B034486

Lifford Common

Generic Quantitative Risk Assessment (GQRA)

TETRA TECH

Version 1
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PRESENTED TO

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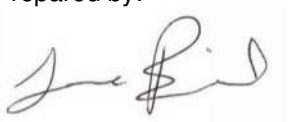

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EXECUTIVE SUMMARY

The Site	Tetra Tech Environment Planning Transport (NI) Limited was instructed by McAdam Design Ltd to complete a Generic Quantitative Risk Assessment (GQRA) for a proposed mixed-use development on agricultural land at Lifford Common.
Site Description	The site is located off Letterkenny Road and is comprised of undeveloped agricultural land. The site is surrounded by mix of agricultural, commercial and residential land use. The topography of the site falls c.18m towards the north.
PRA Summary	Previously a Preliminary Risk Assessment (ref: P2564-1, dated January 2022) was completed by MCL Consulting Ltd which identified numerous potential pollutant linkages identified at the site associated with the historical railway on site, alluvium in the north, adjacent filling station (Applegreen Service Station), made ground and radon.
Site Investigation Data	A ground investigation was undertaken on 17th February 2022 and comprised three boreholes advanced to a maximum depth of 5.0m bgl and eight trial pits advanced to a maximum depth of 2.0m bgl. All three boreholes were installed as combined groundwater and ground gas monitoring wells. In total, 9 no. soil samples and 3 no. groundwater samples were obtained and analysed for a range of organic and inorganic determinants. Ground gas monitoring has been undertaken on 2 no. occasions between 25th February and 4th March 2022.
Generic Quantitative Risk assessment	On completion of the GQRA and an assessment of the soils, groundwater and ground gas regime the following conclusions were drawn: • Reported contaminant concentrations detected within the soils are considered to pose a low risk to human health, surface water and groundwater receptors • The site's ground gas regime has been assessed as CS1 – very low risk • Radon on the site is indicated to be around 9.72%, and consideration of Radon ingress should be taken into account during the building design stage.
Conclusions & Recommendations	Following completion of the GQRA the site is considered to present an overall low to moderate risk to the proposed future development and mitigation measures are not required. Short term exposure risks to construction workers can be effectively managed via the adoption of appropriate Health and Safety protocols. It is recommended that off-site removal of soils should be undertaken in accordance with EU waste legislation. Should any unexpected contamination be encountered during the construction phase then works should cease and the consultant conferred to advise.

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1.0 INTRODUCTION

1.1 INSTRUCTION

Tetra Tech Consulting (NI) Limited was instructed by McAdam Design Ltd to conduct a Generic Quantitative Risk Assessment (GQRA) to appropriately characterise current site conditions and associated potential risks based on the proposed multi-use park development on lands located at Lifford Common in Donegal, Ireland (Irish Grid Reference: H 33151 98950).

A site location plan is included at Figure 1.

1.2 BRIEF

The report has been prepared to support the proposed development of site with a multi-use park as shown on Figure 2. Proposals include for the development of a roadway infrastructure connecting to 2 no. pitches varying in size from 60m x 40m to 105m x 70m which will be located in the northern portion of site. A foul pumping station is also proposed at the intersection of the roadway infrastructure.

This report follows a Preliminary Risk Assessment (PRA) (ref: P2564-1, dated January 2022) undertaken by MCL Consulting Ltd. The PRA identified potential pollutant links (PPLs) which may be present at the site. The objective of this report is to further investigate the PPLs to provide a Generic Quantitative Contaminated Land Risk Assessment (GQRA) in the context of the abovementioned development proposals. Where pollutant linkages have been identified to required remediation an outline remediation options has been provided.

1.3 LEGAL CONTEXT

The work, as presented in this report, has been completed in accordance with best practice guidance documents including “Guidance On The Management Of Contaminated Land And Groundwater At EPA Licensed Sites, 2013 and the “EA (UK) Guidance on Land Contamination Risk Assessment” (EA UK, 2020). The latter piece of guidance is specifically relevant to land contamination in the United Kingdom (UK), however it is relevant, as the EPA’s framework has been broadly based on it.

The framework approach identifies three stages as outlined below:

Stage 1 – Site Investigation and Assessment including

- Preliminary Site Assessment
- Detailed Site Investigation
- Quantitative Risk Assessment

Stage 2 – Corrective Action Feasibility and Design

- Outline Corrective Action Strategy (Objectives)
- Feasibility study and outline design
- Detailed design
- Final Strategy and implementation plan

Stage 3 – Corrective Action Implementation and Aftercare

- Enabling works
- Corrective Action Implementation and Verification
- Aftercare

The assessment presented in this report presents the results of a site investigation and generic quantitative risk assessment in accordance with Stage 1 above.

The risk assessment process is underpinned by the establishment and continual refinement of a Conceptual Site Model (CSM). A CSM describes the potential sources of contamination at a site, the contaminant migration pathways it may follow and the receptors that could be or are being impacted. When all three are present i.e. source, pathway and receptor, then a potential pollutant linkage is present, requiring characterisation and assessment in order to determine whether remedial works are needed to adequately address any potentially unacceptable risks.

1.4 TERMS AND CONDITIONS

Attention is drawn to the report conditions, included in Appendix A, and the terms and conditions of the engagement as detailed in our accepted proposal.

2.0 SUMMARY OF PRELIMINARY RISK ASSESSMENT

A review of a Preliminary Risk Assessment (PRA) (ref: P2564-1, dated January 2022) completed for the site by MCL Consulting Ltd has been undertaken by TT and a summary of which provided below.

The preliminary risk assessment collated information from a wide range of sources including geological and hydrogeological mapping; historical mapping; EPA Ireland; GSI (Geological Survey Ireland); FloodInfo Ireland; and a site walkover. A summary of the PRA findings relevant to the site are presented below.

- **Site Description** – The site is currently occupied by agricultural land (5 no. fields) northwest of Lifford, County Donegal. Surrounding lands are characterised as largely agricultural, with mixed residential and commercial land uses to the south (including Applegreen Service Station) and southwest.
- **Site Environment** – The site is shown to be underlain by superficial deposits consisting of glacial till (derived from metamorphic rocks) across the majority of site and an outcrop of alluvium in the northern extent. Bedrock underlying the superficial deposits is shown to be of Schist and grit with thin marble units, as part of the Lough Foyle Succession. Groundwater vulnerability is largely classified as moderate, with an area in the northwest not classified as denoted as not available on mapping. Potential superficial aquifers are not associated with Glacial Till on site. The bedrock aquifer on site is assigned an aquifer code of 'Pl', characterised as a Poor Aquifer, which is generally unproductive except for Local Zones. The aquifer is located within the Lough Foyle Succession with Schist and grit with thin marble units. The nearest watercourse recorded is along the western boundary named 'Lifford Common' and the northern boundary named the 'Gort 01'. There are no groundwater abstractions located within 500m radius if the site.
- **Site History** – A review of available historical mapping from 1837 shows the site was agricultural fields with a farm dwelling in the northwest corner. The farm dwellings are shown present in mapping dated 1904 along with a railway line transecting the northern boundary of site, however both no longer exist by 2010. Applegreen Service Station to the south of site was constructed between 2013 and 2016.

From the gathered information the potential sources, receptors and pathways were reviewed with regard to the proposed development. An initial conceptual site model was produced outlining numerous potential pollutant linkages identified at the site associated with the historical railway on site, alluvium in the north, adjacent filling station (Applegreen Service Station), made ground and radon.

3.0 GENERIC QUANTITATIVE RISK ASSESSMENT

The purpose of a Generic Quantitative Risk Assessment (GQRA) is to refine the conceptual model developed following the preliminary risk assessment. If the GQRA identifies potentially unacceptable risks then it may be necessary to carry out remedial works or further assessment in the form of a DQRA, which in turn may result in remedial works being recommended.

3.1 SITE INVESTIGATION

Based on the outline conceptual model and possible pollutant linkages identified a ground investigation was undertaken on 17th February 2022 with subsequent monitoring undertaken between 25th February 2022 and 4th March 2022 and comprised the following:

- Three boreholes advanced by dynamic sampling drilling to a maximum depth of 5.0m bgl;
- Eight trial pits advanced by 13T excavator to a maximum depth of 2.0m bgl;
- Soil sampling and laboratory testing of samples obtained from boreholes;
- Groundwater sampling and laboratory testing of samples obtained from boreholes; and,
- Ground gas monitoring on 2 no. occasions from boreholes installed with monitoring wells.

The exploratory hole locations are presented at Figure 4 and an investigation rationale is detailed in Table 1 below.

Table 1 – Investigation Rationale

Location	Investigation Rationale
BH1	Targeted location to investigate former railway line and alluvium in the north of the site. To allow collection of samples for contamination testing. Installation of gas and groundwater monitoring well. Determine groundwater presence and subsequent flow direction.
BH2 & BH3	Targeted location to investigate adjacent filling station to the south of the site. To allow collection of samples for contamination testing. Installation of gas and groundwater monitoring well. Determine groundwater presence and subsequent flow direction.
TP1, TP3, TP4, TP5, TP6, TP7 & TP8	To assess shallow ground conditions and confirm composition of made ground (if present) To allow collection of samples for contamination testing. Nominal 50m spacing depending on access, but no formal grid pattern.
TP2	To assess shallow ground conditions and confirm composition of made ground (if present) from historical farm dwelling To allow collection of samples for contamination testing.

3.1.1 Monitoring Well Installation

In total three boreholes (BH1, BH2 & BH3) were installed as permanent groundwater and ground gas monitoring wells. The wells were constructed with 50mm-diameter HDPE pipe and finished with heavy duty metal flush covers. The construction details for the installed wells are presented in the Borehole Logs in Appendix C.

3.2 SOIL SAMPLING

A total of 9 no. representative soil samples were collected during the intrusive works for submission to an independent UKAS accredited laboratory for analysis. Samples were selected at intervals to best characterise made ground and underlying subsoils and/or where there suspected (visual/olfactory evidence) contamination was noted. Selected soil samples were analysed for the following parameters;

- Heavy metals;
- Total phenols;
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Speciated Total Petroleum Hydrocarbons (TPH-CWG incl. BTEX); and,
- Several inorganic parameters inc. asbestos.

3.3 WATER SAMPLING

In total, 3 no. groundwater samples from monitoring wells BH1, BH2 and BH3 were collected on 4th March 2022. Samples were submitted for the following suites of analysis:

- Heavy metals.
- Total phenols;
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Speciated Total Petroleum Hydrocarbons (TPH-CWG incl. BTEX); and,
- Several Inorganic Parameters.

3.4 GROUND GAS MONITORING

The installed borehole locations were monitored for ground gas on 2 no. occasions between 25th February 2022 and 4th March 2022. Measurements of flow rate, methane (CH_4), carbon dioxide (CO_2), oxygen (O_2) carbon monoxide (CO) and hydrogen sulphide (H_2S) concentrations were taken using a GA5000 Gas Analyser in accordance with CIRIA guidance for a proposed residential development.

3.5 GROUND CONDITIONS ENCOUNTERED

A summary of geological conditions encountered in all boreholes is presented in Table 2.

Table 2 - Encountered Geological Conditions

Geology	Details	Top (mbgl) (min – max)	Base (mbgl) (min – max)	Thickness (m) (min- max)
TOPSOIL	Grass over sandy gravelly silt or clayey sandy silt	0.0	0.10 – 0.40	0.10 – 0.40
ALLUVIUM	Organic silt or organic silt with seams of sand (BH1)	0.2	>5.0	Not proven
GLACIAL TILL	Silty sandy gravelly clay	0.2	0.5	0.3
	Sandy and/or gravelly silt	0.1 - 0.5	0.4 - 2.3	0.4 – 1.9
	Silty gravelly sand (some locations with cobbles/boulder content)	0.25 - 0.6	>1.7 – >2.0	Not proven
POSSIBLE WEATHERED BEDROCK	Sandy gravelly silt with frequent cobbles	0.4 - 0.5	>2.3 - >2.7	Not proven

There was no visual or olfactory evidence of contamination noted during the intrusive investigation.

3.5.1 Groundwater

During the intrusive investigation groundwater was not encountered within any of boreholes or trial pits. Subsequent groundwater monitoring (Round 1 - 2) indicated groundwater levels between 0.03m (BH1) and 1.1m bgl (BH3). Table 3 below outlines the groundwater level data recorded.

Table 3 – Groundwater Level Data Summary

Borehole location	Round 1	Round 2
	Standing Water Levels m bgl (metres below ground level)	
BH1	0.05	0.03
BH2	0.36	0.36
BH3	1.1	1.1

3.6 CONTAMINATION ASSESSMENT METHODOLOGY

To assess the human health and environmental risks posed by potential contaminants within the underlying soils and groundwater, Tetra Tech undertook a comparison of laboratory analysis for soil samples using generic assessment criteria. Generic assessment criteria are contaminant concentration values used for comparison purposes to assess the risk associated with contaminant concentrations found on site and are derived using non-site-specific information.

3.6.1 Water

The results from the groundwater and surface water samples have been assessed in accordance with Freshwater criteria provided in the Water Framework Directive or by direct comparison with the Freshwater Environmental Quality Standards (EQS) in the first instance due to the presence of nearby surface water receptor, the River Foyle. Where EQS are unavailable results will be compared with UK Drinking Water Standards (DWS), WHO (World Health Organisation standards for Drinking Water) or other appropriate guidance values.

A summary of the assessment criteria used, and the method of their derivation is included in Appendix F.

3.6.2 Soil

Following the UK CLEA methodology, generic assessment criteria in the form of CIEH S4UL`s and Tetra Tech Threshold Screening Values (TSVs) have been used to assess a risk to human health.

A soil organic matter value of 1% has been used to calculate TSVs using the CLEA v1.07 model for all contaminant which is considered conservative based on reported site-specific soil organic matter concentrations. For each contaminant, threshold screening values (TSVs) have been derived for various land use types. These include:

- Residential with plant uptake (RwP).
- Residential without plant uptake (RwoP).
- Commercial and industrial.
- **Public open space (POS) near residential.**
- Public open space (park); and,
- Allotments.

Development proposals for the site indicate a mixed used including both playing fields and a fuel pumping station. The Public open space (POS) near residential will be adopted to assess risk to health from contaminants present in soils relevant to their location in the first instance. Where exceedances are reported these will be considered further in the context of the development proposals. A summary of the assessment criteria used, and the method of their derivation is included within the S4UL document[1] however, this cannot be reproduced for inclusion in the report. Where S4UL`s are not available Tetra Tech criteria are used, a copy of the source reference material is presented in Appendix F.

[1] *The LQM/CIEH S4ULs for Human Health Risk Assessment Authors: Nathanail, C.P.; McCaffrey, C.; Gillett, A.G.; Ogden, R.C. & Nathanail, J.F. Publisher: Land Quality Press, Nottingham Published: 2015*

3.6.3 Ground Gas

The CIRIA C665 document provides guidance on the collection of relevant and valid data that will allow an accurate description of soil gases to be made; a rigorous consistent and transparent assessment of the risks posed by soil gas to be undertaken which in conjunction with relevant British Standard Guidance BS8485:2015+A1:2019 (Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings) will allow an appropriate strategy for remedial works to be developed should they be required.

The criteria shown in Appendix F uses both gas concentrations and boreholes flow rates to define a characteristic situation for a site based on limiting borehole gas volume flow for methane and carbon dioxide, called the Gas Screening Value. The Gas Screening Value (litre of gas per hour) = borehole flow rate (l/h) x gas concentration (%). This calculation is carried out for both carbon dioxide and methane, and the worst-case value adopted. The characteristic situation is then determined.

On the basis of the proposed development type the site's ground gas regime will be assessed via the Wilson and Card Methodology considered appropriate for a Situation A type development as described in the CIRIA C665 document.

3.7 SOIL ASSESSMENT

A total of 9 no. soil samples were selected and analysed for a range of the following determinants - metals, speciated PAHs, speciated TPH with BTEX, asbestos ID and several inorganic parameters. The results of the laboratory soil analyses are summarised in Appendix F in which they are compared to the relevant generic assessment criteria (POS near residential) GACs.

A summary of the soil results are compared with the relevant GACs in Appendix F, and the laboratory analysis certificates are presented in Appendix H.

3.7.1 Heavy Metals

A total of 6 no. samples, obtained from depths between 0.5mbgl and 1.0mbgl were analysed for a range of heavy metals. All samples analysed were found to be below the relevant GAC.

3.7.2 Organics

Samples were selected for analysis for a range of organic determinants, including TPH-CWG, PAHs, BTEX and total phenols. The findings of the assessment are as follows:

Total Petroleum Hydrocarbons (TPHs)

All 9 no. samples analysed individual aromatic and aliphatic TPH fractions reported concentrations largely below the laboratory limit of detection and below the POS near residential GAC.

Polycyclic Aromatic Hydrocarbons (PAHs)

All 9 no. samples analysed for PAHs reported concentrations below the POS near residential GACs.

BTEX and Phenols

The reported concentrations for BTEX and Phenols for the samples analysed were all below the laboratory limit of detection and POS near residential GACs.

3.7.3 Inorganics

A total of 8 no. samples were analysed for inorganics (including free cyanide and pH) and did not exceed the POS near residential GACs where available. The pH of soils was generally reported within the neutral range pH5 to pH9, with the exception of BH1 at 0.50mbgl which report a pH of 4.52 indicating slightly acidic conditions.

3.7.4 Asbestos

In total, 6 no. samples were obtained from depths between 0.5mbgl and 1.0mbgl and were analysed for asbestos. The laboratory analysis did not identify asbestos within any of the 8 no. soil samples analysed.

3.7.5 Summary of Soils Assessment

The assessment of soil sample analysis has identified that all results were reported below the GACs for 'commercial' end use. In addition, asbestos or asbestos containing materials (ACMs) were not identified. Slightly acidic soil conditions were noted in BH1 at 0.5m bgl. Overall, it is considered that the soils concentrations of contaminants do not present a significant risk to human health on the basis of the public open space (near residential) land use.

3.8 CONTROLLED WATERS ASSESSMENT

In total 3 no. groundwater samples were collected from BH1, BH2 and BH3 following appropriate well development. These samples were submitted to a UKAS accredited laboratory for analysis for suites of metals, organic hydrocarbons and a number of inorganic compounds. The screening summary sheet presented in Appendix F details the selected water quality standards used to assess each given contaminant and summarises the associated laboratory data, highlighting any results that exceed the relevant screening value. Laboratory Certificates are provided in Appendix H.

3.8.1 Metals

The groundwater samples were analysed for a variety of metals and from review of the results all the samples were found to be below the relevant TSV's.

3.8.2 Organic

Total Petroleum Hydrocarbons (TPHs)

All samples were analysed for the presence of petroleum hydrocarbons, and results were found to be below the

relevant TSV's (World Health Organisation (WHO) guideline values for petroleum hydrocarbons in groundwater and UK Drinking Water Standards (UK DWS)).

Polycyclic Aromatic Hydrocarbons (PAHs)

All samples were analysed for the presence of PAH compounds and were reported at concentrations below the relevant TSV's.

BTEX and Phenols

All samples were analysed for BTEX and from review of the results are found to all be below the relevant TSV's.

3.8.3 Inorganics

All samples were tested for a variety of inorganic compounds and from review of the results were found to all be below the relevant TSV's.

3.9 CONTROLLED WATERS ASSESSMENT – HUMAN HEALTH

Risk to health from contaminants in groundwater (via the vapour pathway) has been assessed via comparison of organic contaminant concentrations with applicable SOBRA GACgwvap.

Measured groundwater concentrations did not exceed the SoBRA groundwater screening criteria for assessing the risk to commercial developments from volatilisation of TPH, BTEX and PAH to indoor air.

3.10 CONTROLLED WATERS ASSESSMENT SUMMARY

The controlled waters assessment has identified contaminant concentrations in groundwater all below the relevant TSV's and therefore it is considered the site does not present a significant or potentially significant risk to controlled water receptors.

3.11 GROUND GAS ASSESSMENT

Two rounds of gas monitoring were undertaken between 25th February 2022 and 4th March 2022 from all three installed boreholes using a GA5000 Gas Analyser. The full ground gas screening tables are presented in Appendix G.

3.11.1 Meteorological Conditions

Weather conditions varied over the 2 no. monitoring rounds varied from sunny to rainy conditions. Barometric pressure was recorded between 1013mb during the 1st round, to 999mb during the 2nd round.

A wide range of metrological conditions can influence the generation and migration of soil gases at the site. Atmospheric pressure will increase emission rates, during low and falling atmospheric pressures. The solubility of gases also increases with pressure, lowering concentrations within the ground, as more gas will be dissolved in the

groundwater.

High rainfall may cause shallow groundwater (where present) levels to rise, reducing the available pore space in which gases can exist, increasing the concentration of gas and therefore the release of gas to the atmosphere. Conversely, in some instances, rainfall can potentially seal off the ground surface, causing a build-up of gas and lateral migration. It is noted the monitoring screens were fully submerged in BH1 and BH2 and partially submerged in BH3 across the 2 no. monitoring rounds.

Higher temperatures increase mobility and decrease the gas solubility as well as having an impact on the source material of the gas. Higher temperatures increase degradation and therefore gaseous emissions.

Increased wind velocities can also cause increased gas emissions due to the Venturi effect, where high wind flows across a surface cause a pressure differential, resulting in movement of gas from the soil to atmosphere.

Considering the meteorological conditions recorded during each site visit, the results of the ground gas monitoring are considered representative with sufficient variation in temporal variations experienced over the monitoring period.

3.11.2 Site Gas Concentrations

The ground gas monitoring data collected from the 2 no. rounds of gas monitoring is presented in Appendix G with peak concentrations of methane (CH_4), carbon dioxide (CO_2), hydrogen sulphide (H_2S), and carbon monoxide (CO) summarised in Table 4. The minimum concentrations of oxygen (O_2) encountered at each borehole over all monitoring rounds is also present in Table 4 along with flow rates. The values are presented as the 'worst case' scenario for the existing boreholes. Table 4 also lists the Gas Screening Value (GSV) and modified Wilson and Card "characteristic situation" for each borehole, following the calculation methods and assumptions detailed in C665, section 8; for situation A (all development types except situation B).

Table 4 - Summary of Gas Monitoring Results

Location	Max CH_4 (%)	Max CO_2 (%)	Min O_2 (%)	Max H_2S (ppm)	Max CO (ppm)	Max Flow (l/hr)	GSV (l/hr)	Characteristic Situation / Risk (worst-case) *
BH1	0.5	9.2	18.8	0	1	16.8	1.546	Characteristic Situation 3 (CS3)
BH2	0.2	3.9	20.3	0	2	2.8	0.109	Characteristic Situation 2 (CS2)
BH3	0.2	0.9	21.0	0	1	0.3	0.003	Characteristic Situation1 (CS1)

Notes:
* GSV calculated based on conversion of the negative flow rate to positive flow rate to give 'worst case' scenario.

3.11.3 Ground Gas Risk Discussion

Shallow groundwater levels are high across the site, which can affect the movement of gases within the ground.

Water levels are noted to cover the well response zone completely for BH1 and BH2 and partially for BH3 across the 2 no. gas monitoring rounds. A reduced response zone can result in an increased gas pressure and release known as the "piston effect" caused by rising and falling water levels. As mentioned, the groundwater is shown to be above the response zone within BH1 and BH2 and an increased gas flow rates of 16.8l/hr (BH1) was encountered which is likely to be the piston effect. The increased gas flows rates from BH1 and BH2 are not considered to be representative of potential ground gas flow rates at the site due to the piston effect. BH3 was the only borehole not fully submerged by groundwater which showed a ground gas flow rate of 0.3l/hr which is considered appropriate for the geology underlying the site. The ground gas data retrieved from BH3 is considered to be provide the most representative ground gas data from the site.

As a further line of evidence in addition to ground gas monitoring data, soils were tested for Total Organic Carbon (TOC) concentrations which were reviewed in line with the methodology of CL:AIRE RB17 research bulletin (November 2012). Descriptions of the ground conditions at the site were examined and found to be generally absent of degradable materials, with the exception of BH01 which comprised an outcrop of Alluvium in the northern portion of site only. TOC concentrations were generally <0.7% (excluding BH1) which would represent a low organic content and thus a low gassing potential. Based on the above information the gas generation potential of soils across the majority of site (excluding the northern portion of site) is judged to be very low given the low organic content proven by TOC concentrations of soils.

From the 2 no. gas monitoring rounds undertaken to date the maximum methane concentrations ranged 0.2%v/v (BH2 and BH3) and 0.5%v/v (BH1). Maximum carbon dioxide concentrations ranged between 0.9%v/v (BH3) and 9.2%v/v (BH1). The maximum flow rate ranged between 0.3l/hr (BH3) and 16.8l/hr (BH1).

Whilst ground conditions vary across the site, the maximum recorded carbon dioxide concentration and maximum recorded flow rate from BH3 have been adopted as appropriate values as a suitably conservative approach for assessing the sites ground gas regime. Where elevated carbon dioxide concentrations above 5% have been detected these are not considered to be typical across the site and localised to BH1 only.

Based on the maximum calculated GSV at BH1 of 0.003l/hr, the ground gas risk for the current development proposals is considered to be indicative of a Characteristic Situation 1 (CS1) ground gas regime and consequently there no requirement for ground gas protection measures in future buildings on site.

3.12 UPDATED CONCEPTUAL SITE MODEL (CSM)

For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- a source, i.e. a substance that is capable of causing pollution or harm.
- a receptor (or target), i.e. something which could be adversely affected by the contaminant; and
- a pathway, i.e. a route by which the contaminant can reach the receptor.

If one of these elements is missing, there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

A refined conceptual model of the site is developed in this section to identify sources, pathways and receptors, and thus identify plausible pollutant linkages. Following a review of the PRA, review of site investigation data, ground gas and groundwater sampling from the recent ground investigation and assessment of the associated data, the sources and potential pollutant linkages are discussed in the following sections and summarised in Table 5.

3.12.1 Sources

Reported contaminant concentrations in soils and groundwater are not considered to present a significant risk to future site users or water environment receptors.

Made ground was not identified onsite and therefore has been removed from the updated conceptual site model as a potential source.

The sites ground gas regime has been characterised as Characteristic Situation 1 (CS1), based on the site being underlain predominantly by Glacial Till. Alluvium deposits present in the northern portion of site may be a potential ground gas source, however due to the shallow groundwater table ground gas readings have been increased due to the piston effect and not considered to be fully representative of the ground gas risk in this area.

The PRA identified Radon on the site to be around 9.72%, and between 5-10% of homes within a 10km2 area are estimated above the Reference Level. This level is below the High level (>10% of homes within a 10km2 area estimated above the Reference Level), however consideration of Radon ingress should be taken into account during the building design stage.

3.12.2 Pathway – Receptor Linkages

The majority of site is underlain by Glacial Till which did not exhibit as elevated concentrations of hazardous ground gases. Proposed development plans indicate the development to comprises new pitches, roadway infrastructure and a pumping station. The pumping station is the only proposed new building as part of the current development plans and is shown to be in an area underlain by Glacial Till deposits, therefore the risk to the new proposed building in this area is low.

The Radon on the site is around 9.72%, and between 5-10% of homes within a 10km2 area are estimated above the Reference Level and therefore further consideration for the requirement of radon protection measures in proposed new buildings is recommended.

Table 5 - Updated Conceptual Site Model

On-site Contaminant	Pathway	Receptor	Risk	Comment
Potential contamination from historical railway in the north of site	• Direct dermal contact • Inhalation of dust / vapours • Ingestion • Indirect (volatilisation to indoor air)	• Future site users • Construction Workers	**Low**	Soil and groundwater samples tested did not contain any elevated contaminants above the relevant GAC or TSV.
	• Leaching to shallow groundwater and offsite migration	• Groundwater • Surface Water	**Low**	
Methane and carbon dioxide ground gases	• Inhalation of vapours / gases • Ground gas migration via service entries	• Construction workers • Future site users	**Low**	The ground gas regime is classified as CS1.
Radon	• Migration through soils indoor air	• Future site users	**Moderate**	The Radon on the site is around 9.72%, and between 5-10% of homes within a 10km2 area are estimated above the Reference Level.
Off-site Contaminant	**Pathway**	**Receptor**	**Risk**	**Comment**
Offsite potential contaminative industries including adjacent filling station (Applegreen Service Station).	• Leaching to shallow groundwater and onsite migration	• Onsite and shallow groundwater.	**Low**	Soil and groundwater samples tested did not contain any elevated contaminants above the relevant GAC or TSV.

4.0 CONCLUSIONS & RECOMMENDATIONS

Following an assessment of soil, groundwater and ground gas concentrations the following conclusions have been drawn on the basis of the proposed commercial end use at the site:

- Reported contaminant concentrations detected within the soils and groundwater are considered to pose a low risk to receptors.
- The site's ground gas regime has been assessed as CS1 – very low risk.
- Radon on the site is indicated to be around 9.72%, and consideration of Radon ingress should be taken into account during the building design stage.

On the basis of the above, there is considered to be a **low to moderate** risk to the future development and mitigation measures are not required.

Recommendations to address short term potential risks to construction workers are provided in section 4.1.

4.1 CONTRACTOR WORKER HEALTH AND SAFETY

The risks posed to construction workers through short term exposure to potentially reduced quality soils and groundwater can be minimised through adherence to the following relevant health and safety regulations / guidance:

- Management of Health and Safety at Work Regulations (NI) 1999.
- Construction (Health, Safety and Welfare) Regulations (NI) 1999.
- 'Protection of workers and the General Public during the Development of Contaminated Land' published by HSE (1991); and
- 'A Guide to Safe Working on Contaminated Sites, R132' published by CIRIA (1996).

The health and safety implications of working with potentially contaminated soils and groundwater should be fully considered prior to the commencement of any earthworks through the development of an appropriate health and safety plan. It is considered that the measures adopted to minimise the exposure of construction workers to contaminants should include following as a minimum:

1) Provision should be made for washing and toilet facilities; clean and dirty collection, laundering and storage facilities for protective clothing; and wash facility for footwear.

2) Provision of Personal protective equipment (PPE) as a minimum PPE should include the following:

- headwear
- footwear
- disposable overalls/impermeable outer garments

- gloves
- eye protection

4.2 OFF-SITE REMOVAL OF SOIL

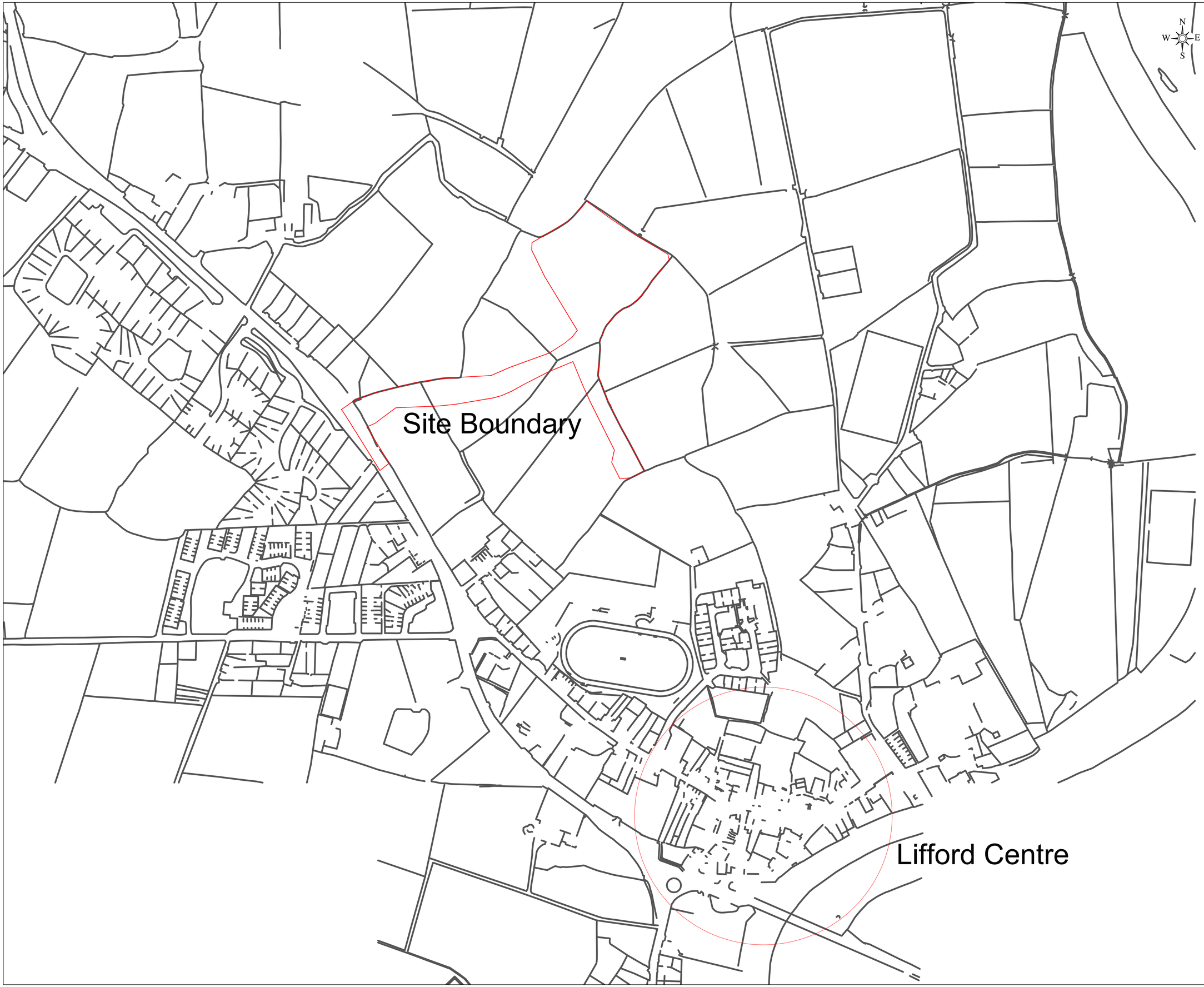
Where there is a requirement to remove materials from site as part of the future development a waste classification should be carried out in order to classify the material and to determine appropriate disposal options (including transportation).The characterisation and classification of wastes in Ireland is governed by waste management legislation primarily informed by EU Directives including the Waste Framework Directive, as implemented at national level in Ireland via the Waste Management Acts 1996-2008 and subsequent regulations.

4.3 UNEXPECTED CONTAMINATION

Should any unexpected materials be encountered during the development earthworks, site operations should stop until the materials have been identified. Examples of such materials include buried barrels or containers, soil or water with an unusual colour or odour, and other evidence of contamination, for example iridescent sheens (like oil or diesel) on soil or water. Should such contamination be identified the following measure should be undertaken by construction workers to minimise the potential risks.

FIGURES

Figure 1- Site Location Plan



NOTES

1. All measurements shown are in metres, and all levels are to ordnance datum unless otherwise indicated

2. All Coordinates are to Irish Grid, unless otherwise noted.

Rev	Issue Date	Description	App
P2	01/01/2022	Boundary Alteration	PA

Status	PRELIMINARY
Client	Donegal County Council
Project	The Common, Lifford Multi-Use Development
Drawing	Site Location Plan
Scale	1:2500 @ A1

McAdam
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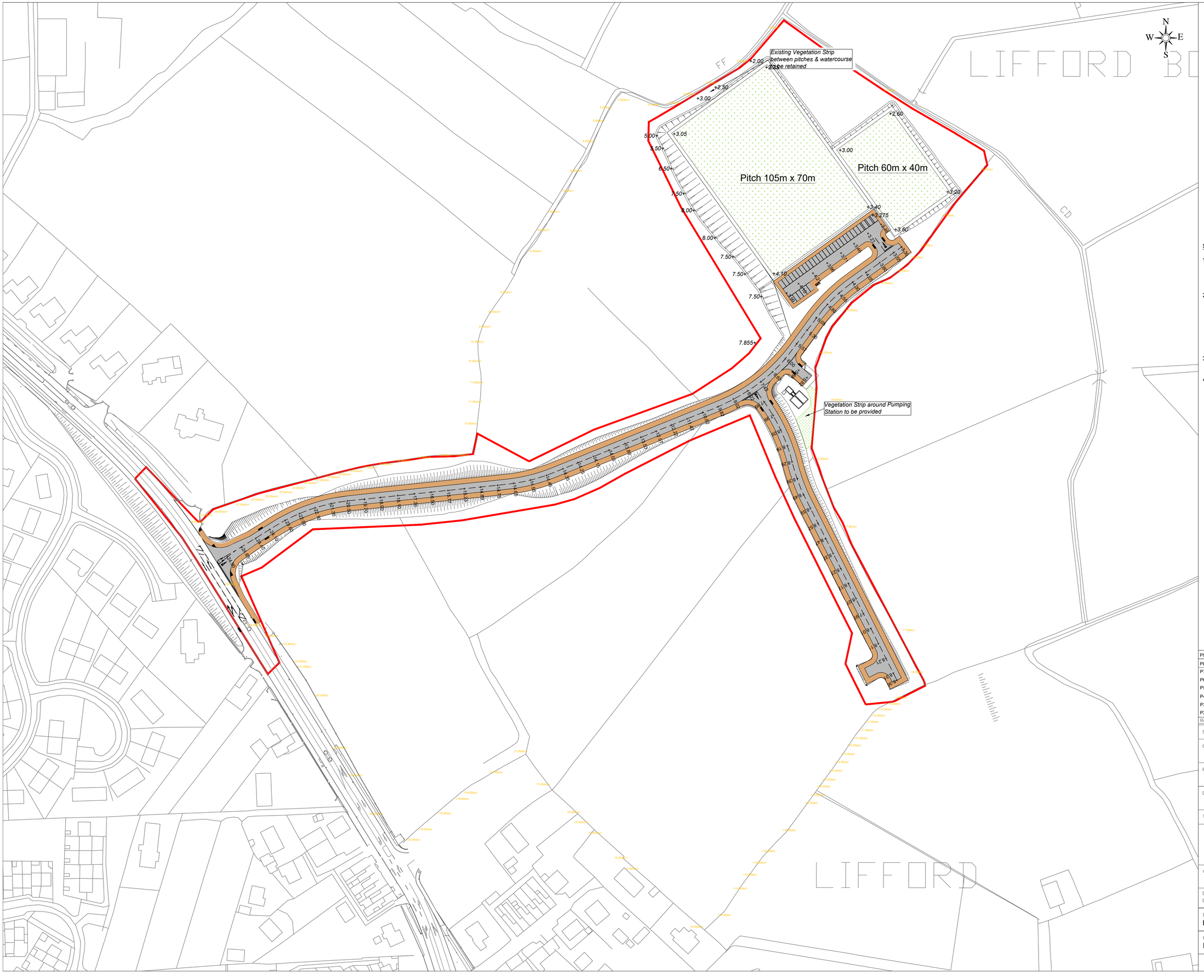
Drawn	DWW	Checked	PA	Approved	PA
Date	2022-02-09	Date	2022-02-09	Date	2022-02-09

Project	- Organisation	- Zone	- Level	- Type	- Role	- Number	- Revision
LIF	- MCA	- ST1	- 00	- DR	- C	- 1000	- P2

Project Number	Status code & Description
E2324	S2 - For Information

Figure 2- Proposed Development Plan



NOTES:

1. *All levels and dimensions are in meters unless stated otherwise.*
2. *The mapping illustrated on this drawing is the proposed site layout which will be subject to change following design development.*
3. *This drawing should be read in conjunction with all relevant drawings (Architectural and Engineering).*
4. *The landscaping proposals illustrated on this drawing are indicative only.*
5. *All levels shown are for illustration purposes only and will require refinement at detailed design.*

LEGEND

- +4.10 *Proposed Level*
- +5.50(ex) 18.00 *Existing Level / Contour*
- Proposed Vehicular Pavements
- Proposed Footpaths
- Proposed Grass Soccer Pitches
- Site Boundary

Site Plan Notes.

1. Right hand turn lane
   Design traffic to be determined.
   Assumed lane widths as existing with central hatched area used for right turn pocket.

2. Roads within development - Design speed 50 kph
   Widths indicated at 6.0m wide (3.0m lanes).
   Footway/verge indicated at 3.0m.
   Junction radii with N14 10m.
   Junction within development 6.0m.
   Horizontal radii 105m.
   Vertical 'K' factor 5 used.
   Embankments to access roads 1 in 3.

3. Development sites
   Embankments indicated at 1 in 3.

4. Site 5
   Site 5 is extensively within the flood plain as illustrated within the Flood Risk Assessment.

Rev	Issue Date	Description	App
P9	13/04/2022	Amendments Following Stage 1 RSA	PA
P8	30/03/2022	Background Mapping Amended	PMcM
P7	28/02/2022	Site Layout Amendments	PA
P6	20/02/2022	Building Amendment	PA
P5	09/02/2022	Red Line Boundary Amended	PA
P4	01/02/2022	Minor Layout Amendments	PA
P3	06/12/2021	Levels Building Amended	PA
P2	23/11/2021	Road Dimensions Altered	PA

Status	PRELIMINARY
Client	Donegal County Council
Project	The Common, Lifford Multi-Use Development
Drawing	Proposed Site Layout
Scale	1:1000 @ A1

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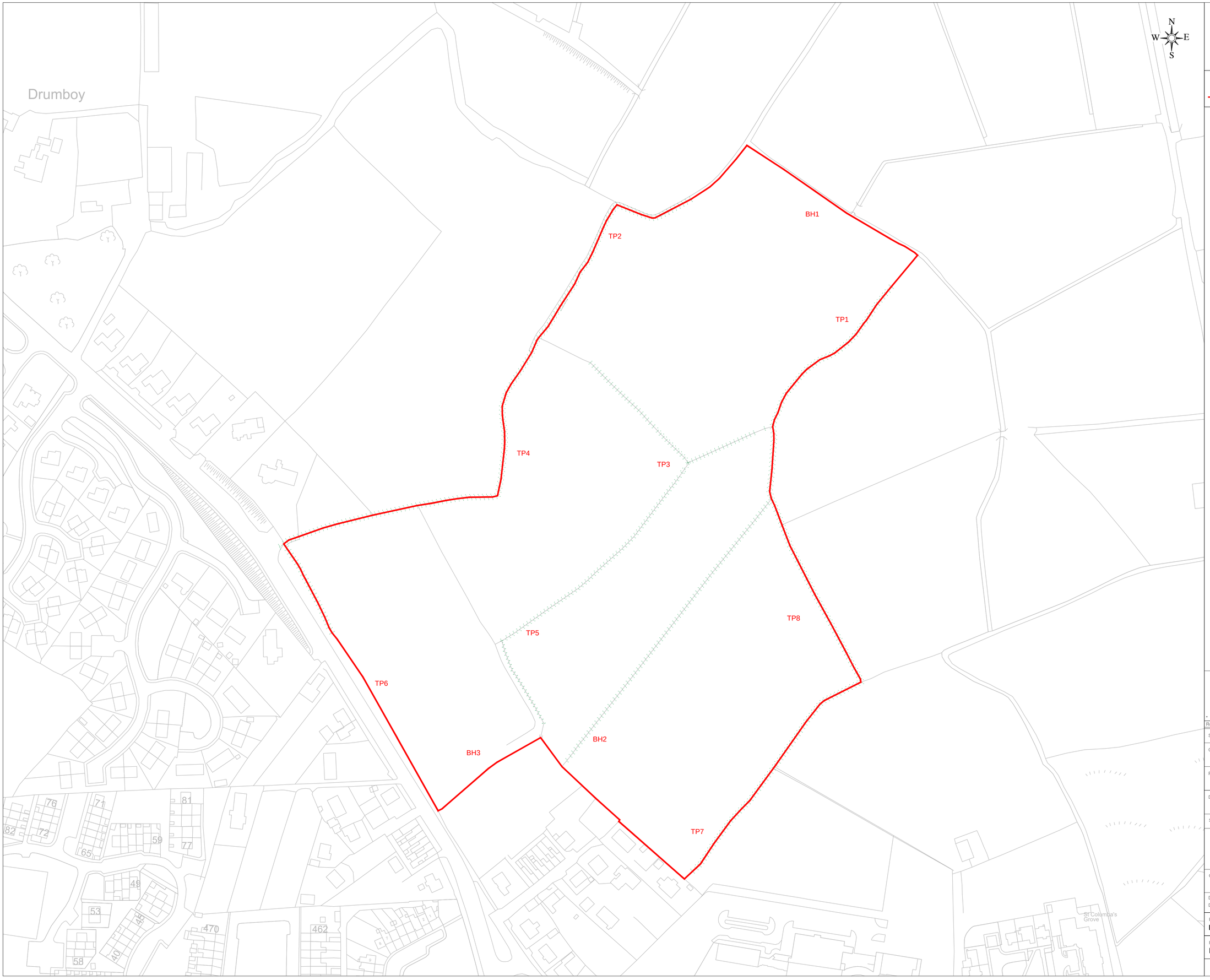
Drawn	Checked	Approved
DWW	PA	PA
Date 2021-09-21	Date 2021-09-21	Date 2021-09-21

Project	- Organisation	- Zone	- Level	- Type	- Role	- Number	- Revision
LIF	- MCA	- ST1	- 00	- DR	- C	- 1003	- P9

Project Number	Status code & Description
E2324	S2 - For Information

Figure 3- Site Investigation Plan



NOTES

1. All measurements shown are in metres, and all levels are to ordnance datum unless otherwise indicated

2. All Coordinates are to Irish Grid, unless otherwise noted.

Legend:

Site Boundary

Rev	Issue Date	Description	App
-	-	-	-

Status: PRELIMINARY

Client: Donegal County Council

Project: The Common, Lifford
Multi-Use Development

Drawing: Site Location Plan

Scale: 1:1250 @ A1

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Drawn	Checked	Approved
DWW	PA	PA
Date 2021-09-21	Date 2021-09-21	Date 2021-09-21

Project	Organisation	Zone	Level	Type	Role	Number	Revision
LIF	MCA	ST1	00	DR	C	1003	P1

Project Number: E2324

Status code & Description: S2 - For Information

APPENDIX A – REPORT CONDITIONS

REPORT CONDITIONS

Generic Quantitative Risk Assessment

This report is produced solely for the benefit of McAdam Design Ltd and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to TTech. In time improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of TTech using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary, and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted, and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to TTech by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted, or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather-related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the representativeness of data used by the model and the assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. TTech accept no liability for issues with performance arising from such factors.

APPENDIX B – PHOTOGRAPHIC LOG

BH1 install

BH1 core samples

BH2 install

BH2 core samples

BH3 install

BH3 core samples

TP1 excavation

TP1 excavation

TP1 excavation

TP1 excavation

TP2 excavation

TP2 excavation

Tracks around TP2 excavation

TP2 excavation

TP3 excavation

Material removed from TP3 excavation

TP3 excavation

TP3 infilled

TP4 excavation

TP4 infilled

TP4 excavation

TP5 excavation

TP5 infilled

TP5 infilled

TP6 excavation

TP6 excavation

TP6 excavation

TP6 Possible Weathered Rock

TP6 infilled

TP7 excavation

TP7 excavation

TP7 infilled

TP6 infilled

TP7 excavation

TP7 excavation

TP7 infilled

TP8 excavation

TP8 excavation

Material removed from TP8 excavation

TP8 infilled

General Photo of Site from SW Corner

General Photo of Site from SW Corner

General Photo of Site from SW Corner, with access track bounding Applegreen to south

General Photo of Site from Southern Border

General Photo of Site from Southern Border

General Photo of Site from Southern Border

General Photo of Site from Southern Border

General Photo of Site facing Southern Border/Applegreen

Access lane to site from along southern border

Access gate to site from along southern border

APPENDIX C – BOREHOLE AND TRIAL PIT LOGS

TETRA TECH

Project: **Lifford Common**

Location: **Letterkenny, Lifford, Co. Donegal**

Client: **McAdam Design Ltd**

Location Details			
Easting:		Northing:	
Level:		Depth:	5.00m
Logger:	JA	Type:	WS
		Inclination:	90°

Status: FINAL

Borehole Number: **BH1**

Sheet 1 of 1

Scale: 1:50

Checked By:

Approved By:

Start Date: 17/02/2022

Finish Date: 17/02/2022

Method, Plant and Crew					Diameter		Casing		Groundwater					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	1.20	Inspection Pit	HAND TOOLS	JS	1.20	300	5.00	101						
1.20	5.00	Window Sampler	DANDO TERRIER	JS	5.00	101								

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Vegetation underlain by clayey sandy SILT. Sand is fine. TOP		0.20						
Orangey brown mottled reddish brown organic SILT.						0.50	ES1	
Brown occasionally dark brown organic SILT with intermittent seams (<10mm) of silty SAND throughout. Sand is fine.		1.00				2.50	ES2	
EOH at 5.00m - Terminated at scheduled depth.		5.00				5.00	ES3	

Observations / Remarks

No groundwater encountered.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %

Project Number: **787-B034486**

TETRA TECH

Project: **Lifford Common**

Location: **Letterkenny, Lifford, Co. Donegal**

Client: **McAdam Design Ltd**

Location Details			
Easting:		Northing:	
Level:		Depth:	2.30m
Logger:	JA	Type:	WS
		Inclination:	90°

Status: FINAL

Borehole Number: **BH2**

Sheet 1 of 1

Scale: 1:50

Checked By:

Approved By:

Start Date: 17/02/2022

Finish Date: 17/02/2022

Method, Plant and Crew					Diameter		Casing		Groundwater					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	1.20	Inspection Pit	HAND TOOLS	JS	1.20	300	2.30	101	2.20	-	-	1.40	20	
1.20	2.30	Window Sampler	DANDO TERRIER	JS	2.30	101								

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass underlain by sandy gravelly SILT. Sand is fine to coarse. Gravel is subrounded to subangular fine to medium of schist and sandstone. TOP		0.20						
Brown gravelly silty sandy CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of schist.		0.50						
Orangish brown sandy gravelly SILT with frequent cobbles (Possible weathered bedrock). Sand is fine to coarse. Gravel is subangular fine to coarse of schist. Cobbles are subangular of schist.						1.00	ES1	
						2.00	ES2	
EOH at 2.30m - Terminated on possible boulder/bedrock.		2.30						

1 2 3 4 5 6 7 8 9 10

Observations / Remarks

Sampling Runs					Hammer Information	
From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %

Project Number: **787-B034486**

TETRA TECH

Project: **Lifford Common**

Location: **Letterkenny, Lifford, Co. Donegal**

Client: **McAdam Design Ltd**

Location Details			
Easting:		Northing:	
Level:		Depth:	2.70m
Logger:	JA	Type:	WS
		Inclination:	90°

Status: FINAL

Borehole Number: **BH3**

Sheet 1 of 1

Scale: 1:50

Checked By:

Approved By:

Start Date: 17/02/2022

Finish Date: 17/02/2022

Method, Plant and Crew					Diameter		Casing		Groundwater					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	1.20	Inspection Pit	HAND TOOLS	JS	1.20	300	2.70	101	2.60	-	-	2.20	20	
1.20	2.70	Window Sampler	DANDO TERRIER	JS	2.70	101								

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass underlain by sandy gravelly SILT. Sand is fine to coarse. Gravel is subrounded to subangular fine to medium of schist and sandstone. TOP		0.10						
Orangish brown sandy SILT. Sand is fine to medium.		0.40						
Brown sandy gravelly SILT with frequent cobbles (Possible weathered bedrock). Sand is fine to coarse. Gravel is subangular fine to coarse of schist. Cobbles are subangular of schist.						1.00	ES1	
						2.50	ES2	
EOH at 2.70m - Terminated on possible boulder/bedrock.		2.70						

1 2 3 4 5 6 7 8 9 10

Observations / Remarks

Sampling Runs					Hammer Information	
From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %

Project Number: **787-B034486**

TETRA TECH

Project: **Lifford Common**

Location: **Letterkenny, Lifford, Co. Donegal**

Client: **McAdam Design Ltd**

Location Details

Easting: Northing:

Level: Depth: 2.00m

Logger: JA Type: TP

Status: FINAL

Pit Number: **TP1**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.60m x 3.00m

Orientation: 255°

Shoring: NONE

Stability: STABLE

Plant: TRACKED EXCAVATOR

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By:

Approved By:

Start Date: 17/02/2022

Finish Date: 17/02/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over brown slightly sandy slightly gravelly SILT (TOPSOIL). Sand is fine to coarse. Gravel is subrounded fine to medium of schist and mudstone.								
Light grey mottled brownish grey gravelly very silty fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of schist.		0.40				0.50	ES1	
						1.50	ES2	
EOH at 2.00m - Terminated in natural strata at scheduled depth.		2.00						

Observations / Remarks

No groundwater encountered.

1 Locksley Business Park,
Montgomery Road,
Belfast,
BT6 9UP
028 9070 6000

Project Number: **787-B034486**

TETRA TECH

Project: **Lifford Common**

Location: **Letterkenny, Lifford, Co. Donegal**

Client: **McAdam Design Ltd**

Location Details

Easting: Northing:

Level: Depth: 2.00m

Logger: JA Type: TP

Status: FINAL

Pit Number: **TP2**

Sheet 1 of 1

Hole Information

Pit Dimensions: 3.00m x 0.60m

Orientation: 158°

Shoring: NONE

Stability: STABLE

Plant: TRACKED EXCAVATOR

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By:

Approved By:

Start Date: 17/02/2022

Finish Date: 17/02/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over brown slightly sandy slightly gravelly SILT (TOPSOIL). Sand is fine to coarse. Gravel is subrounded fine to medium of schist and mudstone. TOP								
Dark grey mottled black and light grey occasionally red gravelly fine to coarse SAND. Gravel is subrounded to subangular fine to coarse of mudstone and sandstone.		0.40				0.50	ES1	
Light brown silty very gravelly fine to coarse SAND. Gravel is subrounded to subangular fine to coarse of quartz sandstone and rare mudstone.		0.60				1.50	ES2	
EOH at 2.00m - Terminated in natural strata at scheduled depth.		2.00						

Observations / Remarks

No groundwater encountered.

1 Locksley Business Park,
Montgomery Road,
Belfast,
BT6 9UP
028 9070 6000

Project Number: **787-B034486**

TETRA TECH

Project: **Lifford Common**

Location: **Letterkenny, Lifford, Co. Donegal**

Client: **McAdam Design Ltd**

Location Details

Easting: Northing:

Level: Depth: 2.00m

Logger: JA Type: TP

Status: FINAL

Pit Number: **TP3**

Sheet 1 of 1

Hole Information

Pit Dimensions: 3.00m x 0.60m

Orientation: 127°

Shoring: NONE

Stability: STABLE

Plant: TRACKED EXCVATOR

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By:

Approved By:

Start Date: 17/02/2022

Finish Date: 17/02/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over brown slightly sandy slightly gravelly SILT (TOPSOIL). Sand is fine to coarse. Gravel is subrounded fine to medium of schist and mudstone. TOP								
Light brown mottled reddish brown gravelly very silty fine to coarse SAND with moderate cobble and boulder content. Gravel is subrounded to subangular fine to coarse of schist and sandstone. Cobbles (up to 240mm x 240mm x 220mm) are subrounded to subangular of sandstone and pelite. Boulders are subrounded to subangular of sandstone and pelite.		0.30				0.50	ES1	
						1.50	ES2	
EOH at 2.00m - Terminated in natural strata at scheduled depth.		2.00						

Observations / Remarks

No groundwater encountered.

1 Locksley Business Park,
Montgomery Road,
Belfast,
BT6 9UP
028 9070 6000

Project Number: **787-B034486**

TETRA TECH

Project: **Lifford Common**

Location: **Letterkenny, Lifford, Co. Donegal**

Client: **McAdam Design Ltd**

Location Details

Easting: Northing:

Level: Depth: 2.00m

Logger: JA Type: TP

Status: FINAL

Pit Number: **TP4**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.60m x 3.00m

Orientation: 95°

Shoring: NONE

Stability: STABLE

Plant: TRACKED EXCAVATOR

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By:

Approved By:

Start Date: 17/02/2022

Finish Date: 17/02/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over brown slightly sandy slightly gravelly SILT (TOPSOIL). Sand is fine to coarse. Gravel is subrounded fine to medium of schist and mudstone. TOP								
Dark brown mottled reddish brown slightly gravelly sandy SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of sandstone.		0.30				0.50	ES1	
Light brown/grey slightly silty very gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of quartz sandstone and mudstone.		0.80				1.50	ES2	
EOH at 2.00m - Terminated in natural strata at scheduled depth.		2.00						

Observations / Remarks

No groundwater encountered.

1 Locksley Business Park,
Montgomery Road,
Belfast,
BT6 9UP
028 9070 6000

Project Number: **787-B034486**

TETRA TECH

Project: **Lifford Common**

Location: **Letterkenny, Lifford, Co. Donegal**

Client: **McAdam Design Ltd**

Location Details

Easting: Northing:

Level: Depth: 2.00m

Logger: JA Type: TP

Status: FINAL

Pit Number: **TP5**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.60m x 3.00m

Orientation: 69°

Shoring: NONE

Stability: STABLE

Plant: TRACKED EXCAVATOR

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By:

Approved By:

Start Date: 17/02/2022

Finish Date: 17/02/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over brown slightly sandy slightly gravelly SILT (TOPSOIL). Sand is fine to coarse. Gravel is subrounded fine to medium of schist and mudstone. TOP		0.25						
Light brown/grey slightly silty very gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of quartz sandstone and mudstone.						0.50	ES1	
						1.50	ES2	
EOH at 2.00m - Terminated in natural strata at scheduled depth.		2.00						

Observations / Remarks

No groundwater encountered.

1 Locksley Business Park,
Montgomery Road,
Belfast,
BT6 9UP
028 9070 6000

Project Number: **787-B034486**

TETRA TECH

Project: **Lifford Common**

Location: **Letterkenny, Lifford, Co. Donegal**

Client: **McAdam Design Ltd**

Location Details

Easting: Northing:

Level: Depth: 1.70m

Logger: JA Type: TP

Status: FINAL

Pit Number: **TP6**

Sheet 1 of 1

Hole Information

Pit Dimensions: 3.00m x 0.60m

Orientation: 212°

Shoring: NONE

Stability: STABLE

Plant: TRACKED EXCAVATOR

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By:

Approved By:

Start Date: 17/02/2022

Finish Date: 17/02/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over brown slightly sandy slightly gravelly SILT (TOPSOIL). Sand is fine to coarse. Gravel is subrounded fine to medium of schist and mudstone. TOP		0.25						
Light brown/grey slightly silty very gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of quartz sandstone mudstone and schist.						0.50	ES1	
						1.50	ES2	
EOH at 1.70m - Terminated in natural strata at scheduled depth.		1.70						

Observations / Remarks

No groundwater encountered.

1 Locksley Business Park,
Montgomery Road,
Belfast,
BT6 9UP
028 9070 6000

Project Number: **787-B034486**

TETRA TECH

Project: **Lifford Common**

Location: **Letterkenny, Lifford, Co. Donegal**

Client: **McAdam Design Ltd**

Location Details

Easting: Northing:

Level: Depth: 2.00m

Logger: JA Type: TP

Status: FINAL

Pit Number: **TP7**

Sheet 1 of 1

Hole Information

Pit Dimensions: 3.00m x 0.60m

Orientation: 45°

Shoring: NONE

Stability: STABLE

Plant: TRACKED EXCAVATOR

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By:

Approved By:

Start Date: 17/02/2022

Finish Date: 17/02/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over brown slightly sandy slightly gravelly SILT (TOPSOIL). Sand is fine to coarse. Gravel is subrounded fine to medium of schist and mudstone. TOP		0.25						
Light brown/grey slightly silty very gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of quartz sandstone mudstone and schist.						0.50	ES1	
						1.50	ES2	
EOH at 2.00m - Terminated in natural strata at scheduled depth.		2.00						

Observations / Remarks

No groundwater encountered.

1 Locksley Business Park,
Montgomery Road,
Belfast,
BT6 9UP
028 9070 6000

Project Number: **787-B034486**

TETRA TECH

Project: **Lifford Common**

Location: **Letterkenny, Lifford, Co. Donegal**

Client: **McAdam Design Ltd**

Location Details

Easting: Northing:

Level: Depth: 2.00m

Logger: JA Type: TP

Status: FINAL

Pit Number: **TP8**

Sheet 1 of 1

Hole Information

Pit Dimensions: 3.00m x 0.60m

Orientation: 87°

Shoring: NONE

Stability: STABLE

Plant: TRACKED EXCAVATOR

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By:

Approved By:

Start Date: 17/02/2022

Finish Date: 17/02/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over brown slightly sandy slightly gravelly SILT (TOPSOIL). Sand is fine to coarse. Gravel is subrounded fine to medium of schist and mudstone. TOP								
		0.30						
Light brown slightly gravelly silty fine to coarse SAND. Gravel is subrounded to subangular fine to coarse of sandstone and schist.						0.50	ES1	
						1.50	ES2	
		2.00						
EOH at 2.00m - Terminated in natural strata at scheduled depth.								

Observations / Remarks

No groundwater encountered.

1 Locksley Business Park,
Montgomery Road,
Belfast,
BT6 9UP
028 9070 6000

Project Number: **787-B034486**

APPENDIX D – SOIL AND WATER ASSESSMENT CRITERIA

SOIL - TIER ONE HUMAN HEALTH SCREENING VALUES (Northern Ireland)

Status	End Use	Issue No	Issue Date
WYG FINAL	**Public Open Space (Park)**	**16**	**23/05/17**

Determinand	Units	SOIL ORGANIC MATTER 1%	SOIL ORGANIC MATTER 2.5%	SOIL ORGANIC MATTER 6%	SOURCE
pH		<5, >9			
Asbestos	%	Presence			
HEAVY METALS/METALLOIDS					
Arsenic	mg/kg	170			CIEH/LQM S4ULs
Cadmium	mg/kg	532			CIEH/LQM S4ULs
Chromium (III)	mg/kg	33,000			CIEH/LQM S4ULs
Chromium (VI)	mg/kg	220			CIEH/LQM S4ULs
Lead Note 12	mg/kg	1300			C4SL
Mercury (Elemental) Note 09	mg/kg	30 vap (25.8)			CIEH/LQM S4ULs
Mercury (Inorganic) Note 09	mg/kg	240			CIEH/LQM S4ULs
Mercury (Methyl) Note 09	mg/kg	68			CIEH/LQM S4ULs
Nickel	mg/kg	800			CIEH/LQM S4ULs
Selenium	mg/kg	1,800			CIEH/LQM S4ULs
Berylium	mg/kg	63			CIEH/LQM S4ULs
Boron	mg/kg	46,000			CIEH/LQM S4ULs
Vanadium	mg/kg	5,000			CIEH/LQM S4ULs
Copper	mg/kg	44,000			CIEH/LQM S4ULs
Zinc	mg/kg	170,000			CIEH/LQM S4ULs
GENERAL INORGANICS					
Easily Liberatable Cyanide (free) Note 13	mg/kg	24			WYG Acute Effects to Infant 1 dose 5g of soil
US EPA PRIORITY PAHs					
Acenaphthene	mg/kg	29,000	30,000	30,000	CIEH/LQM S4ULs
Acenaphthylene	mg/kg	29,000	30,000	30,000	CIEH/LQM S4ULs
Anthracene	mg/kg	150,000	150,000	150,000	CIEH/LQM S4ULs
Benzo(a)anthracene	mg/kg	49	56	62	CIEH/LQM S4ULs
Benzo(b)fluoranthene	mg/kg	13	15	16	CIEH/LQM S4ULs
Benzo(k)fluoranthene	mg/kg	370	410	440	CIEH/LQM S4ULs
Benzo(g,h,i)perylene	mg/kg	1400	1,500	1,600	CIEH/LQM S4ULs
Benzo(a)pyrene	mg/kg	11	12	13	CIEH/LQM S4ULs
Chrysene	mg/kg	93	110	120	CIEH/LQM S4ULs
Di-benzo(a,h)anthracene	mg/kg	1.1	1.3	1.4	CIEH/LQM S4ULs
Fluoranthene	mg/kg	6,300	6,300	6,400	CIEH/LQM S4ULs
Fluorene	mg/kg	20,000	20,000	20,000	CIEH/LQM S4ULs
Indeno(1,2,3-cd)pyrene	mg/kg	150	170	180	CIEH/LQM S4ULs
Naphthalene	mg/kg	1,200 (76.4)sol	1,900 (183)sol	3,000	CIEH/LQM S4ULs
Phenanthrene	mg/kg	6,200	6,200	6,300	CIEH/LQM S4ULs
Pyrene	mg/kg	15,000	15,000	15,000	CIEH/LQM S4ULs
Chloroalkanes and alkenes					
1,2-Dichloroethane (1,2 DCA)	mg/kg	21	24	28	CIEH/LQM S4ULs
1,1,1-Trichloroethane (1,1,1 TCA)	mg/kg	57,000 (1,425)vap	76,000 (2,915)vap	100,000 (6,392)vap	CIEH/LQM S4ULs
1,1,1,2-Tetrachloroethane (1,1,1,2 PCA)	mg/kg	1,500	1,800	2,100	CIEH/LQM S4ULs
1,1,2,2-Tetrachloroethane (1,1,2,2 PCA)	mg/kg	1,800	2,100	2,300	CIEH/LQM S4ULs
Tetrachloroethene (PCE)	mg/kg	810 (424)sol	1,100 (951) sol	1,500	CIEH/LQM S4ULs
Tetrachloromethane (Carbon Tetrachloride)	mg/kg	190	270	400	CIEH/LQM S4ULs
Trichloroethene (TCE)	mg/kg	70	91	120	CIEH/LQM S4ULs
Trichloromethane (Chloroform)	mg/kg	2,600	2,800	3,100	CIEH/LQM S4ULs
Vinyl Chloride (VC)	mg/kg	4.8	5.0	5.4	CIEH/LQM S4ULs
Phenolics					
Phenol	mg/kg	440	690	1,300	CIEH/LQM S4ULs
Chlorophenols	mg/kg	1,100	1,100	1,100	CIEH/LQM S4ULs
Pentachlorophenols	mg/kg	110	120	120	CIEH/LQM S4ULs
TPH Note 10					
TPH Aliphatic >C5-6	mg/kg	95,000 (304)sol	130,000 (558)sol	180,000 (1,150)sol	CIEH/LQM S4ULs
TPH Aliphatic >C6-8	mg/kg	150,000 (144)sol	220,000 (322)sol	320,000 (736)sol	CIEH/LQM S4ULs
TPH Aliphatic >C8-10	mg/kg	14,000 (78)sol	18,000 (190)vap	21,000 (451)vap	CIEH/LQM S4ULs
TPH Aliphatic >C10-12	mg/kg	21,000 (48)sol	23,000 (118)vap	24,000 (283)vap	CIEH/LQM S4ULs
TPH Aliphatic >C12-16	mg/kg	25,000 (24) sol	25,000 (59) sol	26,000 (142) sol	CIEH/LQM S4ULs
TPH Aliphatic >C16-35	mg/kg	450,000	480,000	490,000	CIEH/LQM S4ULs
TPH Aliphatic >C35-44	mg/kg	450,000	480,000	490,000	CIEH/LQM S4ULs
TPH Aromatic >EC5-7 (Benzene)	mg/kg	76000 (1220)sol Note14	84000 (2260) sol Note14	92000 (4710) sol Note14	CIEH/LQM S4ULs
TPH Aromatic >EC7-8	mg/kg	87,000 (869)vap	95,000 (1,920)sol	100,000 (4,360)vap	CIEH/LQM S4ULs
TPH Aromatic >EC8-10	mg/kg	7,200 (613)vap	8,500 (1,500)vap	9,300 (3,580)vap	CIEH/LQM S4ULs
TPH Aromatic >EC10-12	mg/kg	9,200 (364)vap	9,700 (899)sol	10,000	CIEH/LQM S4ULs
TPH Aromatic >EC12-16	mg/kg	10,000	10,000	10,000	CIEH/LQM S4ULs
TPH Aromatic >EC16-21	mg/kg	7,600	7,700	7,800	CIEH/LQM S4ULs
TPH Aromatic >EC21-35	mg/kg	7,800	7,800	7,900	CIEH/LQM S4ULs
TPH Aromatic >EC35-44	mg/kg	7,800	7,800	7,900	CIEH/LQM S4ULs
TPH Aliphatic & Aromatic >EC44-70	mg/kg	7,800	7,800	7,900	CIEH/LQM S4ULs
Total TPH	mg/kg	**No Sum**	**No Sum**	**No Sum**	
BTEX					
Benzene	mg/kg	90	100	110	CIEH/LQM S4ULs
Toluene	mg/kg	87,000 (869)vap	95,000 (1,920) vap	100,000 (4,360) vap	CIEH/LQM S4ULs
Ethylbenzene	mg/kg	17,000 (518) vap	22,000 (1,220) vap	27,000 (2,840) vap	CIEH/LQM S4ULs
m-Xylene	mg/kg	17,000 (625) vap	24,000 (1,470) vap	32,000 (3,460) vap	CIEH/LQM S4ULs
o-Xylene	mg/kg	17,000 (478) sol	24,000 (1,120) vap	33,000 (2,620) sol	CIEH/LQM S4ULs
p-Xylene	mg/kg	17,000 (576) sol	23,000 (1,350) sol	31,000 (3,170) sol	CIEH/LQM S4ULs
Xylenes (mixed isomers)	mg/kg	17,000 (478) sol	23,000 (1,350) sol	31,000 (3,170) sol	CIEH/LQM S4ULs

SOIL - TIER ONE HUMAN HEALTH SCREENING VALUES (Northern Ireland)

Status	End Use	Issue No	Issue Date
WYG FINAL	**Public Open Space (Park)**	**16**	**23/05/17**

Determinand	Units	SOIL ORGANIC MATTER 1%	SOIL ORGANIC MATTER 2.5%	SOIL ORGANIC MATTER 6%	SOURCE
Explosives					
2,4,6 - Trinitrotoluene	mg/kg	260	270	270	CIEH/LQM S4ULs
RDX and HMX	mg/kg	49,000 (18.7)[sol]	51,000	51,000	CIEH/LQM S4ULs
Pesticides					
Aldrin	mg/kg	30	31	31	CIEH/LQM S4ULs
Dieldrin	mg/kg	30	31	31	CIEH/LQM S4ULs
Atrazine	mg/kg	2,300	2,400	2,400	CIEH/LQM S4ULs
Dichlorvos	mg/kg	26	26	27	CIEH/LQM S4ULs
Alpha-Endosulfan	mg/kg	2,400	2,400	2,500	CIEH/LQM S4ULs
Beta-Endosulfan	mg/kg	2,400	2,400	2,500	CIEH/LQM S4ULs
Alpha-Hexachlorocyclohexane	mg/kg	47	48	48	CIEH/LQM S4ULs
Beta-Hexachlorocyclohexane	mg/kg	15	15	16	CIEH/LQM S4ULs
Gamma-Hexachlorocyclohexane	mg/kg	14	15	15	CIEH/LQM S4ULs
Chlorobenzenes					
Chlorobenzene	mg/kg	1,300 (675)[sol]	2,000 (1,520)[sol]	2,900	CIEH/LQM S4ULs
1,2-Dichlorobenzene	mg/kg	24,000 (571)[sol]	36,000 (1,370)[sol]	51,000 (3,240)[sol]	CIEH/LQM S4ULs
1,3-Dichlorobenzene	mg/kg	390	440	470	CIEH/LQM S4ULs
1,4-Dichlorobenzene	mg/kg	36,000 (224)[vap]	36,000 (540)[vap]	36,000 (1,280)[vap]	CIEH/LQM S4ULs
1,2,3-Trichlorobenzenes	mg/kg	770 (134)[vap]	1,100 (330)[vap]	1,600 (789)[vap]	CIEH/LQM S4ULs
1,2,4-Trichlorobenzenes	mg/kg	1,700 (318)[vap]	2,600 (786)[vap]	4,000 (1,880)[vap]	CIEH/LQM S4ULs
1,3,5-Trichlorobenzenes	mg/kg	380 (36.7)[vap]	580 (90.8)[vap]	860 (217)[vap]	CIEH/LQM S4ULs
1,2,3,4-Tetrachlorobenzene	mg/kg	1,500 (122)[vap]	1,600	1,600	CIEH/LQM S4ULs
1,2,3,5-Tetrachlorobenzene	mg/kg	110 (39)[vap]	120	130	CIEH/LQM S4ULs
1,2,4,5-Tetrachlorobenzene	mg/kg	25	26	26	CIEH/LQM S4ULs
Pentachlorobenzene	mg/kg	190	190	190	CIEH/LQM S4ULs
Hexachlorobenzene	mg/kg	30	30	30	CIEH/LQM S4ULs
Other					
Carbon Disulphide	mg/kg	1,300	1,900	2,700	CIEH/LQM S4ULs
Hexachlorobutadiene	mg/kg	48	50	51	CIEH/LQM S4ULs

NOTES

1) Compare individual samples values against Soil Screening Values (SSV). If exceedences are identified this will signify a potential human health risk and will warrant further consideration. If in doubt regarding next steps discuss with Project Manager and / or member of the WYG QRA Group.

2) These values are for initial screening of potential risk to human health only. They are not remediation thresholds. Assessment of risk to other receptors to be completed separately as appropriate for the site, e.g. for water, ecology, building materials.

3) Where the SSV exceeds saturation limits, (derived in CLEA by using partitioning equations) the saturation limit is given in brackets.
Further background information on the derivation and implication of saturation limits is provided in Section 4.12 of the CLEA Software Handbook (SR4).
a) sol - S4UL exceeds soil saturation limit which is given in brackets (Note that if soil data exceeds the solubility limit, free product may be present)
b) vap - S4UL exceeds vapour saturation limit which is given in brackets
For screening consider applicability of both solubility limit and SSV.

4) Screening criteria denoted with hash (#) were capped at 1000000mg/kg, the maximum theoretical value.

5) SSVs are provided for a select range of more commonly encountered chemical constituents listed above. **For VOC and SVOC not listed above refer to CL:AIRE "Soil Generic Assessment Criteria for Human Health Risk Assessment" January 2010.** If screening criteria are required for other chemical constituents, contact a member of the WYG QRA group.

6) SSVs derived for certain constituents may be low in relation to standard laboratory Limits of Detection (LoD). It is advised that the Project Team check that laboratory limits of detection are sufficient to permit comparison of soil data with screening criteria. Ideally the LoD should be no more than 10% of the screening criteria noting though that this is not practicable for all constituents.

7) SSVs were calculated using a Soil Organic Matter (SOM) values of 1.0%, 2.5% and 6%. This is equivalent to a Fraction Organic Carbon (FOC) values of approx. 0.006, 0.0145 and 0.035 respectively (For reference FOC = 0.58*SOM/100). Note that some soils may have SOM lower than 1.0%; in these situations it may be appropriate to consider derivation of alternative screening criteria using the CLEA software. If in doubt discuss with Project Manager and / or member of the WYG QRA Group.

8) In general, SSVs have been rounded down to 2 significant figures.

9) Use Mercury (Inorganic) SSV for Mercury unless evidence suggesting elemental or methyl mercury may be present.

10) For sites with a known TPH issue it may be of benefit to determine the TPH Hazard Index (EA Science Report P5-080/TR3 2005). For a given soil sample first divide each TPH fraction concentration by the SSV of that TPH fraction. This gives the Hazard Quotient for the TPH fraction. Then sum all the Hazard Quotients together for the soil sample to give the Hazard Index. A Hazard Index > 1 respresents a potentially significant risk to human health. Alternatively this can be done using the CLEA Model by entering the TPH source concentrations for indiviual fractions and running the model in ratio mode. If required seek advice from a member of the WYG QRA Group.

11) Definition of scenario in CL:AIRE SP1010 C4SL Main Report in section 3.6.

12) The TSV for lead is the C4SL derived using a Low Level of Toxicological Concern (LLTC) of 3.5ug/dL blood lead.

13) See WYG Technical Memorandum: Derivation of a SSV for Cyanide for explanation of deriviation

14) Variation of S4ULs for benzene and TPH Aromatic >EC5-7 (Benzene) is due to the health criteria value (HCV) applied in each case. The HCV for benzene is based on its non threshold (carcinogenic) effects, whereas that for Aromatic >EC5-7 is for threshold (see section 17.3.5 S4UL Document). The latter is intended to allow the additive effect from this fraction to be considered together with the threshold effects of all other fractions, however individual assessments for the indicator compounds (e.g. benzene), are also required.

WYG Tier 1 Water Quality Standard

Receiving Water	Status	Issue No.	Date of Release
Groundwater	DRAFT	1D	20/04/2012

All criteria are sourced from The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010 unless otherwise stated.

Determinand	Value (µg/l)			Notes
	Groundwater Impacts on Surface Water (minimun threshold value)	Groundwater Drinking Water Protected Areas	General Quality of Groundwater Body	
Electrical Conductivity (µS/cm)		1,880 (µS/cm)		
Aluminium		150		
Ammonia	300	290	290	
Anthracene	0.1			
Arsenic	51.6	7.5		
Bentazone	514	0.075	0.075	Herbicide
Benzene	10.1	0.75	0.75	
Benzo(a)pyrene		0.075		
Boron		750		
Bromate		7.5	7.5	
Cadmium	0.2	3.75		
Carbendazim		0.075		Fungicide
Carbetamide		0.075		Herbicide
Carbon tetrachloride	12.1	2.25	2.25	Tetrachloromethane, freon 10, halon 104
Chloride (water soluble)		188,000	187,500	
Chlorfenvinphos	0.1	0.075	0.075	Insecticide
Chloroform	2.53	75	75	Trichloromethane
Chlorotoluron		0.075		
Chromium	5	37.5		
Clopyralid		0.075		Herbicide
Copper	10.1	1,500		
Cyanazine		0.075		Herbicide
Cypermethrin	0.0001	0.075	0.075	Insecticide
Dalapon		0.075		Herbicide
Diazinon	0.01	0.075	0.075	Insecticide
Dichlorobenzenes		2.25	2.25	Sum of all isomers
Dichloromethane	20.7	7.5		
Dichlorprop		75		Herbicide
Diuron	0.2	0.075	0.075	Herbicide
Fluoranthene	0.1			
Fluoride		1.1		
Glyphosate		0.075		Herbicide
Isoproturon	0.3	0.075	0.075	Algicide, herbicide
Lead	7.3	18.8		
MCPA		0.075		Herbicide
Mecoprop	5.1	0.075	0.075	Herbicide
Mercury		0.75		
Metazachlor		0.075		Herbicide
Naphthalene	2.4			
Nickel	20.2	15		
Nitrate		42,000	42,000	
Pentachlorophenol	0.4	0.075	0.075	
Permethrin	0.01	0.075	0.075	cis and trans, insecticide, acaricide
Phenol	15.2	7.5		
Phosphate	41.4			
Propazine		0.075		Herbicide
Propetamphos		0.075	0.075	Insecticide, acaracide
Simazine	1	0.075	0.075	Herbicide
Sodium		133,000		
Sulphate		188,000	188,000	
Terbutryn		0.075		Algicide, herbicide
Tetrachloroethene	10.1	7.5	7.5	
Toluene	50.5			
Trichloroethene	10.1	7.5	7.5	
1,1,1-trichloroethane	101		7.5	
1,1,2-trichloroethane	404		7.5	
Trietazine		0.075		Herbicide
Trifluralin		0.075		Herbicide
Xylene	30.3		37.5	
Zinc	75.8	3,750		

WYG Tier 1 Water Quality Standard

Receiving Water	Issue No.	Date of Release
Transitional, Coastal & Marine	1D	20/04/2012

All criteria are sourced from The Water Framework Directive (Priority Substances and Classification) Regulations (Northern Ireland) 2011 unless otherwise stated.

Determinand	Value (µg/l)	Origin of TSV	Notes
Abamectin	0.003	Saltwater Annual Average	
Un-ionised ammonia (as N)	21	Annual Mean	Good quality transitional and coastal waters
anthracene (NI)	0.1	Annual Mean	Good quality transitional and coastal waters
Arsenic	25	Annual Mean	Good quality transitional and coastal waters
Benzene (NI)	8	Annual Mean	Good quality transitional and coastal waters
cadmuim	0.2	Annual Mean	Good quality transitional and coastal waters
Chlorine (northern ireland)	10	95th percentile	Good quality transitional and coastal waters
Chromium VI (dissolved)	0.6	Annual Mean	Good quality transitional and coastal waters
Copper (dissolved)	5	Annual Mean	Good quality transitional and coastal waters
Cyanide	1	Annual mean concentration of hydrogen cyanide	Good quality transitional and coastal waters
Cypermethrin	0.0001	Annual Mean	Good quality transitional and coastal waters
Diazinon	0.01	Annual Mean	Good quality transitional and coastal waters
2,4-dichlorophenol	20	Annual Mean	Good quality transitional and coastal waters
Dimethoate	0.48	Annual Mean	Good quality transitional and coastal waters
Iron (dissolved)	1000	Annual Mean	Good quality transitional and coastal waters
Linuron	0.5	Annual Mean	Good quality transitional and coastal waters
Mecoprop	18	Annual Mean	Good quality transitional and coastal waters
Permethrin	0.01	95%ile	Good quality transitional and coastal waters
Phenol	7.7	Annual Mean	Good quality transitional and coastal waters
Toluene	40	Annual Mean	Good quality transitional and coastal waters
Zinc	40	Annual Mean	Good quality transitional and coastal waters
Carbontetrachloride	12	Annual Mean	Good quality transitional and coastal waters
C10-13 Chloroalkanes	0.4	Annual Mean	Good quality transitional and coastal waters
Cyclodiene pesticides: Aldrin, Dieldrin, E	0.005	Annual Mean	Good quality transitional and coastal waters
DDT	0.025	Annual Mean	Good quality transitional and coastal waters
ppDDT	0.01	Annual Mean	Good quality transitional and coastal waters
1,2 - Dichloroethane	10	Annual Mean	Good quality transitional and coastal waters
Dichloromethane	20	Annual Mean	Good quality transitional and coastal waters
Di(2-ethylhexyl)-phthalate (DEHP	1.3	Annual Mean	Good quality transitional and coastal waters
Fluoranthene	0.1	Annual Mean	Good quality transitional and coastal waters
Hexachloro_benzene	0.01	Annual Mean	Good quality transitional and coastal waters
Hexachloro_butadiene	0.01	Annual Mean	Good quality transitional and coastal waters
hexachloro-cylohexane	0.002	Annual Mean	Good quality transitional and coastal waters
isoproturon	0.3	Annual Mean	Good quality transitional and coastal waters
Lead	7.2	Annual Mean	Good quality transitional and coastal waters
Mercury	0.05	Annual Mean	Good quality transitional and coastal waters
naphthalene	1.2	Annual Mean	Good quality transitional and coastal waters
nickel	20	Annual Mean	Good quality transitional and coastal waters
Nonylphenol	0.3	Annual Mean	Good quality transitional and coastal waters
Pentachloro-benzene	0.0007	Annual Mean	Good quality transitional and coastal waters
Pentachloro-phenol	1	Annual Mean	Good quality transitional and coastal waters
benzo(a)pyrene	0.05	Annual Mean	Good quality transitional and coastal waters
Benzo(b&k)fluoranthanene	0.03	Annual Mean	Good quality transitional and coastal waters
benzo(ghi)pyrene & indeno(1,2,3-cd)pyr	0.002	Annual Mean	Good quality transitional and coastal waters
Simazine	1	Annual Mean	Good quality transitional and coastal waters
Tetrachloroethylene	10	Annual Mean	Good quality transitional and coastal waters
tricholorethylene	10	Annual Mean	Good quality transitional and coastal waters
Tributlytin compounds	0.0002	Annual Mean	Good quality transitional and coastal waters
trichlorobenzene	0.4	Annual Mean	Good quality transitional and coastal waters
Trichloromethane	2.5	Annual Mean	Good quality transitional and coastal waters
Trifluralin	0.03	Annual Mean	Good quality transitional and coastal waters
2-chlorophenol	50	Annual Mean	Good quality transitional and coastal waters
Biphenyl	25	Annual Mean	Good quality transitional and coastal waters
1,1,1-trichloroehane	100	Annual Mean	Good quality transitional and coastal waters
1,1,2-trichloroethane	300	Annual Mean	Good quality transitional and coastal waters
xylene	30	Annual Mean	Good quality transitional and coastal waters

WYG Tier 1 Water Quality Standard

Receiving Water	Status	Issue No.	Date of Release
Freshwater	DRAFT	1D	01/02/2012

Freshwater includes inland surface waters, lakes, rivers etc

All criteria are sourced from The Water Framework Directive (Priority Substances and Classification) Regulations (Northern Ireland) 2011 unless

Determinand	Value (µg/l)		Origin of TSV	Notes
pH	>6-<9			
Abamectin	0.01		Annual Average	
Alachlor	0.3		AA-EQS	
Ammonium (as NH4)	See Miscellaneous Worksheet			
Anthracene	0.1		AA-EQS	
Arsenic	50		Annual Mean	Good standard for rivers and freshwater lakes
Atrazine	0.6		AA-EQS	
Bentazone	500		AA-EQS	
Benzene	10		AA-EQS	
Benzo(a)pyrene	0.05		AA-EQS	
Benzo (b&k)fluorahthene (NI)	0.03		AA-EQS	
Biphenyl	25		AA-EQS	
Brominated diphenylether	0.0005		AA-EQS	
C10-13 chloroalkanes	0.4		AA-EQS	
Cadmium (and its compounds)	0.08		Inland Surface Waters	
Carbon tetrachloride	12		AA-EQS	
Chlorine	2		Annual Mean	Good standard for rivers and freshwater lakes
Chlorvinphos	0.1		AA-EQS	
4-chloro-3-methyl-phenol	40		AA-EQS	
Chloronitrotoluenes	10		AA-EQS	
2-chlorophenol	50		AA-EQS	
Chlorpyrifos	0.03		AA-EQS	
Chromium III	4.7		Annual mean concentration of dissolved	Good standard for rivers and freshwater lakes
Chromium VI	3.4		Annual mean concentration of dissolved	Good standard for rivers and freshwater lakes
Copper	1	$CaCO_3$ 0 - 50 mg/l	Good standard for rivers and freshwater lakes	
	6	$CaCO_3$ 50 - 100 mg/l		
	10	$CaCO_3$ 100 - 250 mg/l		
	28	$CaCO_3$ >250 mg/l		
Cyanide	1		Annual mean concentration of hydrogen cyanide	Good standard for rivers and freshwater lakes
Cyclodiene pesticides	0.0001		AA-EQS	Sum of aldrin, dieldrin, endrin and isodrin
Cypermethrin	0.1		Annual Mean	Good standard for rivers and freshwater lakes
2,4-D (2,4-dichlorophenoxyacetic acid)	0.3		Annual Mean	
DDT (Total all 4 isomers)	0.025		Annual Mean	
ppDDT	0.01		Annual Mean	
Diazinon	0.01		Annual Mean	
1,2-dichloroethane	10		Annual Mean	
Dichloromethane	20		Annual Mean	
2,4-dichlorophenol	20		Annual Mean	
Di(2ethylhexyl)phthalate	1.3		AA-EQS	
Dichlorvos	0.001		AA-EQS	
Dimethoate	0.48		Annual Mean	
Diuron	0.2		AA-EQS	
Endosulphan	0.005		AA-EQS	
Fenitrothion	0.01		AA-EQS	
Fluoranthene	0.1		AA-EQS	
Hexachlorobenzene	0.01		AA-EQS	
Hexachlorobutadiene	0.1		AA-EQS	
Hexachlorocyclohexane	0.02		AA-EQS	
Iron (dissolved)	1,000		Annual Mean	
Isoproturon	0.3		AA-EQS	
Lead (Dissolved)	7.2		AA-EQS	
Linuron	0.5		Annual Mean	
Mecoprop	18		Annual Mean	
Mercury (and its compounds)	0.05		AA-EQS	
Naphthalene	2.4		AA-EQS	
Nickel (Dissolved) (and its compounds)	20		AA-EQS	
Nonylphenol	0.3		AA-EQS	
Octylphenol	0.1		AA-EQS	
PAH: sum of benzo(b)fluoranthene and benzo(k)fluoranthene	0.03		AA-EQS	
PAH: sum of benzo(g,h,i)perylene and indeno(1,2,3-cd)pyrene	0.002		AA-EQS	
Pentachloro-benzene (NI)	0.007		AA-EQS	
Pentachloro-phenol (NI)	0.4		AA-EQS	
Permethrin	0.01		95%ile	
Phenol	7.7		Annual Mean	
Simazine	1		AA-EQS	
Tetrachloroethylene	10		AA-EQS	
Toluene	50		Annual Mean	
Tributyltin compounds	0.0002		AA-EQS	
Trichlorobenzenes	0.4		AA-EQS	
1,1,1-trichloroethane	100		AA-EQS	
1,1,2-trichloroethane	400		AA-EQS	
Trichloroethylene	10		AA-EQS	
Trichloromethane	2.5		AA-EQS	
Trifluralin	0.03		AA-EQS	
Triphenyltin and its derivatives	0.02		AA-EQS	
Xylene	30		AA-EQS	
Zinc (total)	8	$CaCO_3$ 0 - 50 mg/l	Good standard for rivers and freshwater lakes	
	50	$CaCO_3$ 50 - 100 mg/l		
	75	$CaCO_3$ 100 - 250 mg/l		
	125	$CaCO_3$ >250 mg/l		

APPENDIX E – GAS ASSESSMENT CRITERIA

Wilson & Card Method for Classifying Gassing Sites

Characteristic Situation (CIRIA R149)	Comparable Partners in Technology Gas Regime	Gas Screening Value (CH4 or CO2) (l/hr)1	Additional limiting factors	Typical source of generation
1	A	<0.07	Typically methane ≤ 1% and or carbon dioxide =/ >5% otherwise consider increasing to situation 2.	Natural soils with low organic content
2	B	<0.7	Borehole air flow rate not to exceed 70l/hr otherwise increase to characteristic situation3	Natural soil, high peat/organic content
3	C	<3.5		Old landfill, inert waste, mine working flooded
4	D	<15	Quantitative risk assessment required to evaluate scope of protection measures	Mine working – susceptible to flooding, completed landfill, inert waste (WMP 26B criteria)
5	E	<70		Mine working unflooded inactive
6	F	>70		Recent landfill site

Notes:
Gas screening value: litres of gas/hour is calculated by multiplying the gas concentration (%) by the measured borehole flow rate (l/h)
Site characteristics should be based on gas monitoring of gas concentrations and borehole flow rates for specified minimum periods in table 5.5 of the CIRIA guidance
Source of gas and generation potential/performance must be identified
Soil gas investigation to be in accordance with guidance provided in chapters 4-6 of CIRIA guidance.
If there is not a detectable flow use the limit of detection of the instrument.
The boundaries between the Partners in Technology classification do not fit exactly with the boundaries for the CIRIA classification.

APPENDIX F - SOIL AND WATER SCREENING ASSESSMENT

Soil Analysis Screening Assessment

TETRA TECH

Contaminant GAC	Public Open Space near residential housing	BH1	BH2	BH3	TP1	TP3	TP4	TP6	TP7	TP7
	Depth(m)	0.50	1.00	1.00	0.50	0.50	1.50	1.50	0.50	1.50
Heavy Metals	mg/kg									
Arsenic	79	15.80	6.90	8.20	4.00	5.80	NA	NA	7.00	NA
Cadmium	120	<0.1	<0.1	<0.1	<0.1	<0.1	NA	NA	<0.1	NA
Chromium	NA	74.40	82.50	89.50	74.80	68.40	NA	NA	82.40	NA
Chromium III	1500	74.40	82.50	89.50	74.80	68.40	NA	NA	82.40	NA
Chromium VI	7.7	<0.3	<0.3	<0.3	<0.3	<0.3	NA	NA	<0.3	NA
Copper	12000	19.00	95.00	39.00	18.00	14.00	NA	NA	25.00	NA
Inorganic Mercury	120	0.10	<0.1	<0.1	<0.1	<0.1	NA	NA	0.10	NA
Nickel	230	31.10	53.70	46.00	26.30	15.20	NA	NA	29.30	NA
Lead	630	20.00	16.00	15.00	25.00	20.00	NA	NA	24.00	NA
Selenium	1100	1.00	<1	<1	<1	1.00	NA	NA	1.00	NA
Zinc	81000	73.00	65.00	80.00	71.00	38.00	NA	NA	64.00	NA
Vanadium	2000	69.00	48.00	49.00	34.00	41.00	NA	NA	47.00	NA
Beryllium	2.2	1.00	0.70	0.70	<0.5	<0.5	NA	NA	0.50	NA
Boron	21000	0.90	0.10	0.10	0.10	0.40	NA	NA	0.30	NA
Phenolics										
Phenol	440	<0.15	<0.15	<0.15	<0.15	<0.15	NA	NA	<0.15	NA
Total Petroleum Hydrocarbons										
Aliphatics	-									
EC>C5-C6	570000	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EC>C6-C8	600000	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EC>C8-C10	13000	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EC>C10-C12	13000	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EC>C12-C16	13000	<4	<4	<4	<4	<4	<4	<4	<4	<4
EC>C16-C21	250000	<7	<7	<7	<7	<7	<7	<7	<7	<7
EC>C21-C35	250000	<7	<7	<7	<7	<7	<7	<7	<7	<7
EC>C35-C44	250000	<7	<7	<7	<7	<7	<7	<7	<7	<7
Total aliphatics	NA	<26	<26	<26	<26	<26	<26	<26	<26	<26
Aromatics	-									
EC 5-7 (benzene)	56000	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EC>C7-C8 (toluene)	56000	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EC>C8-C10	5000	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EC>C10-C12	5000	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
EC>C12-C16	5100	<4	<4	<4	<4	<4	<4	<4	<4	<4
EC>C16-C21	3800	<7	<7	<7	<7	<7	<7	<7	<7	<7
EC>C21-C35	3800	<7	<7	<7	<7	<7	<7	<7	<7	<7
EC>C35-C44	3800	<7	<7	<7	<7	<7	<7	<7	<7	<7
Total aromatics	NA	<26	<26	<26	<26	<26	<26	<26	<26	<26
Total Aliphatics and Aromatics	NA	<52	<52	<52	<52	<52	<52	<52	<52	<52
BTEX/MTBE										
MTBE	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Benzene	72	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Toluene	56000	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ethylbenzene	24000	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
m&p-xylene	41000	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
o-xylene	41000	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Polycyclic Aromatic Hydrocarbons										
Naphthalene	4900	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Acenaphthylene	15000	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Acenaphthene	15000	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	9900	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Phenanthrene	3100	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Anthracene	74000	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Fluoranthene	3100	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Pyrene	7400	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Benz(a)anthracene	29	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Chrysene	57	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(b)fluoranthene	7.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	190	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(a)pyrene	5.7	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Indeno(123cd)pyrene	82	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Dibenz(a,h)anthracene	0.6	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Benzo(ghi)perylene	640	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
PAH 16 Total	NA	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Inorganics										
pH (pH Units)	<5, >9	4.52	6.72	6.71	6.21	6.18	NA	NA	5.90	NA
Sulphate (2:1 Water Soluble) as SO4 (g/l)		0.087	0.020	0.007	0.007	0.0	NA	NA	0.0	NA
Free Cyanide	36	<0.5	<0.5	<0.5	<0.5	<0.5	NA	NA	<0.5	NA
Asbestos Screening										
Present/Absent	NA	Absent	Absent	Absent	Absent	Absent	NA	NA	Absent	NA
ORGANICS										
Fraction Organic Carbon	NA	0.02	0.00	<0.001	0.00	0.01	NA	NA	0.01	NA
Mositure (%)										

GACs are the LQM S4ULs with 1% SOM with the exception of those listed below:-
1. The GAC for lead is the C4SL derived using a Low Level of Toxicological Concern (LLTC) of 3.5ug/dL blood lead. 2. Free Cyanide - WYG derived using CLEA. See WYG Technical Memorandum: Derivation of a SSV.

Compiled by: JC
Date: March 2022

Groundwater Analysis Screening Assessment

TETRA TECH

Sample Point / Determinds	TSV	SOBRA Commercial GACgwvap	BH1	BH2	BH3
HEAVY METALS	**µg/l**	**µg/l**	**GW**	**SW**	**SW**
Antimony	5 (5)	-	<2	<2	<2
Barium	100 (4)	-	61	49	45
Beryllium	-	-	<0.5	<0.5	<0.5
Arsenic	50 (1), 50 (4), 7.5 (6)	-	<2.5	<2.5	<2.5
Boron	-	-	49	19	15
Cadmium	0.08 (1), 5 (4)	-	<0.5	<0.5	<0.5
Chromium (total)	37.5 (6)	-	<1.5	<1.5	5.1
Copper	10 (1)	-	<7	<7	11
Lead	7.2 (1), 7.5 (6)	-	<5	<5	6
Mercury	0.05 (1), 1 (4), 0.75 (6)	-	<1	<1	<1
Molybdenum	-	-	<2	<2	<2
Nickel	20 (1)	-	5	7	15
Selenium	-	-	<3	<3	<3
Zinc	75 (1), 75 (6)	-	14	8	22
Phenols	**µg/l**				
Total Phenols	-	-	<0.15	<0.15	<0.15
Speciated TPH	**µg/l**				
Aliphatics					
EC C5-C6	15000(7)	190000	<10	<10	<10
EC>C6-C8	15000(7)	150000	<10	<10	<10
EC>C8-C10	300(7)	5700	<10	<10	<10
EC>C10-C12	300(7)	3600	<5	<5	<5
EC>C12-C16	300(7)	-	<10	<10	<10
EC>C16-C21	-	-	<10	<10	<10
EC>C21-C35	-	-	<10	<10	<10
Total Aliphatics >C5-C35	-	-	<10	<10	<10
Aromatics					
EC C5-C7	10(7)	20000000	<10	<10	<10
EC>C7-C8	700(7)	21000000	<10	<10	<10
EC>C8-C10	300(7)	190000	<10	<10	<10
EC>C10-C12	90(7)	660000	<5	<5	<5
EC>C12-C16	90(7)	3700000	<10	<10	<10
EC>C16-C21	90(7)	-	<10	<10	<10
EC>C21-C35	90(7)	-	<10	<10	<10
Total Aromatics >EC5-EC35	-	-	<10	<10	<10
Total Aliphatics & Aromatics >C5-C35	-	-	<10	<10	<10
BTEX	**µg/l**				
Benzene	10 (1), 0.75 (3), 30 (4), 0.75 (6)	20000	<5	<5	<5
Toluene	50 (1), 525 (3), 50 (4), 525 (6)	21000000	<5	<5	<5
Ethylbenzene	20 (4)	960000	<5	<5	<5
p/m-Xylene		940000	<5	<5	<5
o-Xylene		1100000	<5	<5	<5
Polyaromatic Hydrocabons	**µg/l**				
Acenaphthene (aq)	-	15000000	0.026	<0.005	<0.005
Acenaphthylene (aq)	-	20000000	<0.005	<0.005	<0.005
Anthracene (aq)	0.1 (1), 0.1 (4)	-	<0.005	<0.005	<0.005
Benzo(a)anthracene (aq)	-	-	<0.005	<0.005	<0.005
Benzo(a)pyrene (aq)	0.05 (1), 0.03 (4), 0.0075 (6)	-	<0.005	<0.005	<0.005
Benzo(b)fluoranthene (aq)	-	-	<0.008	<0.008	<0.008
Benzo(g,h,i)perylene (aq)	-	-	<0.005	<0.005	<0.005
Benzo(k)fluoranthene (aq)	-	-	<0.008	<0.008	<0.008
Chrysene (aq)	-	-	<0.005	<0.005	<0.005
Dibenzo(a,h)anthracene (aq)	-	-	<0.005	<0.005	<0.005
Fluoranthene (aq)	0.1 (1), 0.02 (4)	-	0.009	<0.005	<0.005
Fluorene (aq)	-	18000000	0.02	<0.005	<0.005
Indeno(1,2,3-cd)pyrene (aq)	-		<0.005	<0.005	<0.005
Naphthalene (aq)	2.4 (1), 10 (4)	23000	0.4	<0.1	<0.1
Phenanthrene (aq)	-	-	0.022	0.006	<0.005
Pyrene (aq)	-	-	0.007	<0.005	<0.005
PAH, Total USEPA 16 (aq)	-	-	0.484	<0.173	<0.173
INORGANICS	**mg/l**				
Sulphate	250000 (4), 187500 (6)	-	93.9	61.3	13.6
Chloride	187.5 (3)	-	24.1	40.8	11.5
Nitrate NO_3	37.5 (3)	-	3.5	0.4	5.4
Nitrite NO_2	375 (3)	-	<0.02	<0.02	<0.02
Ammoniacal Nitrogen as NH3	-	-	10.88	0.11	0.05
Ammoniacal Nitrogen as NH4	-	-	11.52	0.12	0.05
Total Cyanide	-	-	<0.01	<0.01	<0.01
Dissolved Organic Carbon	-	-	7	8	4
Total Alkalinity as $CaCO_3$	-	-	92	282	100
pH (pH Units)	>6-<9	-	6.48	7.01	6.78

1. The Water Framework Directive (Priority Substances and Classification) Regulations (Northern Ireland) 2011 - freshwater

2. Assessment of adverse impacts of chemical inputs from groundwater on associated surface water bodies - European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016.

3. European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016 - Assessment of whether groundwater intended for human consumption in drinking water protected areas is impacted by pollutants and/or is showing a significant and sustained rise in pollutant levels.

4. Freshwater EQS (AA)

5. UK Drinking Water Standard

6. Assessment of the general quality of groundwater in a groundwater body in terms of whether its ability to support human uses has been significantly impaired by pollution - - European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016.

7. WHO guide values as per CL:AIRE 2017 *Petroleim hydrocarbons in groundwater*

8. WHO Guidelines for Drinking Water Quality. Third edition (2004)

*Total PAH = Sum of 4:-
Benzo(b) & (k)fluoranthene
Indeno(123cd)pyrene
Benzo(ghi)perylene

9. WFD UK Standard Protection of Surface Water Quality

10. UK Non-statutory EQSs Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (Dangerous Substances Directive) - List II substances

#. AQC failure, accreditation has been removed from this result.

Result outside calibration range, results should be considered as indicative only and are not accredited.

APPENDIX G – GROUND GAS MONITORING DATA AND SCREENING ASSESSMENT

Gas Monitoring Results

Monitoring Round 1 - 25/02/2021 - NOTE: No H2S filter used

Weather Rainy

Ambient Conditions	Barometric Pressure	CH_4	$C0_2$	O_2
Before Monitoring	1013	0	0.1	20.9
After Monitoring	1013	0	0.1	20.9

BH01

Time (sec)	CH_4(%)	$C0_2$(%)	0_2(%)	H_2S(ppm)	C0(ppm)	Barometric pressure (mb)	Positive Flow l/h	Limiting Value CH_4	Limiting value CO_2	Characteristic Situation (Wilson & Card)
30	0.50	9.20	18.8	0.00	1.00	1013	16.8	0.084	1.546	3
60	0.50	9.20	18.9	0.00	1.00	1013	16.8	0.084	1.546	3
90	0.50	9.20	18.9	0.00	1.00	1013	16.8	0.084	1.546	3
120	0.50	9.10	18.9	0.00	1.00	1013	16.8	0.084	1.529	3
150	0.50	9.00	20.0	0.00	1.00	1013	16.8	0.084	1.512	3
180	0.50	9.00	20.0	0.00	1.00	1013	16.8	0.084	1.512	3
210	0.50	9.00	20.0	0.00	1.00	1013	16.8	0.084	1.512	3
240	0.50	9.00	20.0	0.00	1.00	1013	16.8	0.084	1.512	3
270	0.50	9.00	20.0	0.00	1.00	1013	16.8	0.084	1.512	3
300	0.50	9.00	20.0	0.00	1.00	1013	16.8	0.084	1.512	3

Water	m
depth to top of water (m)	0.05
depth to bottom of borehole (m)	4.69

BH02

Time (sec)	CH_4(%)	$C0_2$(%)	0_2(%)	H_2S(ppm)	C0(ppm)	Barometric pressure (mb)	Positive Flow l/h	Limiting Value CH_4	Limiting value CO_2	Characteristic Situation (Wilson & Card)
30	0.20	3.60	20.5	0.00	2.00	1013	2.8	0.006	0.101	2
60	0.20	3.60	20.3	0.00	2.00	1013	2.8	0.006	0.101	2
90	0.20	3.60	20.3	0.00	1.00	1013	2.8	0.006	0.101	2
120	0.20	3.60	20.3	0.00	1.00	1013	2.8	0.006	0.101	2
150	0.20	3.60	20.3	0.00	1.00	1013	2.8	0.006	0.101	2
180	0.20	3.60	20.3	0.00	1.00	1013	2.8	0.006	0.101	2
210	0.20	3.60	20.3	0.00	1.00	1013	2.8	0.006	0.101	2
240	0.20	3.60	20.3	0.00	1.00	1013	2.8	0.006	0.101	2
270	0.20	3.60	20.3	0.00	1.00	1013	2.8	0.006	0.101	2
300	0.20	3.60	20.3	0.00	1.00	1013	2.8	0.006	0.101	2

Water	m
depth to top of water (m)	0.36
depth to bottom of borehole (m)	2.22

BH03

Time (sec)	CH_4(%)	$C0_2$(%)	0_2(%)	H_2S(ppm)	C0(ppm)	Barometric pressure (mb)	Positive Flow l/h	Limiting Value CH_4	Limiting value CO_2	Characteristic Situation (Wilson & Card)
30	0.20	0.70	21.3	0.00	1.00	1013	0.3	0.001	0.002	1
60	0.20	0.70	21.2	0.00	1.00	1013	0.3	0.001	0.002	1
90	0.20	0.70	21.2	0.00	1.00	1013	0.3	0.001	0.002	1
120	0.20	0.70	21.2	0.00	1.00	1013	0.3	0.001	0.002	1
150	0.20	0.70	21.2	0.00	1.00	1013	0.3	0.001	0.002	1
180	0.20	0.70	21.2	0.00	1.00	1013	0.3	0.001	0.002	1
210	0.20	0.70	21.2	0.00	1.00	1013	0.3	0.001	0.002	1
240	0.20	0.70	21.2	0.00	1.00	1013	0.3	0.001	0.002	1
270	0.20	0.70	21.2	0.00	1.00	1013	0.3	0.001	0.002	1
300	0.20	0.70	21.2	0.00	1.00	1013	0.3	0.001	0.002	1

Gas Monitoring Results

Monitoring Round 2 - 04/03/2021 - NOTE: No H2S filter used

Weather Fair

Ambient Conditions	Barometric Pressure	CH_4	$C0_2$	O_2
Before Monitoring	999	0	0.1	20.9
After Monitoring	999	0	0.1	20.9

BH01

Time (sec)	CH_4(%)	$C0_2$(%)	0_2(%)	H_2S(ppm)	C0(ppm)	Barometric pressure (mb)	Positive Flow l/h	Limiting Value CH_4	Limiting value CO_2	Characteristic Situation (Wilson & Card)
30	0.50	9.10	19.0	0.00	1.00	999	16.4	0.082	1.492	3
60	0.50	9.00	19.0	0.00	1.00	999	16.4	0.082	1.476	3
90	0.50	9.00	18.9	0.00	1.00	999	16.4	0.082	1.476	3
120	0.50	8.90	18.9	0.00	1.00	999	16.4	0.082	1.460	3
150	0.50	8.90	18.8	0.00	1.00	999	16.4	0.082	1.460	3
180	0.50	8.90	18.8	0.00	1.00	999	16.4	0.082	1.460	3
210	0.50	8.90	18.8	0.00	1.00	999	16.4	0.082	1.460	3
240	0.50	8.90	18.8	0.00	1.00	999	16.4	0.082	1.460	3
270	0.50	8.90	18.8	0.00	1.00	999	16.4	0.082	1.460	3
300	0.50	8.90	18.8	0.00	1.00	999	16.4	0.082	1.460	3

Water	m
depth to top of water (m)	0.03
depth to bottom of borehole (m)	4.69

BH02

Time (sec)	CH_4(%)	$C0_2$(%)	0_2(%)	H_2S(ppm)	C0(ppm)	Barometric pressure (mb)	Positive Flow l/h	Limiting Value CH_4	Limiting value CO_2	Characteristic Situation (Wilson & Card)
30	0.20	3.60	20.5	0.00	2.00	999	2.7	0.005	0.097	2
60	0.20	3.70	20.3	0.00	2.00	999	2.7	0.005	0.100	2
90	0.20	3.80	20.3	0.00	2.00	999	2.7	0.005	0.103	2
120	0.20	3.80	20.3	0.00	2.00	999	2.7	0.005	0.103	2
150	0.20	3.90	20.3	0.00	2.00	999	2.7	0.005	0.105	2
180	0.20	3.90	20.3	0.00	1.00	999	2.7	0.005	0.105	2
210	0.20	3.90	20.3	0.00	1.00	999	2.7	0.005	0.105	2
240	0.20	3.90	20.3	0.00	1.00	999	2.7	0.005	0.105	2
270	0.20	3.90	20.3	0.00	1.00	999	2.7	0.005	0.105	2
300	0.20	3.90	20.3	0.00	1.00	999	2.7	0.005	0.105	2

Water	m
depth to top of water (m)	0.36
depth to bottom of borehole (m)	2.22

BH03

Time (sec)	CH_4(%)	$C0_2$(%)	0_2(%)	H_2S(ppm)	C0(ppm)	Barometric pressure (mb)	Positive Flow l/h	Limiting Value CH_4	Limiting value CO_2	Characteristic Situation (Wilson & Card)
30	0.20	0.70	21.2	0.00	1.00	999	0.3	0.001	0.002	1
60	0.20	0.70	21.2	0.00	1.00	999	0.3	0.001	0.002	1
90	0.20	0.80	21.1	0.00	1.00	999	0.3	0.001	0.002	1
120	0.20	0.80	21.1	0.00	1.00	999	0.3	0.001	0.002	1
150	0.20	0.90	21.1	0.00	1.00	999	0.3	0.001	0.003	1
180	0.20	0.90	21.1	0.00	1.00	999	0.3	0.001	0.003	1
210	0.20	0.90	21.0	0.00	1.00	999	0.3	0.001	0.003	1
240	0.10	0.90	21.0	0.00	1.00	999	0.3	0.000	0.003	1
270	0.10	0.90	21.0	0.00	1.00	999	0.3	0.000	0.003	1
300	0.10	0.90	21.0	0.00	1.00	999	0.3	0.000	0.003	1

Water	m
depth to top of water (m)	1.1
depth to bottom of borehole (m)	2.53

APPENDIX H - LABORATORY TEST CERTIFICATES

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
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Tetra Tech
1 Locksley Business Park,
Montgomery Road
Belfast
BT6 9UP

Attention :	Jane Baird
Date :	25th February, 2022
Your reference :	787-B034486
Our reference :	Test Report 22/2838 Batch 1
Location :	Lifford Common
Date samples received :	21st February, 2022
Status :	Final Report
Issue :	1

Twenty three samples were received for analysis on 21st February, 2022 of which nine were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Element Materials Technology Environmental UK Limited
Registered in England and Wales
Registered Office: 3rd Floor Davidson Building, 5 Southampton Street, London WC2E 7HA
Company Registration No: 11371415

Client Name: Tetra Tech
Reference: 787-B034486
Location: Lifford Common
Contact: Jane Baird
EMT Job No: 22/2838

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	10-12	16-18	22-24	34-36	43-45	55-57	58-60	61-63		LOD/LOR	Units	Method No.
Sample ID	BH1	BH2	BH3	TP1	TP3	TP4	TP6	TP7	TP7				
Depth	0.50	1.00	1.00	0.50	0.50	1.50	1.50	0.50	1.50				
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T				
Sample Date	17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1	1	1				
Date of Receipt	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022				
Arsenic #	15.8	6.9	8.2	4.0	5.8	-	-	7.0	-		<0.5	mg/kg	TM30/PM15
Beryllium	1.0	0.7	0.7	<0.5	<0.5	-	-	0.5	-		<0.5	mg/kg	TM30/PM15
Cadmium #	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	-		<0.1	mg/kg	TM30/PM15
Chromium #	74.4	82.5	89.5	74.8	68.4	-	-	82.4	-		<0.5	mg/kg	TM30/PM15
Copper #	19	95	39	18	14	-	-	25	-		<1	mg/kg	TM30/PM15
Lead #	20	16	15	25	20	-	-	24	-		<5	mg/kg	TM30/PM15
Mercury #	0.1	<0.1	<0.1	<0.1	<0.1	-	-	0.1	-		<0.1	mg/kg	TM30/PM15
Nickel #	31.1	53.7	46.0	26.3	15.2	-	-	29.3	-		<0.7	mg/kg	TM30/PM15
Selenium #	1	<1	<1	<1	1	-	-	1	-		<1	mg/kg	TM30/PM15
Vanadium	69	48	49	34	41	-	-	47	-		<1	mg/kg	TM30/PM15
Water Soluble Boron #	0.9	0.1	0.1	0.1	0.4	-	-	0.3	-		<0.1	mg/kg	TM74/PM32
Zinc #	73	65	80	71	38	-	-	64	-		<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06		<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07		<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
PAH 16 Total	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6		<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	95	96	95	91	97	97	94	96	95		<0	%	TM4/PM8

Please see attached notes for all abbreviations and acronyms

Client Name: Tetra Tech
Reference: 787-B034486
Location: Lifford Common
Contact: Jane Baird
EMT Job No: 22/2838

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	10-12	16-18	22-24	34-36	43-45	55-57	58-60	61-63		LOD/LOR	Units	Method No.
Sample ID	BH1	BH2	BH3	TP1	TP3	TP4	TP6	TP7	TP7				
Depth	0.50	1.00	1.00	0.50	0.50	1.50	1.50	0.50	1.50				
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T				
Sample Date	17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1	1	1				
Date of Receipt	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022	21/02/2022				
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	<4	<4	<4	<4	<4	<4	<4	<4		<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
>C35-C44 (EH_1D_AL)	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-44 (EH+HS_1D_AL)	<26	<26	<26	<26	<26	<26	<26	<26	<26		<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	<4	<4	<4	<4	<4	<4	<4	<4		<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
>EC35-EC44 (EH_1D_AR)	<7	<7	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-44 (EH+HS_1D_AR)	<26	<26	<26	<26	<26	<26	<26	<26	<26		<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-44) (EH+HS_CU_1D_Total)	<52	<52	<52	<52	<52	<52	<52	<52	<52		<52	mg/kg	TM5/TM36/PM8/PM12/PM16
MTBE#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Benzene#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Toluene#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Ethylbenzene#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
m/p-Xylene#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
o-Xylene#	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM36/PM12
Total Phenols HPLC	<0.15	<0.15	<0.15	<0.15	<0.15	-	-	<0.15	-		<0.15	mg/kg	TM26/PM21B
Hexavalent Chromium#	<0.3	<0.3	<0.3	<0.3	<0.3	-	-	<0.3	-		<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext)#	0.0869	0.0196	0.0073	0.0072	0.0139	-	-	0.0123	-		<0.0015	g/l	TM38/PM20
Chromium III	74.4	82.5	89.5	74.8	68.4	-	-	82.4	-		<0.5	mg/kg	NONE/NONE
Free Cyanide	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-		<0.5	mg/kg	TM89/PM45
Fraction Organic Carbon	0.020	0.001	<0.001	0.004	0.010	-	-	0.011	-		<0.001	None	TM21/PM24
pH#	4.52	6.72	6.71	6.21	6.18	-	-	5.90	-		<0.01	pH units	TM73/PM11

Please see attached notes for all abbreviations and acronyms

Client Name: Tetra Tech
Reference: 787-B034486
Location: Lifford Common
Contact: Jane Baird

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Asbestos sub-samples are retained for not less than 6 months from the date of analysis unless specifically requested.

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analyst Name	Date Of Analysis	Analysis	Result
22/2838	1	BH1	0.50	3	Catherine Coles	23/02/2022	**General Description (Bulk Analysis)**	soil
					Catherine Coles	23/02/2022	**Asbestos Fibres**	NAD
					Catherine Coles	23/02/2022	**Asbestos ACM**	NAD
					Catherine Coles	23/02/2022	**Asbestos Type**	NAD
22/2838	1	BH2	1.00	12	Matthew Turner	23/02/2022	**General Description (Bulk Analysis)**	Soil/Stone
					Matthew Turner	23/02/2022	**Asbestos Fibres**	NAD
					Matthew Turner	23/02/2022	**Asbestos ACM**	NAD
					Matthew Turner	23/02/2022	**Asbestos Type**	NAD
22/2838	1	BH3	1.00	18	Catherine Coles	23/02/2022	**General Description (Bulk Analysis)**	soil
					Catherine Coles	23/02/2022	**Asbestos Fibres**	NAD
					Catherine Coles	23/02/2022	**Asbestos ACM**	NAD
					Catherine Coles	23/02/2022	**Asbestos Type**	NAD
22/2838	1	TP1	0.50	24	Kevin Hughes	23/02/2022	**General Description (Bulk Analysis)**	soil
					Kevin Hughes	23/02/2022	**Asbestos Fibres**	NAD
					Kevin Hughes	23/02/2022	**Asbestos ACM**	NAD
					Kevin Hughes	23/02/2022	**Asbestos Type**	NAD
22/2838	1	TP3	0.50	36	Kevin Hughes	23/02/2022	**General Description (Bulk Analysis)**	soil
					Kevin Hughes	23/02/2022	**Asbestos Fibres**	NAD
					Kevin Hughes	23/02/2022	**Asbestos ACM**	NAD
					Kevin Hughes	23/02/2022	**Asbestos Type**	NAD
22/2838	1	TP7	0.50	60	Kevin Hughes	23/02/2022	**General Description (Bulk Analysis)**	soil
					Kevin Hughes	23/02/2022	**Asbestos Fibres**	NAD
					Kevin Hughes	23/02/2022	**Asbestos ACM**	NAD
					Kevin Hughes	23/02/2022	**Asbestos Type**	NAD

Client Name: Tetra Tech
Reference: 787-B034486
Location: Lifford Common
Contact: Jane Baird

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/2838						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/2838

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/2838

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes

EMT Job No: 22/2838

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes

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Zone 3
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Deeside
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F: +44 (0) 1244 833781
W: www.element.com

Tetra Tech
1 Locksley Business Park,
Montgomery Road
Belfast
BT6 9UP

Attention :	Jane Baird
Date :	10th March, 2022
Your reference :	787-B034486
Our reference :	Test Report 22/3712 Batch 1
Location :	Lifford Common
Date samples received :	7th March, 2022
Status :	Final Report
Issue :	1

Three samples were received for analysis on 7th March, 2022 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Client Name: Tetra Tech
Reference: 787-B034486
Location: Lifford Common
Contact: Jane Baird
EMT Job No: 22/3712

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-7	8-14	15-21								LOD/LOR	Units	Method No.
Sample ID	BH1	BH2	BH3										
Depth	N/A	N/A	N/A										
COC No / misc													
Containers	V H HN N P G	V H HN N P G	V H HN N P G										
Sample Date	04/03/2022	04/03/2022	04/03/2022										
Sample Type	Ground Water	Ground Water	Ground Water										
Batch Number	1	1	1										
Date of Receipt	07/03/2022	07/03/2022	07/03/2022										
Dissolved Antimony #	<2	<2	<2								<2	ug/l	TM30/PM14
Dissolved Arsenic #	<2.5	<2.5	<2.5								<2.5	ug/l	TM30/PM14
Dissolved Barium #	61	49	45								<3	ug/l	TM30/PM14
Dissolved Beryllium	<0.5	<0.5	<0.5								<0.5	ug/l	TM30/PM14
Dissolved Boron	49	19	15								<12	ug/l	TM30/PM14
Dissolved Cadmium #	<0.5	<0.5	<0.5								<0.5	ug/l	TM30/PM14
Total Dissolved Chromium #	<1.5	<1.5	5.1								<1.5	ug/l	TM30/PM14
Dissolved Copper #	<7	<7	11								<7	ug/l	TM30/PM14
Dissolved Lead #	<5	<5	6								<5	ug/l	TM30/PM14
Dissolved Mercury #	<1	<1	<1								<1	ug/l	TM30/PM14
Dissolved Molybdenum #	<2	<2	<2								<2	ug/l	TM30/PM14
Dissolved Nickel #	5	7	15								<2	ug/l	TM30/PM14
Dissolved Selenium #	<3	<3	<3								<3	ug/l	TM30/PM14
Dissolved Zinc #	14	8	22								<3	ug/l	TM30/PM14
PAH MS													
Naphthalene #	0.4	<0.1	<0.1								<0.1	ug/l	TM4/PM30
Acenaphthylene #	<0.005	<0.005	<0.005								<0.005	ug/l	TM4/PM30
Acenaphthene #	0.026	<0.005	<0.005								<0.005	ug/l	TM4/PM30
Fluorene #	0.020	<0.005	<0.005								<0.005	ug/l	TM4/PM30
Phenanthrene #	0.022	0.006	<0.005								<0.005	ug/l	TM4/PM30
Anthracene #	<0.005	<0.005	<0.005								<0.005	ug/l	TM4/PM30
Fluoranthene #	0.009	<0.005	<0.005								<0.005	ug/l	TM4/PM30
Pyrene #	0.007	<0.005	<0.005								<0.005	ug/l	TM4/PM30
Benzo(a)anthracene #	<0.005	<0.005	<0.005								<0.005	ug/l	TM4/PM30
Chrysene #	<0.005	<0.005	<0.005								<0.005	ug/l	TM4/PM30
Benzo(bk)fluoranthene #	<0.008	<0.008	<0.008								<0.008	ug/l	TM4/PM30
Benzo(a)pyrene #	<0.005	<0.005	<0.005								<0.005	ug/l	TM4/PM30
Indeno(123cd)pyrene #	<0.005	<0.005	<0.005								<0.005	ug/l	TM4/PM30
Dibenzo(ah)anthracene #	<0.005	<0.005	<0.005								<0.005	ug/l	TM4/PM30
Benzo(ghi)perylene #	<0.005	<0.005	<0.005								<0.005	ug/l	TM4/PM30
PAH 16 Total #	0.484	<0.173	<0.173								<0.173	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.008	<0.008	<0.008								<0.008	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.008	<0.008	<0.008								<0.008	ug/l	TM4/PM30
PAH Surrogate % Recovery	93	87	88								<0	%	TM4/PM30
MTBE #	<5	<5	<5								<5	ug/l	TM36/PM12
Benzene #	<5	<5	<5								<5	ug/l	TM36/PM12
Toluene #	<5	<5	<5								<5	ug/l	TM36/PM12
Ethylbenzene #	<5	<5	<5								<5	ug/l	TM36/PM12
m/p-Xylene #	<5	<5	<5								<5	ug/l	TM36/PM12
o-Xylene #	<5	<5	<5								<5	ug/l	TM36/PM12

Client Name: Tetra Tech
Reference: 787-B034486
Location: Lifford Common
Contact: Jane Baird
EMT Job No: 22/3712

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

EMT Sample No.	1-7	8-14	15-21									
Sample ID	BH1	BH2	BH3									
Depth	N/A	N/A	N/A									
COC No / misc												
Containers	V H HN N P G	V H HN N P G	V H HN N P G									
Sample Date	04/03/2022	04/03/2022	04/03/2022									
Sample Type	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1									
Date of Receipt	07/03/2022	07/03/2022	07/03/2022									

Please see attached notes for all abbreviations and acronyms

											LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 #	<10	<10	<10								<10	ug/l	TM36/PM12
>C6-C8 #	<10	<10	<10								<10	ug/l	TM36/PM12
>C8-C10 #	<10	<10	<10								<10	ug/l	TM36/PM12
>C10-C12 #	<5	<5	<5								<5	ug/l	TM5/PM16/PM30
>C12-C16 #	<10	<10	<10								<10	ug/l	TM5/PM16/PM30
>C16-C21 #	<10	<10	<10								<10	ug/l	TM5/PM16/PM30
>C21-C35 #	<10	<10	<10								<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35 #	<10	<10	<10								<10	ug/l	TM5/TM36/PM12/PM16/PM30
Aromatics													
>C5-EC7 #	<10	<10	<10								<10	ug/l	TM36/PM12
>EC7-EC8 #	<10	<10	<10								<10	ug/l	TM36/PM12
>EC8-EC10 #	<10	<10	<10								<10	ug/l	TM36/PM12
>EC10-EC12 #	<5	<5	<5								<5	ug/l	TM5/PM16/PM30
>EC12-EC16 #	<10	<10	<10								<10	ug/l	TM5/PM16/PM30
>EC16-EC21 #	<10	<10	<10								<10	ug/l	TM5/PM16/PM30
>EC21-EC35 #	<10	<10	<10								<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35 #	<10	<10	<10								<10	ug/l	TM5/TM36/PM12/PM16/PM30
Total aliphatics and aromatics(C5-35) #	<10	<10	<10								<10	ug/l	TM5/TM36/PM12/PM16/PM30
Total Phenols HPLC	<0.15	<0.15	<0.15								<0.15	mg/l	TM26/PM0
Sulphate as SO4 #	93.9	61.3	13.6								<0.5	mg/l	TM38/PM0
Chloride #	24.1	40.8	11.5								<0.3	mg/l	TM38/PM0
Nitrate as NO3 #	3.5	0.4	5.4								<0.2	mg/l	TM38/PM0
Nitrite as NO2 #	<0.02	<0.02	<0.02								<0.02	mg/l	TM38/PM0
Total Cyanide #	<0.01	<0.01	<0.01								<0.01	mg/l	TM89/PM0
Ammoniacal Nitrogen as NH3 #	10.88	0.11	0.05								<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH4 #	11.52	0.12	0.05								<0.03	mg/l	TM38/PM0
Total Alkalinity as CaCO3 #	92	282	100								<1	mg/l	TM75/PM0
Dissolved Organic Carbon #	7	8	4								<2	mg/l	TM60/PM0
pH #	6.48	7.01	6.78								<0.01	pH units	TM73/PM0

Client Name: Tetra Tech
Reference: 787-B034486
Location: Lifford Common
Contact: Jane Baird

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/3712						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/3712

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/3712

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16/PM30	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE/Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5/TM36	please refer to TM5 and TM36 for method details	PM12/PM16/PM30	please refer to PM16/PM30 and PM12 for method details	Yes			
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.				
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified				
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes			
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.	Yes			
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.	Yes			

EMT Job No: 22/3712

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM75	Modified US EPA method 310.1 (1978). Determination of Alkalinity by Metrohm automated titration analyser.	PM0	No preparation is required.	Yes			
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM0	No preparation is required.	Yes			