

Cefn Saeson Comprehensive School

Remediation Strategy and Discovery Strategy
Phase 2





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Remediation Strategy and Discovery Strategy

B027006
June, 2021

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AOD	above Ordnance Datum
bgl	below ground level
BGS	British Geological Survey
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
C4SL	Category 4 Screening Levels
CIEH	Chartered Institute of Environmental Health
CLEA	Contaminated Land Exposure Assessment
CoC	Constituent of Concern
CSM	Conceptual Site Model
DEFRA	Department of Environment, food and Rural Affairs
DQRA	Detailed Quantitative Risk Assessment
DTS	Desktop Study
DRO	Diesel Range Organics
DWS	Drinking Water Standard
EA	Environment Agency (England)
EPH	Extractable Petroleum Hydrocarbons
EQS	Environmental Quality Standards
FOC	Fraction Organic Carbon
GPR	Ground Penetrating Radar
LOD	Limit of detection
LQM	Land Quality Management
NRW	Natural Resources Wales
OS	Ordnance Survey
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PPE	Personal Protection Equipment
ppm	parts per million
PRO	Petroleum Range Organics
SGV	Soil Guideline Values
SOM	Soil Organic Matter
SVOC	Semi-volatile organic compounds
TPH	Total Petroleum Hydrocarbon
TSV	Tier 1 Screening Values
VOC	Volatile Organic Carbon
VPH	Volatile Petroleum Hydrocarbons
AOD	above Ordnance Datum

1.0 INTRODUCTION

1.1 INSTRUCTION

Tetra Tech EPT Ltd was commissioned by Morgan Sindall (the client) to prepare a Remediation Strategy to manage the removal of an area of hydrocarbon contamination identified within the area of the Cefn Saeson Comprehensive School development referred to as Phase 1a and to provide a Discovery Strategy to identify and manage any previously unidentified contamination that may be encountered during the development of the former school site¹.

1.2 BRIEF

A planning application (ref: P2019/5028) for “the demolition of existing school and construction of a new comprehensive school with car parking, accesses, sport facilities, external lighting, CCTV, landscaping, drainage works, changes to ground levels plus associated works” at Cefn Saeson Comprehensive School was submitted to Neath Port Talbot council on 30th May 2019. The planning permission was approved on 20th July 2019 subject to a number of planning conditions. The planning permission includes a condition relating to ground contamination within the site, namely:

Condition 10

No development shall commence on Phase 2 of the approved development, as identified in the Construction Method Statement, until a remediation scheme to bring the site to a condition suitable for the intended use by removing any unacceptable risks to human health, buildings, other property and the natural and historic environment shall be prepared and submitted to and agreed in writing with the Local Planning Authority. The scheme shall include all works to be undertaken, proposed remediation objectives, remediation criteria and site management procedures. The measures proposed within the remediation scheme shall be implemented in accordance with an agreed programme of works.

Reason: To ensure that risks from land contamination to the future users of the land and neighbouring land are minimised, together with those to controlled waters, property and ecological systems, and to ensure that the development can be carried out safely without unacceptable risks to workers, neighbours and other offsite receptors, and to ensure compliance with Policies SP16 and EN8 of the Neath Port Talbot Local Development Plan.

1.3 PREVIOUS WORK

Tetra Tech (formerly WYG) have previously completed a number of reports relating to the school development, namely:

- Phase 1 Geo-Environmental Assessment, Desk Top Study in February 2019 (ref: A110444);
- Ground Investigation Report in August 2019 (ref: A110444) which covers the Phase 2 Development Area and land to the south east (known as Phase 1 Development Area). This Ground Investigation Report includes relevant desk-based information from the February 2019 Desk Top Study. This report then provides details of the intrusive ground investigation undertaken in the Phase 2 Development area and provides a risk assessment of any identified contamination to human, environmental and ecological receptors;
- Updated Ground Investigation Report (ref: B027006) in May 2021 relating to additional phases of investigatory work conducted between the 17th February 2021 & 23rd February 2021, and 8th of May 2021 to further refine the conceptual site model and geo-environmental risk assessment and included

¹ Referred to as Phase 2 in planning application documents.

recommendations for a Remediation Strategy and Discovery Strategy for the proposed development. The findings of this work are also summarised in Section 2.6 of this report and should be read in conjunction with this Remediation Strategy.

1.4 PROPOSED DEVELOPMENT

The redevelopment of the school site is split into two phases.

‘Phase 1’ of the development involves the reprofiling and construction of the new school building on the eastern portion of the school site, formerly occupied by the school playing fields. At the time of writing this phase of development is largely complete.

‘Phase 2’ of the development involves the demolition of the existing school and construction of a ‘Multi Use Games Area’ with an access road/bus drop off point adjacent to the west boundary. The proposed development plan for the wider Cefn Saeson School (Drawing reference 6W007-WSP-00-XX-DR-C-0 dated August 2019) is presented at the end of this report.

This Remediation Strategy pertains only to Phase 2 of the development, as previous desktop study and site investigation works covering Phase 1 demonstrated that ground conditions did not present a significant risk to human health or the wider environment.

1.5 REPORT SCOPE

The remediation strategy presented herein includes an outline of the proposed works, requirements for the monitoring and verification of the works, and demonstration that the scheme will result in the removal of potentially significant pollutant linkages. It also provides a pro-active Discovery Strategy setting out how any as-yet undiscovered contamination will be properly identified, characterised and dealt with in the event that such contamination is encountered during the construction works.

The overall objectives of the Remediation Strategy are as follows:

- Set out the general principles and methods that will be adopted to reduce risks to future end users to an acceptable level, in line with the proposed development plan as submitted to the Local Planning Authority;
- Outline management procedures which may be required to protect key receptors in the event of contamination being identified on the site; and,
- Provide a defined criteria and validation procedure for demonstrating that the remediation works have been implemented to a suitable degree.

1.6 LIMITATIONS

The recommendations and opinions expressed in this report are based on information obtained as part of the desk study or provided by others. Information provided from other sources is taken in good faith and Tetra Tech EPT cannot guarantee its accuracy.

This report is subject to the report conditions presented in Appendix A.

The information contained in this report is intended for the use of the Morgan Sindall and Tetra Tech EPT can take no responsibility for the use of this information by any third party or for uses other than that described in this report or detailed within the terms of our engagement.

2.0 SITE INFORMATION

2.1 LOCATION

The site is located at Cefn Saeson Comprehensive School on Afan Valley Road, Castell-Nedd/Neath, SA11 3TA. The site is approximately 2.21ha in area and is centered on National Grid Reference (NGR) 277265, 196139. The approximate postcode of the site is SA11 3TA.

A site location plan is presented in Figure 1.

2.2 SITE DESCRIPTION

Prior to redevelopment, the wider site was occupied by the Cefn Saeson Comprehensive school site, with buildings, hard standing, car parking and paths in the north and west of the site and playing fields in the south east. Two sports courts (one all weather and one tarmac) are located in the north of the site.

The newly built school building has now been constructed on the former playing fields to the east of the former school building.

2.3 GEOLOGY, HYDROGEOLOGY AND HYDROLOGY

Ground conditions on site were anticipated to comprise Made Ground underlain by Glacial Till in the west and Head deposits in the east of the site, underlain by solid geology of the Brithdir Member with a coal seam out cropping south of the site.

The Brithdir Member is designated as a Secondary A aquifer, the Glacial Till designated as a Secondary Undifferentiated aquifer and the Head deposits and an unproductive aquifer. Based on historical borehole logs groundwater was anticipated to be around 0.9m bgl.

The Cefn Saeson Dingle water course was noted adjacent to the north east boundary running east to west, feeding into the Prewylfa Brook. Nant Gelli-Gaer was noted 200m south of the site running east to west feeding Crythan Brook.

Findings from the Ground Investigations are summarised in Section 2.6.

2.4 RADON

The BRE document 211 (Scivyer, 2015) mapping coverage for the site area was consulted and indicates that the site is located within an area where basic radon protection measures are required for new developments. However, the proposed development plan for the Phase 2 Development Area does not indicate the construction of any enclosed buildings or structures on site.

2.5 SUMMARY OF SITE HISTORY

The historical mapping obtained for the WYG DTS February 2019 was used to review the previous site use of the Phase 2 Development Area. Available historical mapping shows the Phase 2 Development area to have remained as agricultural/grass land from the earliest available mapping (1878) to mapping from 1949-1975. The school appears on mapping dated to 1975. A chimney is identified in the central/south east of the site which is identified from the 1975 to 1993 mapping.

2.6 SUMMARY OF PREVIOUS REPORTS

The following reports have been produced for the wider Cefn Saeson Comprehensive School development site and should be read in conjunction with this report:

- WYG (February 2019), Phase 1 Geo-environmental Assessment Desk Top Study ref: A110444 (hereby referred to as WYG DTS February 2019); and
- WYG (August 2019) Ground Investigation Report ref: A110444 (hereby known as WYG GIR August 2019).
- Tetra Tech (March 2021) Cefn Saeson Comprehensive School Stockpile Sampling Letter Report ref: B027006 – Cefn Saeson CS MMP (hereby known as Stockpile Sampling Letter Report 2021).
- Tetra Tech (May 2021) Ground Investigation Report version 2 ref: B027006 (hereby known as TT GIR April 2021)

Relevant information from these reports has been extracted and summarised in the following sections.

2.6.1 WYG (Tetra Tech) DTS February 2019

Morgan Sindall commissioned a Geo-environmental Desk Top Study assessment of the Cefn Saeson Comprehensive School site in February 2019 to provide a preliminary qualitative geotechnical and contamination risk assessment on the proposed redevelopment of the site.

The site was noted to consist of the existing comprehensive school and multi-level grassed areas used as sport pitches along with a concrete tennis court and an all weather sports pitch in the north. The topography of the site was noted to decrease in elevation from the south to the western corner. During a site walkover no obvious signs of contamination were noted.

The site was noted to be within a Coal Mining Risk Reporting Area and a Development High Risk Area. A Coal Authority report was obtained but did not indicate the presence of past or present coal mining in the vicinity of the site.

The site is shown to have been a mixture of woodland and open pasture land until the construction of the site in the 1970s. Mapping from 1999 shows structural changes to the school and the construction of additional buildings. In the surrounding area, land is shown to have been predominantly woodland/open pasture until the construction of residential housing from 1935 west.

2.6.2 WYG (Tetra Tech) GIR August 2019

Morgan Sindall commissioned an intrusive ground investigation and report of the Cefn Saeson Comprehensive School site in August 2019 to aid in the design of the new school. The ground investigation was intended to obtain information relating to geotechnical and geo-environmental properties of the ground.

A ground investigation was undertaken between December 2019 and January 2020 comprising of the following scope of works:

- Six cable percussive boreholes to a maximum depth of 6.60m bgl,
- Eight machine excavated trial pit to a maximum depth of 2.80m bgl
- Five windowless sample boreholes to a maximum depth of 5.00mbgl.
- In-situ testing (California Bearing Ratio and permeability testing) undertaken at various locations across the site.
- Six return monitoring visits undertaken for ground gas and groundwater monitoring and sampling.

Of the exploratory locations discussed above, two trial pits (TP03 and TP04), two window sample boreholes (WS03 and WS04) and one CBR test location (CRB02) were undertaken within the Phase 2 development area; site investigation works were initially limited in the Phase 2 area of the site due to its ongoing usage as an active school site.

The investigation encountered ground conditions of Topsoil (max. depth 0.3m bgl) or Made Ground of reworked soils (maximum 6.00m bgl) overlying glacial deposits (max. depth 6.30m bgl) overlying Brithdir Member (max. depth 6.60m bgl). With respect to the Phase 2 development area, the maximum depth of Made Ground

encountered was 2.50m bgl at WS03 with bedrock encountered from a minimum depth of 1.75m bgl at TP04. Groundwater was encountered between 1.50m bgl and 3.70m bgl.

In the Phase 2 development area groundwater was encountered between 1.80m and 2.40m bgl., thought to be representative of perched water within Glacial Till.

Subsequent monitoring found groundwater levels between a minimum of 0.09m bgl and 2.72m bgl both recorded at BH03 in different rounds. Groundwater sampling was undertaken using Low Flow methodology as described in the WYG GIR August 2019 report Section 4.3.2. Ground gas monitoring indicated maximum gas concentrations of 7.6% for carbon dioxide and 7.8% for methane with a maximum flow rate of 1.2l/hr.

Representative soil and groundwater samples were obtained during the ground investigation and subsequent monitoring and tested for a range of contaminants. The results of the soil analysis were compared against screening values for a public open spaces end use as specific screening criteria for school facilities are not available. No contaminants of concern were noted exceeding their relevant screening values. The results of the groundwater analysis were compared against industry screening values for controlled waters. Elevated concentrations metals of Polyaromatic hydrocarbons (PAHs) and Total Petroleum Hydrocarbons (TPH) were noted at BH06 and BH03.

The results of the ground gas monitoring indicate a peak methane concentration of 7.8% at WS04 and peak carbon dioxide concentration of 7.6% at WS03 both located within the Phase 2 development area. Based on the available data the site was classified as Characteristic Situation 2 i.e. low risk but requiring basic gas protection measures for new developments.

Based on the information within the report the following sources were noted to have a **Low** risk to human health:

- Ground gases derived from organic content in re-worked Made Ground and Till;
- Radon

A **Low** risk was also identified to groundwater and surface water from elevated heavy metals, TPH and PAHS.

2.6.3 Tetra Tech Stockpile Sampling Letter Report 2021

Tetra Tech was commissioned by Morgan Sindall to undertake soil sampling of stockpiled site won materials on the Phase 1 development , for re-use within the wider Phase 2 area of the site under the framework of a Materials Management Plan (MMP).

Sampling of the stockpiled materials was undertaken on the 11th February 2021 by Tetra Tech in order to assess the suitability of the stockpiled materials for re-use. Four stockpiles totaling approximately 9,750m³, comprised of Glacial till and Weathered Brithdir Member were sampled. Eleven Samples were collected via hand excavation and scheduled for a range of solid and leachable chemical analyses.

Soil results have initially been screened against Tier 1 screening criteria relating to a Public Open Space (Park) with a Soil Organic Matter (SOM) content of 1% as being the most appropriate given the proposed end use. The screening exercise has highlighted no exceedances above the Public Open Space (Park) criteria.

The screening assessment of the leachate samples resulted in exceedances identified for four analytes (copper, fluoranthene, benzo(b)fluoranthene, and benzo(a)pyrene). An M-BAT assessment reduced the bioavailable copper concentration to below that of the bioavailable screening value. Given the small number of exceedances against conservative screening criteria, the environmental setting of the site and the predominate, natural nature of the site won soils; the risk to controlled waters was considered to be low.

The NRW response to the letter report dated 21/04/2021 indicated that they had no objections to the material being re-used on the site under an MMP:

As we discussed earlier, NRW do not comment or approve CLAIRE declarations, however we are notified of their use.

Given the information you have provided I would consider that the material you wish to use is site won material which is yet to enter the waste stream. As such its reuse on the site of production in the manner described is appropriate.

2.6.4 Tetra Tech GIR April 2021

Morgan Sindall commissioned an additional phase of intrusive ground investigation at the site in April 2021 to aid in the design of the new coach drop off point and MUGA's. The ground investigation was intended to obtain information relating to ground conditions of Phase 2 of the development, i.e. the area currently occupied by the existing school building.

A ground investigation was undertaken between the 17th of February and 23rd of February 2021, comprising five windowless sample boreholes to a maximum depth of 5.00mbgl across Phase 2 of the site. One return monitoring visit was undertaken for ground gas and groundwater monitoring and sampling.

The investigation encountered ground conditions of Topsoil (max. depth 0.22m bgl, two locations) or Made Ground of reworked soils (maximum 2.50m bgl) overlying glacial deposits (max. depth 5.00m bgl) overlying Brithdir Member (max. depth 2.50m bgl).

Representative soil and groundwater samples were obtained during the ground investigation and subsequent monitoring and tested for a range of contaminants. The results of the laboratory testing indicated localised, elevated pH, Lead and hydrocarbons in soils at WS105, in the south of the site in the location of the existing staff car park. Whilst, these exceedances were thought to present a low risk to current site users and a low/moderate risk to future site users, it was recommended that further ground investigation is undertaken in this area to delineate the extent of hydrocarbon contamination.

The results of the groundwater analysis indicated site wide marginally elevated concentrations of heavy metals and PAHs exceeding their relevant screening criteria. However, based on marginal exceedances and low permeability superficial deposits the risk to the underlying Secondary A Aquifer within the Brithdir Member and surface water features off-site was considered to be low. No groundwater information was available from WS105, in the area of elevated hydrocarbon and therefore a low/moderate risk was identified to underlying, localised groundwater. Additional groundwater sampling was recommended in this area to allow for an updated risk assessment.

The results of the ground gas monitoring indicated a peak methane concentration of 7.8% at WS04 and peak carbon dioxide concentration of 7.6% at WS03 both located within the Phase 2 development area. Based on the available data the site was classified as Characteristic Situation 2 i.e. low risk but requiring basic gas protection measures for new developments.

Based on the findings of the risk assessment the following recommendations were initially made:

- A post demolition survey was recommended for the areas currently covered by the building footprint;
- Further ground investigation in the vicinity of WS105 to include soil sampling and the installation of a groundwater monitoring well;
- A proactive approach to be adopted across the site to identify any previously unidentified contamination;
- All movement of materials should be undertaken in conjunction with the Materials Management Plan (MMP).
- A remediation strategy may be required for the re-use of materials from the vicinity of WS105;
- A Waste Classification is required for any soils designated for off-site disposal to include Waste Assessment Criteria(WAC) testing.

2.7 TETRA TECH GIR MAY 2021 (VERSION 2)

Morgan Sindall commissioned an additional phase of intrusive ground investigation at the site in May 2021, focusing on the Upper Staff Car Park area, where hydrocarbon impacted soils were discovered in WS105.

Following an additional day of window sampling conducted on the 8th of May 2021, representative soil and obtained during the ground investigation were tested for a range of contaminants.

The ground investigation and subsequent laboratory testing of soil samples indicated elevated concentrations of the following contaminants within the Phase 2 area of the site:

- Visual and olfactory contamination of oily substance
- TPH, mainly composed of Aliphatic carbon bands C12 to C35, and aromatic bands C12 to C21;
- Heavy metals Arsenic, Beryllium, Lead and Zinc;
- Polyaromatic Hydrocarbons.

These contaminants have been identified in an area of the site, centred around exploratory hole WS105, with total TPH values in the Made Ground sub base beneath the car park surfacing ranging up to 3,450mg/kg. When screened against Generic Assessment Criteria for a 'Public Open Space – Park' end use, only lead was found to exceed the GAC. The GIR was updated in May 2021 to include this latest phase of site investigation works.

In line with Land Contamination Risk Management (LCRM) procedures, a CIRIA 552 (CIRIA, 2001) compliant risk assessment has been presented in TT GIR April 2021 indicating the following potential pollutant linkages requiring additional risk management procedures.

Table 2-1 – Summary of Potential Pollutant Linkages Requiring Additional Risk Management

Source	Pathway	Receptor	Comment
Visual hydrocarbon contamination, containing TPH, heavy metals and PAHs	Inhalation, ingestion and dermal contact	Future Site Users	Concentrations in exceedance of the Generic Assessment Criteria for a 'Public Open Space – Park' end use indicates that Made Ground is unsuitable for use at or close to the surface beneath the site.
	Leaching and vertical/ lateral migration of contaminants	Controlled Waters	In the absence of further site investigation, and detailed quantitative risk assessment, the hydrocarbon and heavy metal contamination is considered to present a moderate risk to controlled waters.
	Phytotoxicity (prevention or inhibition of plant growth)	Natural Environment - Phytotoxicity	Heavy metal and hydrocarbon contamination in made ground may inhibit plant growth

3.0 OUTLINE REMEDIATION APPROACH

3.1 RISK REQUIRING REMEDIAL ACTION

- Potential for exposure of future site users to contaminants in soils by ingestion, inhalation (both dust and vapour) and direct contact.
- Protection of Controlled Waters from pollution, including groundwater and adjacent surface waters.
- Protection of groundworks contractors and others who may be at risk due to contamination and hazardous materials during demolition, site preparation and construction.
- Prevention of adverse effects on and landscape planting.

The objective of the Remediation Strategy is to ensure that all significant pollutant linkages relevant to the proposed development have been removed.

3.2 IDENTIFIED CONTAMINATION SOURCES AND OPTIONS APPRAISAL

3.2.1 General Made Ground Across the Site

With the exception of Made Ground in the vicinity of WS105 in the Upper Staff Car Park, site investigation has demonstrated that made ground across the remainder of the site does not exceed Generic Assessment Criteria Screening targets for a 'Public Open Space – Park' end use.

Consequently, the majority of Made Ground soil present on the site appear to be suitable for retention and reuse.

Groundwater and soils leachability testing conducted across the site, the presence of a significant thickness of Glacial Till, and the distance to local watercourses shows no evidence of significant pollution or likelihood of significant pollution, of controlled waters from the majority of Made Ground soils.

3.2.2 Made Ground in the Vicinity of WS105

The presence of a contamination source in the vicinity of WS105 has been identified by intrusive investigation and soil analysis. The presence of heavy metals in exceedance of the Generic Assessment Criteria for a 'Public Open Space – Park' end use indicates that Made Ground is unsuitable for use at or close to the surface beneath the site. The soils in this area of the site are visibly contaminated with hydrocarbons, with a strong hydrocarbon odor. Although the GAC for aliphatic and aromatic hydrocarbon bands are not exceeded within soils samples collected from the Upper Staff Car Park, considering the sensitive nature of the site end use as school playing fields, this material is considered to be unsuitable for retention at shallow depths in their current state. In the absence of mitigation or remediation this poses a potential risk from a direct exposure pathways to future site users.

Additionally, the presence of heavy metals and presentation of gross olfactory and visual hydrocarbon contamination in soils in the vicinity of WS105 presents a potential risk to controlled waters, indicating retention on site via methods such as cover systems or encapsulation under hardstanding is not appropriate in this area of the site.

Due to the risks presented to human health considering the sensitive end use, and the risks posed to controlled waters, a remediation strategy based on the treatment of the contamination source in the vicinity of WS105 is therefore presented below.

The approximate distribution of the area of contamination identified to date has been identified in WS105, and WS201 to 204. The area of contamination is thought to be confined to only the Upper Staff Car Park area of the site, however the exact extent will need to be determined on site during the remedial process.

4.0 OUTLINE REMEDIATION STRATEGY

The methodology outlined below is designed to effectively remove Source – Pathway – Receptor linkages whereby any residual risks to future site users and the controlled waters of the wider environment are reduced to an acceptable level.

A procedure is also set out below that provides a proactive approach with respect to any previously unidentified contamination that is encountered during the construction phase and details the requirements to mitigate risks posed to ground workers during the construction phase.

An options appraisal indicates that a remedial strategy based on the in-situ treatment of impacted soils within the identified area of contamination is a robust solution with regard to human health/controlled waters risk.

The proposed strategy is consequently based on:

- In-situ treatment of hydrocarbon and heavy metal contamination in the vicinity of WS105, and WS201 to 204 (Upper Staff Car Park).
- Proactive active approach to previously unidentified contamination.

4.1 IN-SITU TREATMENT OF UPPER STAFF CAR PARK (AREA AROUND WS105)

Where significant areas of contamination are identified, treatment is required prior to cut and fill works, unless specific assessment of the material demonstrates that it is suitable to remain on site and that it does not pose an unacceptable risk to future site users or controlled waters in its current state.

Based on the findings of the site investigation undertaken to date, the Made Ground in the area of WS105 in the Upper Staff Car Park will require treatment. The impacted material was noted to be within a discrete band beneath hard standing and overlying cohesive Glacial Till, from 0.30m to 1.40m bgl and was described as a black and grey visually and olfactory hydrocarbon impacted sub base material, comprising sand and gravel sized particles anthropogenic materials including brick, concrete, slag and burnt shale.

4.1.1 In Situ Treatment

Site investigation has demonstrated that most hydrocarbon and heavy metal contaminated material located beneath the car park is visibly contaminated, and therefore identification of the material by visual and olfactory methods and treatment will result in the removal of the source-pathway receptor linkage. Additionally, a delineation exercise with soils testing will be conducted prior to treatment to ensure that the lateral and vertical extent of the contamination is identified prior to treatment. Treatment is conducted insitu, with no excavation or movement of the the impacted soils.

Envirotreast will be conducting the treatment of the contaminated soils in the Upper Staff Car Park area of the site. A Remediation Method Statement produced by Envirotreast in June 2021 details the methodology that will be adopted for the treatment of the impacted soils; the methodology is summarized below.

1. A delineation exercise will be conducted via trial pitting, where trial pits will be excavated around the impacted area in the vicinity of WS105 and WS201 to 204 to determine the lateral and vertical extent of the impacted soils. Delineation will be undertaken by visual and olfactory assessment of the material within the sides and base of the excavation, in addition to headspace analysis using a handheld Photo Ionisation Detector (PID). Soil samples from the trial pitting delineation exercise will be submitted to a UKAS / MCERTS accredited laboratory for analysis to confirm hydrocarbon concentrations are below the acceptable threshold limits. Envirotreast are proposing delineation criteria of total TPH 500 mg/kg, Lead 500 mg/kg and Zinc 500 mg/kg, which are below the 'Public Open Space -Park' GAC.

2. Following delineation of the soils requiring treatment, the treatment area will be gridded and E-clay formulation and cementitious material added in situ via grout pump. The impacted soils and treatment mixture are then mixed in situ using an excavator bucket.
3. Validation testing of the treated soils is then conducted via leachability testing, and screened against the validation criteria provided in Envirotest's Method Statement, derived from WHO DWS and UK DWS.

4.1.2 Validation

On completion of the treatment process, and prior to the reuse of treated cut material on other areas of the site, composite samples will be obtained by a suitably qualified and experienced geo-environmental consultant from the treated area and sent for testing for a range of determinants.

Testing frequency will include composite samples from treated area at a frequency of one sample per 100m³ volume of treated area. A minimum of 4 samples should be obtained.

The analytical suite should be not less than that listed in Appendix C, and should conform to the Generic Assessment Criteria presented in Appendix D.

4.1.3 Offsite Disposal

Materials exceeding the validation criteria following treatment, or any encountered soils deemed un-treatable due to gross contamination and requiring off-site disposal will be removed in accordance with the requirements of the Duty of Care Regulations, 1991 and where appropriate the Hazardous Waste Regulations, 2005.

Materials removed from site as waste will be subject to waste classification testing to allow for appropriate classification, to ensure correct disposal to an appropriately licensed facility.

It will remain the responsibility of the contractor as waste producer to classify the material for off site disposal.

4.2 DEMONSTRATION OF REMEDIATION WORKS TO BREAK POLLUTANT LINKAGES

Table 4-1 demonstrates that each of the potential pollutant linkages, based upon the conceptual site model, will be satisfactorily addressed by the proposed remediation scheme:

Table 4-1 - Summary of Removal of Pollutant Linkages

Receptor	Potential Risk	Mitigation
Human Health	Inhalation, ingestion and dermal contact	Localised treatment of areas of significant contamination, extent of excavation to be determined by visual/olfactory observations and verified through laboratory testing to confirm that impacted material has been delineated and treated. Validation testing of treated material to ensure that if reused at shallow depths, it meets the GAC for a 'Public Open Space – Park' end use. Proactive approach to unforeseen contamination across whole of the site.

		. All movements of excavated materials for re-use, including materials which have undergone treatment in-situ, will need to be undertaken in line with a Materials Management Plan. A cover system of 600mm of clean, naturally occurring soils is recommended for treated soils, post materials movement.
Controlled Waters	Leaching and vertical/ lateral migration of contaminants	A combination of the treatment of the hydrocarbon and heavy metal contaminated areas of Made Ground soils and the presence of low permeability Glacial Till across much of the site will minimise the risk to controlled waters. Leachability testing also progressed following treatment to ensure sufficient protection for controlled waters.
Natural Environment	Phytotoxicity (prevention or inhibition of plant growth)	The removal of the hydrocarbon and heavy metal contaminated areas of Made Ground will mitigate any potential phytotoxic risk for new planting.

*The transient risks to construction workers will be addressed by the adoption of appropriate health and safety measures in accordance with the Health and Safety at Work Act 1974 and associated Regulations.

5.0 DISCOVERY STRATEGY

5.1 INTRODUCTION

The objective of the Discovery Strategy is to ensure that a methodology is in place to identify, manage and deal with any previously unidentified areas of contamination which may be encountered during future site works. The strategy is consequently required to address the following:

- The identification of previously un-encountered ground contamination during the site development works including the requirement for further assessment and implementation of appropriate risk management methodologies to ensure the protection of human health and controlled waters; and,
- Protection of groundwork contractors and others who may be at risk due to contamination and hazardous materials encountered during site preparation and construction.

5.2 PROACTIVE APPROACH (WATCHING BRIEF)

In common with all brownfield sites, there is potential for other contamination to be present within the soils beneath the site over and above that identified during the site investigation, for example beneath buildings/structures on site which were inaccessible during the original site investigation.

Assessment based on trial pit/borehole data cannot provide a complete picture and as such, a detailed proactive 'watching brief' will be maintained during excavation works. The Contractor for the works will be responsible for providing an experienced banksman to observe and control excavations. In addition, the supervising person must be suitably trained and experienced in order to identify the presence of other visible or olfactory evidence of contamination including hydrocarbons and asbestos.

5.3 OUTLINE APPROACH

Should any evidence of previously unidentified contamination be found, these materials will be separately stockpiled and assessed for suitability for re-use. The contractor should seek further specialist advice from a suitably qualified and experienced geo-environmental engineer independent of the contractor.

Visual and olfactory inspection shall be used to identify potentially impacted soils. Following agreement on a plan of action it is possible that a conventional delineation exercise can be used to segregate impacted soil from the surrounding material. The discovery and management of potentially impacted soils should be dealt with on a case-by-case basis in order to address the specific nature of the ground conditions uncovered. However, a general approach is described below:

- Potentially contaminated ground conditions are identified by groundworker(s) and the works are halted in this area;
- Contractor assesses the requirement for any additional health and safety or environmental management control measures; The site manager is informed of the identification of potential contamination who will inform the client and Tetra Tech to agree a proposed methodology for managing the impacted materials;
- Requirements for additional sampling and risk assessment is confirmed with the contractor, Tetra Tech, and Contaminated Land Officer for the Local Planning Authority;
- Additional remedial action, if necessary, and programming of the works will be agreed with the Local Planning Authority;
- Any findings of potentially contaminated materials will be reported to the local authority and included within the Verification Report for the works.

5.4 ASBESTOS

In the event of previously unidentified asbestos containing materials being encountered on site during the groundworks the following procedures should be implemented:

- Works should cease immediately in the vicinity of the identified asbestos;
- The affected area should be fenced off and covered with plastic sheeting if necessary;
- The site manager informed of the identification of potential contamination who will inform Tetra Tech or specialist asbestos consultant to agree a proposed methodology for managing the impacted materials;
- Specialist advice should be obtained from an asbestos consultant with regard the identification of the asbestos and risk management procedures;
- Agreement will be sought between the Contractor, the Specialist Asbestos Consultant, client, Tetra Tech, and Local Planning Authority with regard to the additional site procedures and risk management required to appropriately manage the identified asbestos containing materials;
- This document will be updated in line with the additional requirements for risk management in the light of this additional information.

6.0 MATERIALS MANAGEMENT PLAN

It is recommended that a 'Materials Management Plan' (MMP) or similar protocol will be prepared in accordance with the CL:AIRE Code of Practice, setting out proposals for the appropriate re-use of materials at the site within the proposed development. The need for off-site disposal of materials potentially suitable for retention will consequently be minimised. It is possible that surplus materials may be available for re-use at other sites, subject to volumetric assessment. In accordance with the Code of Practice, the MMP will provide:

- A description of the materials with regard to potential use and quantity, underpinned by an appropriate risk assessment.
- Details of where and how materials will be stored.
- Details of proposed final destination and use, and how they will be tracked.
- Contingency arrangements required prior to movement (e.g. out-of-specification material; surplus; identified persons responsible, etc.)

The majority of the site derived soils from both Phase 1 and Phase 2 likely to be generally suitable for re-use as fill, both chemically and geotechnically. The material may be excavated, processed if necessary to remove any unsuitable material, and replaced within the site in order to achieve the required level profile. Any unsuitable materials which are removed before re-use will be treated as waste and disposed of off-site in accordance with relevant regulations.

As significant levels of cut and fill are taking place across the site, and materials which have been treated in situ will also be moved, it is recommended that where these treated materials have been moved they are placed underneath a cover system comprising at least 600mm of clean materials, with a hard to dig or warning geotextile layer.

The MMP will include quantitative assessment of material volume availability and requirements (mass balance calculations). Only those materials necessarily required for the site development works will be excepted from classification as waste.

The draft MMP will be subject to scrutiny by an appropriately qualified and experienced 'Qualified Person', as defined in the Code of Practice, who must not otherwise be directly involved with the remediation scheme. On completion of the works, and of a Verification Report to demonstrate that materials have been handled and placed in accordance with the MMP, the Qualified Person will be required to sign a Declaration. The content of the Verification Report will meet the requirements of the Code of Practice, as set out in Section 3.25 therein.

The Contractor will be responsible for ensuring that materials are treated and used as set out in the MMP. Any deviations from the MMP will be recorded in the Verification Report.

7.0 VERIFICATION

An integral part of the remediation strategy proposed for the site involves suitable monitoring of the works to ensure they are undertaken as specified, to demonstrate the achievement of the remediation objectives and to document all aspects of the remediation work.

The remediation works will be controlled by the appointed contractor. The following records will be maintained on site as a minimum, and provided as necessary to the regulatory authorities for approval:

- i) Records of the treatment and contamination testing within the region of the Upper Car Park. Including:
 - a. Records of the extent of the final treatment area;
 - b. Location of the samples obtained for laboratory testing;
 - c. Details of the storage of material prior to off-site disposal (if required) including location and number of stockpiles and management systems to minimise cross contamination with clean soils;
 - d. Records pertaining to the volume of soil treated, and waste transfer notes (if required).
- ii) Results of any additional contamination testing in the event that unexpected and suspect materials are identified, including laboratory quality assurance accreditation information.
- iii) Details of the actions taken to store, contain, treat, dispose or re-use any suspect materials.
- iv) Results of testing of all soils proposed for import, including information on the source location and quantity imported. Contamination testing results are to be approved by a competent person before the soils are brought to site.
- v) Chain of custody documentation for any soils imported.
- vi) Record of all disposals of unsuitable soils or hazardous / contaminated materials, including waste transfer documentation if applicable.
- vii) Records of health, safety and environmental controls and any variations to the original strategy/specification.
- viii) Copies of all relevant correspondence with the regulatory authorities during the course of the works.
- ix) Photographic records as required.

If at any time during remediation any unsuspected contamination is identified, the local authority Contaminated Land Officer will be contacted in order to agree a strategy for its remediation. If required by the Local Planning Authority, interim reports shall be provided as necessary for progress monitoring purposes.

FIGURES

Figure 1- Site Location Plan

Figure 2 – Site Investigation Location Plan



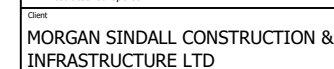
SCALE 1:1250

 BH BOREHOLE LOCATIONS
 CBR CBR LOCATIONS
 TP TRIAL PIT LOCATIONS
 WS WINDOW SAMPLE LOCATIONS

PRELIMINARY ISSUE

P01	PRELIMINARY FIRST ISSUE				26.05.2021	PP	AJ		
Prj	Description	Date	Dm / Chk / Appr						

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Project Name
CEFN SAESON COMPREHENSIVE SCHOOL

Sheet Title

SITE INVESTIGATION LAYOUT PLAN

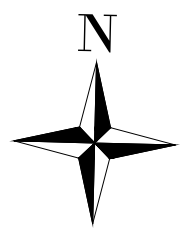
TTE Project Number	Drawn By	Date	Checked By	Date	Approved By	Date	Scale @ A3	Suitability
784-B027006	PP	MAY '21	KW	MAY '21	AJ	MAY '21	As Shown	S0
Client Project Number	Originator	Volume/System	Level/Location	Type/Code	Role	Number	Revision	
B027006	- TTE	- 00	- XX	- DR	- U	- 0002		P01
@ Unsanitized Teken Tools								TTE MT

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TTE_MT_

Figure 3 – Proposed Development Cut and Fill

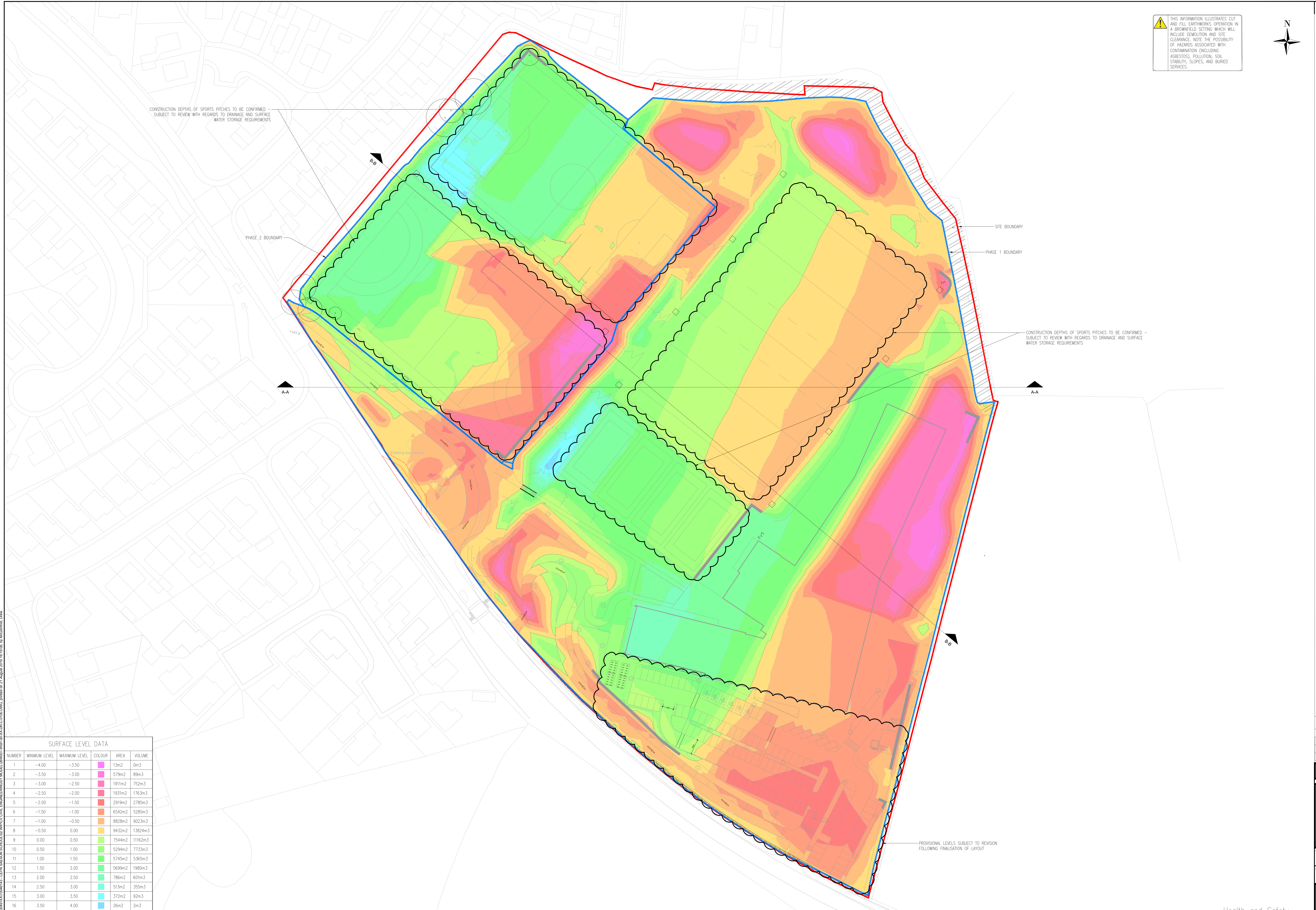
THIS INFORMATION ILLUSTRATES CUT AND FILL EARTHWORKS OPERATION IN A BROWNFIELD SETTING WHICH WILL INCLUDE DEMOLITION AND SITE CLEARANCE. NOTE THE POSSIBILITY OF HAZARDS ASSOCIATED WITH CONTAMINATION (INCLUDING ASBESTOS), POLLUTION, SOIL STABILITY, SLOPES, AND BURIED SERVICES.



DO NOT SCALE

- NOTES
1. ALL ELEVATIONS ARE IN METRES ABOVE ORDNANCE DATUM
 2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED
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 6. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL RELEVANT DOCUMENTATION, DRAWINGS AND STANDARD DETAILS. ANY DISCREPANCIES OR CONFLICTS SHOULD BE REPORTED TO THE ENGINEER IN THE FIRST INSTANCE.
 7. THIS PLAN SHOWS A VOLUME COMPARISON BETWEEN THE FOLLOWING TWO SURFACES:
 - 7.1. THE PROPOSED FORMATION SURFACE (DESIGNED FOR THE PURPOSE OF THIS ANALYSIS ONLY - BASED ON THE CONSTRUCTION DEPTHS IN NOTE 8)
 - 7.2. THE EXISTING GROUND SURFACE
 8. THE FOLLOWING CONSTRUCTION DEPTHS HAVE BEEN ASSUMED IN MODELLING THE FORMATION PROFILE FOR THE PURPOSES OF THIS ANALYSIS:

8.1. BUILDING GROUND BEARING SLAB + SUB-BASE (PROVIDED BY WSP STRUCTURES)	350mm
8.2. BUILDING SUSPENDED SLAB (PROVIDED BY WSP STRUCTURES)	250mm
8.3. ACCESS ROAD (TYPE 1)	415mm
8.4. ACCESS ROAD (TYPE 2)	490mm
8.5. FOOTWAY (TYPE 1)	235mm
8.6. FOOTWAY (TYPE 2)	310mm
8.7. ATTENUATION BASINS (PROVIDED BY LANDSCAPE ARCHITECT)	300mm
8.8. SOFT LANDSCAPING	150mm
8.9. MUGA (PROVIDED BY MORGAN SINDALL)	315mm
8.10. 3G PITCH (PROVIDED BY MORGAN SINDALL)	380mm
8.11. HOCKEY PITCH (PROVIDED BY MORGAN SINDALL)	400mm
8.12. GRASS PITCH (PROVIDED BY MORGAN SINDALL)	220mm
 9. ALL OTHER POSSIBLE CONSTRUCTION MAKE-UPS (INCLUDING BUT NOT LIMITED TO THE DIFFERENCE BETWEEN PERMEABLE PAVING CONSTRUCTION AND ACCESS ROAD CONSTRUCTION, RAIN GARDENS, PLANTING BEDS ETC) HAVE NOT BEEN ACCOUNTED FOR.
 10. THE ABOVE CONSTRUCTION DEPTHS ARE BASED ON AN ASSUMPTION OF 5% MINIMUM CBR BEING ACHIEVED.
 11. NO REFERENCE HAS BEEN MADE TO AVAILABLE INTERPRETATIVE OR FACTUAL GROUND INVESTIGATION AND NO CONSIDERATION HAS BEEN MADE IN RELATION TO THE ACCEPTABILITY OF EXISTING EXCAVATED MATERIALS FOR REUSE IN FILL AREAS.
 12. NO ALLOWANCE IS CURRENTLY MADE FOR A TOPSOIL STRIP.
 13. THIS IS GEOMETRIC VOLUME ANALYSIS AND THEREFORE NO ALLOWANCE HAS BEEN FOR BULKING AND SHRINKING OF ANY MATERIAL OR SUITABILITY OF MATERIAL REUSE. CONTRACTOR TO CONSULT GROUND INVESTIGATION.
 14. NO ALLOWANCE HAS BEEN MADE FOR PIT, TRENCHES ARISING OR BACKFILLING WITH SELECTED MATERIAL FOR RETAINING STRUCTURE CONSTRUCTION.
 15. NO ALLOWANCE HAS BEEN MADE FOR REMOVAL OF HARD OR SOFT SPOT BELOW THE FORMATION PROFILE.
 16. THE PLAN CONTOURS REPRESENT THE ELEVATION DIFFERENCE BETWEEN THE TWO SURFACES, WITH POSITIVE AND NEGATIVE CONTOUR VALUES REPRESENTING AREAS OF FILL AND CUT RESPECTIVELY.



SURFACE LEVEL DATA					
NUMBER	MINIMUM LEVEL	MAXIMUM LEVEL	COLOR	AREA	VOLUME
1	-4.00	-3.50		13m2	0m3
2	-3.50	-3.00		579m2	89m3
3	-3.00	-2.50		1911m2	752m3
4	-2.50	-2.00		1931m2	1763m3
5	-2.00	-1.50		2919m2	2785m3
6	-1.50	-1.00		6542m2	5285m3
7	-1.00	-0.50		8828m2	9023m3
8	-0.50	0.00		9432m2	13824m3
9	0.00	0.50		7544m2	11162m3
10	0.50	1.00		5294m2	7733m3
11	1.00	1.50		5745m2	5365m3
12	1.50	2.00		5699m2	1980m3
13	2.00	2.50		786m2	601m3
14	2.50	3.00		513m2	356m3
15	3.00	3.50		372m2	92m3
16	3.50	4.00		26m2	2m3

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
Phase 1 Volume	1.000	1.000	43609.612sq.m	27140.987 Cu. M.	15804.910 Cu. M.	11336.077 Cu. M.<Cut>
Phase 2 Volume	1.000	1.000	14514.237sq.m	6382.971 Cu. M.	11483.061 Cu. M.	5100.090 Cu. M.<Fill>
Totals			58123.849sq.m	33523.958 Cu. M.	27287.971 Cu. M.	6235.987 Cu. M.<Cut>

Health and Safety Symbols Legend

- INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION
- INDICATES A RESIDUAL RISK FOR INFORMATION
- INDICATES A RESIDUAL RISK REQUIRING A PROHIBITIVE ACTION
- INDICATES A RESIDUAL RISK AS A WARNING

DRAWING STATUS FOR INFORMATION



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CLIENT: MORGAN SINDALL

ARCHITECT: POWELL DOBSON ARCHITECTS

PROJECT: CEFN SAESON

TITLE: INDICATIVE EARTHWORKS VOLUME ANALYSIS

SCALE AS 1:500	CHECKED AG	APPROVED JL
PROJECT NO. 70049143	DRAWN DWM	DATE August 19

DRAWING NO. 26W007-WSP-00-XX-DR-C-0100	REV C01
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APPENDICES

APPENDIX A – REPORT CONDITIONS

APPENDIX A - REPORT CONDITIONS

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

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Tetra Tech. In time improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined.

APPENDIX B – ENVIROTRREAT REMEDIATION METHOD STATEMENT



Cefn Saeson Comprehensive School

REMEDIATION METHOD STATEMENT (Revision 1)

Prepared by:

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Document No	Issue Date	Description	Prepared by:	Checked by	Approved by:
ETL/SSF/CEFN/01	6 th June 2021	Original	Simon Farr	Andy Norman	Neil Mcleod
	14 th June 2021	Revision 1 Following comments / observations by Tetra Tech	Simon Farr	Andy Norman	Neil Mcleod

Cefn Saeson CS – Remediation Method Statement (R1)

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Cefn Saeson CS – Remediation Method Statement (R1)

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Cefn Saeson CS – Remediation Method Statement (R1)

Introduction:

Envirotreant Technologies Limited [ETL] has been requested by Pritchard Holdings to provide a Remediation Method Statement to detail the proposed remediation works to address the identified petroleum hydrocarbon and heavy metals soil contamination at the Cefn Saeson Comprehensive School on Afan Valley Road, Neath, SA11 3TA.

The new development site is located adjacent to the existing Cefn Saeson school (P2019/5028), with the existing sports fields being used as the location for the new school building. It is situated on the edge of Cimla, Neath with housing to the western and southern boundaries.

It is our understanding that an area of shallow contamination has been identified under the existing school car park (south-east corner of existing school development).

The overall objectives of the remediation would be to address the requirements for the protection of human health and protection of groundwater.

A number of remediation options were considered for the remediation of the identified soil contamination, including:

- Do nothing - this was not considered an option due to potential risks to groundwater associated with the identified contamination
- Excavate and remove from site to a suitably licenced facility - this option, although meeting the remediation aims, was discounted as not being in keeping with the Morgan Sindall waste management plan and waste hierarchy principles. The contaminated soils were also not considered suitable for disposal / reuse at local restoration sites.
- Bioremediation - this strategy would address the identified hydrocarbon contamination. However the timeframe would be too long and not in accordance with the overall programme of works. Additionally, the metals contamination within the soils do not lend themselves to bioremediation.
- Chemical stabilisation - this would achieve all the remediation aims (treated material would be placed below a suitable approved capping and the treatment would reduce contaminate mobility to a suitable level) and in a timely manner.

Cefn Saeson CS – Remediation Method Statement (R1)

Site Overview and Plan:

The site is the former Cefn Saeson Comprehensive School.

The site location is shown in Figure 1 below and the area of identified contamination is shown in Figure 2 below.

Figure 1 – Site Location



Cefn Saeson CS – Remediation Method Statement (R1)

Figure 2 – Contamination Hotspot / Area of New Development



Summary of Previous Site investigations:

The site has been subject to a site investigation undertaken by WYG in February 2019. Additional testing has been undertaken in 2021 within the existing school car park (following elevated levels of pollutants being identified within this area).

Contamination Summary:

Identified contamination within the car parking area was centred around WS105 and WS204. This was primarily related to metal and hydrocarbon contamination, which was assessed to be hazardous following a HazWasteOnline assessment.

Based on the assumed area and the depth of the contamination, volumes requiring treatment are considered to be less than 500m³. Delineation will be carried out to determine the full extent of the contamination.

The contamination summary is shown in Table 1 below.

Cefn Saeson CS – Remediation Method Statement (R1)

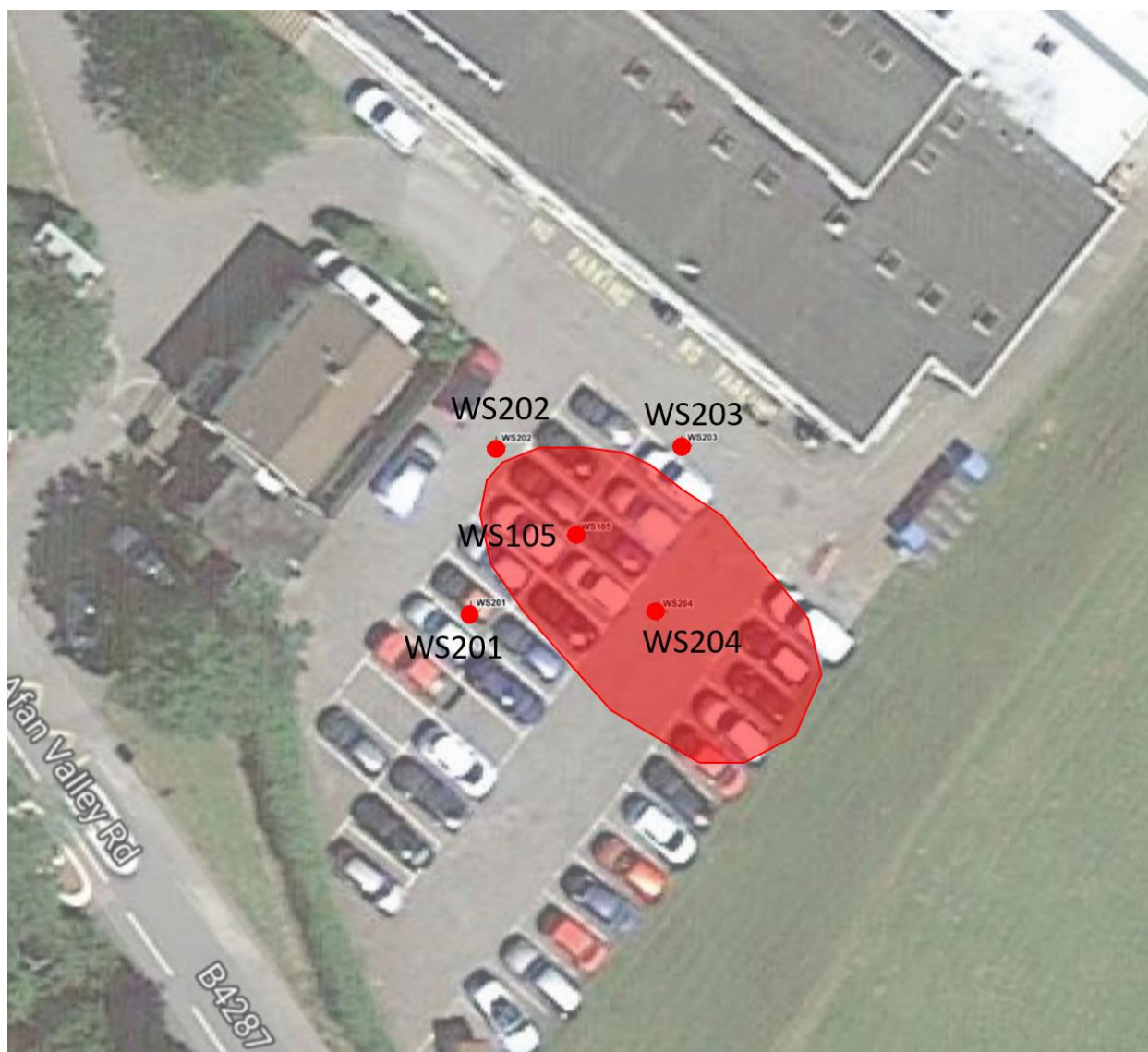
Table 1 – Site Investigation Results

	Depth (m bgl)	TPH (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)
WS201	0.25 – 0.60	397	92.5	165
WS202	0.60 – 0.80	72.3	39.6	156
WS203	1.30 – 1.80	341	224	424
WS203	1.80 – 2.00	< 10	18.1	76.3
WS204	0.10 – 0.30	397	181	418
WS204	0.30 - 0.60	3,450	2,860	4,910
WS204	0.70 – 1.00	< 10	14.5	54
WS204	1.50 – 2.00	< 10	35	97.3
WS105	0.10 – 0.25	116	54.3	214
WS105	0.35 – 0.60	9,320	4,390	7,220
WS105	1.00 – 1.20	3,080	39.1	80.5
WS105	1.80 – 2.00	< 10	15	83

The indicative treatment area is shown in Figure 3 below (centred around WS204 and WS105). At this stage the source has not been fully delineated.

Cefn Saeson CS – Remediation Method Statement (R1)

Figure 3 – Indicative Contaminated Soil Area



Cefn Saeson CS – Remediation Method Statement (R1)

Remediation Strategy:

The Proposed Remediation Strategy is designed to address the identified contamination as referenced in the WYG reported analysis and as summarised in this document above.

The prime contaminants of concern have been identified as total petroleum hydrocarbons and heavy metals.

Both of these pollutants could potentially impact human health receptors (site workers and end site users, through direct contact or inhalation of potential gases) and groundwater receptors (both underlying groundwater).

Following a Remediation Options Appraisal, Envirotrete are proposing the use of E-Clay Stabilisation to address the source contamination (both contaminated soils and any associated contaminated groundwater encountered). This will protect the identified receptors. Human health risks would also be addressed by means of a 'pathway break' i.e, the car parking area, suitable capping layer, etc.

The following scope of works is proposed to address the identified remediation requirements:

- Delineation of the hydrocarbon / metal contaminated area (assessment / confirmatory analysis as required)
- In-situ E-Clay stabilisation of the impacted area (following delineation) and validation
- Provision of a Validation and Verification Report

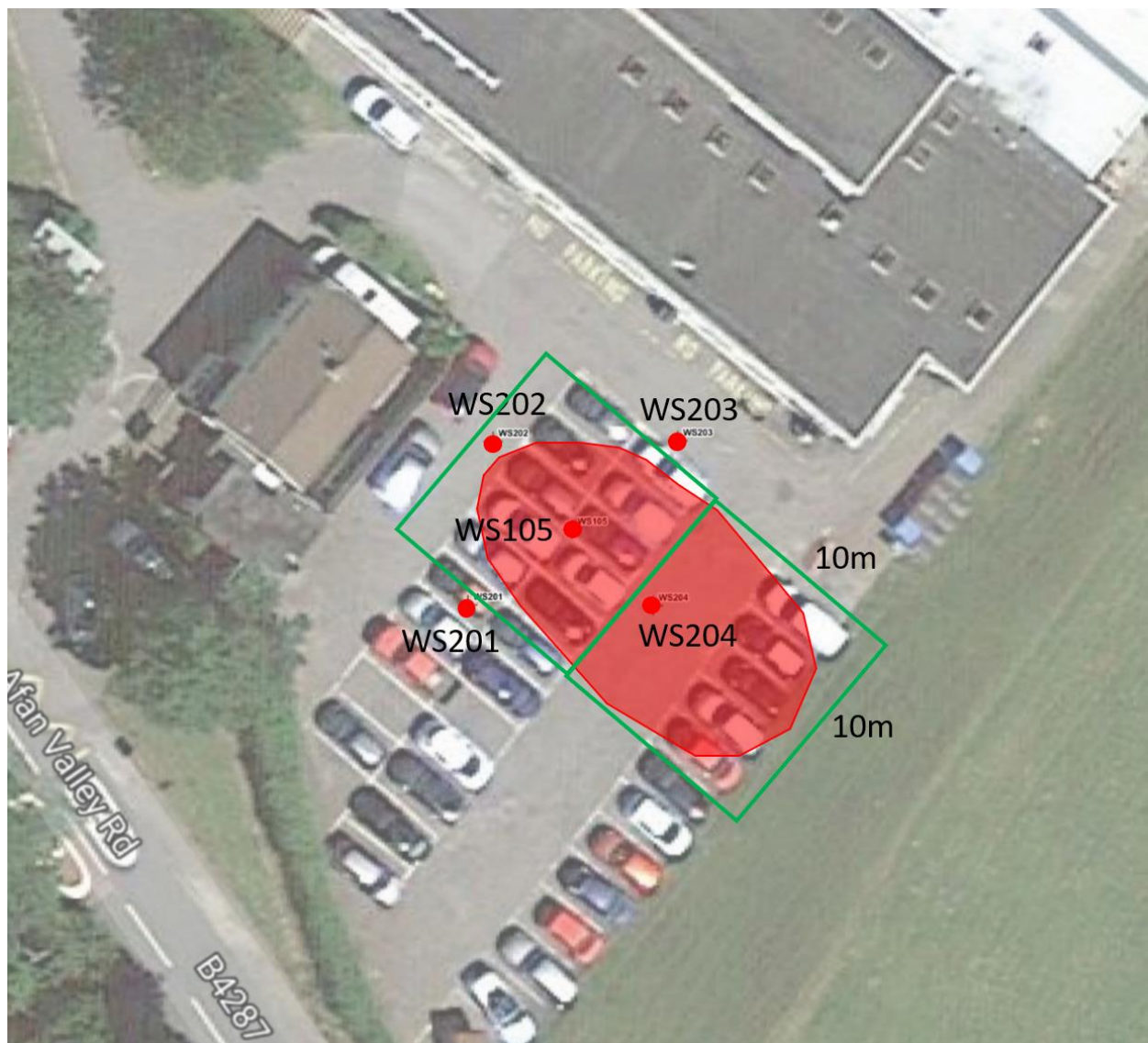
Delineation of Impacted Area:

The envisaged treatment area is shown in Figure 4 below.

A series of trial pits will be excavated around the impacted area to confirm the lateral and vertical extent of the identified hydrocarbon contamination. Soils will be initially assessed using visual and olfactory methods and by headspace analysis using a handheld Photo Ionisation Detector [PID]. Soil samples from the trial pitting delineation exercise will be submitted to a UKAS / MCERTS accredited laboratory for analysis to confirm hydrocarbon concentrations are below the acceptable threshold limits.

Delineation criteria cannot be based on an assessment against EQS / DWS as previous site investigations have shown that the made ground exceeds these parameters. We therefore propose using totals values for TPH and metals as encountered in the surrounding made ground as criteria i.e TPH 500 mg/kg, Lead 500 mg/kg and Zinc 500 mg/kg.

Figure 4 – Indicative Contaminated Area

**Remediation Criteria:**

WYG compared borehole groundwater data against EQS and where EQS are not available, compared with UK Drinking Water Standards.

In line with the above information, the results of chemical testing of water samples have been assessed against available Environmental Quality Standards (EQS) for freshwater; which are considered protective of surface water features beyond the site boundary. Where no EQS is available, the UK Drinking Water Standards (UKDWS) are used instead. The comparison of a concentration against a UKDWS is considered highly conservative but serves to provide an indication of the level of contamination (or otherwise) within groundwater beneath the site and offers protection to the quality of groundwater within the Secondary A Aquifers.

World Health Organisation (WHO) drinking water standards have been used to screen recorded TPH (Aromatic/Aliphatic) concentrations in the water samples. Tier 1 screening assessment against EQS and UKDWS allows for an initial assessment of the results, after which a more targeted assessment can be made based on the derived conceptual site model.

Cefn Saeson CS – Remediation Method Statement (R1)

No site-specific derived remediation criteria was developed, however an assessment of groundwater undertaken by WYG confirmed lead groundwater concentrations observed at 97.6 ug/l and Zinc groundwater concentrations observed at 214 ug/l were acceptable in their statement,

“it can be suggested that the Made Ground on site will have a minimal impact on any perched groundwater within the site.”

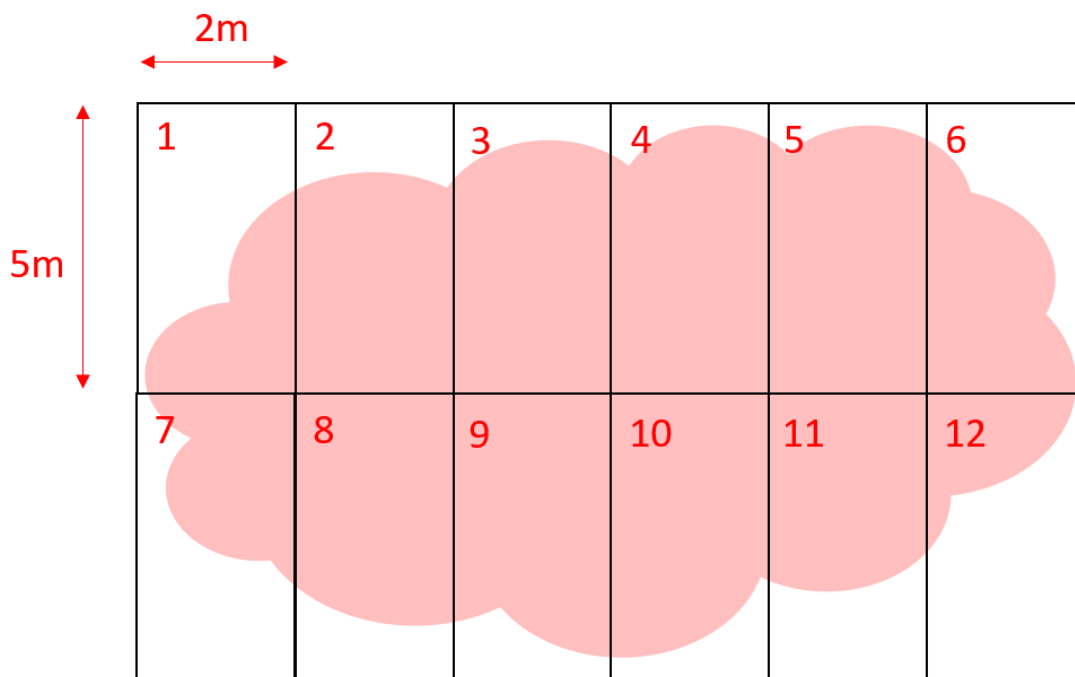
We would adopt WHO DWS for TPH banding

In-Situ E-Clay Stabilisation:

The treatment process will involve the use of E-Clay Stabilisation utilising a site-specific E-Clay formulation designed to chemically immobilise the identified contaminants of concern (within the soils and associated groundwater). Cementitious materials will also be added to provide a degree of physical stabilisation – the treatment process will produce a friable material.

The *in-situ* treatment approach will involve ‘gridding up’ the proposed treatment areas to ensure that the correct quantity of E-Clay slurry and other additives are applied to the contaminated soils. This is shown schematically in Figure 5 below.

Figure 5 – Schematic Showing Potential ‘Gridding up’ of Treatment Area.



Each treated area will require the addition of required volume of E-Clay slurry and cement as determined by the Project Manager (based on treatment volumes, etc).

In each treatment area the local site level will be reduced to remove surface soils (nominally 250 – 750 mm). These soils will be temporarily set aside. The site-specific E-Clay formulation will be produced on-site in slurry form using a grout mixer - proprietary chemical reagents are added to a pre-prepared bentonite slurry – the slurry can either be produced using mains or ‘grey’ water removed from the excavations.

The E-Clay slurry will be pumped from the grout mixer into the void spaces created by either the initial reduced level dig or by the tank excavations. Bentonite and Cementitious materials will be

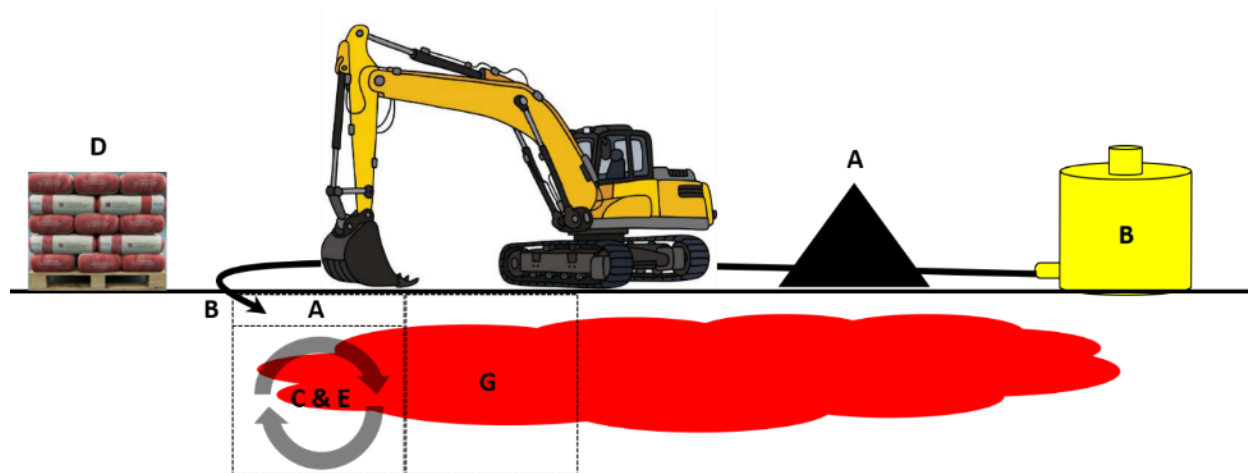
Cefn Saeson CS – Remediation Method Statement (R1)

added in dry form. The soils and associated groundwater will be mixed with the treatment additives until a homogenous treated mass is produced. Previously set aside soils will then be replaced and further treated until homogenous (if required ie. Shown contaminated).

Once complete further areas are treated until the whole contamination area is treated.

The *in-situ* treatment process is shown schematically in Figure 6 below:

Cefn Saeson CS – Remediation Method Statement (R1)

Figure 6 - Schematic Showing *In-Situ* Treatment Process

- A. Reduce suitable area of ground (eg 5m x 2m) by circa 250 – 750 mm and set aside in local stockpile (safely away from excavation to avoid potential collapse).
- B. Add required volume of E-Clay slurry to treat volume of soil (eg 5m x 2m x overall treatment depth).
- C. Using the excavator bucket mix the E-Clay slurry and in-situ soils to required depth until homogenous.
- D. Add dry Bentonite and Cement.
- E. Using the excavator bucket mix the Bentonite and Cement and in-situ soils to required depth until homogenous.
- F. Add back the previously set aside soils and mix until homogenous.
- G. Repeat in next area until all contamination is treated.

Validation of the treated materials will be carried out by a granular leach testing methodology by an accredited laboratory. Representative samples will be taken at a frequency of one sample for every 100m³ of soils treated.

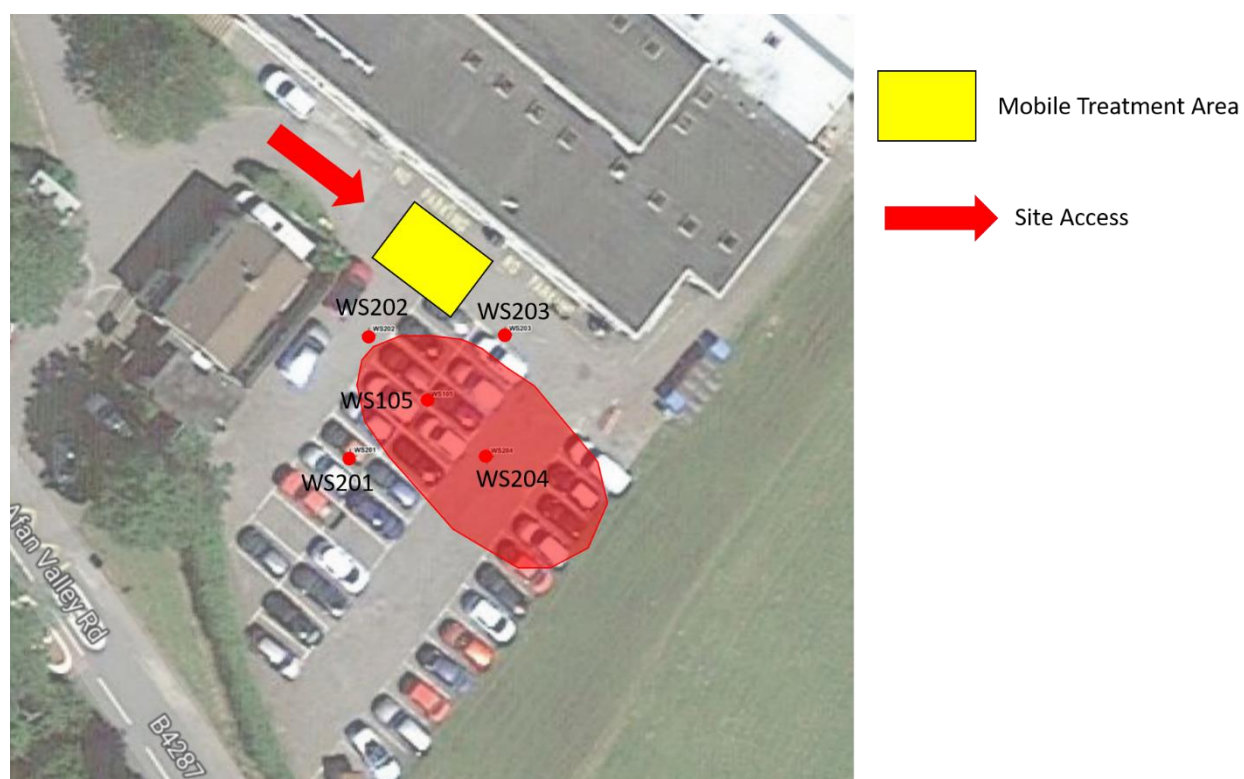
The remediation target criteria are designed to protect controlled waters - see Validation Section.

Should any treated sample fail to achieve the designated remediation target criteria then the material will be retreated to achieve compliance.

The proposed site set-up is shown in Figure 7 below. The mobile treatment area is shown in Figures 8 and 9 below.

Cefn Saeson CS – Remediation Method Statement (R1)

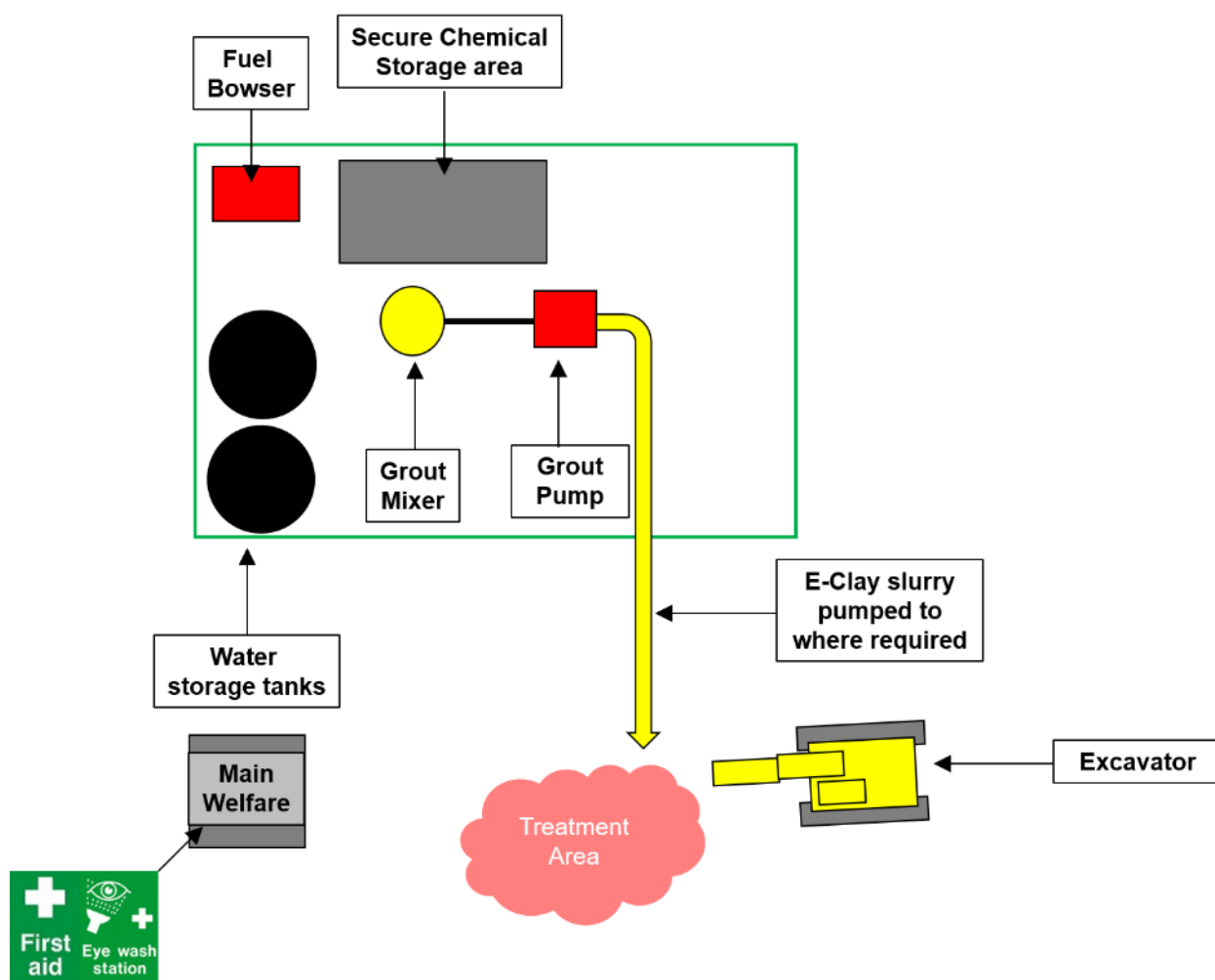
Figure 7 – Site Set-Up



Overall site security will be supplied and maintained by Principal Contractor or Main Contractor.

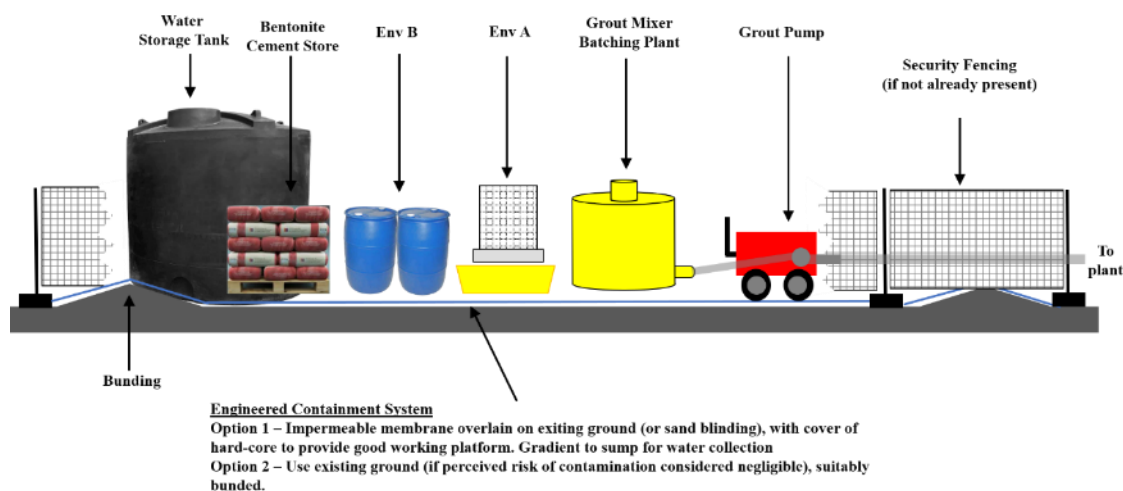
Cefn Saeson CS – Remediation Method Statement (R1)

Figure 8 – Generic Mobile Treatment Area



The welfare will be supplied by Main Contractor.

Figure 9 – Generic Mobile Treatment Area



Organisational Structure / Key Personnel:

Cefn Saeson CS – Remediation Method Statement (R1)

It would be the intention for ETL to carry out the required remediation works.

The proposed organisational structure is shown in Figure 10 below:

Figure 10 - Proposed Organisational Structure



ETL contact details are as follows:

Envirotreant Technologies Limited,
 LCP House,
 Pensnett Trading Estate,
 Kingswinford,
 West Midlands.
 DY6 7NA
 01384 288876

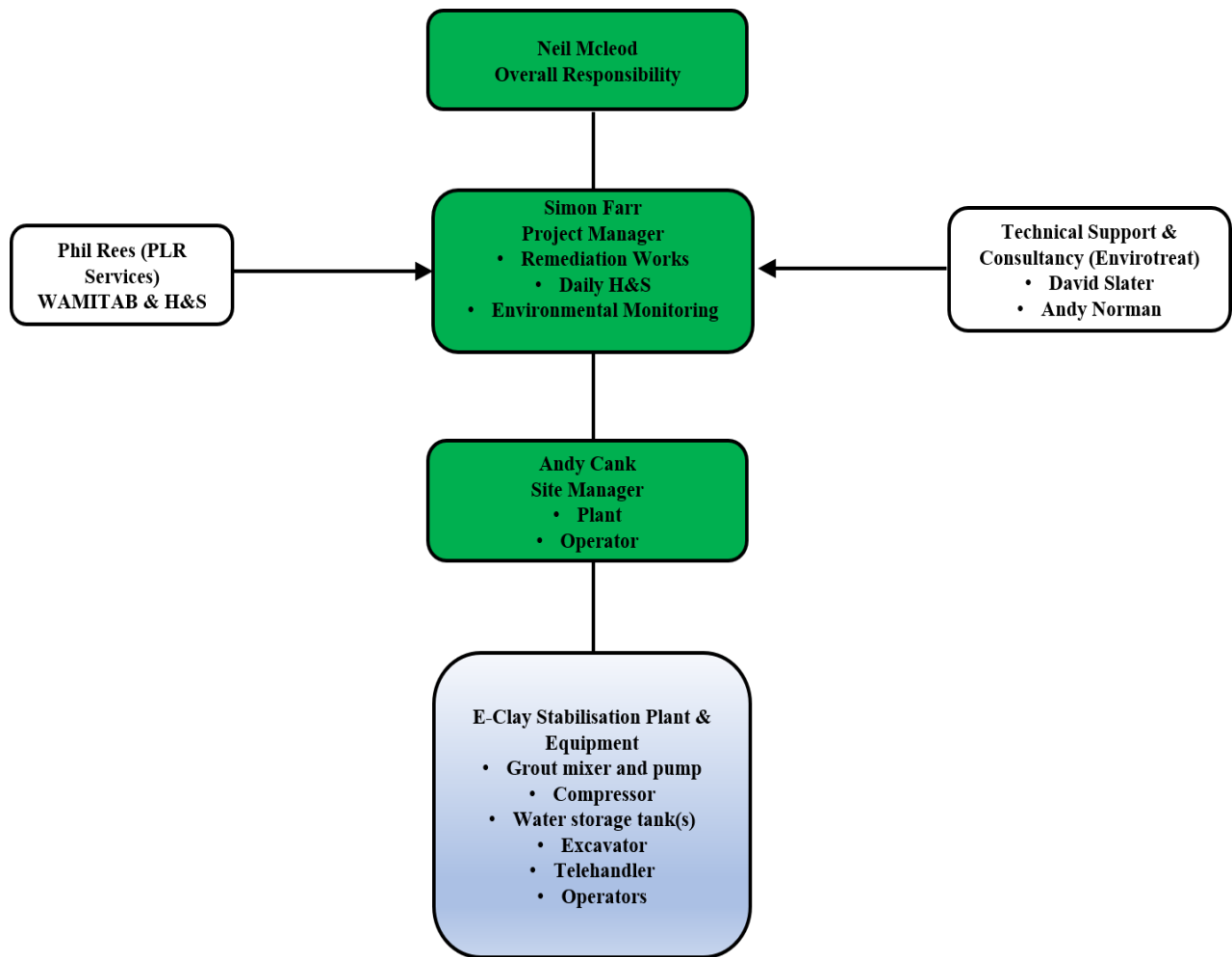
Key contacts are;

- Neil Mcleod (Technical Director - 07968 496927 – neil.mcleod@envirotreant.com)
- Simon Farr (Project Manager - 07803 174046 – simon.farr@envirotreant.com)
- Andy Norman (Principal Consultant – 07949 423059 – andy.norman@envirotreant.com)
- David Slater (Technical Manager - 07949 205896 – david.slater@envirotreant.com)

Neil McLeod is responsible for application of the remediation technologies in accordance with the procedures and safe systems of work outlined in this document. The site responsibilities are summarised in Figure 11 below.

Figure 11 – Site Responsibilities

Cefn Saeson CS – Remediation Method Statement (R1)



The Project Manager and Technical Manager (Simon Farr and / or David Slater) responsibilities would be as follows:

- All site works
- Safety issues
- Quality issues

Compilation, revision and maintenance of the quality system

Health and safety risk assessments identifying potential hazards and risks to site operatives are to be completed and communicated to those all involved through a site induction process implemented prior to works commencing on-site. All prevailing site health & safety procedures take precedence.

A Site-Specific Quality Plan will be prepared which will set out all the quality control and quality assurances protocols along with required monitoring / recording procedures to ensure the precise application of the technology.

Quality Risk Assessments identifying potential risks to the quality of operations on-site are to be completed and communicated to those involved. The assessment sheets will also include controls and measures to ensure quality is stringently adhered to at all times during application of the remediation process. These assessments will form part of the overall validation process.

Cefn Saeson CS – Remediation Method Statement (R1)

A comprehensive Site-Specific Health & Safety Method Statement will be produced including welfare requirements, COSHH, PPE, manual handling, noise, etc to ensure the safety of those working on site and to protect the surrounding environment.

WAMITAB Supervision:

Philip Rees will be act as WAMITAB / Health and Safety advisor for ETL.

Induction and Instruction:

All staff will undertake a site induction by ETL. This will include requirements in line with current COVID-19 guidelines.

The Project Manager would be responsible for ensuring that all ETL staff are fully inducted, trained and supervised in all remediation activities to be carried out on-site. The induction and instruction will be recorded in the Safety & Environmental Plan held on site and a copy can be provided where necessary. If any of the work activities change during the course of a project, an assessment of the hazards and risks associated with the work activity would be undertaken and further job-specific training would be given by the Site Manager / Project Manager as required. All personnel attending site would be required to read the Health, Safety and Environmental Plan, undergo appropriate induction and sign the record book accordingly.

Quality Control:

A daily / weekly record of works (including hours operated, volumes treated, site checks, plant records, etc) will be documented. The record sheets will be reviewed by the ETL Project Manager and on approval will be signed and incorporated into the Site-Specific Quality Plan held on site.

All works will be undertaken in accordance (not exclusively) with:

- HSG66 - Protection of workers and the general-public during development of contaminated land.
- Managing Health and Safety in construction - Construction (Design and Management) Regulations 2015 – HSE Publication (L153).

Cefn Saeson CS – Remediation Method Statement (R1)

Validation:

The soil delineation will be validated by visual and olfactory methods initially and confirmed via the collection of samples from the sides and base of the excavated areas. The samples will be submitted to a UKAS/MCERTS accredited laboratory for TPH-CWG / metals analysis.

Validation of the treated materials will be carried out by an accredited laboratory using a granular leach testing methodology (i.e. following treatment utilising the *in-situ* E-Clay stabilisation process). Representative samples will be taken at a frequency of one sample for every 100m³ of soils treated. The samples will be submitted to a UKAS / MCERTS accredited laboratory for leaching for the identified contaminants of concern in accordance with BS 12457 – 2 (i.e., 10:1 granular leaching test).

No site-specific derived remediation criteria was developed, however an assessment of groundwater undertaken by WYG confirmed lead groundwater concentrations observed at 97.6 ug/l and Zinc groundwater concentrations observed at 214 ug/l were acceptable in their statement,

“it can be suggested that the Made Ground on site will have a minimal impact on any perched groundwater within the site.”

Identification of key risk drivers has been completed in accordance with best practise set out by CL:AIRE and focusses on the lighter-end aromatic fractions. Aromatic hydrocarbons are generally more water soluble and mobile and thus typically represent a greater risk than aliphatic fractions and results in a conservative risk assessment approach. Following the withdrawal of the UK DWS (UK drinking water standard) for TPH there is no approved UK standard for petroleum hydrocarbons fractions. As such a combination of surrogate compounds, for which there are approved UK DWS, or international DWS will be adopted Where UK DWS are available for other contaminants, these have been adopted.

The international standards adopted in the absence of UK standards are, in decreasing order of preference, WHO (World Health Organisation) DWS and other international DWS. The sources of the WQS are presented in the following section.

CL:AIRE note that PHC fractions heavier than >EC16 have only a low or very low mobility in groundwater. As such they are unlikely to comprise key risk drivers. The risk posed by the lighter-end fractions, which are both present at greater concentrations and present greater risk due to higher fluid mobility, is considered to be higher. Assessment of these petroleum hydrocarbons fractions will inform the need for remediation and the heavier end fractions are not considered to be key risk drivers.

Cefn Saeson CS – Remediation Method Statement (R1)

Table 2 – Proposed remediation Criteria.

Contaminant	Proposed Remediation Criteria (ug/l)	Source
Lead	97.6	WYG accepted concentration
Zinc	214	WYG accepted concentration
Benzene	1	UK DWS
Xylenes	500	WHO
Aromatic >EC5-EC7	1 (benzene proxy)	UK DWS
Aromatic >EC8-EC10	300 (ethylbenzene proxy)	WHO
Aromatic >E10-EC12	90	WHO
Aromatic >E12-EC16	90	WHO
Aromatic >E16-EC21	90	WHO
Aromatic >E21-EC35	90	WHO

Any treated materials not meeting the remediation criteria will re-treated as required. In the unlikely event material does not meet the remediation criteria then the material would require offsite disposal.

Environmental Monitoring and Site Controls:Control of Mud and Debris:

The control and prevention of mud and debris being transported off-site will be dependent upon a number of factors. These include the weather and / or the amount of traffic and personnel travelling across the site.

Mitigating measures should therefore reflect the type of operation being carried out and it is not expected that stringent controls, such as those implemented on licensed landfill sites for the control of mud and debris, will need to be applied.

The potential risk for movement of mud and debris off-site is low to negligible during the project and negligible following completion.

The works will be undertaken in-situ.

No vehicles will leave the site other than plant on completion of the works. A visual inspection of all vehicles will be undertaken before allowing them to move off-site.

Control of Potentially Polluting Leaks, Spillages and Aerial Emission:

A number of control measures will be undertaken to minimise the perceived risks and hazards associated with the remediation process.

The works will be undertaken in-situ.

All work will be carried out within a designated area to protect the surrounding environment from potential spillages within the working area.

Fire on the Operating Site:

Due to proposed remediation works, the potential risk from fire to the surrounding environment is negligible. Wastes that are classified as explosive or highly flammable (Special Waste Hazard code H1, H3-A and H3-B) have not been identified on-site.

Identification of the type, composition and relevant hazardous properties of the contaminants on-site is an integral part of the site investigation stage. This information ensures that all wastes, whatever their nature and composition, can be treated and handled in accordance with the hazards they represent.

The emergency procedures for a fire or explosion on-site are detailed in the Fire Action Plan within the site-specific Health and Safety file, in accordance with the Health and Safety at Work Act 1974, and in collaboration with the local Fire Authority.

ALL fires or explosions on-site are considered an emergency and will be treated as such. To prevent the occurrence of a fire or explosion on-site, smoking and the use of naked flames will be prohibited within the treatment zone and fuel storage area.

Only suitably trained personnel, in accordance with the manufacturer's specifications, will carry out maintenance on plant and equipment. Relevant training will be given to all personnel on what to do in the event of a fire and in the use of the firefighting equipment.

Cefn Saeson CS – Remediation Method Statement (R1)

Waste Quantity Measurement Systems:

ETL are not operating a licensed landfill and as such there is not expected to be any material transported on or off the site (with regards to the treatment process) during the project. Waste Quantity Management Systems are not therefore applicable. However treated volumes will be assessed based on area and depth of contamination treated

Asbestos Contaminated Materials / Control of Dust:

Asbestos contaminated materials have not been identified on site. Should asbestos containing materials be encountered during the works it will be necessary to carry out a detailed assessment of the nature and quantity of asbestos to determine the risk classification in accordance with the CL:AIRE CAR-SOIL Guidelines and also to determine whether the asbestos contamination is above or below the 0.1% hazardous threshold. This will determine the course of action required for addressing the material i.e. either treatment for reuse on-site in designated areas of the site if low risk / non-notifiable or offsite disposal to a suitably licensed landfill site if considered to be notifiable and licenced asbestos work.

Appropriate environmental controls will be implemented to monitor and control dust emissions from the site which will also control the potential risks associated with the potential release of asbestos fibres.

These environmental controls will include (as a minimum):

- Damping down on dry days to minimise the risk of dust being generated which could potentially impact on offsite receptors. The damping down process will also control the potential release of asbestos fibres. A suitable water supply will be available at all times for this purpose
- The implementation of effective dust monitoring which will be undertaken at areas of the site deemed to pose a potential risk to offsite receptors. Should the monitoring demonstrate at any time that the potential risk is a concern then the works will cease immediately, and the methodology will be reviewed and demonstrated to be acceptable prior to remediation works recommencing on-site. The monitoring process will be fully supervised by ETL and daily records will be maintained in the Quality Plan.

Control of Dust:

It is unlikely that dust will be generated from the excavation and treatment process.

Local dust will be generated from opening bentonite bags, operatives will use PPE.

Daily dust monitoring assessments will be undertaken by ETL at key Environmental Monitoring Locations (see Figure 17 below) – these will be recorded in the Quality Plan.

Background monitoring will be undertaken to determine baseline levels. Trigger levels will be exceedance of background levels. Further assessment will be undertaken at the site boundaries for exceedances. Works will stop if thresholds are exceeded at the site boundary.

The pathway identified for the transport of odours across the site boundary is via air emissions, with potential receptors being site operatives, the public, neighbours and site visitors. Risks beyond the site boundary are low due to the distances involved.

Cefn Saeson CS – Remediation Method Statement (R1)

Control of Odours and VOCs:

There is a potential that odours could be generated from the remediation works. Volatilisation and the production of odours are therefore deemed to be of medium risk.

These risks will be minimised by undertaking the remediation in-situ.

The pathway identified for the transport of odours across the site boundary is via air emissions, with potential receptors being site operatives, the public, neighbours and site visitors. Risks beyond the site boundary are low due to the distances involved.

Simple olfactory monitoring and VOC monitoring (via hand-held PID) will be undertaken by ETL at key Environmental Monitoring Locations (see Figure 12) during operating days and records of any odours noted in the site logbook.

Background monitoring will be undertaken to determine baseline levels for odours and 1ppm Benzene adopted at the site boundary.

Control of Noise:

Receptors at risk are site operatives and the local community. Noise during the works may originate from the plant and vehicles delivering / removing materials to / from the site.

Noise monitoring (via a hand-held noise meter) will be undertaken by ETL at key Environmental Monitoring Locations (see Figure 12) during operating days.

The delivery process is not generally noisy and will only take place during sociable working hours.

Background monitoring will be undertaken to determine baseline levels using handheld noise meter based on an average over 2 minutes. Trigger levels will be an average of 5dbA over background. If trigger levels are exceeded at the monitoring points. Further assessment will be undertaken at the site boundaries for exceedances. Works will stop if thresholds are exceeded at the site boundary.

Maintenance Procedures.

Maintenance of all plant and equipment required for the treatment process including slurry production will be carried out by qualified engineers. Checks of all plant and equipment will take place on a daily basis and will be recorded within the Quality Plan (a copy of which will be stored on site during the remediation works). Maintenance of the ECS will be undertaken during the course of the remediation works through the visual inspection of the liner system. Any damage to the ECS will be repaired and recorded in the site logbook.

Contamination:

No off-site vehicle or machine / plant traffic movement will be allowed without prior first being decontaminated.

Records:

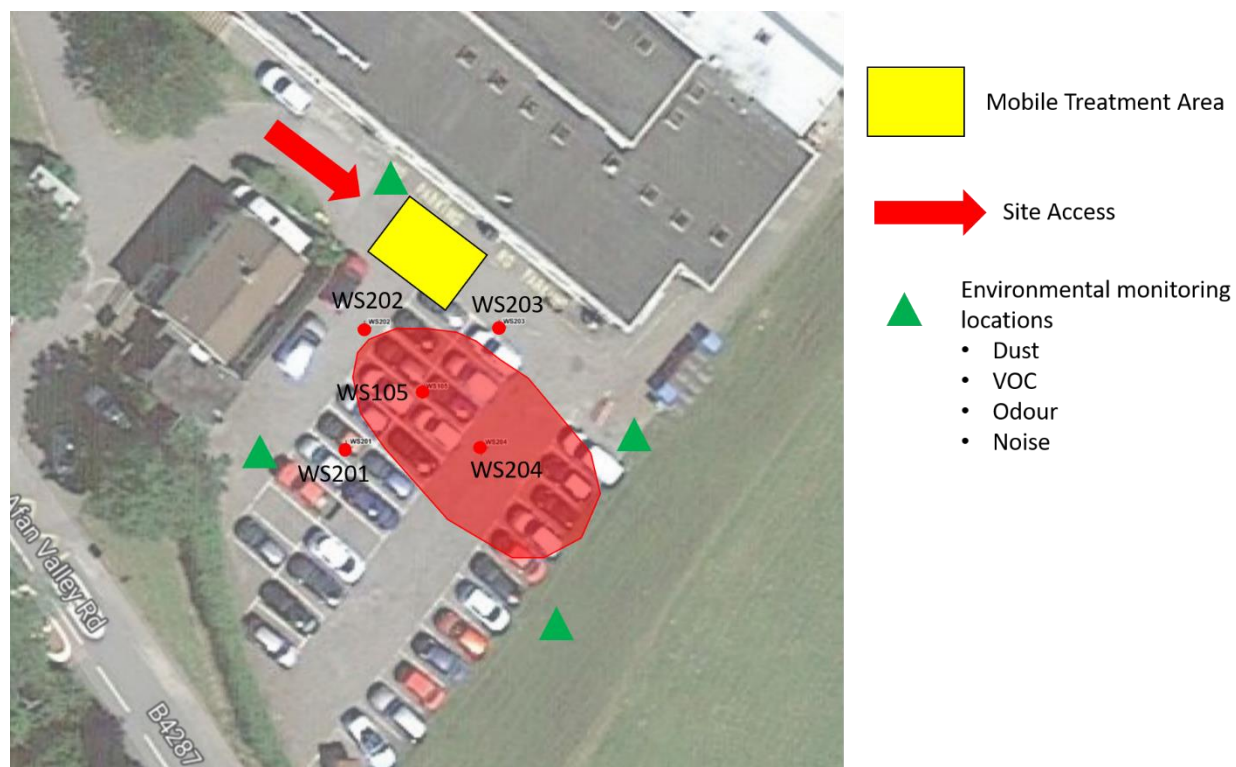
All records regarding the installation, commissioning, operation and maintenance procedures will be noted within the site logbook.

Site Demobilisation:

On completion of the activities summarised above, all plant and equipment associated with the remediation works will be cleaned down (where applicable) and safely removed from site.

Cefn Saeson CS – Remediation Method Statement (R1)

Figure 12 – Environmental Monitoring Locations.



Cefn Saeson CS – Remediation Method Statement (R1)

Regulatory Requirements:

It would **not** be necessary to formally deploy ETL's Mobile Treatment Permit for the soil excavation and disposal works on the basis of small volume.

Treated waste will be deemed "recovered" and reused onsite on the basis that the materials will be compliant with the designated remediation criteria.

The works are anticipated to start on the 14th June 2021 and expected to take one week to complete.

Operational Requirements:

The following equipment will be utilised for the remediation (treatment) works:

- Welfare facilities (to include changing area, toilets, washing facilities and rest / canteen)
- Excavator
- Telehandler
- Mobile Plant (grout mixer and pumps, air compressor, water tanks).

The following staffing levels are proposed:

- Plant Operatives (E-Clay preparation, excavator and telehandler operator)
- Project Manager
- Site Supervision

Other requirements:

- Site-Specific Health & Safety File
- Health & Safety Risk Assessment and Method Statement
- Site-Specific Quality Plan File

Personal Protective Equipment:

Personal Protective Equipment will be provided for onsite personnel where deemed necessary (i.e. where engineering controls and safe systems of work are not considered an effective safeguard against risks to safety and health) in accordance with the Personal Protective Equipment at Work Regulations 1992.

- Minimum site PPE includes the provision of the following to ISO standards:
- Safety Helmet
- Hi-Visibility Jacket / Waistcoat
- Safety Boots
- Builders Gloves
- Eye Protection
- Ear Protection (to be determined on-site)

Cefn Saeson CS – Remediation Method Statement (R1)

Warning signs indicating that construction activities are in progress will be displayed in and around the site where required. A weekly general inspection of conditions on-site including, noise control, dust control, boundary fences etc, etc will be carried out by an ETL representative and recorded and contained within the quality plan. Further to this an inspection of any plant and equipment hired by ETL will be undertaken and recorded and again contained within the quality plan. Inspection of plant and equipment will be carried out by the specialist contractor, prior to start-up each day. Inspection is primarily for possible leakages and/or any potential health hazards. If any item appears unsatisfactory it should be reported to an ETL representative and this should be noted, and appropriate action taken.

- A Health & Safety file will be compiled and maintained on site.
- A Quality File will be compiled and maintained on site.

Hours of Operation.

The proposed working hours on site are as follows:

- Weekdays: 08:00hrs - 17:00hrs
- Saturday N/A
- Sunday/Bank Holidays N/A

APPENDIX C – ANALYTICAL SUITE

Soils Testing Suite for Re-Use Soils

Suite for use with screening GACs presented in Appendix D.

	<u>TPH CWG</u>
pH	Aliphatic EC 5-6
	Aliphatic EC >6-8
Asbestos	Aliphatic EC >8-10
	Aliphatic EC >10-12
Arsenic	Aliphatic EC >12-16
Cadmium	Aliphatic EC >16-35
Chromium(VI)	Aliphatic EC >35-44
Copper	Aromatic EC 5-7 (benzene)
Lead	Aromatic EC >7-8 (toluene)
Mercury	Aromatic EC >8-10
Nickel	Aromatic EC >10-12
Selenium	Aromatic EC >12-16
Zinc	Aromatic EC >16-21
	Aromatic EC >21-35
	Aromatic EC >35-44
<u>PAHs</u>	<u>BTEX</u>
Acenaphthene	
Acenaphylene	
Anthracene	
Benz(a)anthracene	
Benzo(a)pyrene	
Benzo(b)fluoranthene	
Benzo(ghi)perylene	
Benzo(k)fluoranthene	
Chrysene	
Dibenz(ah)anthracene	
Fluoranthene	
Fluorene	
Indeno(123cd)pyrene	
Naphthalene	
Phenanthrene	
Pyrene	

APPENDIX D – GENERIC ASSESSMENT CRITERIA – POS PARK

Contamination Assessment Criteria

(PoS Park, 1% Soil Organic Matter where applicable)

Determinand	Units	Soil Screening Value	Derivation Tool
pH		<5, >9	
Asbestos	%	Presence	
HEAVY METALS/METALLOIDS			
Arsenic	mg/kg	170	C4SL
Cadmium	mg/kg	880	C4SL
Chromium (III)	mg/kg	33,000	CIEH/LQM S4ULs
Chromium (VI)	mg/kg	250	C4SL
Lead	mg/kg	1,300	C4SL
Mercury (Inorganic)	mg/kg	240	CIEH/LQM S4ULs
Nickel	mg/kg	800	CIEH/LQM S4ULs
Selenium	mg/kg	1,800	CIEH/LQM S4ULs
Beryllium	mg/kg	63	CIEH/LQM S4ULs
Boron	mg/kg	46,000	CIEH/LQM S4ULs
Vanadium	mg/kg	9,000	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)	mg/kg	24	WYG Acute Effects to Infant 1 dose 5g of soil
US EPA PRIORITY PAHs ^{Note 9}			
Acenaphthene	mg/kg	29,000	CIEH/LQM S4ULs
Acenaphthylene	mg/kg	29,000	CIEH/LQM S4ULs
Anthracene	mg/kg	150,000	CIEH/LQM S4ULs
Benzo(a)anthracene	mg/kg	49	CIEH/LQM S4ULs
Benzo(b)fluoranthene	mg/kg	13	CIEH/LQM S4ULs
Benzo(k)fluoranthene	mg/kg	370	CIEH/LQM S4ULs
Benzo(g,h,i)perylene	mg/kg	1,400	CIEH/LQM S4ULs
Benzo(a)pyrene ^{Note 9}	mg/kg	21	C4SL, CLEA v1.071 model
Chrysene	mg/kg	93	CIEH/LQM S4ULs
Di-benzo(a,h)anthracene	mg/kg	1.1	CIEH/LQM S4ULs
Fluoranthene	mg/kg	6,300	CIEH/LQM S4ULs
Fluorene	mg/kg	20,000	CIEH/LQM S4ULs
Indeno(1,2,3-cd)pyrene	mg/kg	150	CIEH/LQM S4ULs
Naphthalene	mg/kg	1,200	CIEH/LQM S4ULs

Determinand	Units	Soil Screening Value	Derivation Tool
Phenanthrene	mg/kg	6,200	CIEH/LQM S4ULs
Pyrene	mg/kg	15,000	CIEH/LQM S4ULs
PHENOLICS			
Phenol	mg/kg	440	CIEH/LQM S4ULs
TPH			
TPH Aliphatic >C5-6	mg/kg	95,000	CIEH/LQM S4ULs
TPH Aliphatic >C6-8	mg/kg	150,000	CIEH/LQM S4ULs
TPH Aliphatic >C8-10	mg/kg	14,000	CIEH/LQM S4ULs
TPH Aliphatic >C10-12	mg/kg	21,000	CIEH/LQM S4ULs
TPH Aliphatic >C12-16	mg/kg	25,000	CIEH/LQM S4ULs
TPH Aliphatic >C16-35	mg/kg	450,000	CIEH/LQM S4ULs
TPH Aliphatic >C35-44	mg/kg	450,000	CIEH/LQM S4ULs
TPH Aromatic >EC5-7 (Benzene)	mg/kg	27	C4SL App D, CLEA v1.071 model
TPH Aromatic >EC7-8	mg/kg	190	CIEH/LQM S4ULs
TPH Aromatic >EC8-10	mg/kg	87,000	CIEH/LQM S4ULs
TPH Aromatic >EC10-12	mg/kg	7,200	CIEH/LQM S4ULs
TPH Aromatic >EC12-16	mg/kg	9,200	CIEH/LQM S4ULs
TPH Aromatic >EC16-21	mg/kg	10,000	CIEH/LQM S4ULs
TPH Aromatic >EC21-35	mg/kg	7,600	CIEH/LQM S4ULs
TPH Aromatic >EC35-44	mg/kg	7,800	CIEH/LQM S4ULs
TPH Aliphatic & Aromatic >EC44-70	mg/kg	7,800	CIEH/LQM S4ULs
BTEX			
Benzene*	mg/kg	190	C4SL App D, CLEA v1.071 model
Toluene	mg/kg	87,000	CIEH/LQM S4ULs
Ethylbenzene	mg/kg	17,000	CIEH/LQM S4ULs
m-Xylene	mg/kg	17,000	CIEH/LQM S4ULs
o-Xylene	mg/kg	17,000	CIEH/LQM S4ULs
p-Xylene	mg/kg	17,000	CIEH/LQM S4ULs
Xylenes (mixed isomers)	mg/kg	17,000	CIEH/LQM S4ULs