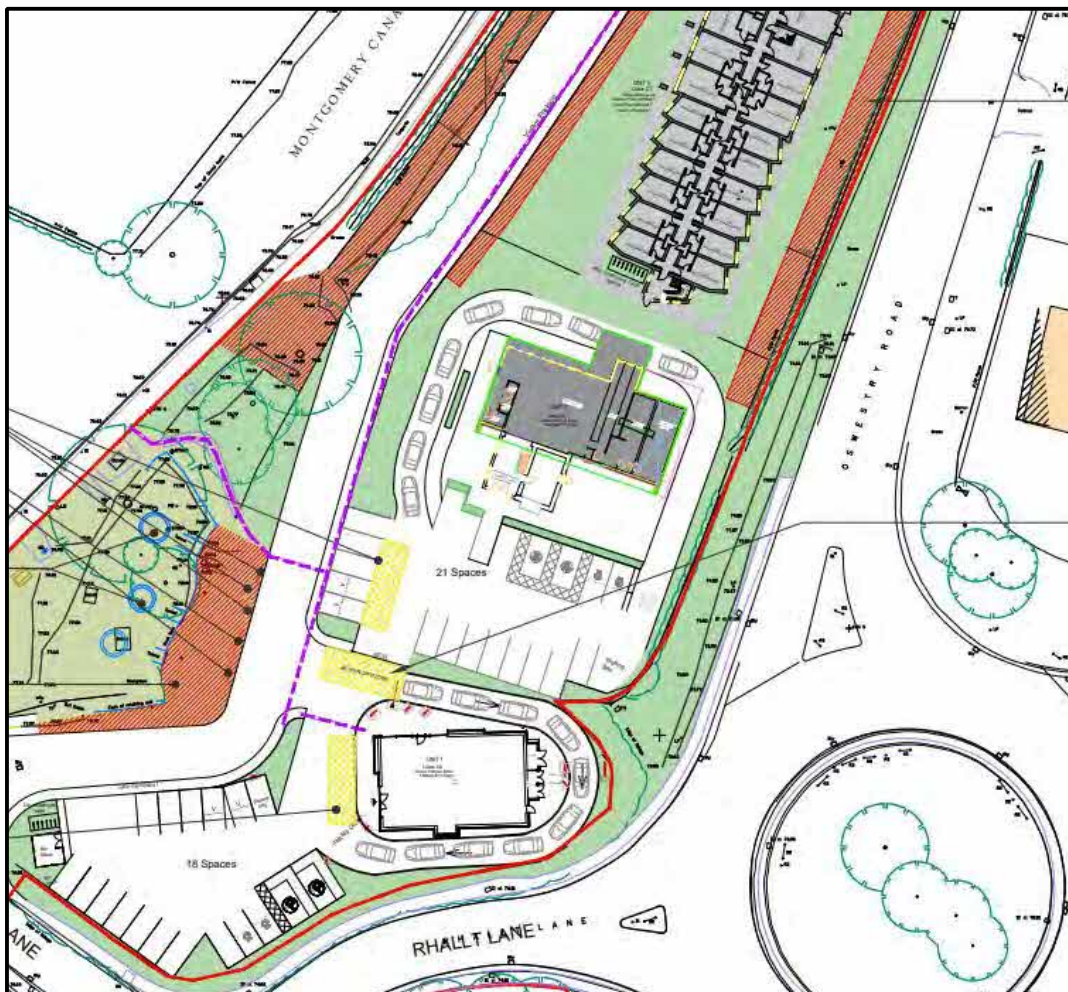
Suite One | No 3 Mitton Road Business Park
Mitton Road | Whalley | Lancashire | BB7 9YE

01254 377622

mbuckley@bekenviron.co.uk | bekenviron.co.uk

LAND TO THE NORTH OF RHALLT LANE, WELSHPOOL

Site Investigation & Ground Assessment



Prepared for:

KIM Property Investments Ltd

Report Ref: BEK-23048-2 (Rev A)

April 2023



GEO-ENVIRONMENTAL CONSULTING ENGINEERS

bEk Enviro Ltd

Suite One | No 3 Mitton Road Business Park
Mitton Road | Whalley | Lancashire | BB7 9YE

01254 377622

mbuckley@bekenviro.co.uk | bekenviro.co.uk

Project Quality Assurance Information Sheet

Site	Land to the north of Rhallt Lane, Welshpool
Report Title	Site Investigation & Ground Assessment
Report Status	Final
Report No	BEK-23048-2 (Rev A)
Date	April 2023
Prepared For	KIM PROPERTY INVESTMENTS LTD Alex House 260/8 Chapel Street Salford Manchester M3 5JZ
Prepared By	BEK ENVIRO LIMITED Suite One No 3 Mitton Road Business Park Mitton Road Whalley Lancashire BB7 9YE
Author(s)	Mitchell Leigh Monk BSc (Hons)
Checked	James Mashiter BSc (Hons) MSc
Authorised	Michael Buckley BSc (Hons) MSc MEnvSci CEnv
Contact	mbuckley@bekenviro.co.uk www.bekenviro.co.uk Office: 01254 377622 Mobile: 07906753583



GEO-ENVIRONMENTAL CONSULTING ENGINEERS

bEk Enviro Ltd

Suite One | No 3 Mitton Road Business Park
Mitton Road | Whalley | Lancashire | BB7 9YE

01254 377622

mbuckley@bekenviro.co.uk | bekenviro.co.uk

LAND TO THE NORTH OF RHALLT LANE, WELSHPOOL

Site Investigation & Ground Assessment

PROJECT NO: 23048

REPORT REF: BEK-23048-2

DATE: April 2023

REVISION STATUS / HISTORY

Rev	Date	Issue / Comment	Prepared	Checked
A	26 April 2023	TRL/CBR Values Added	MLM	MB

GENERAL REPORT LIMITATIONS

BEK Enviro Limited (BEK) has prepared this report for the sole use of the client, showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. The report may not be relied upon by any other party without the express agreement of the client and BEK. No other warranty, expressed or implied, is made as to the professional advice included in this report.

Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by BEK for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

No part of this report may be copied or duplicated without the express permission of BEK and the party for whom it was prepared. Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

Unless explicitly agreed otherwise, in writing, this report has been prepared under BEK's limited standard Terms and Conditions as included within our proposal to the Client.

The report needs to be considered in the light of the BEK proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

TABLE OF CONTENTS

1.	INTRODUCTION
1.1	Appointment
1.2	Background Information
1.3	Proposed Development
1.4	Objective & Scope of Work
1.5	Limitations
2.	BACKGROUND INFORMATION
2.1	Site Location & History
2.2	Environmental Setting
2.3	Potentially Significant Pollutant Linkages
2.4	BEK Comments
3.	SITE INVESTIGATION
3.1	General
3.2	Window Sample Boreholes
3.3	Dynamic Cone Penetrometer
3.4	Laboratory Testing
3.5	Ground Conditions
3.6	Falling Head Test
3.7	In-Situ Testing
4.	QUANTITATIVE RISK ASSESSMENT
4.1	Potentially Significant Pollutant Linkages
4.2	Risk Assessment: Human Health Risks from Exposure to Contaminated Soil
4.3	Risk Assessment: Human Health Risks from Exposure to Ground gas
4.4	Risk Assessment: Controlled Waters
4.5	Risk Assessment: Buildings
4.6	Risk Assessment: Conclusions
5.	GEOTECHNICAL ASSESSMENT
6.	RECOMMENDATIONS

APPENDICES	
Appendix A	Exploratory Logs
Appendix B	TRL Probe Results and CBR Conversion
Appendix C	Chemical Test Results
Appendix D	Geotechnical Test Results
Appendix E	Falling Head Test Results
Appendix F	Drawings

DRAWINGS	
BEK Drawing No 23048-1	Site Location
BEK Drawing No 23048-2	Site Layout
REV-A Associates Drawing entitled 'Moors Farm, Mixed Use Redevelopment' dated 27th November 2020, Drawing Number 'SHR17065-REVA-DR-A-002'.	



1. INTRODUCTION

1.1 Appointment

1.1 BEK Enviro (BEK) has been commissioned by KIM Property Investment Limited to carry out a site investigation for the proposed commercial development at the site located to the north of Rhallt Lane and to the west of Oswestry Road (A483), Welshpool (hereafter known as 'the site') to quantify the potential risks from contamination and ground gas and to provide factual geotechnical information to allow foundation design to be carried out.

1.2 Background Information

1.2.1 The site comprises a roughly rectangularly shaped plot of land approximately 1600 m² which is occupied by Limekiln Cottage, associated outbuildings (to the north-west of the site) and associated grounds. Landscaped garden areas (generally comprising overgrown grasses) lie in the central/south-western sections of the site. The site is accessed via a farm access track immediately south of the site which links to Rhallt Lane some 40 m south.

1.2.2 The site location and site layout are presented on BEK Drawing No 23048-1 and BEK Drawing No 23048-2, respectively. Copies of these drawing are presented in Appendix F.

1.3 Proposed Development

1.3.1 It is proposed to construct a Class A3 unit with a drive through and associated car parking.

1.3.2 The proposed development can be seen on REV-A Associates Drawing entitled 'Moors Farm, Mixed Use Redevelopment' (Drawing Ref: 'SHR17065-REVA-DR-A-002, dated 27th November 2020) a copy of which is presented in Appendix F.

1.3.3 The area to which this site investigation and contamination assessment report applies is highlighted in red in Figure 1.



Figure 1: Red Line Site Boundary

1.4 Objective & Scope of Work

1.4.1 The objective of the site investigation is to provide indicative information on the ground conditions to facilitate a quantitative risk assessment for contamination and to provide factual geotechnical information.

1.4.2 The site investigation was undertaken by BEK during March 2023 in accordance with the recommendations detailed in the Preliminary Risk Assessment (PRA) prepared by BEK (Report Ref: BEK-23048-1, dated March 2023) and with consideration to site conditions. The PRA should be read in conjunction with this report.

1.5 Limitations

1.5.1 The conclusions and recommendations presented in this report are the result of our professional interpretation of the information currently available. BEK reserve the right to amend the conclusions and recommendations if further information becomes available.

1.5.2 However, it should be noted that much of the information has been derived from reports written by others and BEK takes no responsibility for the accuracy of that information. Notwithstanding the above, the reports reviewed have all been written by professional environmental consultants with a duty of care to provide relevant and accurate information.

1.5.3 The comments given in this report and the opinions expressed are based on review of reports provided to BEK, ground conditions encountered during site works and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigations and therefore could not be taken into account.



2. PRELIMINARY RISK ASSESSMENT

2.0.1 This section provides an overview of the findings and recommendations presented in the PRA.

2.1 Site Location & History

Site Location and Layout

2.1.1 The site is located immediately west of the A483 and some 40 m north of Rhallt Lane. The site is approximately 2.4 km north-east of Welshpool and some 10.5 km south of Four Crosses.

2.1.2 The site comprises a roughly rectangularly shaped plot of land approximately 1600 m² which is occupied by Limekiln Cottage, associated outbuildings (to the north-west of the site) and associated grounds. The two-storey residential dwelling (Limekiln Cottage) occupies the north-west of the centre of the site and is of part stone, part rendered construction with a slate roof. The cottage is in a generally poor state of repair. Access to the main property was not possible at the time of the site walkover. A wooden shed occupies the north-western corner of the site. An asphalt driveway occupies the northern and eastern peripheries of the site.

2.1.3 Landscaped garden areas (generally comprising overgrown grasses) lie in the central/south-western sections of the site. At the time of the site walkover, old furniture and general waste was noted to be scattered across the site. The site is accessed via a farm access track immediately south of the site which links to Rhallt Lane some 40 m south.

Site History

2.1.4 Based on the earliest available historical maps dating from 1887 the site was occupied by the present-day Limekiln Cottage, a small outbuilding present in the north-western corner of the site and a road along the southern periphery of the site. At this time, the remainder of the site was vacant besides sparse trees. On maps dating from 1902, a further three outbuildings were present on the western boundary of the site with a further outbuilding on the north-western corner of the site. From circa 1971 the three outbuildings on the western boundary of the site were no longer present (presumably demolished). At this time, Lime Kiln Cottage remained to the north-west of the centre and the outbuilding remained in the northwest of the site. At some time around 1988 the Limekiln Cottage grounds were connected directly to the A483. Circa 1995 the Limekiln Cottage grounds were no longer connected to the A483. The access road in the north was extended along the eastern and southern peripheries of the site linking to Rhallt Lane to the south-west of the site.

2.2 Environmental Setting

Geology

- 2.2.1 Furthermore, site investigation information has been sought from the British Geological Society (BGS) website. There are six exploratory locations within 250 m of the site. The BGS boreholes indicated the presence of 'brown sandy topsoil' in all six locations to depths varying from 0.3 m (SJ20NW41 & SJ20NW45) to 0.46 m (SJ20NW39). This was underlain by 'Firm brown sandy stony clay' to the base of each borehole. The clay contained pieces of shale to a depth of 2.74 m within SJ20NW41 and cobbles between 2.74 m and 4.27 m within SJ20NW41.
- 2.2.2 According to the Enviro & GeoInsight report there is no made ground overlying the site. In addition, no BGS borehole records from within 250 m of the site encountered made ground. Topsoil varying in depth from 0.3 m to 0.46 m was encountered in the vicinity of the site.
- 2.2.3 The superficial geology overlying the north-eastern, eastern, central and southern peripheries of the site comprises 'Glaciofluvial Fan Deposits' Formation. The superficial strata overlying the western and north-western peripheries of the site comprises low permeability Glacial Till (Boulder Clay). This is likely to be regionally continuous and is likely to be present below the 'Glaciofluvial Fan Deposits' Formation. Boreholes drilled within the vicinity of the site suggest that 'Boulder Clay' is present where 'Glaciofluvial Fan Deposits' are noted as the published geology.
- 2.2.4 The underlying solid geology comprises the Nantglyn Flags Formation in the western section of the site. The Forden Mudstone Formation is present across the east and central parts of the site.

Linear Features

- 2.2.5 According to the Enviro & GeoInsight Report a 'fault, inferred' runs north-east to south-west slightly west of the centre of the site.

Mining & Ground Stability

- 2.2.6 The site is located within an area which is unlikely to have been affected by Coal Mining.
- 2.2.7 Non-coal mining activities (Vein Mineral) have been carried out on site. However, these are noted to be 'localised small scale underground mining' and the 'potential for difficult ground conditions are unlikely or localised and are at a level where they need not be considered'.



2.2.8 In addition to the above, the Enviro & GeoInsight Report provides hazard ratings associated with ground subsidence at the site, as summarised below:

Shrink-Swell Clay:	Very Low
Landslides:	Very Low
Ground Dissolution of Soluble Rocks:	Negligible
Compressible Deposits:	Negligible
Collapsible Deposits:	Very Low
Running Sands:	Very Low

2.2.9 It can be seen from the above that the site is unlikely to be affected by natural ground instability.

Hydrogeology

2.2.10 The superficial Glaciofluvial Fan Deposits overlying the north-eastern, eastern, central and southern peripheries of the site are classified by the Environment Agency as a 'Secondary A Aquifer'. The Boulder Clay is classified as a 'Secondary Undifferentiated' aquifer which is 'assigned where it is not possible to attribute either category A or B to a rock type.' These aquifers were formerly referred to as 'unproductive'.

2.2.11 The underlying bedrock is classified as a 'Secondary B Aquifer'.

2.2.12 The site is not located within groundwater source protection zone and there are no groundwater abstractions located within 250 m of the site.

Hydrology

2.2.13 There are no surface water features located on site. The Montgomery Canal runs south-west to north of the site some 10 m west of the site and is noted to contain water all year round.

2.2.14 There are no surface water abstractions located on or within 250 m of the site.

2.2.15 There is one licensed discharge to controlled waters located within 250 m of the site. This refers 'Sewage Discharges – Final/Treated Effluent' to Underground Strata' some 161 m south-west of the site. The consent is historical and was issued on 11th July 1977. No revocation date is provided.

2.2.16 Risks from river and coastal flooding have not been identified on site.

Contaminated Land & Landfill Activities

- 2.2.17 There are no current or historic landfill or waste sites sites located within 250 m of the site.
- 2.2.18 There are no waste exemptions located on or within 250 m of the site.
- 2.2.19 A total of 5 no. pollution incidents have taken place within 250 m of the site. These are summarised in Table 1.

Distance/Direction	Incident Date	Pollutant Description	Impact
36 m south-west	11/01/2017	Agricultural Materials & Waste	Water: Minor Air & Land: No Details
36 m south-west	11/01/2017	Not Provided	Water: Minor Air & Land: No Details
146 m South-West	16/07/2001	Oils and Fuel - Diesel	Water: Minor Air & Land: No Impact
215 m South	23/09/2016	Atmospheric Pollutants & Effects - Smoke	Air: Minor Land & Water: No Details
215 m South	23/09/2016	Not Provided	Air: Minor Land & Water: No Details

Table 1: Summary of Pollution Incidents Located Within 250 m of the Site

- 2.2.20 There are no recorded Part A(1), A(2) or IPPC Authorised Activities within 250 m of the site.
- 2.2.21 However, a current Part B permit is held for Timber Manufacture some 178 m south-west of the site. No enforcements have been notified.
- 2.2.22 There are 7 current recorded potentially contaminative land uses within 250 m of the site, the closest of which is a limekiln located on site. This may have impacted upon the site. A further limekiln is present some 20 m west of the south-western corner of the site but is unlikely to have impacted on the site.

Sensitive Land Uses

- 2.2.23 The site is considered to have the potential to affect two ecological systems identified as statutory receptors in the DETR Circular 01/2006. These include a Special Area of Conservation (Otters and Floating water-plantain) and a Site of Special Scientific Interest within Montgomery Canal which is situated some 10 m west of the site. The canal should be considered to represent a potential receptor.

Radon

- 2.2.24 Groundsure reports that estimated between 1% and 3% of properties are affected by radon, therefore no radon protection measures are required in new builds at the site.



Unexploded Ordnance

- 2.2.25 The regional unexploded bomb risk map from Zetica (2014) indicates that the site is in an area with LOW risk from possible Unexploded Ordnance (UXO) resulting from the Second World War. BEK do not consider any further assessment to be required with respect to UXO.

- 2.3 Preliminary Conceptual Model
 - 2.3.1 This section identifies the potential contaminants of concern, sources, pathways and receptors that may be associated with the site based on its known history and current condition and with respect to the redevelopment of the site for residential use. The preliminary conceptual model is summarised in the following table.

Link	Source	Hazard	Transport Mechanism	Pathway	Medium of Exposure	Receptor	Risk Summary*
1	Contaminated soils	Direct contact /ingestion of soil or dust	Direct contact with contaminated soil	Dermal contact/ingestion of soil at surface	Soil	Humans (on-site/off-site), domestic pets	Low
2	Contaminated soils	Particulate inhalation	Wind blown particulates	Inhalation of particulates	Air	Humans (on-site/off-site), domestic pets	Low
3	Contaminated Soils	Inhalation of Ground Gas	Degradation of contaminants generating ground gas through unsaturated zone to soil leading to inhalation	Inhalation of Gases	Air	Humans (on-site/off-site, domestic pets)	Low
4	Contaminated Soils	Inhalation of Vapours	Volatilisation of Organic Compounds and migration to property	Inhalation of Vapours	Air	Humans (on-site/off-site, domestic pets)	Low
5	Contaminated Soils	Damage to structure/services	Direct contact of contaminants with building structures/services	Direct contact	Soil/Water	Flora, Services, concrete	Low
6	Contaminated Soils	Degradation of perched water quality	Dissolution or suspension of contaminants into perched waters and migration to off-site receptors	Dissolution or Suspension	Water	Perched Waters, Montgomery Canal (also an ecological receptor)	Low
7	Contaminated Soils	Pollution of underlying groundwater	Dissolution or suspension of contaminants into groundwaters (Superficial Aquifer within Glaciofluvial Fan Deposits and Bedrock Aquifer)	Dissolution or Suspension	Water	Groundwaters	Low

Table 2: Preliminary Conceptual Model

*Relative Risk Screening and Prioritisation for further Investigation & or Assessment

High	Higher probability of occurrence and identification of primary sources of contamination with respect to most sensitive receptors.
Medium	Pollutant linkage generally dependent on the presence of other primary pollutant linkages and/or where pollutant linkage generally associated with less sensitive receptors.
Low	Lower probability of occurrence such as based on requirement for significant migration pathway or where pollutant linkage requires the presence of source contaminants at concentration likely to be much higher than other identified pollutant linkages.

3. SITE INVESTIGATION

3.1 General

3.1.1 This section provides a summary of the site investigation works undertaken by BEK during March 2023.

3.1.2 The site investigation has been designed to provide indicative information for the ground conditions across the site with respect to the quantitative assessment of the potential risks associated with contamination and to carry out geotechnical testing to support foundation design.

3.1.3 Six exploratory locations were initially set out by the site engineer and the exploratory locations are illustrated on Figure 2 below.

3.1.4 Note, it was not possible to drill Borehole No WS4 due to the presence of a septic tank and services in this location. However, BEK considers a reasonable spatial spread has been achieved across the site.



Figure 2: Borehole Location Plan

3.2 Window Sample Boreholes

3.2.1 Five window sample boreholes were drilled using a window sample borehole rig to a maximum depth of 2.5 m. In-situ testing (SPTs) were carried out in each of the boreholes. One of the boreholes (WS5) was installed with a groundwater monitoring well.

3.2.2 The ground conditions were recorded by an engineer from BEK and samples were recovered for chemical testing. Copies of the borehole records are presented in Appendix A.

3.2.3 The window sample borehole locations are illustrated on Figure 2.

3.3 Dynamic Cone Penetrometer

3.3.1 A total of 6 TRL dynamic cone penetrometer (DCP) locations were progressed across the site to a maximum depth of 1 m below ground level and to provide information on shallow ground properties. The DCP tests were carried out on the sub-base following removal of the concrete cores.

3.3.2 The results of the TRL results are presented in Appendix B and the average CBR results are summarised in Table 3 below.

Location	CBR Value (%)
CBR1	53.36
CBR2	14.40
CBR3	11.28
CBR4	No Data (Services in location)
CBR5	29.53
CBR6	25.55

Table 3: CBR Test Results (Converted from TRL Test Results)

3.4 Laboratory Testing

Soil Chemical Testing

3.4.1 Following a review of the ground conditions encountered, BEK selected 5 samples for chemical testing.

3.4.2 Chemical laboratory testing was undertaken by Envirolab, a UKAS accredited laboratory. All testing was undertaken to MCERTS standard (where available). The samples were submitted for the following chemical analysis:

Arsenic (Total), Cadmium (Total), Copper (Total), Lead (Total), Nickel (Total), Zinc (Total), Chromium (Total), Selenium (Total), Mercury (Total), Boron (Soluble), Hexavalent Chromium, Cyanide (Total), pH, 16 EPA Poly-Aromatic Hydrocarbons (PAH), Total Phenols, Total Sulphate, Sulphate 2:1 extract, Soil Organic Matter, Speciated Total Petroleum Hydrocarbons.

Furthermore, all samples were tested for an Asbestos Screen.

3.4.3 Copies of the chemical test results are provided within Appendix C.



Geotechnical Testing

- 3.4.4 Geotechnical testing was carried out on a bulk sample by the UKAS accredited laboratory of Murray Rix.
- 3.4.5 Three samples were tested for Plasticity Index testing and natural Moisture Content.
- 3.4.6 Copies of the geotechnical test results are presented in Appendix D.
- 3.5 Ground Conditions
- 3.5.1 The site investigation proved the presence of made ground at each location. This is described as 'grass onto soft brown/black slightly silty sandy clay with occasional ash and clinker fragments, rare broken brick and frequent rootlets' to depths varying from 0.2 m (in Borehole No WS1 and WS2) to 0.4 m (in Borehole No WS3, WS4 and WS5). The made ground was noted to have a higher sand content within Borehole No WS5.
- 3.5.2 'Very stiff brown very silty slightly sandy clay' was encountered below the made ground to depths varying from 1.2 m (Borehole No WS2 and WS3) to 1.6 m (Borehole No WS1).
- 3.5.3 'Hard weathered siltstone' was encountered at the base of each borehole to depths of 2.45 m (Borehole Nos WS1, WS2, WS5, WS6) to 2.5 m (Borehole No WS3) at which point the boreholes refused.
- 3.5.4 There was no visual or olfactory evidence of contamination identified within any of the boreholes.
- 3.5.5 Groundwater was not encountered during the site investigation.
- 3.6 Falling Head Test
- 3.6.1 A falling head test was carried out within 1 exploratory location at the site (Borehole No WS6). The results are presented in Appendix E.
- 3.6.2 Water levels were measured in each borehole prior to water being added as quickly as possible. The time taken for the water level to fall to original levels was recorded at intervals. The falling head test results are presented in Appendix E.
- Only minimal reduction in water level was noted in the borehole over 4 hours from 0.31 to 0.39 m bgl.



3.6.3 The results indicate that infiltration in the location of Borehole WS6 may not be possible as the ground conditions appear to be relatively impermeable indicating infiltration is unlikely to be a viable means of disposing surface water at the proposed development site. However, it is recommended that infiltration testing to BRE365 (2016) should be undertaken to confirm infiltration rates for detailed drainage design.

3.7 In-Situ Testing

3.7.1 Standard Penetration Tests (SPTs) were carried out every 1 m in natural strata during drilling. The results are summarised in Table 4 below and presented on the borehole logs (Appendix A).

Depth (m)	WS1	WS2	WS3	WS5	WS6
1.0 – 1.45	23	23	20	21	20
2.0 – 2.45	>50	>50	36	>50	>50

Table 4: Summary of SPT 'N' Values



4. QUANTITATIVE RISK ASSESSMENT

4.1 Potentially Significant Pollutant Linkages

4.1.1 Potentially significant pollutant linkages have been identified within the preliminary conceptual model developed by BEK. These risks include:

- (i) Human Health - risks associated with contamination in site soils: risk via ingestion (soil and/or water), inhalation (dust, gas or vapour) or direct contact.
- (ii) Controlled waters - risks associated with contamination from site soils leading to lateral migration within perched waters to off-site receptors (including the Canal 10 m west which is also considered an ecological receptor) and vertical migration of contaminants to the underlying groundwater present within the superficial Secondary A Aquifer and the underlying bedrock Secondary B Aquifer
- (iii) Services and property - risks associated contamination affecting service pipes, flora and concrete.

4.2 Risk Assessment: Human Health Risks from Exposure to Contaminated Soil

4.2.1 The risks to human health have been assessed by inspection of shallow soils for the presence of elevated contaminants based on the expected contaminant findings detailed in the conceptual model and completion of a quantitative risk assessment.

4.2.2 The soil contamination concentrations have initially been compared to a range of generic assessment criteria. These include the use of the Land Quality Management and Chartered Institute of Environmental Health assessment criteria (S4ULs), Category 4 Screening Levels (C4SLs) and the Contaminated Land: Applications in Real Environments assessment criteria (CL:AIRE).

4.2.3 These assessment criteria have been derived using the CLEA model and fully justified input parameters. The proposed land use is commercial with the possibility for limited landscaped areas. The derivation of the assessment criteria assumes an end use of Public Open Space (Park) as landscaped areas are present on site and this is the most conservative land use. The initial assessment assumes a soil organic matter (SOM) of 1% for all soils which is considered the most conservative approach.

4.2.4 The following table summarises the chemical test results for the samples tested and lists the relevant assessment criteria and the samples with a concentration in excess of the assessment criteria.

4.2.5 Note that only determinands with a concentration above the laboratory limit of detection are presented in the table below:

Determinands	Range of Concentrations (mg/kg)	Assessment Criteria (mg/kg)	Samples Fail
Arsenic	8.0 -21	170 ¹	---
Boron (water soluble)	<1.0 - 1.5	46000 ¹	---
Cadmium	1.2 - 1.8	532 ¹	---
Copper	43 - 46	44000 ¹	---
Chromium	26 - 27	33000 ¹	---
Lead	128 - 198	1400 ²	---
Mercury	0.8 - 2.49	240 ¹	---
Nickel	30 - 39	3400 ¹	---
Zinc	206 - 343	170000 ¹	---
Acenaphthene	<0.01 - 0.03	29000 ¹	---
Acenaphthylene	<0.01 - 0.03	29000 ¹	---
Anthracene	<0.02 - 0.1	150000 ¹	---
Benzo(a)anthracene	0.06 - 0.89	49 ¹	---
Benzo(a)pyrene	0.05 - 1.2	11 ¹	---
Benzo(b)fluoranthene	0.08 - 1.32	13 ¹	---
Benzo(ghi)perylene	<0.05 - 0.76	1400 ¹	---
Benzo(k)fluoranthene	<0.07 - 0.44	370 ¹	---
Chrysene	0.09 - 1.01	93 ¹	---
Dibenzo(ah)anthracene	<0.04 - 0.14	1.1 ¹	---
Fluoranthene	0.13 - 1.42	6300 ¹	---
Fluorene	<0.01 - 0.03	20000 ¹	---
Indeno(123-cd)pyrene	<0.03 - 0.84	150 ¹	---
Naphthalene	<0.03 - 0.04	1200 ¹	---
Phenanthrene	0.13 - 0.42	6200 ¹	---
Pyrene	0.1 - 1.42	15000 ¹	---
Aliphatic Hydrocarbons >C8-C10	<1 - 1	14000 ¹	---
Aliphatic Hydrocarbons >C10-C12	<1 - 1	21000 ¹	---
Aliphatic Hydrocarbons >C12-C16	<1 - 3	25000 ¹	---
Aliphatic Hydrocarbons >C16-C21	<1 - 4.0	450000 ¹	---
Aliphatic Hydrocarbons >C21-C35	5.0 - 42	450000 ¹	---
Aromatic Hydrocarbons >C8-C10	<1 - 1	7200 ¹	---
Aromatic Hydrocarbons >C10-C12	<1 - 3	9200 ¹	---
Aromatic Hydrocarbons >C12-C16	2.0 - 12	10000 ¹	---
Aromatic Hydrocarbons >C16-C21	4.0 - 29	7600 ¹	---
Aromatic Hydrocarbons >C21-C35	10 - 116	7800 ¹	---
Asbestos ID	No Asbestos Identified 5 samples		

Table 5: Summary of Contamination Assessment

1 CIEH/LQM Derived Assessment Criteria (S4ULs based on 1 % SOM)

2 Category 4 Screening Levels

N.A.D No Asbestos Detected

4.2.6 It can be seen from the table that there are no elevated concentrations above the assessment criteria.

4.2.7 Furthermore, none of the samples tested positive for the presence of asbestos.



- 4.3 Risk Assessment: Human Health Risks from Exposure to Ground Gas
 - 4.3.1 Potential risks associated with ground gas were identified in the PRA. The potential source of gas was made ground on site or organic rich natural strata.
 - 4.3.2 However, ground conditions encountered on the site do not represent a potentially significant source of ground gas and associated risks are not considered further.
- 4.4 Risk Assessment: Controlled Waters
 - 4.4.1 Potential risks to controlled waters have been identified in the PRA.
 - 4.4.2 However, based on ground conditions encountered and the fact that no elevated concentrations of contaminants of concern were identified and perched water was absent, the potential risks to controlled waters are considered to be very low/negligible and not considered further.
- 4.5 Risk Assessment: Buildings
 - 4.5.1 Risks to buildings include the assessment of the aggressive nature of the shallow ground with respect to concrete, the risks to the degradation of water pipes and flora due to contamination.

Risk to Concrete

- 4.5.2 To assess the potential risks to concrete, BEK has compared the previous site investigation data to assessment criteria presented in the BRE Special Digest 1: Concrete in Aggressive Ground.
- 4.5.3 The sulphate concentrations (water soluble 2:1) in the shallow ground range were all <0.01 g/l. The results are below the BRE 2:1 water/soil extract concentration of 0.5 g/l for Class DS-1 concrete.
- 4.5.4 With consideration to the range of pH values (7.77 to 8.24) and the water soluble sulphate concentrations, the concrete classification suitable for the site would be DS-1 AC-1.

Risks to Services

- 4.5.5 Potable water supply pipes can be at risk from degradation if the shallow ground consists of specific organic contamination. Guidance published by UKWIR includes a methodology for the site investigation and risk assessment to determine pipe specification.

- 4.5.6 For brownfield sites, site investigation may be required along the intended route of the water pipeline and samples recovered from specific depths and tested for specific contaminants of concern.
- 4.5.7 On the basis of the ground conditions encountered, risks to water supply pipelines are considered to be low to medium, however it is recommended that consultation is undertaken with the water service supplier to confirm this.

Risks to Flora

- 4.5.8 Copper, nickel and zinc are toxic to plants. The effects of copper, nickel and zinc are often regarded as additive.
- 4.5.9 The assessment criteria used for copper, nickel and zinc, are ‘pseudo total concentrations’ are derived from BS3882:2007 as follows:

Phytotoxic Contaminant	pH Range		
	<6.0	6.0 to 7.0	>7.0
Zinc (nitric acid extractable)	<200	<200	<300
Copper (nitric acid extractable)	<100	<135	<200
Nickel (nitric acid extractable)	<60	<75	<110

Table 6: Limits for Phytotoxic Contaminants (Units mg/kg)

- 4.5.10 By comparing the chemical test results (Appendix C) to the concentrations in the above table, it can be seen that there are localized elevations of zinc (343 mg/kg vs 300 mg/kg) within Borehole No WS3 (0.2 m). A further elevated concentration of zinc (327 mg/kg vs 300 mg/kg) was encountered within Borehole No WS6 (0.1 m). However, given the low level exceedences and the fact that the site is generally overlain with well grassed garden areas, these are not considered to be significant.

4.6 Risk Assessment: Conclusions

- 4.6.1 The site investigation encountered ‘grass onto soft brown/black slightly silty sandy clay with occasional ash and clinker fragments, rare broken brick and frequent rootlets’ to depths varying from 0.2 m (Borehole No WS1 and WS2) to 0.4 m (Borehole No WS3, WS4 and WS5). The made ground was noted to have a higher sand content within Borehole No WS5.
- 4.6.2 ‘Very stiff brown very silty slightly sandy clay’ was encountered below the made ground to depths varying from 1.2 m (Borehole No WS2 and WS3) to 1.6 m (Borehole No WS1). ‘Hard weathered siltstone’ was encountered at the base of each borehole to depths of 2.45 m (Borehole Nos WS1, WS2, WS5, WS6) to 2.5 m (Borehole No WS3) at which point the boreholes refused.



- 4.6.3 Representative samples recovered from site investigation have been tested for a wide range of contaminants of concern outlined within the PRA and based on observations made during the site investigation.
- 4.6.4 The chemical test results have been compared to relevant generic assessment criteria to identify potential contaminants of concern.
- 4.6.5 Based on the contamination assessment herein and with respect to the redevelopment of the site to a drive thru restaurant with associated car parking, no contaminants of concern have been identified with respect to human health, controlled waters or the environment.
- 4.6.6 Potential risks to the service pipes are considered to be low but advice should be sought from the water supply provider.
- 4.6.7 Risks to concrete are considered to be low and concrete classification of DS-1 AC-1 will be suitable.
- 4.6.8 There are no potentially significant risks to groundwater and no potentially significant risks from ground gas.

5. GEOTECHNICAL ASSESSMENT

- 5.1 The proposed mixed development consists of the construction of two new retail units of single storey height and a two storey hotel building. Should the development use change from this profile, re-assessment may be required to consider the likely geotechnical considerations imposed by the alternative development.
- 5.2 Site investigation has confirmed that the site is overlain with made ground, varying in depth from 0.2m to 0.4m. The made ground generally comprises grass, topsoil and rootlets, with clinker and ash. Underlying the made ground at all locations is stiff clay and underlying the clay is weathered siltstone. The siltstone was encountered at depths of between 1.2 m and 1.6 m below the surface.
- 5.3 Groundwater was not encountered at any of the borehole locations.
- 5.4 Standard Penetration Tests (SPT) were conducted in the window sample boreholes, starting at a depth of 1.0m and repeated at 1m levels from 2 m onwards. The SPT results are summarised in Table 7 below.

SPT Readings (N)	Depth of Test	
	1.0 – 1.45m	2.0 – 2.45m
WS1	23	>50
WS2	22	>50
WS3	20	36
WS5	21	>50
WS6	20	>50

Table 7: Window Sample SPT Results

- 5.5 Clay samples were taken from borehole WS1, WS3 and WS6 at varying depths. Atterberg testing was undertaken in the laboratory conditions to determine the plasticity index of the clay. The results are presented in Appendix D. The modified plasticity index for the sample was calculated in accordance with NHBC guidance and summarised in Table 8 below.

Sample	Location	Depth (m)	Plasticity Index (P.I.)	Retained 425 Sieve	Passing 425 Sieve	Modified P.I. (%)
1	WS1	1.0-1.5m	23	8.0%	92.0%	21.2
2	WS3	1.0-1.5m	26	13.0%	87.0%	22.6
3	WS6	0.5-1.0m	29	6.0%	94.0%	27.3
		Average	26		Average:	23.7

Table 8: Plasticity Results

- 5.6 The plasticity result indicates that the soil can be categorised to be of medium volume change potential, requiring a medium foundation formation depth of 0.90 m below existing or proposed ground level, whichever is the lower, in areas where clay soils are present. Adjustments to formation depths, to comply with LABC requirements and NHBC Ch.4.2 guidance, may be required where trees are within influence of new structures.

Assessment and Conclusions

- 5.7 The underlying clay soils have been encountered at depths of between 0.2 m and 0.4 m below existing ground level. Weathered bedrock has been encountered at between 1.2 m and 1.6 m underlying the natural clay strata. The geotechnical data obtained from the borehole SPT readings taken, indicate that bearing capacities on the clays are of a minimum capacity of 200 kN/m².
- 5.8 The restaurant building is likely be formed from lightweight roofing supported on a steel frame, with lightweight cladding and masonry walling elements. This is likely to generate localised point loads of up to 200 kN and foundation line loadings of between 20 and 30 kN/m, which indicates that pad foundations and strip footings would be suitable to the underlying clay strata. Should soft clays be encountered at formation depth, it is recommended that the formation of footings extended down to clays of suitable strength is encountered, with the over-dig backfilled with lean mix concrete.
- 5.9 All formations must be checked on site to confirm that the design bearing capacity is extent before foundations are installed. Should areas of poor ground be encountered, the excavations may require extending until suitable strata is found, and the design engineer's instruction must be sought.
- 5.10 As stiff clays have been encountered within 600 mm of the surface, ground bearing slabs are considered to be suitable for the proposed building.
- 5.11 Local trees may have a bearing on the proposed building foundations and ground floor slab, which will need to be appraised by the foundation designer. Formation levels must be designed to comply with LABC requirements and NHBC Ch.4.2 guidance.
- 5.12 All foundation designs must be reviewed and designed by a suitably qualified design engineer. The above advice is based upon the ground condition information obtained during the survey. The design engineer must satisfy themselves that the information meets with their design requirements.



6. RECOMMENDATIONS

6.1 This report provides an assessment of the ground conditions based on the assessment of available site investigation information and quantifies the potential risks associated with contamination and provides a geotechnical assessment with respect to foundation design.

Contamination Assessment

6.2 Based on the results of the contamination risk assessment undertaken at the land located off Chandler Way and with consideration to the environmental setting and the proposed redevelopment of the site for commercial use (possibly containing limited landscaped areas), no risks to human health have been identified.

6.3 Notwithstanding, BEK recommends the following:

- (i) All ground workers adopts suitable PPE when working on the site and consider the requirements of site specific risk assessments and working method statements.
- (ii) All groundworkers should remain vigilant during ground excavations for the presence (or suspected presence) of contamination. Should suspected contamination be identified then work should cease and specialist advice sought.
- (iii) Any material removed from the site should be disposed of in accordance with appropriate in accordance with appropriate legislation and regulations, including the Duty of Care Regulations.
- (vi) Consideration should be given to the requirements of the water supply provider. They are likely to require the UKWIR risk assessment to be completed to determine the specification for the water pipes. BEK recommends that the water supply provider is contacted and enquiries made.

Infiltration Rate

6.4 Indicative infiltration rates from the falling head tests suggests infiltration in the location of Borehole WS1 and Borehole No WS4 may not be possible as the ground conditions appear to be relatively impermeable indicating infiltration is unlikely to be a viable means of disposing surface water at the proposed development site.

Geotechnical Assessment

6.5 The underlying clay soils have been encountered at depths of between 0.2 m and 0.4 m below existing ground level. Weathered bedrock has been encountered at between 1.2 m and 1.6 m underlying the natural clay strata. The geotechnical data obtained from the borehole SPT readings taken, indicate that bearing capacities on the clays are of a minimum capacity of 200 kN/m².



- 6.6 The restaurant building is likely be formed from lightweight roofing supported on a steel frame, with lightweight cladding and masonry walling elements. This is likely to generate localised point loads of up to 200 kN and foundation line loadings of between 20 and 30 kN/m, which indicates that pad foundations and strip footings would be suitable to the underlying clay strata. Should soft clays be encountered at formation depth, it is recommended that the formation of footings extended down to clays of suitable strength is encountered, with the over-dig backfilled with lean mix concrete.
- 6.7 All formations must be checked on site to confirm that the design bearing capacity is extent before foundations are installed. Should areas of poor ground be encountered, the excavations may require extending until suitable strata is found, and the design engineer's instruction must be sought.
- 6.8 As stiff clays have been encountered within 600 mm of the surface, ground bearing slabs are considered to be suitable for the proposed building.
- 6.9 Local trees may have a bearing on the proposed building foundations and ground floor slab, which will need to be appraised by the foundation designer. Formation levels must be designed to comply with LABC requirements and NHBC Ch.4.2 guidance.
- 6.10 All foundation designs must be reviewed and designed by a suitably qualified design engineer. The above advice is based upon the ground condition information obtained during the survey. The design engineer must satisfy themselves that the information meets with their design requirements.

Waste Soil Management

- 6.11 Careful management of soils during the excavation works will ensure optimum utilisation of soil resources. Excavated soils which require off-site disposal are anticipated to be classified in accordance with the following document: Guidance on the Disposal of "Contaminated Soils" Version 3 (April 2001); produced by the Environment Agency.
- 6.12 In all cases where excess soils require off-site disposal, the materials needs to be managed under the appropriate legislation and consideration given to any remedial techniques that could be used to improve the soil.
- 6.13 If waste soils are to be re-used on site then a suitable permit exemption should be put in place (if appropriate) or a Material Management Plan (MMP) should be prepared as part of compliance with the CL:AIRE Definition of Waste:Code of Practice.

APPENDIX A

Exploratory Logs



GEO-ENVIRONMENTAL CONSULTANTS

GEO-ENVIRONMENTAL CONSULTING ENGINEERS

PROJECT NUMBER 23048 PROJECT NAME Welshpool CLIENT KIM Property Investment Limited	DATE 29th March 2023 DRILLING METHOD Window Sample Borehole BOREHOLE NO WS1 SHEET 1/6
---------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------

COMPLETION	CASING uPVC	SCREEN uPVC Factory Slotted
-------------------	--------------------	------------------------------------

COMMENTS Borehole dry

Depth (m)	Well Instal.	Samples/ Test	Material Description
0.0 - 0.2		D=0.15 m	Grass onto brown / black slightly silty sandy clays with occasional ash and clinker fragments, rare broken brick, rare fine to coarse gravel and frequent rootlets Very stiff brown very silty slightly sandy clay
0.2 - 1.0		SPT (C) N= 23 B=1.0-1.5 m	
1.0 - 1.45		3,3/5,5,5,8	
1.45 - 1.6			Hard brown weathered siltstone
1.6 - 2.0		50 for no movement	
2.0 - 2.45		4,8/10,14,50/30 refusal	
2.45 - 2.8			Termination Depth at: 2.45 m



GEO-ENVIRONMENTAL CONSULTANTS

GEO-ENVIRONMENTAL CONSULTING ENGINEERS

PROJECT NUMBER 23048 PROJECT NAME Welshpool CLIENT KIM Property Investment Limited	DATE 29th March 2023 DRILLING METHOD Window Sample Borehole BOREHOLE NO WS2 SHEET 2/6
---------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------

COMPLETION	CASING uPVC	SCREEN uPVC Factory Slotted
-------------------	--------------------	------------------------------------

COMMENTS Borehole dry. 1 Liner.

Depth (m)	Well Instal.	Samples/ Test	Material Description
0.0 - 0.2		D=0.10 m	Grass onto brown slightly silty sandy clay with rare ash and clinker, rare broken brick, rare fine to coarse gravels and rare rootlets
0.2 - 0.6			Very stiff brown very silty slightly sandy clay
0.6 - 1.0		D= 0.6 m	
1.0 - 1.45		SPT (C) N= 23 4,4/5,5,6,6	
1.45 - 2.0			Hard brown weathered siltstone
2.0 - 2.45		50 for no movement 4,4/8,14,50/50 refusal	
2.45 - 2.8			Termination Depth at: 2.45 m



GEO-ENVIRONMENTAL CONSULTANTS

GEO-ENVIRONMENTAL CONSULTING ENGINEERS

PROJECT NUMBER 23048 PROJECT NAME Welshpool CLIENT KIM Property Investment Limited	DATE 29th March 2023 DRILLING METHOD Window Sample Borehole BOREHOLE NO WS3 SHEET 3/6
---------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------

COMPLETION	CASING uPVC	SCREEN uPVC Factory Slotted
-------------------	--------------------	------------------------------------

COMMENTS Borehole dry. 1 Liner. Refusal on barrel at 2.50 m.

Depth (m)	Well Instal.	Samples/ Test	Material Description
0.0 - 0.2		D=0.2 m	Grass onto brown / black slightly silty sandy clays with occasional ash and clinker fragments, rare broken brick, rare fine to coarse gravel and rare rootlets
0.2 - 0.4			Very stiff brown very clayey silt/ silty clay
0.4 - 1.0		SPT (C) N= 20 B = 1.0 - 1.5 m	
1.0 - 1.2		3,3/4,5,5,6	Hard brown weathered siltstone
1.2 - 1.4			
1.4 - 1.6			
1.6 - 1.8			
1.8 - 2.0		D= 2.0 m	
2.0 - 2.2		SPT (C) N= 36	
2.2 - 2.4		4,5/7,7,8,14	
2.4 - 2.6			Termination Depth at: 2.5 m
2.6 - 2.8			



GEO-ENVIRONMENTAL CONSULTANTS

GEO-ENVIRONMENTAL CONSULTING ENGINEERS

PROJECT NUMBER 23048 PROJECT NAME Welshpool CLIENT KIM Property Investment Limited	DATE 29th March 2023 DRILLING METHOD Window Sample Borehole BOREHOLE NO WS5 SHEET 5/6
---------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------

COMPLETION	CASING uPVC	SCREEN uPVC Factory Slotted
-------------------	--------------------	------------------------------------

COMMENTS Borehole dry. 1 Liner.

Depth (m)	Well Instal.	Samples/ Test	Material Description
0.0 - 0.2		D=0.15 m	Grass onto brown slightly clayey silty sand with frequent rootlets and occasional broken brick
0.2 - 0.4			Very stiff golden / brown very silty slightly sandy clay with frequent gravels and rare coal fragments
0.4 - 1.0			
1.0 - 1.45		SPT (C) N= 21	
1.45 - 1.6			
1.6 - 2.0			Hard brown weathered siltstone
2.0 - 2.45		50 for no movement	
2.45 - 2.6		4,6/8,14,50/30 refusal	
2.6 - 2.8			Termination Depth at: 2.45 m