Appendix E5 - ASCR

Pam Brown Associates

SITE CONDITION REPORT

PICKHILL LANE
CROSS LANES,
WREXHAM
LL13 0UE

August 2016

SITE CONDITION REPORT

PICKHILL LANE
CROSS LANES,
WREXHAM
LL13 0UE

	NAME	SIGNATURE	DATE
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Client Company Name: Maelor Foods Ltd

Report Status: Final – 12th August 2016
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1.0 INTRODUCTION

Pam Brown Associates Ltd (PBA) has been appointed by *Maelor Poultry Ltd* (now *Maelor Foods Ltd*) to prepare an Application Site Condition Report (ASCR) for their installation at Pickhill Lane, Cross Lanes, Wrexham LL13 0UE.

The report has been prepared with the purpose of providing baseline data on the ground and groundwater conditions on site prior to commencement of the facility's activities – "*as a poultry slaughterhouse, poultry meat portioning and cutting plant and an on-site effluent treatment plant*". This ASCR supports the application for an environmental permit for the installation, as required under the Environmental Permitting (England and Wales) Regulations (as amended).

The Industrial Emissions Directive requires that the operator of any IED installation using, producing or releasing "relevant hazardous substances" (RHS) shall, having regarded the possibility that they might cause pollution of soil and groundwater, submit a "baseline report" with its permit application. This ASCR fulfils this requirement.

The report includes a characterisation of the site's geological, hydrological, hydrogeological and environmental setting, as well as an overview of its previous uses. It also reports the findings of a Phase II Geo-environmental investigation carried out with the aim of assessing the soil and groundwater quality across the site and on a limited basis ground gas generation, in order to evaluate the risk to sensitive receptors, and to confirm the potential requirement or otherwise for remedial action. The investigation also aimed to provide preliminary geotechnical data for foundation and slab design for the proposed building extension and water treatment plant.

Reference has also been made to the following report:

- Aardvark "The First Milk Cheese Company - IPPC Application Report' prepared for SDI Plant Maelor. October 2006.
- Nicholls Colton Geotechnical "Preliminary Ground Investigation Report' for Chalcroft Limited. Ref. No. G11109. Final. September 2011.
- 'Site Condition Report – SDI Plant, Maelor' prepared for the First Milk Cheese Company. August 2011.

The report aims to characterise the site based upon the procedures identified within Environment Agency Contaminated Land Report 11 'Model Procedures for the Management of Land Contamination'. These procedures relate to 'past' contamination, and assume that legislative controls such as Pollution Prevention and Control authorisations control current potentially polluting activities. Emphasis is therefore upon historic use and the overall approach in dealing with past land contamination is one of risk management.

A conceptual model is formulated by reviewing the environmental setting of the site using, geological, hydrological, hydrogeological and historical data determined from a review of available information sources including site based data, mapped references and extracts from the Groundsure environmental database.

The information obtained is then used to evaluate the environmental sensitivity (vulnerability) of aquatic, human and ecological systems in the site's vicinity in support of the identification and assessment of pollutant linkages. This is undertaken in accordance with CIRIA C552 (2001)[1] to determine whether significant harm is being caused or there is a significant possibility of such harm being caused as outlined in EPA1990: Part IIA[2] and further described in DEFRA (2006, 2012) statutory guidance[3,4]. The classification of risk is obtained by combining the severity of the harm likely to arise from a given on/off site activity and the probability that harm may arise to a particular sensitive receptor.

Limitations

The conclusions and recommendations contained within this report are strictly restricted to the areas investigated and the scope under which the study was commissioned based on the site area and development plans specified by the client. Any conclusions and interpretations are limited to those which can be determined from the available data to date and within the inherent limitations of a discrete investigation. Whilst this report may express an interpretation of the ground conditions, groundwater, contaminative issues between and/or beyond exploratory hole positions and/or potential presence of features based on either visual, verbal, anecdotal or published evidence, this is for guidance only, and no liability can be accepted for its accuracy.

Conclusion and/or recommendations made in this report may be subject to amendment in the light of additional information becoming available and/or after consultations with the pertinent authorities.

The information derived from previous studies carried out by 3rd parties is presented in good faith; however it is important to emphasise these studies were commissioned under different scopes and without the knowledge of future development plans. On this basis, PBA cannot accept any liability for the information derived from previous studies and/or for discrepancies and/or inaccuracies found in the data.

This report has been prepared solely for the use of the *Maelor Foods* to support the environmental permit application under which this study was commissioned and is strictly restricted to the areas investigated. If the document is used/viewed by any other party for any other purpose than the one specified above, reference must be made to PBA to confirm its suitability for use. No responsibility will be accepted where a third party uses this report, either in part or in its entirety, unless formally re-assigned.

[1] Rudland, D., Lancefield, R.M., Mayel, P.N. (2001) "Contaminated land Risk Assessment: A guide to good practice. CIRIA C552. UK. pp.80.
[2] Environmental Protection Act 1990: Part IIA. Contaminated Land. Section 78A(ii).
[3] Department of Environment, Food and Rural Affairs (2006) DEFRA Circular 01/2006 – Environmental Protection Act 1990: Part2A. September 2006. U.K.
[4] Department of Environment, Food and Rural Affairs (2012) Environmental Protection Act 1990:Part2A – Contaminated Land Statutory Guidance. April 2012. U.K.

2.0 SITE DETAILS

Name of Applicant	Maelor Foods Ltd
Activity Address	Pickhill Lane, Cross Lanes, Wrexham LL13 0UE
National Grid Reference	338510E, 346712N

Document reference and dates for Site Condition Report at permit application or surrender	PBA 'Site Condition Report' May 2016

Document references for site plans (including location and boundaries)	Figure 1 - Site Location Plan Figure 2 - Existing Site Plan

2.1 SITE LOCATION AND DESCRIPTION

The site is situated in Pickhill Lane, Cross Lanes in Wrexham, close to the A525 road between Wrexham and Whitchurch and approximately 1km north of the village of Bangor on Dee.

An extract of the 1:50,000 Ordnance Survey map showing the general location of the site is included as Figure 1.

The site is irregular in shape and covers and an area of approximately 4.00ha. The site consists of a disused facility, formerly used by the First Milk Cheese Company for the treatment and processing of whey into lactose derivatives, powder and delactosed whey concentrate. The facility comprised the Specialised Dairy Ingredients (SDI) area and Effluent Treatment Plant (ETP). The latter allowed for the biological treatment of process effluents. The facility was closed in January 2011 and was partially dismantled with a large part of its infrastructure now removed, although the main creamery building, offices and ETP are still in place. A plan showing the current site layout is presented in Figure 2.

The site's topography falls about 3m from Pickhill Lane and continues to fall in a southeasterly direction, towards the river Dee. The river is located at approximately 78m south.

Access into the site is via Pickhill Lane, which runs perpendicular to the A525 to the northeast. The road defines the northern boundary and a small number of residential dwellings are noted towards the northwest. Adjacent to the site's western and southern boundaries are two derelict areas with demo rubble where the chill store, production plant, tanks and silos of the former creamery used to be located.

Beyond these, the site surroundings comprise agricultural fields to the north, west and south, whilst a heavily vegetated / wooded area is noted to the east.

It is understood a surface water culvert runs under the site in a southeastly direction and joins the land drainage system that flows to the northeast. The ETP discharged at circa 500m southeast of the site into the river Dee.

2.2 PROPOSED DEVELOPMENT

It is understood that the site is to be redeveloped to allow the operation of a poultry processing facility, with the main building being refitted and extended and a new effluent treatment plant constructed on the southeastern corner of the site. An indicative layout of the proposed development scheme is presented as Figures 3 and 4.

The proposed effluent treatment plant layout has subsequently been modified, after this study had been completed. The plans are included in Appendix F1, Figure 1 of the main permit application document PPN-00003. It is worth noting this was not an area of the site that was investigated by PBA for either geotechnical nor environmental purposes. A further assessment of the ground conditions will be required in this revised location.

2.3 SITE WALKOVER

A site walkover was undertaken on February 29th and March 1st, 2016. The main site features and potential issues identified during this survey are detailed below.

The facility was not operational at the time of the visit but was in the process of being redeveloped. The site is irregular in shape (Figure 2) and comprises a main creamery building subdivided into several areas, stores, offices, plant room, substation and an engineer's room and a water / effluent treatment plant on the southeast corner.

The areas of the facility are shown in Figure 5 and Photographic Record is included in Appendix 1.

The general site topography drops towards the south / southeast. The site is levelled with Pickhill Lane on the northwest corner and then drops till approximately 3m below the road level to the northeast. The majority of the buildings across the site are found at roughly the same ground level, apart from those on the eastern and southeastern parts of the site.

The majority of the site is covered by tarmac or concrete hardstanding in good condition, apart from the area of the substation and effluent treatment plant where bare ground was noted. Landscaping areas were present mainly to the front of the building and along the northern boundary. Topsoil was noted at the surface and where present, trees and shrubs seemed healthy.

The former creamery unit comprises a two storey brick building which occupies most of the site area. The unit is divided into several subsections, most of them empty and in the process of being stripped out, re-floored and / or refurbished. There is a basement beneath the main building which contained various structures and equipment from the former creamery.

Adjacent to the northwestern elevation of the main unit, is a store and a plant room. The store is a small single storey brick building which was being used to store building materials and other ancillary items. A small number of unlabelled plastic gallons were noted within. The plant room was of steel cladding and roof construction and contained two (2No.) hot water boilers, a fridge plant, compressor, electric control switchboard and a gas tank. It is understood these had been disconnected.

A bunded plastic tank was noted next to the plant room. The tank was found within a raised concrete bund with ponded oily water at the bottom. The tanks and bund were in a good state. It is unclear if the tank is empty. A further inspection by a specialist contractor is recommended.

A compressor unit and a series of transformers were noted along the northeastern and northwestern corners of the main building, respectively.

To the west of the site, there are two (2No.) single storey brick / glass buildings which were and continue to be used as offices, with an associated car park area covered by tarmacadam surfacing which is in poor condition.

A substation is present on the southeastern area of the site. The station is still live and is understood to be under the management of an unspecified third party.

A brick building with a mezzanine is found between the main building and the substation. Anecdotal evidence suggests it was used as a maintenance yard. Concrete hardstanding was found within, with marking where machines used to be present, no staining was noted. It is currently used for storage purposes (f/e shelves, fans, extractors, etc). Pipework noted at the entrance including water, gas and electrics.

The effluent treatment plant is located on the southern part of the site, comprising two large tanks and a series of filter beds. A pump house and a deep concrete pit believed to be associated with the ETP are located further to the north. The plant was not operational at the time of the visit.

3.0 CONDITION OF LAND AT PERMIT ISSUE

3.1 ENVIRONMENTAL SETTING

An overview of the site's environmental setting is provided below based on the mapped references and extracts from the Groundsure 'GeoInsight' and 'EnviroInsight' reports (Appendices 2 and 3).

<table>
<tr><th colspan="3">Environmental Setting</th></tr>
<tr><td rowspan="2">Geology</td><td colspan="2">The British Geological Survey (BGS) and Groundsure reports record the site to be underlain by undifferentiated River Terrace Deposits, comprising sands and gravels. The stratum is considered to have a high to very high permeability with intergranular flow.

The bedrock geology comprises the Kinnerton Sandstone Formation, which includes soils of high permeability with intergranular flow.

An area of historic surface workings covers the southeastern section of the site, listed as an unspecified heap.

Historic ground workings had taken place across the western part of the site, from north to south and extending beyond the site boundary. These are identified by Groundsure as railway sidings, which were associated with an abandoned / disused railway line which ran across the northeastern corner of the site, from the northwest towards the south east.

Risks identified in association with geological hazards include:
• Negligible to very low risk from shrinking and swelling clay ground stability hazards
• Very low risk from landslides
• Very low risk from collapsible ground stability hazards
• Negligible to Moderate risk from compressible ground stability hazards
• Negligible risk of ground dissolution stability hazards
• Very low to Low risk from running sand ground stability hazards

BGS records indicate a 25m deep borehole, Porthwgan Sesswick, was excavated at 63m west of the site. In addition to this, previous studies indicated shallow well was located at Pickhill Old Hall; it is unclear if this remains operational.</td></tr>
<tr><td>Mining</td><td>According to Groundsure, the site is not recorded as being within an area affected by coal and non / coal mining. However, it is within the specified search distance of an indentified mining area at 474m northwest.</td></tr>
<tr><td>Radon</td><td colspan="2">According to the Health Protection Agency (HPA), the site is not located within a Radon Affected Area, as less than 1% of properties are above the action level.

According to Building Research Establishment publication BR211 (2007) 'Radon: Guidance on Protective Measures for New Dwellings', no radon protective measures are necessary.</td></tr>
</table>

<table>
<tr><th colspan="6">Environmental Setting</th></tr>
<tr><td>Hydrogeology</td><td colspan="5">The superficial River Terrace Deposits are classes as a Secondary A aquifer. These formations are permeable layers capable of supporting water supplies at a local rather than strategic scale, in some cases forming an important source of base flow to rivers.

The Kinnerstone Sandstone Formation is classed as a Principal aquifer, with soils of an intermediate to high leaching potential. Such aquifers comprise materials of high intergranular or fracture permeability, typically providing a high level of water storage and may support water supply and base flow to rivers on a strategic scale.

There are no groundwater abstraction licenses recorded within 1km, although anecdotal evidence suggest there is a well at Pickhill Old Hall, at approximately 250m northeast.

Despite no abstraction points are present within a 1km radius; the site is located within a groundwater source protection zone (SPZ) 3 – Total Catchment. This is defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source.</td></tr>
<tr><td rowspan="8">Surface Water Hydrology</td><td colspan="5">The closest surface water feature is a drain, immediately adjacent to the southeastern corner. The River Dee is located at approximately 92m south, running in a northerly direction. The chemical quality of this feature has been graded as A - ‘Very good’. A series of tertiary water features (rivers/culverts) are also noted within a 250m radius.

There are 2 active surface water abstraction licenses at 267m south, for the direct abstraction of potable water from the River Dee at Twll, Bangor.

The Environment Agency Flood Map for Planning shows the majority of the site is not an area at risk of 'Flooding from Rivers and the Sea', however the southeastern corner fall marginally within Zone 2 and Zone 3 Floodplains (fluvial/tidal models). Similarly, this section of the site has been identified as being at 'High' risk from flooding (1 in 30 or greater chance of flooding in any given year) by the Risk of 'Flooding from Rivers and the Sea' (RoFRaS) map. The site doesn’t benefit from Flood defences in the area.

The site and surrounding area is considered to be prone to groundwater flooding, (Clearwater) from the unconfined aquifer, however BGS have low confidence in this assessment.</td></tr>
<tr><td rowspan="7">Discharge Consents (within 250m)</td><td>PTP @ Maelor Poultry Ltd</td><td>Sewage Discharges – final/treated effluent</td><td>17m E</td><td>New issued under EPR 2010 01.02.16</td></tr>
<tr><td>Maelor Creamery Maerchweil</td><td>Trade discharges - unspecified</td><td>151m E</td><td>Revoked 05.01.95</td></tr>
<tr><td>The First Milk Cheese Factory Ltd</td><td>Sewage & Trade combined - Unspecified</td><td>175m E</td><td>New issued under EPR 2010 03.08.10</td></tr>
<tr><td>Maelor Creamery Marchweil</td><td>Sewage & Trade combined - Unspecified</td><td>247m E</td><td>Revoked 16.03.09</td></tr>
<tr><td>Maelor Creamery Marchweil</td><td>Trade discharges - unspecified</td><td>247m E</td><td>New consent by application WRA91-Section 88</td></tr>
<tr><td>Pickhill Old Hall Marchweil</td><td>Sewage discharges – final treated effluent</td><td>254m NE</td><td>New consent by application WRA91-Section 88</td></tr>
</table>

Environmental Sensitive Sites		
Sites of Special Scientific Interest	Afon Dyfrdwy (River Dee)	78m SE
Special Areas of Conservation (SAC)	River Dee and Bala lake	78m SE
Ancient Woodlands	6No. ancient woodlands recorded – restored, ancient and semi-natural woodlands	500-1000m SW, NW, W

3.2 POLLUTION HISTORY

Pollution History					
Pollution Incidents	Incident date: 01-Nov-2001	Pollutant: Oils and Fuel - Diesel	118m S	Water Impact: Minor (Cat. 3) Land Impact: No impact (Cat. 4) Air Impact: No impact (Cat. 4)	
Part 1(A)&IPPC Authorised Activities	The First Milk Cheese Company Ltd	Process: Other waste disposal; non-hazardous waste >50T/D by biological treatment		On site	Status: Effective
		Process: Animal Vegetable and food, treated ETC animal raw materials (not milk) for food >75T/D		On site	Status: Effective
		Process: Other waste disposal; non-hazardous waste >50T/D by biological treatment		On site	Status: Superceded
		Process: Animal Vegetable and food, treated ETC animal raw materials (not milk) for food >75T/D		On site	Status: Superceded
		Process: Other waste disposal; non-hazardous waste >50T/D by biological treatment		On site	Status: Surrender effective
		Process: Animal Vegetable and food, treated ETC animal raw materials (not milk) for food >75T/D		On site	Status: Surrender effective
Records of Part A(2) and Part B Activities and Enforcements	The First Milk Cheese Company Ltd	Other waste Disposal		On site	Historic Permit (Wood Processing)
Environment Agency Historic Landfill Sites	Cross Lanes Landfill	Waste type: Inert		324m NW	Licence issued: 08.12.1980 Last recorded deposit 01.10.1980 Licence surrendered 01.10.1981
Potential for Infilled Land	Two unspecified heaps recorded as being present on site. Potential infilled land in the vicinity includes ponds, cuttings and unspecified ground workings.				

Potentially contaminative uses recorded within a 500m radius include:

- Unspecified tanks
- Creamery
- Railway Sidings
- Unspecified heaps
- Unspecified commercial / industrial use
- Cuttings
- Unspecified Ground workings

The previous Aardvark report (2006) listed up to 36 tanks associated with the facility, which were used for multiple purposes.

3.3 SITE HISTORY

A review of the historic maps and anecdotal evidence provided by the client as part of previous appraisals is summarised below with the aim to provide an overview of the site's development history and relevant activities that took place in the vicinity. The historic maps covered the period **1873-2011** and were included in the Nicholls Colton 2011 report.

By the 1900, the Wrexham and Ellesmere Railway line ran parallel to the northern site boundary. This feature was dismantled in the late 1970's.

The site was a green field until the late 1930s when various large and medium size units were constructed on site. It is understood the site was used as a creamery and was bought from Cadbury's by Dairy Crest in the 1970's.

By the 1960's the facility is recorded as 'works'. A chimney was present and two railway sidings running along the eastern part of the site. Various large circular features were also noted. A drain ran along the southern site boundary.

In the 1970's and 1980's, the facility was expanded with additional units built to the north and tanks established to the west. The site is noted as a 'creamery' and by 1988; it was expanded across the former railway line, with a new complex of small buildings noted towards the north. Evidence provided in previous studies indicated the SDI plant was built during this period as a joint venture with Corning and became fully owned by Dairy Crest in 1989, when the site expanded to enable the drying of lactose and manufacture of delactosed whey concentrate. Whey syrups were apparently discontinued in 2001 and a new boiler was installed in 2006.

The water treatment plant was constructed in the 1970's. The plant went through a series of upgrades between the late 1970's and early 1990's which included the installation of high rate bio-filters, a balancing tank, DAF unit and a divert system to measure ph, dissolved oxygen and turbidity.

By 2002, one of the large buildings within the creamery complex to the south of the site was demolished.

The site ownership was transferred to First Milk Ltd in October 2006.

It is understood operations at the facility ceased in 2012.

3.4 PREVIOUS GROUND INVESTIGATIONS

In 2011, Nicholls Colton Geotechnical were appointed by Chalcroft Ltd and Grout Buckton Partners to carry out a 'Preliminary Ground Investigation' with the aim to provide preliminary data about the ground conditions across to areas adjacent to the southern and eastern boundaries of the site to allow for the design and construction of two food processing buildings.

A summary of the ground conditions encountered across these specific areas and their environmental quality is provided below. Further details on the geotechnical appraisal and foundation recommendations applicable for these two zones (which are not within the current permit application area) can be consulted in the full version of the report.

Scope of the investigation

The investigation comprised the excavation of five (5No.) Cable Percussive holes to depths of 5.0-15.45m below ground level (bgl). An additional borehole location was attempted but could not be progressed due to the presence of a concrete floor slab which could not be penetrated. Standard penetration tests were carried out using split spoon apparatus (SPT) and cone apparatus (CPT). Soil samples were retrieved for chemical and geotechnical testing.

Ground Conditions

Made ground varied in thickness between 0.2m to 0.75m, comprising a combination of reinforced concrete floor slabs, bituminous surfacing, sub-base and turf over red brown slightly organic silty sandy gravel. A layer of probable made ground was noted on the area to the east of the site between 0.75-4.0m bgl, consisting of very loose and loose clayey / silty sand and gravel with a basal layer of slightly organic sandy gravelly silt / clay. SPT values in this stratum ranged between N=1-6.

Underground concrete obstructions were identified on the areas investigated, as deep and notably hard concrete.

River Terrace Deposits were recorded beneath the made ground between 2.65m and 6.5m bgl, comprising medium dense variably clayey / silty sand and gravel. SPT values ranged between N=7-25.

Kinnerton Sandstone Formation was found beneath the river terrace deposits, comprising a combination of stiff to very stiff clay, dense and very dense sand and very weak and weak sandstone. SPT values ranged between N=33- >50.

Contamination Assessment

Five (5No.) soil samples were taken from the exploratory boreholes and tested for a range of organic and inorganic contaminants. The results have been compared with generic assessment criteria current at the time of the investigation[5], for a commercial land use.

When compared with the former soil assessment criteria for commercial / industrial land use, all contaminant concentrations were below their respective criterion.

[5] It is worth noting such criteria have been superseded and a reassessment of the results is required under the current framework of assessment of land contamination.

Two soil samples were tested for the presence of asbestos. No asbestos was encountered in either one of the samples.

Leachate analysis was carried out on two (2No.) soil samples and the results were compared against the EA Environmental Quality Standards and Drinking Water Standards. Nicholls Colton concluded on the basis of the leachate results that no further assessment or remedial measures were necessary with regards to groundwater contamination.

Further works

Nicholls Colton recommended for further investigations to be carried out in the areas to the east and south of the site to include:

- Further trial pits and/or boreholes to confirm foundation recommendations and ground conditions if these areas are developed in the future
- Further soil and groundwater chemical analysis to assess the risk to the underlying aquifers and submission of the findings to the regulatory authorities.

4.0 PHASE II – GEO-ENVIRONMENTAL SITE INVESTIGATION

4.1 GENERAL

Upon instructions from *Maelor Poultry* (now Maelor Foods), a geo-environmental ground investigation was undertaken based on CLR11 (2004) 'Model Procedures for the Assessment of Land Contamination' and carried out in accordance with BS5930 (1999) 'Code of Practice for Site Investigations', Eurocodes 7, BS10175 (2001) 'Investigation of Potentially Contaminated Sites – Code of Practice' based on the requirements of the client and appointed engineers unless otherwise stated.

The site investigation works were commissioned with the following objectives:

- To provide indicative foundation solutions for the proposed extension plans (Cassidy & Aston Drawing No.c3697L03 Rev.P1) and water treatment plant (Webbs Ltd Drawing: 'Proposed plan layout aeration & DAF treatment system' No.MPL-GA-002 Issue A. Dated: 16.12.15
- To provide an assessment of the environmental quality (baseline conditions) of the site

The fieldwork was carried out between the 29th February and 4th March 2016 and comprised the following:

- Five (5No.) Cable Percussive Boreholes excavated to depths of between 10-17.5m bgl, as specified by the client's engineers within the area of the building extension and proposed water treatment plant.
- Thirteen (13No.) Trial Pits extended to a maximum depth of 2.5m bgl, as per the client's specifications.

Prior commencement of works, all service plans as provided by the client were reviewed and the exploratory locations were cleared of services and confirmed as safe to drill by the client. Hand / machine excavated inspection pits were progressed to a maximum 1.2m depth within each of the Cable Percussive borehole positions before commencement of drilling/boring to confirm that no underground services were present.

Equipment brought onto site was inspected by PBA personnel prior to commencement of the investigation and confirmed as being in a clean, safe and tidy condition free of any leaks of fuel, hydraulic, engine and gear oil.

The soil profile and other significant features were recorded from the materials extracted from each exploratory location as the excavation proceeded. The logging of soils and rocks was undertaken in accordance with BS5930 (1999) except where superseded by the soil and rock description methodology in BS EN14688-1(2002), BS EN14688-2(2004) and BS EN14689-1(2003). The exploratory logs with descriptions of the strata encountered are included in Appendix 4.

Details of ground water conditions were noted in all boreholes, where present. Water level observations made at the time of the investigation vary across the site and may not reflect seasonal fluctuations. Two (2No.) representative disturbed soil samples were obtained from each excavation and sent to a UKAS accredited laboratory to be subjected to geotechnical / chemical testing.

4.2 CABLE PERCUSSIVE BOREHOLES

Five (5No.) 150mm diameter cable percussive borehole (designated BH1 to BH5 inclusive) were progressed using a conventional 'tripod' cable percussion boring rig (Dando 2000) to depths of between 10.0m and 17.5m bgl.

The location of the cable percussive holes aimed to provide an initial assessment of the ground conditions in the area of the building extension and proposed water treatment plant, based on the proposed development drawings provided by Maelor at the time of the investigation. The locations were determined by the client's engineers and further refined following a brief site walkover with the client undertaken prior to commencement of the intrusive works. The walkover also identified additional areas of concern and constraints which restricted the position of the excavations i.e. positions of above and underground services, obstructions, accessibility to the areas and safe working conditions due to level changes in the terrain, as well as ongoing site operations as part of the facilities refurbishment.

Based on the above issues, the boreholes were positioned as follows:

Exploratory Hole	Rationale
BH1	Positioned within the southeastern corner of the site, in the area of the proposed water treatment plant
BH2	Positioned within the southeastern corner of the site, in the area of the proposed water treatment plant. Terminated at 0.9m bgl as a plastic pipe was found.
BH2a	Re-located positioned in the southeastern corner of the site, in the area of the proposed water treatment plant.
BH3	Positioned in the northwestern corner of the proposed building extension
BH4	Positioned in the southwestern corner of the proposed building extension
BH5	Positioned in the central part of the proposed building extension, restricted by changes in the ground level and services.

A plan showing the location of each borehole is included as Figure 6.

An obsolete plastic pipe was encountered on the southeastern corner of the site (BH2) at 0.90m bgl. Consequently, another location was attempted in the area to overcome this (BH2a).

The rig comprises a large tripod and winch, driven by a diesel engine and a derrick of approximately 6-7m in height. Boreholes are advanced by the percussive action of drill tools suspended on a steel cable driven by the winch. Tools generally included a clay-cutter for penetrating fine-grained "cohesive" soils, and a shell for use in coarse-grained, or "granular", soils. The boreholes were advanced using steel casing tubes to prevent collapse of the borehole during drilling. Chiselling techniques were employed where necessary, to advance the boreholes through obstructions or into/through hard strata as far as practicable.

Representative disturbed and undisturbed samples were recovered as boring proceeded and Standard penetration tests (SPT's) were carried out every meter. The details regarding the type and depth of each sample recovered and STP values for the materials are included in the borehole logs in Appendix 4.

Samples were collected and sent to a UKAS Accredited laboratory, and subjected to chemical and geotechnical testing as described in the Supplemental Geotechnical Report, which is available on request.

On completion, BH1, BH2 and BH5 were was backfilled using arisings, whilst a monitoring well was installed in BH2a, BH3 and BH4.

4.3 TRIAL PITTING

Thirteen (13No.) trial Pits (TP1-TP13 inclusive) were progressed to maximum depth of 2.5m bgl as required by the client. The pits were excavated using a rubber tracked excavator, equipped with a hydraulic breaker and steel bucket provided by the client, under the supervision of Pam Brown Associates.

The location of the trial pit holes aimed to provide fair coverage of the site area but were constrained by the presence of buildings, above and underground services and as well as site operations being carried out at the time of the investigation. The location of the trial pits was determined following discussions with the client and based on the site boundary details provided prior commencement of works. As a result, the trial pits were positioned as follows:

Exploratory Hole	Rationale
TP101	Positioned on the eastern part of the site, adjacent to the substation and water treatment plant
TP102	On the eastern part of the site, adjacent to the area where several tanks used to be located. Location restricted to landscaping area due to presence of services and use of the access road.
TP103	On the eastern section of the site, within the landscaping area adjacent to the main building.
TP104	Positioned on the northeastern corner of the site, accessible and safe location for excavator to operate, due to steep drop in ground level across this area.
TP105	Positioned on the northern part of the site, adjacent to the compressor unit and main building. Restricted by the presence of services, drainage infrastructure and use of access rd.
TP106	Positioned on the southeastern part of the site, in the vicinity of the former engineering workshop. Restricted due to the presence of drainage runs.
TP107	Positioned on the southern part of the site, adjacent to the area where buildings and tanks used to be present, part of the former creamery.
TP108	Positioned on the southern part of the site, adjacent to the area where buildings and tanks used to be present, part of the former creamery.
TP109	Positioned on the western part of the site, to the front of the main unit and store.
TP110	Positioned on the northwestern corner of the site, at the entrance of the facility within landscaping
TP111	Positioned on the southwestern part of the site, to the front of the main unit
TP112	Position on the far southeast corner of the site, in the area of the proposed water treatment plant
TP113	Positioned on the far southeast corner of the site, within a suspected area of waste disposal / fill.

A plan showing the location of each borehole is included as Figure 6.

The soil profile and other significant features were recorded as materials were excavated from each exploratory pit. Measurements were taken from ground level. The exploratory trial pit logs with descriptions of the strata encountered are included in Appendix 4.

On average two (2No.) disturbed samples were taken from each excavation. The samples obtained were representative of made ground and/or natural materials (where encountered), and / or where visual or olfactory evidence of potential contamination was identified. All samples obtained were subsequently sent for further laboratory chemical analysis.

On completion, each trial pit was backfilled using arisings and left in a safe and tidy condition.

4.4 INSTRUMENTATION AND MONITORING

On completion, monitoring wells were installed within three (3No.) of the cable percussive boreholes for subsequent ground gas and groundwater monitoring. Details of the installations are summarised in the table below, and are included within the exploratory borehole logs (Appendix 4).

The installations were placed with the aim to provide coverage of the area of the proposed building and water treatment plant.

Table 1. Installation of Long-Term Monitoring Wells

Exploratory Hole	Response Zone (m bgl)
BH2a	1.0 - 10.0
BH4	1.0 – 10.0
BH5	1.0 – 10.0

Two ground gas and groundwater monitoring visits were carried out post completion of the drilling works on the 15th and 21st March 2016. Where present, groundwater samples were retrieved at the time of the first visit.

4.5 CHEMICAL LABORATORY TESTING

Soils
Thirty-six (36No.) soil samples were taken from the boreholes and trial pits representative of the made ground and/or natural materials, depending on what was encountered in the excavation or if evidence of contamination was noted. Soil samples were stored within appropriate glass and plastic containers and kept within cool boxes at approximately 4°C. These were then sent within a 48hr-period to a UKAS accredited laboratory to be subjected to a suite of contamination testing which included:

- Metal and metalloid suite, including arsenic, boron and cyanide
- Petroleum hydrocarbons with aliphatic/aromatic speciation by CWG methodology
- Speciated polyaromatic hydrocarbons (PAH)
- Sulphate, sulphide and sulphur
- Organic matter content
- Total phenols
- Soil pH

Certificates for the chemical analysis of soil samples are presented in Appendix 5.

Groundwater
Following the installation of monitoring wells in three (3No.) of the boreholes, and after a 1 week stabilisation period, representative groundwater samples were collected from each well.

A total of three (3No.) samples were collected and subsequently stored within appropriate glass and plastic containers and placed in cool boxes. These were then sent within an approximate 48hr-period to a UKAS accredited laboratory to be subject to an identical suite of chemical testing comparable to the one applied to the soil samples.

Chemical analysis certificates for the groundwater samples are presented in Appendix 6.

5.0 GROUND CONDITIONS ENCOUNTERED

5.1 GENERAL

On the basis of published geological information and the findings of the investigation, the strata encountered in the exploratory holes included:

- Made Ground
- Weathered Kinnerton Sandstone (clays and sands)

The materials encountered are described in the following sections and strictly relate to the areas investigated. Reference should also be made to the exploratory borehole/trial pit records (Appendix 4) for further detail on the nature and depth of the strata observed in each exploratory hole.

Made Ground
Made ground was encountered at the surface of all exploratory excavations to a maximum depth of 4.2m bgl.

Surface materials across the site comprised topsoil, hardcore fill / demolition crush, granular made ground and on two occasions hardstanding. Topsoil was found at the surface of seven (7No.) excavations carried out in areas of landscaping. The stratum comprised brown organic slightly clayey slightly gravelly to gravelly sand with abundant roots and rootlets, concrete, quartz, granite, sandstone and occasionally ceramic pipe fragments. Superficial made ground of a granular nature was recorded in those excavations to the east and southeast of the site, comprising slightly clayey gravelly sand, of brick, concrete, limestone, quartzite and granite. Concrete and tarmac hardstanding was noted in two locations TP108 and TP109, with a thickness of 0.27m and 0.13m, respectively.

Beneath the surface materials, a series of strata of granular materials were encountered, mostly consisting of slightly clayey to clayey ashy gravelly sand to sandy gravel with charcoal, brick concrete, granite, clinker, slag, charcoal, ceramic pipe fragments, sandstone, limestone, burnt wood, rope, rebar, coal and kerb stone. The ashy nature of some of the materials and the presence of slag, coal, charcoal and other anthropogenic items suggest this fill is derived from the former railway and sidings. The extent of the fill seemed more prominent towards the southeast end of the site. Cohesive made (gravelly sandy clay) was encountered in one exploratory hole (TP103), beneath the granular materials.

Creosote / hydrocarbon odour was noted in the materials retrieved from TP112 from 0.7 to 2.1m bgl,

A concrete obstruction (probably boulder) was encountered at the base of TP112 (2.1m bgl). Obsolete plastic pipes were found in TP105 at a depth of 1.3m bgl and in BH2 at a depth of 0.9m bgl, the latter warranting for the excavation to be relocated (BH2A).

Natural Strata
Weathered Kinnerton Sandstone was found beneath the made ground, comprising initially soft to firm becoming firm to stiff sandy clay with gravel overlying dense to very dense sand.

5.2 GROUNDWATER

Groundwater strikes were not encountered during the intrusive investigation apart from seepages in two exploratory locations – TP106 and TP107, between 1.25 and 2.08m bgl. Water ingress was noted in TP104 at 1.0m bgl.

Standing groundwater levels recorded during subsequent monitoring visits ranged between 4.65m and 7.16m bgl.

A copy of the monitoring certificates is included in Appendix 7.

5.3 GROUND GAS MONITORING

Two (2No.) ground gas and groundwater monitoring visit were carried out on 15th and 21st March 2016. The results are summarised in Table 2 below, although full details can be consulted in Appendix 7.

Table 2. Ground Gas Monitoring Results for the period 15th-21st March 2016.

Exploratory Hole	Max CH_4 (%vol) Steady	Max CO_2 (%vol) Steady	Min O_2 (% vol) Steady	Flow Rate (l/hr)
BH2A	<0.1	2.8	16.9	<0.1
BH3	<0.1	2.3	18.1	<0.1
BH4	<0.1	3.3	14.7	<0.1

No Methane was recorded during the monitoring visit. Carbon dioxide concentrations ranged between 0.2%vol and 3.3%vol. A minimum oxygen concentration of 14.7%vol was noted. Recorded gas flow rates were below instrument levels of detection (<0.1l/hr).

Based on the guidance in BS 8485:2015[6], a preliminary calculation of the hazardous gas flow rate (Q_{hg}) has been undertaken based on the maximum flow rate (0.1l/hr) and concentration of a hazardous gas observed on site, in this instance carbon dioxide (3.9%v/v) observed throughout the monitoring period. The preliminary Q_{hg} estimate is provided below:

$$Q_{hg} \text{ (WS5)} = 0.1 \times 3.3/100 = 0.0033 \text{ l/hr}$$

This would indicate a Gas Risk Situation 1 (CS1) would be adequate for the site, with a 'Very low' hazard potential, as the maximum concentration of CO_2 and CH_4 recorded were below 5% and 1%, respectively.

Details provided about the building extension due to be constructed, suggest the building type as per Table 3 of the BS8485:2015 would be 'Type C', as it would comprise a large industrial unit with small to large size rooms. This will require a "Gas Protection Score" of 0, in line with Table 4 of the abovementioned guidance.

[6] BS8485:2015 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

The '0' score could be achieved by installing a precast suspended segmental floor slab (i.e. beam and block), however it is understood the foundation design for the extension is due to be finalised.

It is worth noting the current gas assessment is based on the findings of two monitoring rounds and that at least two (2No.) additional rounds are recommended to be carried out to adequately assess the ground gas regime on site. Additional monitoring round may also be required if materials used (either imported or site-won) to raise levels along the western elevation of the current main building, in the area where the extension will be built.

6.0 ENVIRONMENTAL ASSESSMENT

6.1 METHODOLOGY

The results of the site investigation works have been assessed utilising a Tier 1 quantitative risk assessment. The risk assessment methodology used is taken from the Environment Agency (EA) R+D Publication 20 *'Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources'*.

The tiered approach acts as a screening process whereby low risk sites are eliminated in order to identify sites that present the greatest environmental risks. The information obtained from the site investigation is used to characterise any contaminant source and subsequently to identify any sensitive environmental receptors and appropriate target concentration at the receptor.

Any requirement for further quantitative analysis or remedial action is based on comparison of the soil and/or groundwater concentrations for each contaminant with current applicable screening criteria. A decision is then made as to appropriate action to be taken which includes; no action, continuation to the next tier assessment or to take remedial action. In a Tier 1 Assessment generic guidelines and screening values are adopted in the first instance as remedial target values as a conservative approach.

The adopted approach currently involves the following stages:

- selection of generic Tier 1 screening criteria
- comparison of measured contaminant concentrations with the generic screening criteria as part of a Tier 1 assessment
- where the Tier 1 screening level is exceeded then the Conceptual Site Model (CSM) is refined to summarise sources of contamination, potential migration/exposure pathways and potential receptors that may exist at the site and could be characterised by significant levels of risk

6.2 ENVIRONMENTAL LABORATORY RESULTS - SOIL

Soil contaminant concentrations determined by the chemical analyses have been compared against CLEA (2009) Soil Guideline Values (SGVs) and CL:AIRE Category 4 Screening Levels (C4SLs). Where no SGV/C4SL is available, the analytical results have been compared against LQM CIEH (2015) 'Suitable for Use Levels for Human Health Risk Assessment' (S4ULs) or the EIC/AGS/CL:AIRE (2009) 'Soil Generic Assessment Criteria for Human Health Risk Assessment'.

The specific criteria used for comparison purposes with soil analysis results correspond to values for land under a 'commercial/industrial' end use scenario for materials with an average 1% Soil Organic Matter Content.

A copy of the assessment criteria for commercial/industrial end use is included as Appendix 8, and the soil analysis certificates are included in Appendix 5.

Metals and Metalloids
None of the metal/metalloid determinands were recorded at concentrations which exceeded their respective assessment criteria.

Total Petroleum Hydrocarbons (TPHs)
None of the hydrocarbon fractions was found to be present at concentrations which exceeded their respective guideline criterion protective of human health given an industrial land use. In general, all results were below the laboratory limit of detection.

Polycyclic Aromatic Hydrocarbons (PAHs)
All PAH species within the soil samples were within their respective guideline values for the proposed industrial end use.

Phenols
All phenol determinations were below the laboratory limit of detection.

6.3 Environmental Laboratory Results - Groundwater

Groundwater analysis results were compared against Environmental Quality Standards (EQS) for Inland Surface waters[7], freshwaters[8] and/or UK Drinking Water Standards (DWS)[9]. Where a range of EQS values is provided, the concentration used for comparison purposes is generally dependent upon the water hardness of the area - 73mg/l $CaCO_3$ for the Dee Valley area[10].

The chemical analysis certificates are included in Appendix 6.

A summary of the contaminants which were identified in concentrations above their respective guidance criteria is shown in Table 3.

Table 3. Groundwater Contaminant Concentrations (µg l^{-1}) above analytical limits of detection compared against groundwater quality criteria.

Determinand	Groundwater contaminant concentration range (µg l^{-1})	Groundwater Assessment criteria (µg l^{-1})	No. of exceedances
Cadmium	<0.08 – 0.29	0.08	3
Nickel	23 - 38	4	4
Lead	<0.1 – 2.8	1.2	1
Selenium	1.9 - 97	10	2
Total Petroleum Hydrocarbons	<10 - 9700	10	2

Metals and Metalloids
Most of the metals and metalloids concentrations in groundwater were below their respective guideline criteria, apart from the dissolved concentrations of Cadmium, Nickel, Lead and Selenium.

[7] The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015
[8] Environment Agency. Surface Water Abstraction Directive (75/440/EEC) and Environmental Quality Standards List 1-2, EC Dangerous Substance Directive (76/464/EEC).
[9] Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) as amended and Water Supply (Water Quality) Regulations 2000 (SI 2000/3184) as amended.
[10] Dee Valley Water (2016) 'My water quality' Available at: https://www.deevalleywater.co.uk/my-account/my-water-quality/?address=ll13 oue

It is possible the ashy / fill materials noted on the eastern and southeastern parts of the site could be responsible for the trace metal contamination identified in the underlying aquifer and may potentially pose a risk to the nearby river Dee.

Petroleum Hydrocarbons
Evidence of petroleum hydrocarbon contamination was found on the eastern and southeastern sections of the site. The maximum concentration of petroleum hydrocarbons (9700µg/l) was noted on BH4 adjacent to the main building, which exceeded 100 times the UK DWS for the assessment of these contaminants.

The hydrocarbon footprint mainly comprised medium to heavy range aliphatic and aromatic hydrocarbons.

Polycyclic Aromatic Hydrocarbons (PAHs)
No PAH species were detected in the groundwater samples retrieved from the site.

It is understood the operations of the new installation will not include the use of substances which could originate contaminants such as those identified in the dissolved phase as a result of historic activities, apart from the use of fuel for the boilers, containing petroleum hydrocarbons.

Supporting Information	Appendix 4. Exploratory Borehole and Trial pit Logs Appendix 5. Soil Analysis Certificates Appendix 6. Groundwater Analysis Certificates Appendix 7. Ground Gas Monitoring Certificates

7.0 CONCEPTUAL SITE MODEL

For the assessment of land contamination, a Conceptual Site Model (CSM) is developed to identify the key sources of contamination, potential migration and exposure pathways and sensitive receptors which could be adversely affected. The CSM takes into account the hydrogeological conditions at the site and within this context aims to evaluate the significance of each pollutant pathway in accordance with Part IIA Environmental Protection Act 1990 (as amended 2012).

7.1 IDENTIFIED CONTAMINATIVE ISSUES AND SOURCES

According to DEFRA (2012)[4], a contaminant is "a substance which is in, on or under the land and has the potential to cause significant harm to a relevant receptor, or to cause significant pollution to controlled waters". This section lists the potential contaminants which may have arisen in soil and groundwater as a result of historic and/or current activities. The hazards are assessed according to the magnitude of their potential consequences (severity) when reaching a receptor, as described in CIRIA C552 report (2001)[1]. This is known as environmental harm and can be classified as minor, mild, medium or severe. These classifications are defined in Appendix 9.

Historic Uses

The site and its immediate vicinity have a history of industrial use. The site itself was used as a creamery since the 1930's which extended further to the east and south. By the 1970's, an Effluent Treatment Plant was installed and was expanded in the following decades. A Specialised Dairy Ingredients facility was established in the 1980's for the manufacture of lactose and manufacture of delactosed whey concentrate. By 2002, the southern units of the creamery complex were demolished. It is understood operations at the facility ceased in 2012 and it is in the process of being re-purposed to process poultry products.

Immediately to the north, the Wrexham and Ellesmere Railway line ran towards the north / north-east of the site boundary. Two associated railway sidings were present on the eastern part of the site. These features are believed to have been dismantled in the late 1970's.

The ground investigation identified made ground materials in excess of 4.0m, frequently of an ashy nature across the eastern and southeastern parts of the site, possibly associated with the former railway. Contaminant concentrations within these materials complied with the current generic assessment criteria protective of human health under a commercial/industrial scenario. However, it is worth noting these materials may be the cause of metal and hydrocarbon contamination noted in the groundwater.

Based upon the nature of the materials encountered and on the information available to date, it is anticipated that **medium** harm could arise to the underlying aquifer and nearby river Dee from the ground conditions and/or contamination identified on site.

Proposed Site Use

The site is in the process of being redeveloped to allow for the operation of a poultry slaughterhouse, meat portioning and cutting plant facility and an on-site effluent treatment plant.

Information provided by the client and its consultants indicate the following hazardous substances will be employed as part of the facility's activities.

Table 4. Raw material pollution risk by application

Application	Purpose	Materials used	Hazardous substance	Risk phrases (CHIP)	Environmental fate	Potential pollution risk	Storage arrangements	Delivery and use details	Estimated annual consumption
Poultry slaughter and processing	Production of poultry portions for sale	Live birds	No	NA	Biodegradable	Yes - odour	NA	Live birds delivered to lairage by HGVs.	52million birds/year
Packaging	To protect product during distribution	Plastic wrap and trays	No	NA	Essentially inert	No	Inside	By vehicle, used inside	
Fuel	Combustion in boilers to raise hot water for process	Gas oil (low S content)	Yes	See Figures 1 - 12 in Appendix D - Chemical and fuel MSDSs of Permit Document Ref. PPN-00003	Immiscible, floats on water. Moderate to high toxic effects and bioaccumulation potential	Yes	Bunded storage tank, compliant with Oil Storage Regs.	By tanker and offloaded to bulk tank	
Cleaning applications	Cleaning of vehicles, crates, process equipment & floor areas	Detergents	Yes		Biodegradable	Yes	Inside in plastic containers, drums or IBCs	By vehicle, used internally for various cleaning applications	25T
Effluent treatment	pH control, flocculants, sterilisation	Sodium hydroxide	Yes		May cause long-term adverse effects in the aquatic environment. Readily degradable in water. Iron compounds are mainly resistant to degradation.	Yes	Inside or in bunded areas in plastic containers, drums or IBCs. Bulk storage in bunded tanks	Delivered by vehicle or tanker offloaded to bulk storage tanks	120T
		Ferric sulphate	Yes						125T
		Phosphoric acid	Yes						
		Sodium hypochlorite	Yes						
		Polymer	No		Readily degradable in water				12T
		Anti-foam	No						
Odour abatement	Chemical scrubber	Sodium hypochlorite Sodium hydroxide	Yes		May cause long-term adverse effects in the aquatic environment. Readily degradable in water	Yes	Bunded bulk storage tanks or IBCs in bunded areas or inside	Delivered by vehicle or tanker offloaded to bulk storage tanks	90T 40T
Anti-coagulant	anti-coagulant of blood	Sodium citrate or similar - to be considered if needed	No		Readily degradable in water	No	Inside in plastic containers	By vehicle	

7.2 PROTECTIVE MEASURES AND SURVEILLANCE

It is acknowledged that environmental permits will normally include a condition requiring the permit holder to carry out periodic monitoring of groundwater at least once every five years and soil at least once every ten years. However, in this instance, it is considered Maelor Foods should not be required to undertake periodic monitoring of groundwater and soil as a condition in their permit. This is based on the understanding their environmental risk assessments indicate the risk of contamination is 'low to medium' and the facility will have suitable infrastructure and controls in place to ensure no impact is caused as described below:

Drainage

Details provided by the client and its consultants suggest all clean site drainage has been segregated from the trade effluent drains. Drainage plans, included in Appendix 10, indicate trade effluents will flow into the Effluent Treatment Plant for their subsequent treatment.

It is noted there will be no external hardstanding areas that are likely to be contaminated by spillages of organic material as all processing and handling of ABPs will be done internally.

The site drainage discharges via two surface water sewers into the surface water culvert running southeast. This joins the land drainage system flowing northeast, then east before joining the River Dee further downstream.

The current site drainage plan only shows the existing buildings which include the meat processing plant. Once the design and locations for the slaughtering plant buildings and effluent treatment plant are finalised, the site drainage plan will be revised and made available for review. There will not be any additional emission points and clean drainage from these areas will be linked into the two surface water sewers.

As there will be HGVs on site, oil interceptors are to be installed on the surface water sewers upstream of the outfalls. Shut off facilities will be included for closure during maintenance and in emergency scenarios such as major spillage or fire.

It is understood there will be no direct or indirect fugitive emission points to land. The working areas will be completely surfaced with impermeable hard standing and contained with kerbing, walls or sleeping policeman to ensure no potentially polluting liquids enter the ground or surface waters.

The site is outside of the River Dee flood plain but could potentially flood if drains become blocked and overwhelmed in flash storm events. It is noted regular checks of the drainage system will be undertaken to ensure these are in good condition and unrestricted.

Tanks

Potentially polluting substances will be stored in tanks (blood, sludge, effluent, fuel oils, chemicals) or containers (detergents, engineering oils) within bunds or bunded stores or stored inside. Tank contents will be monitored by level controls and high level warning alarms.

Waste oils from engineering will be stored in a dedicated waste oil container and sent for recovery.

Spillages

The facility's operating and emergency procedures will cover safe handling of these materials and measures to take if a spillage occurs.

Spill kits will be available at key locations around the site and should a major spillage occur, this will be dealt with in accordance with the facility's emergency response procedures.

The Site Drainage Plan will be held with the Emergency Management Plan to ensure any spillages can be quickly isolated and prompt and effective remedial action taken.

Environmental Management

During the lifespan of the permit, *Maelor Foods* will undertake routine inspections and maintenance of the site's infrastructure, such as bunds, tanks and hardstanding to ensure that the pollution risk to the ground is as low as possible and make records. The Environmental Management System will include procedures and systems for this.

A site closure and decommissioning procedure will be included in the EMS and reviewed on a regular basis. It will cover the general clean-up of the site, removal of all materials, residues, waste and emptying of any drains or sumps, dismantling of equipment and safe removal of any chemicals or oils.

The history of the ground condition, any incidents and remediation work during the lifespan of the installation permit will be used to inform the site closure plan and permit surrender application.

All environmental accidents, incidents and near misses will be reported to the Site Manager or other person delegated this responsibility. This person will record the details and initiate the response which will include notifying the relevant internal and external parties in a timely manner as appropriate.

The accident, incidents and near miss investigation procedure will explain how to respond and who to notify and how to investigate matters. The root cause and actions to prevent reoccurrence will be identified and full details and investigations will be recorded on the template to be provided.

Further details of control measures can be consulted in Appendix E1 of the main permit application document PPN-00003.

7.3 POLLUTANT PATHWAYS

The possible routes or means by, or through which, sensitive receptors could be exposed to contaminants on the site area, are listed below:

- Ingestion of contaminated soil / dust
- Inhalation of contaminated soil / dust
- Inhalation of ground gases / vapours
- Dermal contact with contaminated soil / dust
- Migration of pollutants through ground into surface or groundwater bodies
- Migration of pollutants via drainage systems or overland flow

7.4 IDENTIFIED RECEPTORS

For the purpose of CSM development, a receptor is considered to be any living organism or group of organisms, ecosystems, or property which could be harmed by a contaminant, as well as any controlled waters which are being or could be polluted by a contaminant. Further details on receptor types can be found in Tables 1 and 2, of the DEFRA (2012) Contaminated Land Statutory Guidance[4].

The potential receptors which could be affected by on site contaminants, as well as the likelihood of the pollutant linkage being completed (receptors being affected by the contaminants on site) are indicated in the table below:

Table 5. Potential Sensitive Receptors and Likelihood of Exposure

Pathway	Receptor	Possible linkage	Likelihood[a]
Ingestion and inhalation of contaminated soil / dust	Site Users	Dust generation and consumption	Low – hardstanding surfaces cover most of the site, although possible in areas of open ground
	Nearby residents		
	Maintenance / Construction Workers	Dust generated and consumed as part of construction / maintenance activities	Low – assuming the adequate use of personal protective equipment and good working practices
Dermal contact with contaminated soils	Site users	Direct contact with contaminated soil	Low - majority of the site is covered with hardstanding and topsoil is present in most areas of open ground
	Nearby residents		
	Maintenance / Construction workers		Low – assuming the adequate use of personal protective equipment and good practice
Inhalation of ground gases / vapours	Site Users	Migration through joints and pipe work into the building	Low – based upon the ground gas monitoring results
	Maintenance / Construction workers	Concentration of gases in trench / foundation excavations	Likely - ground gas monitoring results showed CO_2 concentrations >3.0%, the use of protective respiratory equipment is advised

Pathway	Receptor	Possible linkage	Likelihood[a]
Migration of pollutants through soil profile	Secondary A and Principal aquifers	Vertical migration via leachate generation into underlying aquifers	Likely – evidence of contamination has already been found in the groundwater
	River Dee	Lateral migration via groundwater flow	Low – although the natural strata is likely to be in hydraulic continuity with the River Dee, this feature is found more than 90 away from site
Migration of pollutants via drainage systems or overland flow	River Dee	Surface water runoff and factory effluents from current site	Low – surface run off will be discharged to surface waters via oil interceptors with shut off facilities. Potentially polluting materials will be stored in bunded tanks or inside. Trade effluent will be treated in the new effluent treatment plant before discharge to river or recycled.

[a] - Likelihood of Exposure as outlined in Appendix 9.

7.5 RISK ASSESSMENT

Under the terms of the Environment Act 1995 in order for an environmental risk to exist a plausible pollutant linkage must exist to link the source to the receptors. Once these have been identified the likelihood and severity of each pollutant linkage are considered such that the scenarios of most concern can be addressed. A preliminary assessment of risk is then undertaken using a risk evaluation method, based on an EA/CIRIA scoring system[1,11,12], which aims to categorise the significance of risk in terms of the probability of the receptors being exposed to a given hazard (i.e. high likelihood, likely, low likelihood, unlikely) and the magnitude / severity of the environmental harm resulting from the hazard.

The risk categories are then assessed based upon the consequence vs. probability assigned to each scenario, based upon guidance originally produced by the DETR. These categories are outlined in Appendix 9.

Based on the quality of the fill materials encountered across the eastern and southeastern parts of the site and the levels of groundwater contamination and ground gases identified, it is considered that 'medium' harm could arise to sensitive receptors.

It is regarded as ‘likely’ for construction / maintenance workers to be potentially exposed to harmful concentrations of CO_2, whilst working in excavated areas or laying service pipes / structures. However, the likelihood of exposure could be substantially reduced if adequate respiratory equipment is used and gas concentrations are monitored whilst the works are carried out. The probability for site users and nearby residents to be exposed to contamination via inhalation, ingestion or dermal routes is considered to be ‘low’, as the majority of the site area will be

[11] Environment Agency (2004) Environmental Risk Management and Strategic Environmental Assessment Guidance Note. Version 6. pp 1-5.
[12] DEFRA (2002) Guidelines for Environmental Risk Assessment and Management. Available at: http://www.defra.gov.uk/environment/risk/eramguide/index.htm

covered by hardstanding surfaces or topsoil, which will prevent dust generation and impede direct contact with deleterious materials.

With regards to controlled waters, it is considered as 'likely' for the underlying aquifer to be affected by contaminant concentrations identified in the fill materials. The probability for the River Dee to be affected by a contaminant plume is deemed as 'low' as site drainage is likely to collect any surface water run-off and trade effluents from the site. In addition, the river is located >90m to the south of the site, hence it is possible inorganic contaminants would be reabsorbed by the soil matrix before they have a detrimental impact on the river's quality.

Based on these facts and in accordance with CIRIA 522, the comparison of the magnitude of harm and the likelihood of a pollutant pathway to be established, there is a **Moderate risk** that harm could arise to human health and environmental receptors from contaminative issues, arising, primarily, as a result of historic activities.

The proposed operations of the facility are considered to pose a **Low to Moderate risk** of harm to sensitive receptors.

In accordance with a 'Moderate' risk classification (CIRIA 522), it is possible that harm could arise to a designated receptor from an identified hazard. However, if it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Some remedial works may be required in the longer term.

7.6 RECOMMENDATIONS

The fill materials analysed comply with current industrial guideline values protective of human health. However, these may be causing a detrimental effect in the quality of the underlying aquifers which may warrant some remedial measures.

Some basic protection measures are recommended for the site workers whilst the redevelopment works are carried out. Groundwork's contractors should be made aware of the potential in-ground risks, and adjust their method statements and risk assessments accordingly - incorporating measures such as the use of appropriate PPE, masks, dampening down of soils and, possibly boundary and personal monitoring etc. The concentrations of ground gases should be monitored within the excavations whilst works are undertaken.

Further rounds of ground gas monitoring are required to determine the need and extent of gas protection measures. A full monitoring regime must be carried out in order to adequately characterise the site and its potential for ground gas production in accordance with CIRIA C556.

Due to the nature of the fill materials encountered on site, high specification service supply pipes are likely to be required. Guidance should be sought from the relevant utility service provider(s) regarding any proposed plant and pipework to be installed.

As part of any redevelopment works, arisings are likely to be generated which will require to be characterised in order to dispose of them into a suitable licensed landfill. As waster producer, the Developer has the responsibility to:

- Ensure the waste is adequately characterised in accordance with WM2 and WM3
- Ensure the waste is disposed at a suitable and licensed facility
- Keep records of all wastes disposed off site, including:
    - Types of waste – waste classification
    - Volumes for each waste
    - Waste transfer / consignment notes
    - Details of the facility(es) where was disposed of

It is worth noting that different guidelines and charges will apply to different types of waste.

As with any site, other areas of contamination, or more significant contamination, not identified during site investigation works, may come to light in the course of redevelopment. Accordingly, a Discovery Strategy must be in place during the redevelopment to ensure any unknown/unexpected contamination is identified and dealt with in an appropriate manner. Depending on the nature of any such contamination, it may prove necessary to prepare a formal remedial strategy for the site and also characterise any arisings for waste classification purposes.

Further ground investigation works may be required if the development plans vary / are amended from those under which this investigation was originally design and commissioned.

8.0 STATEMENT OF SITE CONDITION

The site is in the process of being redeveloped as a poultry processing facility, with the main building being refitted and extended and a new effluent treatment plant on the southeastern part of the site.

A site investigation was undertaken in February - March 2016 in order to assess the baseline soil and groundwater conditions across the site.

Soils
Made ground materials were recorded on site in excess of 4.0m, often of an ashy nature on the eastern and southeastern sections of the site. Contaminant concentrations within these materials met the generic assessment criteria protective of human health for land under commercial/industrial use. However, it is possible the materials are having a detrimental effect on the quality of the underlying aquifer.

Groundwater
Elevated concentrations of Cadmium, Nickel, Lead, Selenium and various medium to heavy range aliphatic and aromatic Petroleum Hydrocarbon fractions were identified in groundwater samples retrieved from the eastern and southeastern sections of the site. It is possible these are derived from the ashy / fill materials found in these areas and are not anticipated to be generated by the activities of the facility.

Ground Gases
Two ground gas monitoring visits were undertaken and the findings suggested on a preliminary basis that a Gas Risk Situation 1 (CS1) would be adequate for the site, with a 'Very low' hazard potential, requiring a "Gas Protection Score" of '0' for the extension plans. However, further monitoring rounds are required to confirm this.

Risk Summary
Based upon the findings, it is estimated there is a **Moderate Risk** of harm to sensitive receptors, mainly controlled waters, from the existing contaminative issues on site. It is anticipated there is a **Low to Medium Risk** of harm to sensitive receptors from the proposed activities to be undertaken at the installation.

In accordance with a 'Moderate' risk classification, further works may be required.

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