Appendix 13B

AECOM Heavy Fuel Oil Spill Response, Tarbert Generating Station

Soil Sampling (2022)

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Heavy Fuel Oil Spill Response

Tarbert Generating Station
Soil Sampling

SSE Generation Ireland Limited

Project number: 60673806
60673806_ACM_EN_RP_003

01 July 2022

Delivering a better world

Quality Information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
0	30 June 2022	Draft for client review	Yes	Kevin Forde	Associate Director
1	01 July 2022	Final	Yes	Kevin Forde	Associate Director

Distribution List

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0	Yes	SSE Generation Ireland Limited

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AECOM Ireland Limited ("AECOM") has prepared this Report for the sole use of SSE Generation Ireland Limited ("Client") in accordance with the terms and conditions of appointment (proposal numbers: 60673806-ACM-EN-PL-001, dated 27 April 2022; and 60673806-ACM-EN-PL-002, dated 25 May 2022). No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by AECOM. This Report may not be relied upon by any other party without the prior and express written agreement of AECOM.

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The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken between 28 April 2022 and 01 July 2022 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances. AECOM disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to AECOM's attention after the date of the Report.

The exploratory holes carried out during the fieldwork, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The comments made and recommendations given in this Report are based on the ground conditions apparent at the site of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this Report.

The comments made on groundwater conditions are based on observations made during site work and the limited monitoring programme. It should be noted that groundwater levels might vary owing to seasonal or other effects.

The opinions expressed in this Report concerning any contamination found and the risks arising there from are based on current good practice simple statistical assessment and comparison with available soil guideline values, AECOM generic assessment criteria and other guidance values.

It should be noted that the effects of ground and water borne contamination on the environment are constantly under review, and authoritative guidance values are potentially subject to change. The conclusions presented herein are based on the guidance values available at the time this Report was prepared, however, no liability by AECOM can be accepted for the retrospective effects of any changes or amendments to these values.

Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant changes.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

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1. Introduction

AECOM Ireland Limited (AECOM) is pleased to present SSE Generation Ireland Limited (SSE, the client) with the findings of the heavy fuel oil (HFO) response works at Tarbert Generating Station, Tarbert Island, Co. Kerry (the site). The site location is presented in Appendix A, Figure 1.

The work reported herein has been conducted in accordance with AECOM proposals reference 60673806_ACM_PL_EN_001 and 60673806_ACM_PL_EN_002_0, dated 27 April and 25 May 2022, respectively, and authorised by SSE under purchase order numbers SGI1422900561 and SGI1422900667.

1.1 Background

The site operates under Industrial Emissions Licence (IEL) P0607-02, issued by the Environmental Protection Agency (EPA).

AECOM understands a HFO spill occurred from an above ground pipeline, located in the north of the Generating Station (see Section 2.3 for details). As a result, the EPA issued the client with an incident report (EPA Incident Number: INCI023056) on 12 April 2022, requesting the items below:

1. Groundwater sampling from monitoring wells BH306, BH309A, BH319, BH9 and BH12 for the following minimum parameters:
    a. Total Petroleum Hydrocarbons Criteria Working Group (TPH-CWG)
    b. Diesel Range Organics (DRO)
    c. Mineral Oil.
2. Subsoil sampling and analysis covering the area of the spill.
3. Details of the quantity of contaminated gravel/made ground/subsoil sent off-site for appropriate disposal.
4. The root cause of this leak and measures to be put in place to prevent a reoccurrence of this leak.
5. A detailed investigation report to include all of the above items.

In response to the EPA incident report, AECOM undertook groundwater sampling and a limited soil sampling program in May 2022 and reported on items 3 – 5 in a report submitted to the EPA as AECOM report reference 60673806_ACM_EN_RP_002_1, dated 27 May 2022.

Within that report AECOM recommended additional source removal works be completed to mitigate the potential human health and environmental risk from the HFO spill, these additional works are detailed within this report.

The EPA responded on to the submission on 31 May 2022 via the EDEN online platform, requesting the below items:

6. Details and photos of the current storage measures and location of the removed contaminated soils, as described in Section 5.3 of the submitted report, as well as details of their planned removal from site;
7. Confirmation that all preventative measures outlined in the report have been completed as described;
8. Update, outcomes and detailed report on the process /completion of source removal works as described in submitted report, including revised /updated environmental risk assessment following source removal works; and
9. Details of completion of all recommended actions outlined in the submitted assessment report.

1.2 Objective

The main objectives of the scope of works outlined in this report were to undertake delineation of contamination within made ground and subsoil beneath the leak from the above-ground HFO fuel line and retrieve soil samples for laboratory analysis. Where possible, contaminated soil was removed but, given the density of above and below ground services and infrastructure, complete source removal was not the primary aim.

1.3 Scope of Works

To meet the objective the following scope of works was completed:

- Health and safety preparation and service clearance.
- Vacuum excavation to delineate and remove obviously contaminated soils in the vicinity of the oil spill, where accessible.
- Validation soil sampling from the base and sides of the resulting excavation.
- Further groundwater sampling of BH309A, an additional task requested by the client.
- Data assessment and preparation of this report.

2. Review of Incident and Response

2.1 Site Setting and Operations

The Tarbert Generating Station landholding comprises approximately 35 hectares (excluding areas which are outside of the licensed site boundary) located on the southern shore of the Shannon Estuary, approximately 2 km north of Tarbert village and 50 km west of Limerick city, see Appendix A Figure 1.

The site is divided into two main areas comprising the island area and the mainland area which are connected via a causeway. The site also includes a foreshore lease area that extends into the estuary and includes the HFO unloading jetty. All of the plant associated with power generation (the generating station building, service reservoir and HFO tank farm) is located on the island.

The majority of the island is generally flat and lies at an elevation of 3 m to 5 m above Ordnance Datum (m OD). From the high point on the island there is a relatively gentle gradient towards the estuary to the west in a series of engineered terraces and a relatively steep gradient towards the estuary to the east. The island is surrounded by the Shannon Estuary to the north, east and west and by a tidal lagoon crossed by a causeway to the mainland to the south.

The surface of the island consists of sealed tarmacadam and concrete (approximately 30%) and unsealed hardcore gravel and grassed areas (approximately 70%).

HFO is the fuel which fires the boilers, the heat from which in turn produces steam to drive turbines to power the electricity generators.

HFO is pumped from the oil delivery jetty to the two tank farms located on the site. The island tank farm has four 25,000 tonne capacity tanks, one of which (Tank 4) is heated and lagged. Tank 3 and Tank 4 are currently used by the station, see Appendix A Figure 3. The HFO tanks on the island are contained within earthen bunds. HFO at ambient temperature is highly viscous and does not readily flow.

HFO is heated to make it less viscous and is pumped from the island tank farm to the boilers. The HFO pipelines are all above ground and are insulated and heated by steam.

2.2 Site Environmental Setting

The site's environmental setting is summarised in the Table 1 below. Additional detail is provided in reports on the annual groundwater data review, the most recent being the 2021 Groundwater Monitoring Report, refence 60673806_ACM_EN_RP_001, dated 31 March 2022.

Table 1. Environmental Setting Summary

Attribute	Description
Hydrology	The island is surrounded by the River Shannon Estuary which is tidal and classified as a transitional water body. The quality of this water body is classified as 'unpolluted' (EPA Transitional Water Quality 2018-2020), with its Water Framework Directive (WFD) status recorded as 'good' for the most recent reporting period 2013-2018.
Geology	Geological Survey of Ireland (GSI) data indicate that the site is underlain by Made Ground, with natural topsoil and subsoils in the area consisting of Till derived from sandstone and shale. According to the GSI, the bedrock geology underlying the site consists of the Shannon Group of undifferentiated mudstones, siltstones and sandstones. Bedrock outcrops are shown along the shoreline. Previous investigations on the site found Made Ground underlain by natural gravelly silts and clays. Bedrock, consisting of dark grey siltstone with an upper weathered horizon, was generally encountered at shallow depths, <3.0 m below ground level (bgl), across the site; however up to 6.5 m of subsoil was encountered in borehole BH9. Monitoring well locations are illustrated in Appendix A Figure 4.
Hydrogeology and Groundwater Flow	The Shannon Group is classified by the GSI as a 'Locally Important bedrock aquifer, which is moderately productive only in local zones'. Groundwater vulnerability likely ranges from 'moderate' to 'extreme' dependant on the thickness of overburden across the site. Groundwater beneath the site is classified by the EPA as 'not at risk' in accordance with the WFD. Previous investigations report that shallow groundwater in the overburden across the site is brackish, with groundwater elevations being tidally influenced. Groundwater within overburden material on the island portion of the site was inferred to flow in a divergent radial pattern (i.e. radiating outwards towards the estuary and the cooling water lagoon).
Protected Areas	Tarbert Bay, bordering the site to the southeast, is a proposed Natural Heritage Area; and is listed on the EPA Envision map as a Natural Heritage Area and a Special Area for Conservation of Tidal Mudflats. The combined River Shannon and River Fergus Estuary is a Special Protection Area for Wetland and for Waterbirds such as cormorant, shelduck and black-headed gull. The EPA Envision map describes the area as a Special Area for Conservation of Tidal Mudflats.

The site has a network of twelve accessible monitoring wells located across the island portion of the site. Well locations are illustrated in Appendix A Figure 4.

2.3 HFO Spill and Response

The HFO loss is reported to have occurred on 12 April 2022. SSE reported to AECOM that approximately 250 L of HFO was lost from an above ground pipeline close to the A Station chimney, immediately north of the generating station building, marked by the X in the figure below.

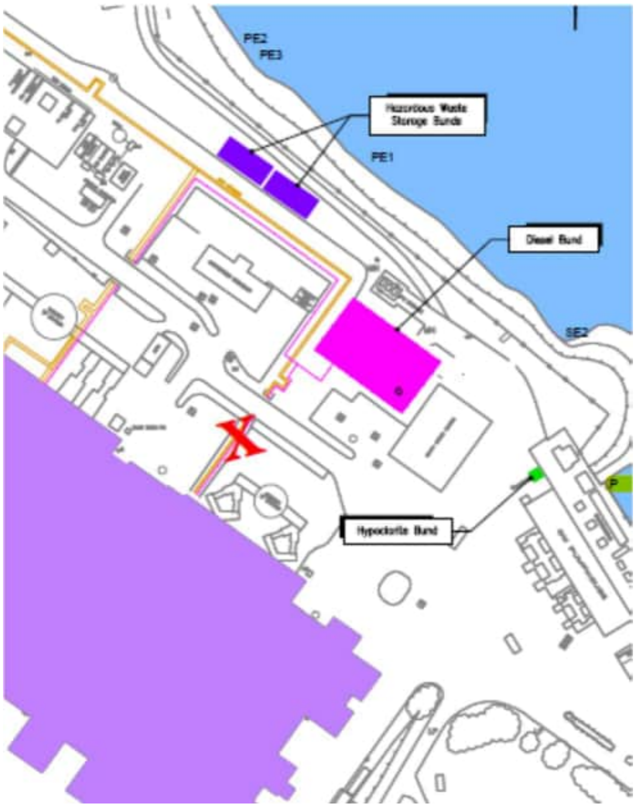

Figure A. HFO Spill Location

As noted in Section 2.1, HFO is the main fuel on site and is heated and pumped from the storage tanks in the west of the island to the generating station. HFO flows continuously in the A and B ring main above ground pipelines.

A few days prior to the incident, the recirculation pumps for Units 1 and 2 were shut down for repair, with the result that there was no flow in the A ring main return pipeline. This resulted in cooling of the HFO in pipeline.

When the HFO pump was restarted during the Unit 3 start-up on the night of the incident, the high viscosity of the cooled HFO in the A ring main meant there was no flow path through the A ring main return pipeline and the increased oil pressure damaged the clamp on the A ring main on the pipe rack north of the boilerhouse and caused a leak to occur. The area where the leak occurred is along an above-ground pipe rack underlain by unsealed ground (gravel fill material).

SSE has identified the root cause of this incident as human error. SSE has notified all shift managers to ensure that a tool-box talk was held before the end of May 2022 in which operations staff were advised to ensure that fuel is kept flowing through both the A and B ring main pipelines continuously whenever the configuration of the HFO system in the station is changed due to maintenance or repair issues.

On identifying the site of the leak, SSE immediately commenced repairing the clamp and cleaning-up the HFO lost to ground beneath the pipe rack. The EPA were notified within 24 hours of the leak being identified.

Due to the density of services in the area of the leak and the presence of the pipe rack above, SSE were initially limited to removing the obviously oil-contaminated gravel fill beneath the leak by means of hand tools.

The above ground pipelines are at <1 m above ground level and are supported by metal frames founded on concrete footings, however the concrete did not appear to extend beneath the full length of the pipeline but to only be present intermittently, to provide foundations for support structures for the above ground pipelines.

When removing the contaminated fill by hand digging, progress to depth was limited due to the presence of difficult digging conditions at depth, possibly indicating shallow bedrock.

Selected photos of the leak location, initial soil removal and pipeline repair are included in Appendix B.

SSE reported that, to date, contaminated fill and soil hand-excavated from beneath the leak has been collected into 40 UN approved metal drums of 205 L capacity each (13.06 tonnes total). The contaminated soil was stored on the hazardous waste bund on site and has since been removed to an appropriately-licensed facility.

3. Site Investigation

3.1 Site Works

All site works were conducted under a site-specific safety health and environment plan that included a risk assessment for the works being undertaken. For site works undertaken June 2022, SSE undertook the roles of Project Supervisor Design Phase and Project Supervisor Construction Stage.

AECOM attended site on three occasions since the HFO spill occurred and completed the following field tasks:

- 28 April 2022 - attended site to observe SSE's response to the spill and initial clean-up by means of hand-dug source removal. AECOM collected one soil sample from the resulting excavation and submitted it to the laboratory for analysis, sample VAL01.
- 05 May 2022 - attended site completed a groundwater monitoring round. Groundwater samples were collected from monitoring wells BH306, BH309A, BH319, BH09 and BH12, as requested by the EPA, and were submitted for laboratory analysis.
- 08 and 09 June 2022 - attended site to supervise vacuum excavation to remove as much of the source as accessible and to delineate the extent of hydrocarbon impact to ground. Validation soil samples VAL02, VAL03 and VAL04 were collected from the excavation, along with a second sample from monitoring well BH309A, and submitted to the laboratory for analysis.

All soil and groundwater samples were submitted to Element Materials Technology (EMT), Deeside, UK for analysis. A full sample inventory is included in Appendix C Table 1, with laboratory reports in Appendix D.

3.2 Source Removal and Delineation

AECOM provided environmental site supervision of the source removal and delineation program by vacuum excavation over two days on 08 June 2022 and 09 June 2022. AECOM had earlier attended site on 28 April 2022 to observe source removal by hand-digging.

Prior to undertaking source removal and delineation by vacuum excavation, the area was scanned with a cable avoidance tool (CAT) to identify live underground services. A CAT can identify live electricity cables and some metal pipes, but does not identify plastic pipes, dead electricity cables or fibre optics. The soil excavation and delineation was advanced using a vacuum excavation truck to remove contaminated soils and reduce the risk of damage to underground services.

Work was initially focussed on the area directly beneath the spill, refered to as the middle trench. During the earlier phase of hand-digging, progress to depth was limited by the compact nature of the fill material and hard base, see Appendix B Photos 1 to 4. At that stage it was not known whether the hard base was due to densely-packed fill, concrete or shallow bedrock.

All visually contaminated soils were removed from this area, to the extent practicable, by vacuum excavation which clarified that the vertical extent of excavation was limited by the shallow depth to bedrock in the area. Bedrock was encountered at between 0.25 m bgl and 1.1 m bgl, see Appendix B Photos 5, 7 and 8. It could be seen that foundations associated with above ground infrastructure, as well as trenches for underground services, had been dug into the top of bedrock and backfilled with compact granular fill or concrete foundations, see Appendix B Photos 7 and 8.

During the excavation works, two underground services were identified running approximately east-west, perpendicular to the above ground pipework (running north-south). One was a known surface water drain and the second is an unknown metal service.

These services are shown in Figure B below, with the green line representing the surface water drain encased in concrete and the red line representing the unknown metal pipe exposed to the north of the surface water drain, see also Appendix B Photo 7. These services appear to have been cut into the bedrock during installation, hence the increased depth to bedrock around these services compared to that to the north and south of the excavation.

Figure B. Services Beneath the HFO Spill – Middle Trench

SSE engaged a subcontractor to undertake a CCTV survey of the surface water drain in the area of the HFO loss. The survey ran from manhole S575, down-stream of the HFO spill area, to manhole S573, up-stream of the HFO spill area. The site service drawing with numbered manholes is included as Appendix E.

It is understood that, following the HFO loss, a minor sheen was noted in manhole S575 (see Appendix B Photo 10). Some defects in the drain line were noted close to the area of the HFO loss and this section of the drain has been relined.

Following the relining works, no sheen has been observed in manhole S575, and it is noted that even following the heavy rainfall of 24 to 26 June 2022[1], no sheen was reported at manhole S575 by SSE.

Soil samples VAL01 and VAL03 represented the material removed as part of the source removal works.

Following source removal from the middle trench, vacuum excavation then focussed on areas to the east and west, referred to as the eastern and western trenches. These trenches folowed the line of a surface water drain in the base of the excavation, to trace the extent of contamination along this granular preferential pathway, see Appendix B Photos 7 and 9. HFO was visible along the line of the eastern trench but less evidence of contamination was noted from the western trench.

Soil removed by vacuum excavation was initially left was left on-site overnight and stored on the hazardous waste bund (Appendix B Photo 11). This waste was collected on 10 June 2022 by the site's licensed waste contractor and taken to a licensed facility for treatment. A total of 33.82 tonnes of soils were removed from site. This included soil removed by vacuum excavation on 08 and 09 June 2022 (20.76 tonnes) and that which had been removed by hand-digging in April 2022 (13.06 tonnes).

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[1] Met Eireann data, 40.3 mm of rain fell between 24 June 2022 and 26 June 2022 at Shannon Airport, https://www.met.ie/climate/available-data/daily-data

3.3 Field Observations

An AECOM field scientist provided environmental supervision of the excavation works, logging soils, including descriptions of visual or olfactory evidence of contamination.

Ground surfacing consisted of tarmac to the east and west of the above-ground pipelines with open ground present underneath the above ground pipelines.

Beneath the ground surface, made ground was encountered to a maximum depth of 1.1 m bgl along the line of the underground surface water drain and the unknown service pipe exposed during excavation works.

Made ground was observed to lie directly on bedrock within the excavation, no natural soils were encountered between made ground and bedrock. Bedrock was shallower in the north and east of excavation, in proximity to foundations for the above ground infrastructure, lying at approximately 0.3 m bgl.

Made ground typically comprised of granular fill, consisting of brown, very sandy gravels, with sand around underground services. Made ground was observed to be generally moist, becoming saturated with oil and water close to the top of bedrock.

Bedrock underlying made ground comprised grey, fine-grained, laminated sandstone/siltstone, with sub-horizontal bedding planes.

Visual and olfactory evidence of contamination was mainly encountered at the bottom of the sandy gravel made ground and sand around the underground services. The gravel and sand were observed to be saturated with water and oil. Soil exposed along the western trench appeared less impacted by contamination. Oily product was observed to seep from sub-horizontal bedding planes present on the top of bedrock (sandstone/siltstone), see Appendix B Photos 5, 7 and 8. Groundwater and oily product were observed to flow from east to west across the top of rock in the middle trench.

A total of four soil samples were collected from the excavations, VAL01 in April 2022 and VAL02-04 in June 2022.

Soil samples VAL01 and VAL03 represent soil from the middle excavation which was excavated and removed from site. Soil samples VAL02 and VAL04 represent soil remaining in site at the western and eastern limits of the delineation trenches.

A summary of soil samples collected is presented in the Table 2 below, with a sample inventory in Appendix C Table 1. Soil sample locations are illustrated in Appendix A Figure 5.

Table 2. Soil Sample Summary

Sample ID	Location	Depth m bgl	PID Reading ppm	Evidence of Contamination
VAL01	Middle trench	-	-	Oily appearance and strong hydrocarbon odour
VAL02	Western trench	0.7	12.9	None
VAL03	Middle trench	1.1	34.0	Oily appearance
VAL04	Eastern trench	1.0	18.9	Oily appearance
DUP01 (VAL04)	Eastern trench	1.0	17.5	Oily appearance

Field measurements of total volatile ionisable compounds were taken in the field using a calibrated photo-ionisation detector (PID). While evidence of oil contamination was observed, including separate phase oil), the corresponding PID readings were low, all less than 35 ppm, consistent with the low volatility of HFO.

3.4 Soil Sampling

AECOM first attended site on 28 April 2022 in relation to the HFO spill with the initial intention of inspecting the soil removal area and assessing, on the basis of field observations, whether the extent of contamination to ground had been sufficiently delineated and to collect validation soil samples from the base and sides of the soil removal area. AECOM collected one soil sample (VAL01) from the base of the soil removal area and submitted it for laboratory analysis.

Following the vacuum excavation works on 08 and 09 June 2022, AECOM collected three soil samples (VAL02, VAL03 and VAL04) at greater depth from the base of the resulting excavation and trenches.

Soil samples were collected in accordance with AECOM field procedures with the aid of a split spoon sampler. Soil sample VAL03 represents soil that has been removed from the middle trench (i.e. from directly beneath the HFO leak), vacuum excavation has removed all accessible soil down to bedrock from this area.

Standard environmental sampling techniques were adopted to minimise the risk of cross-contamination between sampling locations. Soil samples selected for analysis were placed into laboratory-supplied sample containers and the AECOM field scientist wore single-use disposable nitrile gloves, which were changed at each sampling location.

Sampling locations are illustrated in Appendix A, Figure 5.

3.5 Groundwater Sampling

AECOM attended site on 05 May 2022 and conducted groundwater sampling from the five monitoring wells requested by the EPA (BH306, BH309A, BH319, BH09 and BH12). A second sample from BH309A was collected on 09 June 2022, at the request of SSE.

Groundwater samples were collected according to standard AECOM groundwater sampling methods using the three well volume purge method (based on USEPA and BSI methods). Monitoring well BH306 purged dry and was allowed to recover prior to collecting a water sample.

No separate-phase hydrocarbon layer was identified in any of the five monitoring wells sampled in May 2022, and no evidence of hydrocarbon contamination in the form of odour or sheen was observed. A light sheen and hydrogen sulphide odour were observed in groundwater from monitoring well BH309A when it was resampled in June 2022.

Field observations and measurements are presented in Appendix C Table 2.

3.6 Laboratory Analysis

All samples were submitted to Element Materials Technology Limited (EMT) for analysis of:

- Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG), speciated with aliphatic and aromatic split
- BTEX Compounds: benzene, toluene, ethyl benzene and xylenes
- Mineral Oil

Two duplicate samples were collected, one groundwater sample from monitoring well BH319 and one soil sample at location VAL04. Both duplicate samples were analysed for mineral oil only. A full sample inventory is provided in Appendix C Table 1.

4. Conceptual Site Model

4.1 SPR Linkage

In the context of land contamination, there are three essential elements to any risk:

- A **source** – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of groundwater and surface waters.
- A **receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.
- A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Each of these elements can exist independently, but they create a risk only where they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway. This kind of linked combination of contaminant source–pathway–receptor (SPR) is described as a pollutant linkage. This conceptual model was developed to describe viable SPR linkages for the site.

The desktop study in addition to field observations were used to conceptualise the contaminant source area as well as potential pathways and receptors.

By considering the source, pathways and receptors (pollutant linkages), an assessment of the human health and environmental risks is made with reference to the significance and degree of the risk. This assessment is based on consideration of whether the source contamination can reach a receptor, and hence whether the resulting impact is of major or minor significance.

4.2 Risk Assessment Methodology

The risk assessment has been undertaken with reference to BS10175:2001 and CIRIA Document C552: *Contaminated Land Risk Assessment – A Guide to Good Practice*. The risk assessment has been carried out by assessing the severity of the potential consequence, taking into account both the potential severity of the hazard and the sensitivity of the target, based on the categories given in Table 3.

Table 3. Potential Hazard Severity Definition

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters.
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures.
Mild	Pollution of non-sensitive waters, minor damage to buildings or structures.
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species.

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given in Table 4 below.

Table 4. Probability of Risk Definition

Category	Definition
High Likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor.
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term.

Category	Definition
Low Likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Pollutant linkages may be present, but the circumstances under which harm would occur are improbable.

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard as shown in Table 5 below.

Table 5. Level of Risk for Potential Hazard Definition

Probability of Risk	Potential Severity			
	Severe	Medium	Mild	Minor
High	Very high	High	Moderate	Low/Moderate
Likely	High	Moderate	Low/Moderate	Low
Low	Moderate	Low/Moderate	Low	Very low
Unlikely	Low/Moderate	Low	Very low	Very low

4.3 Source

This assessment focuses on one known source of contamination on-site, the loss of HFO to ground that occurred as a single event on 12 April 2022.

The HFO loss was addressed quickly with soil removed from beneath the site of the loss, above ground pipe rack, both by means of hand-digging and by vacuum excavation.

The extent of HFO impacted fill beneath the above ground pipe rack and along the line of underground services that ran perpendicular to it was delineated by vacuum excavation.

However, the shallow depth to bedrock beneath the pipe rack and presence of granular fill, meant that there was no impediment to HFO seeping into discontinuities in the top of bedrock (bedding planes, joints and fractures).

4.4 Potential Receptors

The potential receptors at the site and surrounding area are outlined in Table 6 below.

Table 6. Potential Receptors

Receptor Type	Receptor	Present	Description
Human Health	On-site workers	Yes	The most sensitive human health receptor is considered to be on-site workers. There nearest residential dwelling is over 250 m south-east of the source on the southern side of the island.
Controlled Waters	River Shannon Estuary	Yes	The island is surrounded by the River Shannon Estuary which is tidal and classified as a transitional water body, and therefore not used for potable supply. The quality of this water body is classified as ‘unpolluted’.
	Groundwater in bedrock	Yes	During excavation works, bedrock was encountered at shallow depths from 0.25 m to 1.1 m bgl. According to the GSI, the bedrock geology underlying the site consists of the Shannon Group.

Receptor Type	Receptor	Present	Description
			The Shannon Group is classified by the GSI as a 'Locally Important bedrock aquifer, which is moderately productive only in local zones'. Groundwater vulnerability at the source is 'extreme' given the shallow depth at which it is encountered and field observation of oil pooled at the top of rock and seeping from within fractures and bedding planes. Groundwater within the bedrock aquifer is not used for potable supply at the site.

4.5 Potential Pathways

There are considered to be a number of potential exposure pathways for site users, groundwater and surface waters. The potential pathways to human health and controlled waters which are considered viable are outlined in Table 7.

Table 7 Potential Pathways

Receptors	Pathway
Human health receptors in a commercial/industrial scenario	• Soil and dust ingestion from near surface soils • Dermal contact with near surface soils • Inhalation of vapours
Water receptors	• Lateral migration of contaminants through the bedrock aquifer with groundwater discharge anticipated to occur to the Shannon Estuary down-gradient to the north. • Vertical migration of contaminants through the overburden and bedrock aquifer

4.6 Summary of Viable SPR Linkages

Viable SPR linkages are summarised in Table 8**Error! Reference source not found.**.

Table 8 Viable SPR Linkages

		Pathway						
Receptor	Source	1 – Soil and Dust Ingestion	2 – Dermal Contact	3 –Fugitive Dust Inhalation	4 –Vapour Inhalation	5 – Leaching from Unsaturated Zone	6 – Vertical Groundwater Migration	7 – Horizontal Groundwater Migration
Commercial or industrial site user	Soil	✓	✓	✓	✓			
	Groundwater				✓			
Groundwater	Soil					✓	✓	✓
	Groundwater					✓	✓	✓
Surface Water	Soil					✓	✓	✓
	Groundwater					✓	✓	✓

5. Analytical Results

5.1 Generic Assessment Criteria

A risk-based approach has been adopted for the assessment of data from the site. Constituent concentrations in soil and groundwater at the site are deemed 'potentially significant' where they exceed generaic assessment criteria (GAC). These GAC are used to assess contaminant concentrations for the purpose of providing an initial indication of impacts at a site and evaluating the compounds that may need to proceed to a more detailed assessment.

It should be noted that exceedances of GAC are not an indication of the requirement for remediation; rather, they are an indication of the need for further assessment. If concentrations are below the GAC, then the risks to human health and/or controlled waters, as appropriate, are considered negligible.

Where further risk assessment is considered necessary, use of more site-specific information in the assessment can often lead to the conclusion that the observed concentrations represent an acceptable level of risk, considering the actual or proposed end use of a site (although each site assessment has to be considered on an individual basis).

5.1.1 Soil Screening Criteria for Human Health

Total organic carbon (TOC) was detected by the laboratory at concentrations between 0.3% and 0.45%. Consequently, AECOM has adopted the most conservative (lowest) TOC range of 0.58% to 1.45% for sand soils in an industrial setting.

AECOM considers that the GAC are consistent with the principles of human health protection in Irish EPA, UK DEFRA and UK Environment Agency guidance.

The general hierarchy for selection of soil GAC at the site is as follows:

- AECOM modified LQM/CIEH Suitable 4 Use Levels (2014).
- AECOM modified EIC/AGS/CL:AIRE GAC.
- AECOM modified Defra (2014) SP1010: Development of Category 4 Screening Levels for Assessment of Land Contamination - Policy Companion Document, December 2014.

Total petroleum hydrocarbons (TPH) have also been assessed by assuming an additive toxicological effect for all individual fractions. A hazard quotient (HQ) is calculated for each individual fraction by dividing the reported fraction concentration by its corresponding GAC. The HQs for each TPH fraction in an individual sample are then summed to derive the indicative hazard index (HI) for that sample. Where the indicative HI is less than 1.0 the risks are considered negligible. An indicative HI of greater than 1.0 indicates a potential risk.

It should be noted that numerical values of HQ and HI, particularly where the value is greater than 1, may be an over-estimation, as the calculation described above does not consider vapour saturation and solubility limit effects.

5.1.2 Soil Screening Criteria for Controlled Waters

In terms of controlled waters (i.e., the underlying groundwater and nearby surface waters), there is a potential for soils to impact these via leaching and subsequent lateral migration within the aquifer. Soil leachate results have been screened against groundwater screening criteria for controlled waters as detailed in Section 5.1.4. However, such GAC are typically conservative and, consequently, greater reliance is placed by AECOM on actual groundwater data, where available, when assessing the potential risks to controlled waters receptors in the vicinity of the site.

5.1.3 Groundwater Screening Criteria for Human Health

In terms of human health risks, given that groundwater on the site is not abstracted for potable use on Tarbert Island, the principal risk to human health from groundwater is via vapour inhalation. Therefore, groundwater concentrations were compared against AECOM GAC derived for the assessment of the vapour inhalation pathway on a commercial / industrial site where appropriate.

The screening criteria do not provide detailed information on site-specific risks and, in a significant number of circumstances, may be viewed as being overly conservative. Nevertheless, these values are considered to be appropriate for initial screening of site conditions for the protection of human health.

5.1.4 Groundwater Screening Criteria for Controlled Waters

The probability of wells in the wider Tarbert area being used for abstraction of potable water is low, due to the availability of mains water and brackish nature of groundwater. The location of the HFO loss on the island further reduces the risk of a viable pathway for contaminant migration to potable water wells on the mainland.

The risk to groundwater was assessed using the criteria from the following hierarchy:

- European Communities Environmental Objectives (Groundwater) Regulations, 2010. Statutory Instrument No. 9 of 2010 (as amended S.I 366 of 2016).
- Environmental Protection Agency's Draft Interim Guidelines Values (IGVs) for the Protection of Groundwater, 2003[2].
- WHO, Petroleum Products in Drinking-water. Background document for development of WHO Guidelines for Drinking-water Quality WHO/SDE/WSH/05.08/123, 2008.

In terms of surface waters, appropriate generic assessment criteria were selected based on the site's environmental setting. The island site is located within the River Shannon Estuary, which is considered the most sensitive controlled waters receptors in the vicinity of the site. Accordingly, surface water analytical data were assessed using the following criteria:

- European Union Environmental Objectives (Surface Waters) Regulations 2009. S.I. No. 272 of 2009, (as amended by S.I 386 of 2015 and S.I 77 of 2019) Ireland - AA-EQS & MAC-EQS Coastal.
- The Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015. AA & MAC-EQS Coastal.
- PNEC[3] derived for EU REACH registration dossiers – Coastal.

The criteria contained in the drinking water regulations[4] have not been considered, as consumption of water has been ruled out as a viable pathway.

5.2 Soil Results

Soil analytical results are presented against GAC in Appendix C Table 3. The HQ (for individual TPH analytical fractions) and overall summation of HI calculations are presented in Appendix C Table 4.

Concentrations of petroleum hydrocarbons in soil from samples VAL01 and VAL03 were reported above the laboratory method detection limit (MDL) for all hydrocarbon fractions, with the highest concentrations recorded in the heavier / longer chain length ranges C10-C35. Additionally, concentrations of BTEX, MTBE and mineral oil were all above laboratory MDLs. Both VAL01 and VAL03 represent soil that has been removed from the source area.

Two hydrocarbon fractions (C8-C10 and EC8-EC10) and BTEX were detected above their MDLs in soil sample VAL04. All other hydrocarbon fractions, BTEX, MTBE and mineral oil were reported below their MDLs.

No TPH, mineral oil, MTBE or BTEX in VAL02 was detected above their MDLs.

Samples VAL04 and VAL02 represent soil remaining in situ at the eastern and western extent of the delineation trenches.

---

[2] Environmental Protection Agency, Towards setting guideline values for the protection of groundwater in Ireland (Interim Report).
[3] Predicted no effect concentration.
[4] European Union (Drinking Water) Regulations 2014. Statutory Instrument No. 122 of 2014.

None of the reported concentrations of TPH, mineral oil, BTEX or MTBE exceeded GAC protective of human health.

It is noted that the HI for samples VAL01 and VAL03 were calculated as 1.586 and 1.045, respectively, where a HI>1 suggests a potential risk to human health from additive toxicological effects for all the individual fractions. Both VAL01 and VAL03 represent soil that has been removed from the source area. The HI for both samples representing soil remining in situ, VAL02 and VAL04, were <<1.

The longer chain length, heavier-end hydrocarbon fractions (>C21) detected are consistent with a HFO loss.

5.3 Soil Leachate Results

Soil leachability analytical results are presented against GAC in Appendix C, Table 5. No TPH fractions, BTEX or MTBE were detected in soil leachate from sample VAL02, this is consistent with their absence in the soil sample itself. MTBE and BTEX compounds were also below laboratory MDLs in soil leachate from VAL04.

Several TPH bands were reported above laboratory MDLs in soil leachate from VAL03 and VAL04, with concentrations of aromatics EC10-EC12, EC12-EC16 and total aliphatic and aromatic C5-C35 exceeding GAC protective of groundwater. The total xylene concentration soil leachate from VAL03 exceeded the GAC protective of surface water and groundwater. VAL03 represents soil that has been removed from the source area.

A summary of TPH and BTEX concentrations exceeding GAC is presented in Table 9.

Table 9. Summary of Soil Leachate GAC Exceedances, µg/L

	Surface Water GAC	Groundwater GAC	VAL03	VAL04
EC10-EC12 Aromatics	~	90	1,228	258
EC12-EC16 Aromatics	~	90	1,110	310
C5-C35 Aliphatics & Aromatics	~	7.5	2,374	568
Xylene (Total)	10	10	41	-

~ No GAC defined

- Not detected above MDL

5.4 Groundwater Results

Groundwater analytical results are presented and screened against GAC in Appendix C Table 6.

All results were below the laboratory MDLs in groundwater from wells: BH306, BH319, BH09 and BH12.

Reported concentrations of aromatic fractions EC10-EC12 and EC12- EC16 in groundwater from BH309A exceeded the GAC protective of groundwater in both sampling events. The reported concentration of aromatic fraction EC16-EC21 was below its MDL in May 2022, and increased above the GAC protective of groundwater in June 2022. There is no available GAC for surface water for these fractions.

BH309A is not a routinely monitored well under the site’s IE licence, therefore there is no available historic data for this well. These concentrations are considered minor exceedances given the site setting. Summary of GAC exceedances in groundwater from BH309A is presented in Table 10 below.

Table 10. Summary of Groundwater GAC Exceedances, BH309A, µg/L

Analyte	May 2022	June 2022	GAC
>EC10-EC12 Aromatics	44	64	90
>EC12-EC16 Aromatics	**130**	**260**	**90**
>EC16-EC21 Aromatics	<10	**130**	**90**
>EC5-EC35 Aromatics	**174**	**454**	**7.5**

Bold denotes an exceedance of groundwater GAC

It is noted that concentration of aromatic fractions (EC10-EC12 and EC12- EC16) increased from 44 µg/L (EC10-EC12) and 130 µg/L (EC12- EC16) in May 2022 to 64µg/L (EC10-EC12) and 260 µg/L (EC12- EC16) in June 2022.

5.5 Quality Assurance and Quality Control

Two duplicate samples were collected as part of the soil and groundwater sampling and analysed for mineral oil, results are presented in Appendix C Tables 3 and 6.

The soil duplicate was for sample VAL04, from the eastern end of the eastern trench. While no mineral oil was detected in VAL04 it was detected at 3,184 mg/kg in the duplicate. This may reflect the heterogeneity within the fill material.

Mineral oil was below the laboratory MDL in both the original and duplicate groundwater samples.

6. Discussion and Recommendations

6.1 Discussion

6.1.1 Summary and Updated CSM

Due to the density of services in the area of the leak, SSE were initially limited to removing contaminated fill beneath the leak by means of hand tools in April 2022. Additional source removal and delineation was conducted using vacuum excavation in June 2022.

AECOM collected a total of four soil samples from the resulting excavation, VAL01 on 28 April 2022 and VAL02 to VAL04 in June 2022.

Samples were analysed for TPH, BTEX, MTBE and mineral oil. There is a marked difference in reported concentrations for samples VAL01 and VAL03 (which represent soil remove from the excavation) and VAL02 and VAL04 (which represent soil remaining in situ at the eastern and western extremities of delineation trenches excavated to either side of the HFO leak).

Analytical results for soil remaining in situ do not exceed GAC protective of human health on a commercial / industrial site. Analytical results for soil leachate from those samples indicate limited exceedances of GAC protective of controlled waters (reported concentrations <100 times GAC).

Analytical results for groundwater only detected TPH fractions in groundwater from BH309A, with concentrations of some aromatic fractions and C3-C35 TPH exceeding GAC protective of groundwater. Due to the lack of historic data for BH309A, it is not clear if these detections are directly related to the HFO spill. Given that no aliphatics were detected (and are present in source area soils and tend to be more soluble than the aromatic fractions), it is considered that these hydrocarbons detected may be related to an older source.

On the basis of field observations and analytical results an updated CSM is outlined in Table 11 below.

Table 11. Revised Conceptual Site Model

	Human Health	Controlled Waters
Source	Limited HFO remaining within made ground overlying shallow bedrock. Field observations indicate that HFO is present within the top of bedrock.	
Pathway	HFO has low volatility and no exceedance of GAC protective of human health on a commercial / industrial site via the vapour pathway was identified. The TPH HI was >1 for soil samples VAL01 and VAL03, which represent soil which was removed from the source area. The TPH HI for soil remaining in situ (VAL02 and VAL04) is <<1.	HFO is viscous when cool and has low solubility. Therefore, HFO present within shallow bedrock, and the limited HFO present within the thin made ground is unlikely to result in a dissolved hydrocarbon plume that migrates down-gradient and would be detectable in surface water from the Shannon Estuary shoreline down-gradient of the source to the north.
Receptor	The HFO spill occurred on a commercial / industrial site with the nearest residential dwelling approximately 250 m to the south-east. The HFO loss occurred from an above ground pipeline outside with a car park adjacent. There is no occupied building above the leak.	The Shannon Estuary. Groundwater within shallow bedrock, however, this is not used for potable supply within the site.
Severity	Minor.	Mild.
Probability	Unlikely.	Unlikely.
Potential Risk	Very Low	Very Low

6.1.2 EPA Action Items

In response to the HFO spill, the original five items raised by the EPA in incident report INCI023056 have been addressed (Items 1 to 5), as have the four items (Items 6 to 10) raised following submission of the earlier report, AECOM report reference 60673806_ACM_EN_RP_002_1, dated 27 May 2022.

1. Groundwater sampling from monitoring wells BH306, BH309A, BH319, BH9 and BH12 for TPH CWG, DRO and Mineral Oil.
   - Groundwater sampling was completed on 05 May 2022 with a second groundwater sample collected from BH309A on 09 June 2022.
2. Subsoil sampling and analysis covering the area of the spill.
   - AECOM attended site on two occasions to collect soil samples; once on 28 April 2022 when sample VAL01 was collected from the excavation area that had been progressed by hand-digging due to the density of services in the area; and again on 08 and 09 June 2022, when accessible source removal was completed by vacuum excavation and the extent of contamination delineated to the east and west.
3. Details of the quantity of contaminated gravel/made ground/subsoil sent off-site for appropriate disposal.
   - A total of 33.82 tonnes of soils were removed from site. This included soil removed by vacuum excavation on 08 and 09 June 2022 (20.76 tonnes) and that which had been removed by hand-digging in April 2022 (13.06 tonnes).
4. The root cause of this leak and measures to be put in place to prevent a reoccurrence of this leak.
   - SSE identified the root cause as human error. SSE has notified all shift managers to ensure that a tool-box talk was held before the end of May 2022 in which operations staff were advised to ensure that fuel is kept flowing through both the A and B ring main pipelines continuously whenever the configuration of the HFO system in the station is changed due to maintenance or repair issues. HFO, when cool, is highly viscous and does not readily flow.

  The A and B ring main pipelines are, therefore heated using steam under normal circumstances to reduce the visosity and allow pumping. When the system was shut-down for repairs, the HFO in the above ground pipeline cooled resulting in a blockage.

  - When the HFO pump was restarted on the night of the incident, the high viscosity of the cooled HFO in the A ring main meant there was no flow path through the A ring main return pipeline and the increased pressure in the pipeline damaged the clamp and caused the leak to occur.

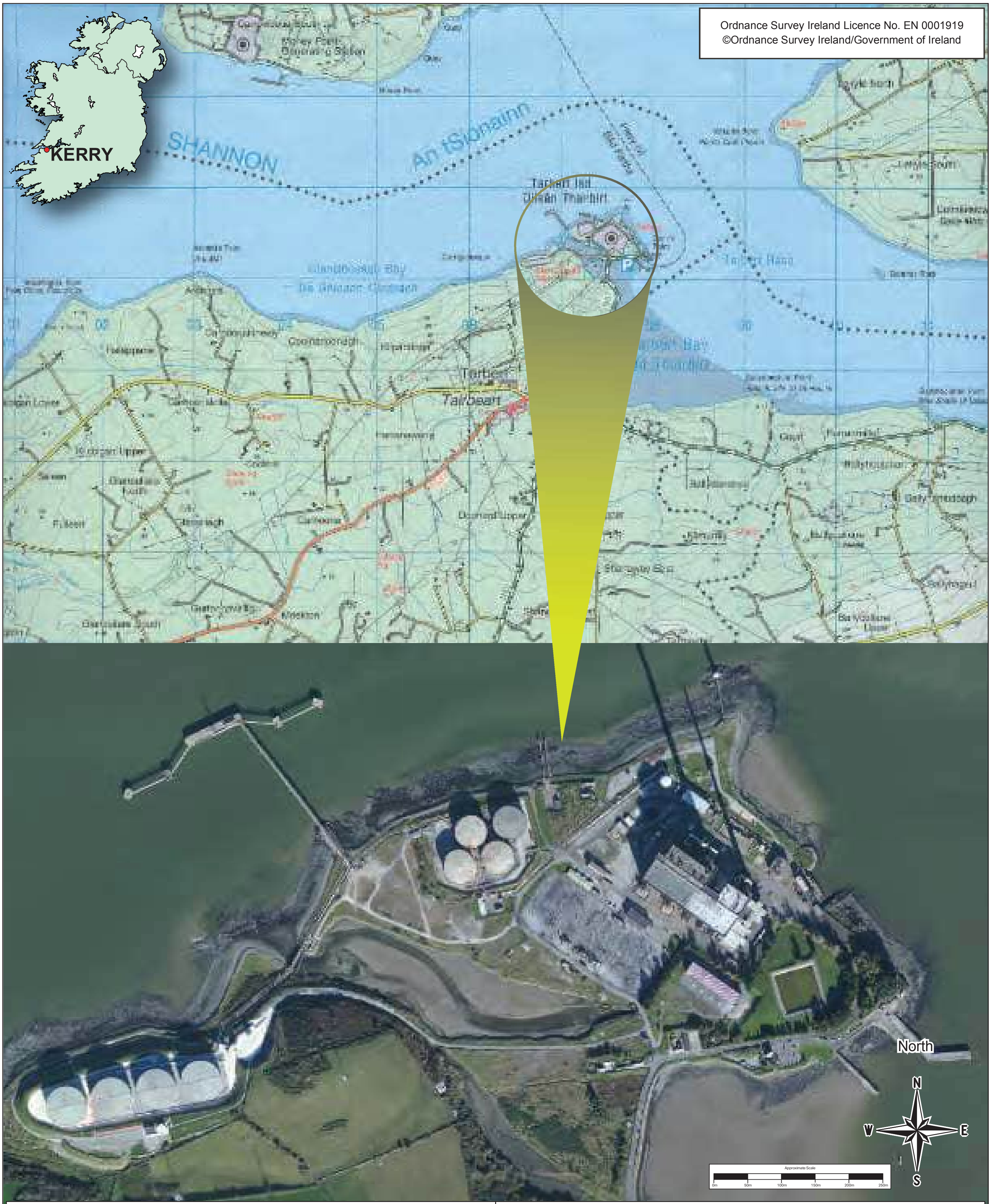
5. A detailed investigation report to include all of the above items.
   - Due to the density of services in the area of the spill, it was not possible to remove all of the contaminated fill material and complete the five original tasks requested by the EPA by the original report deadline. Therefore, an interim report was submitted on 27 May 2022, with this report prepared as an update on subsequent tasks competed.
6. Details and photographs of the current storage measures and location of the removed contaminated soils, as described in Section 5.3 of the submitted report, as well as details of their planned removal from site.
   - All excavated soil has been removed from site by an SSE-appointed waste contractor to an appropriately licensed waste facility. Photographs of the site, including the area where the excavated soil had been stored prior to removal off-site, are presented in Appendix B.
7. Confirmation that all preventative measures outlined in the report have been completed as described.
   - As noted for Item 4, SSE has notified all shift managers to prevent a similar event recurring.
8. Update, outcomes and detailed report on the process / completion of source removal works as described in submitted report, including revised / updated environmental risk assessment following source removal works.
   - These items are addressed within this report.
9. Details of completion of all recommended actions outlined in the submitted assessment report.
   - Addressed within this report.

6.2 Recommendations

As the significant contaminated soil source has been removed from the area and the conceptual site model has identified a very low risk to human health and controlled waters, AECOM recommends that SSE include monitoring wells down-gradient of the HFO spill in future scheduled monitoring events, namely monitoring wells BH306, BH309A and BH319. It is understood that groundwater monitoring is conducted on a biannual basis from well BH306 and BH319 in accordance with the site's IEL. Therefore, only BH309A is an additional well to be monitored in biannual monitoring events.

Groundwater samples should be analysed for TPH CWG, BTEX and MTBE, these analyses are not currently required for BH306 and BH319 under the site's IEL.

Appendix A Figures



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CLIENT

SSE GENERATION IRELAND LIMITED

PROJECT

TARBERT GENERATING STATION
TARBERT, Co. KERRY

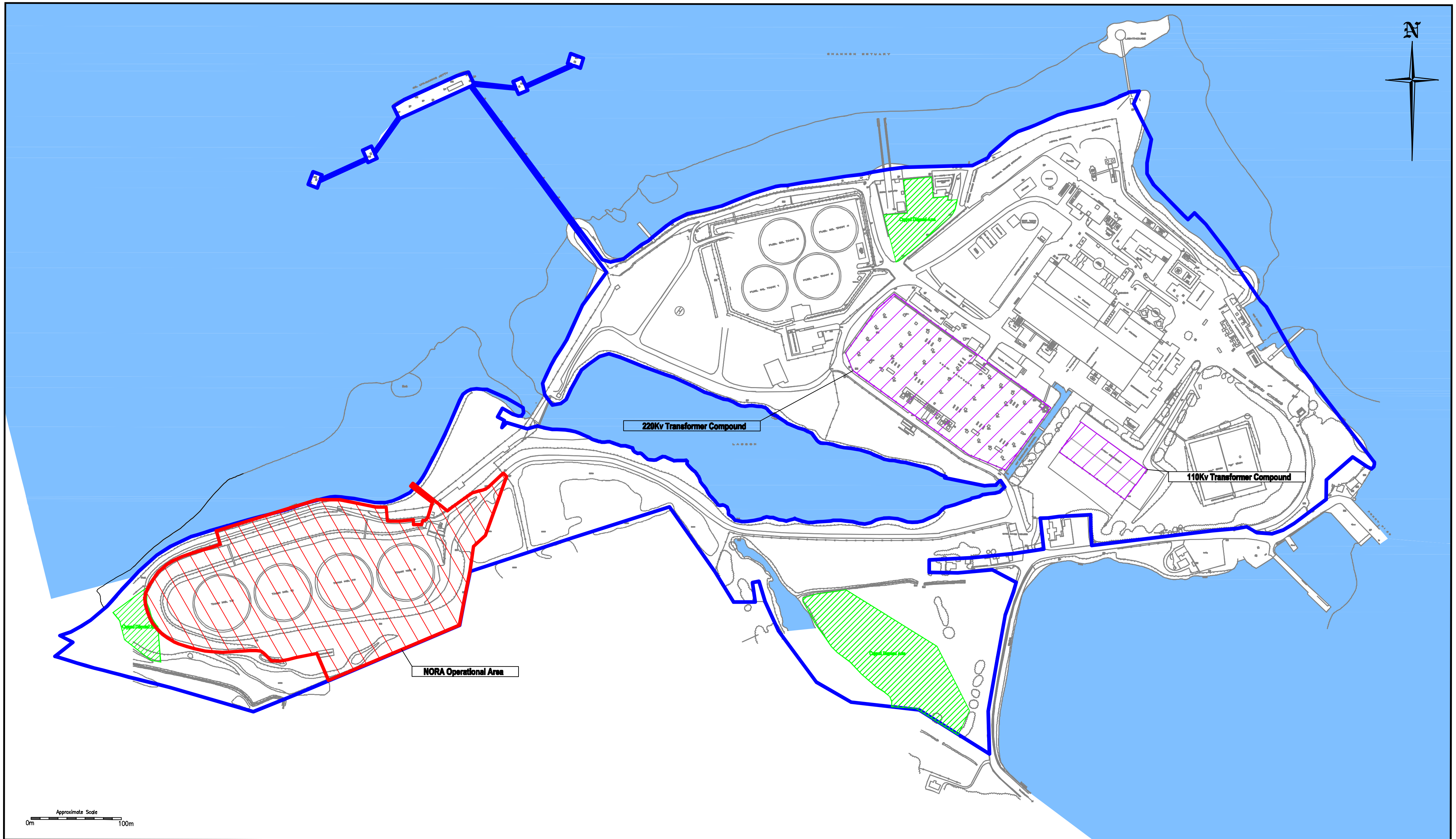
DRAWING TITLE

FIGURE 1 _ SITE LOCATION PLAN

AECOM

4th Floor, Adelphi Plaza, Adelphi Centre, George's Street Upper, Dun Laoghaire, Co. Dublin, Ireland
T +353 (0)1 696-6220
www.aecom.com

DRAWN	ILLUSTRATED	CHECKED	APPROVED	DATE
RMG		EOH	EOH	23/06/2022
SCALE N.T.S	Job No. 60673806			REV. 0



Client

SSE GENERATION IRELAND LIMITED

AECOM

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Office of Origin	DUBLIN		
Designed RMG	Date 26.03.21	Checked JS	Date 26.03.21
Drawn RMG	Date 26.03.21	Approved JS	Date 26.03.21

Contract

TARBERT GENERATING STATION
TARBERT, Co. KERRY

Drg. Title

FIGURE 2 _ SITE LAYOUT PLAN
SHOWING SUBJECT AREA

Original Scale

Original Size
A3

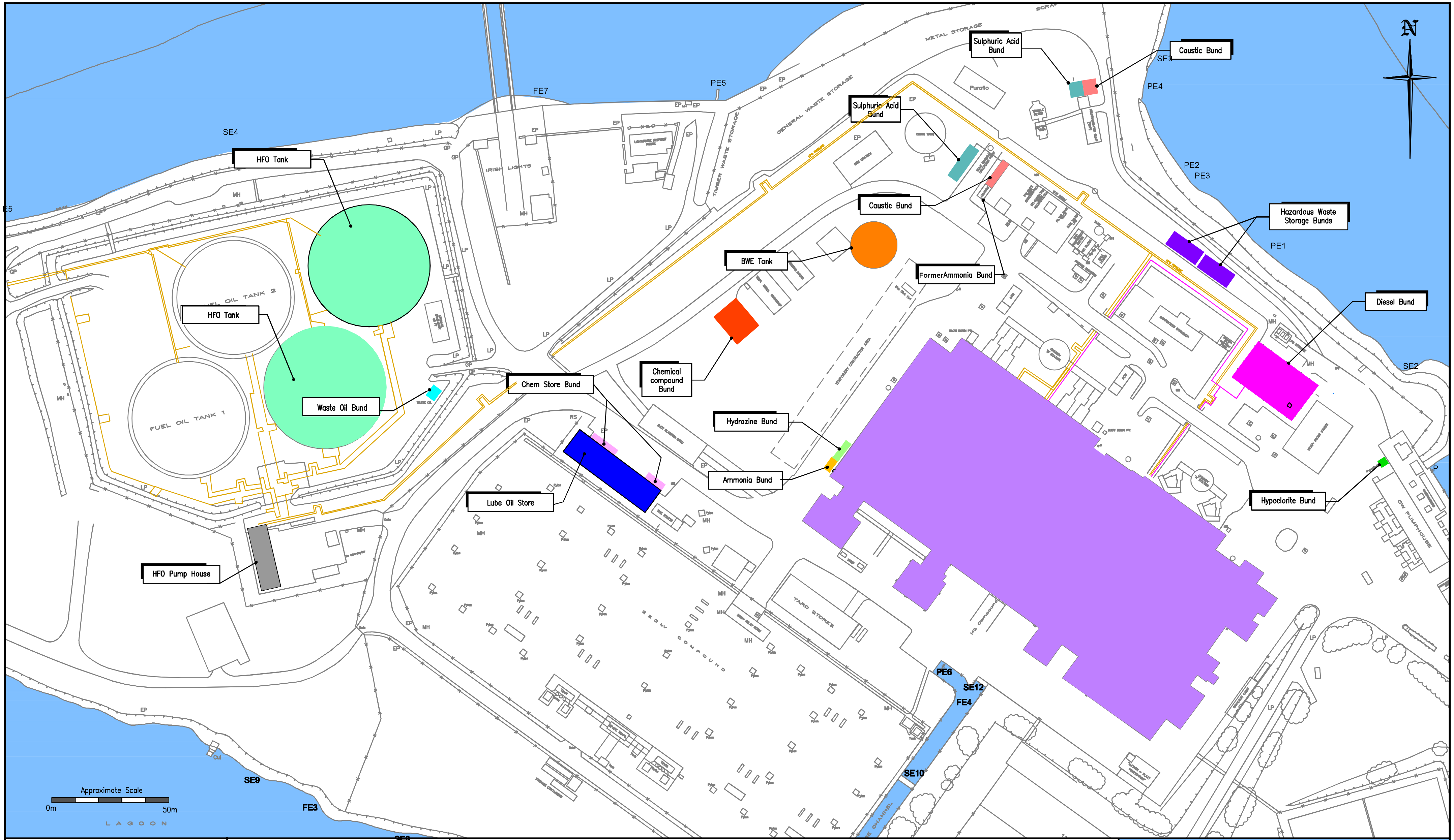
DIMENSIONS IN mm UNLESS STATED OTHERWISE. DO NOT SCALE

Drg. No.
60673806

Rev.
0

LEGEND

▬	**LICENCE BOUNDARY**
🟥	**MAINLAND TANK FARM UNDER CONTROL OF NORA**
🟩	CAPPED DISPOSAL AREA
▨	TRANSFORMER COMPOUNDS REMOVED FROM IPPC LICENSED AREA UNDER CONTROL (OF ESB)



Client

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Office of Origin
DUBLIN

Designed RMG	Date 26.03.21	Checked JS	Date 26.03.21
Drawn RMG	Date 26.03.21	Approved JS	Date 26.03.21

Contract

TARBERT GENERATING STATION
TARBERT, Co. KERRY

Drg. Title

FIGURE 3 _ CHEMICAL AND WASTE STORAGE AREAS

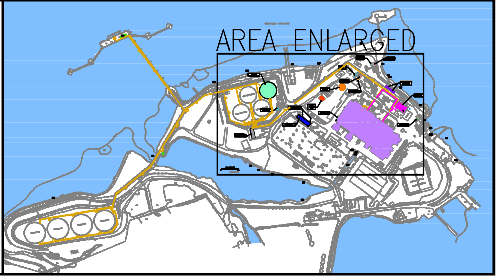
Original Scale
Original Size A3

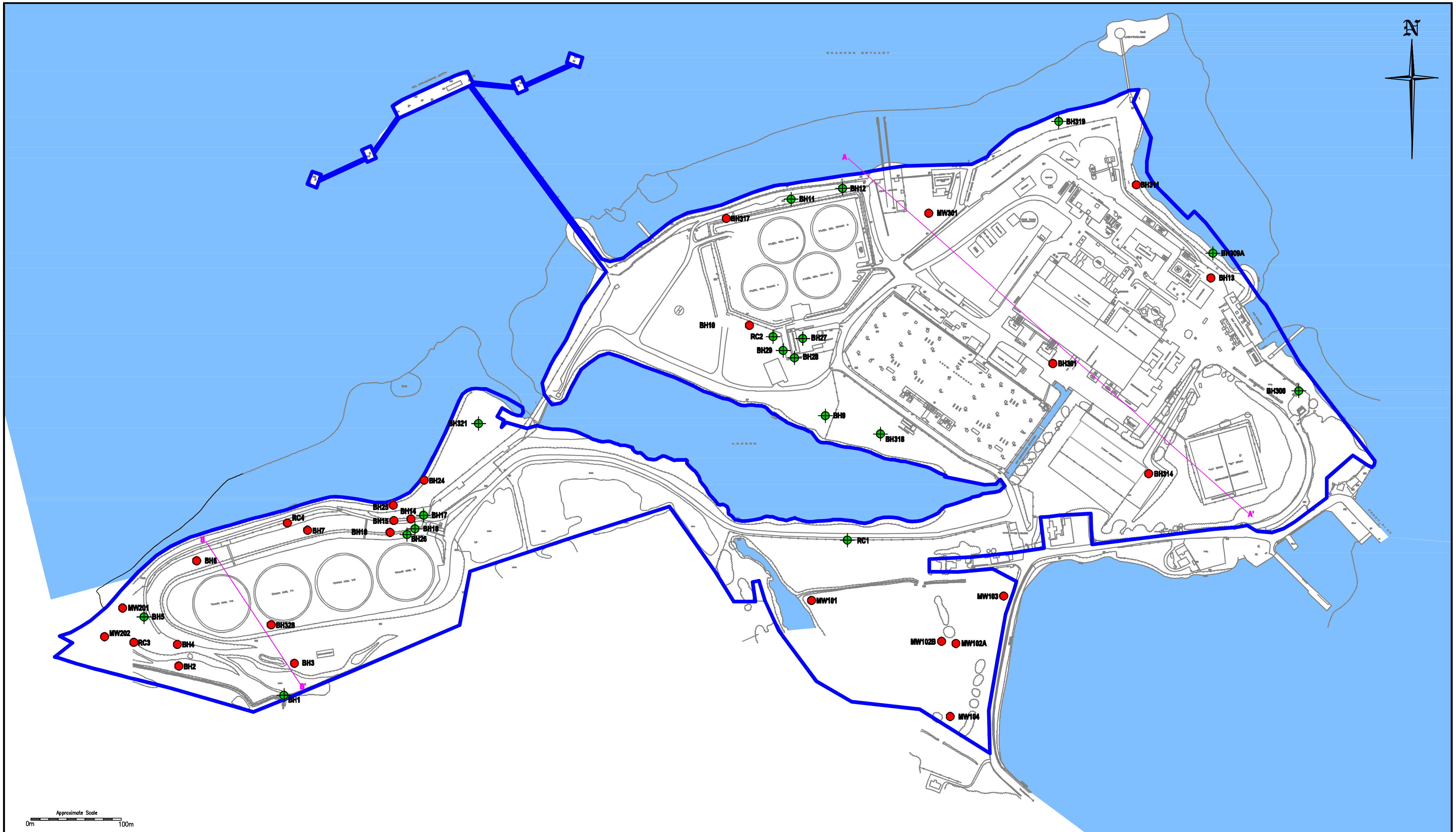
DIMENSIONS IN mm UNLESS STATED OTHERWISE. DO NOT SCALE

Drg. No. 60673806
Rev. 0

Key

- 🟨 Acid Bund
- 🟧 Ammonia Bund
- 🟧 Boiler Wash Effluent
- 🟥 Caustic Bund
- 🟥 Chemical compound Bund
- 🟪 Chem Store Bund
- 🟪 Diesel Bund
- 🟪 Generating Station
- 🟪 Hazardous Waste Storage Bunds
- 🟩 HFO Farm Bund
- 🟩 Hydrazine Bund
- 🟩 Hypoclorite Bund
- 🟦 Sulphuric Acid Bund
- 🟦 Waste Oil Bund
- 🟦 Lube Oil Store
- ⬛ HFO Pump House
- — Heavy Fuel Oil Line
- — Diesel Line





Client

SSE GENERATION IRELAND LIMITED

Contract

TARBERT GENERATING STATION
TARBERT, Co. KERRY

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Drg. Title

FIGURE 4 _ SITE LAYOUT PLAN
SHOWING GROUNDWATER
MONITORING WELLS

Original Scale

Original Size
A3

DIMENSIONS IN mm UNLESS STATED OTHERWISE. DO NOT SCALE

Office of Origin
DUBLIN

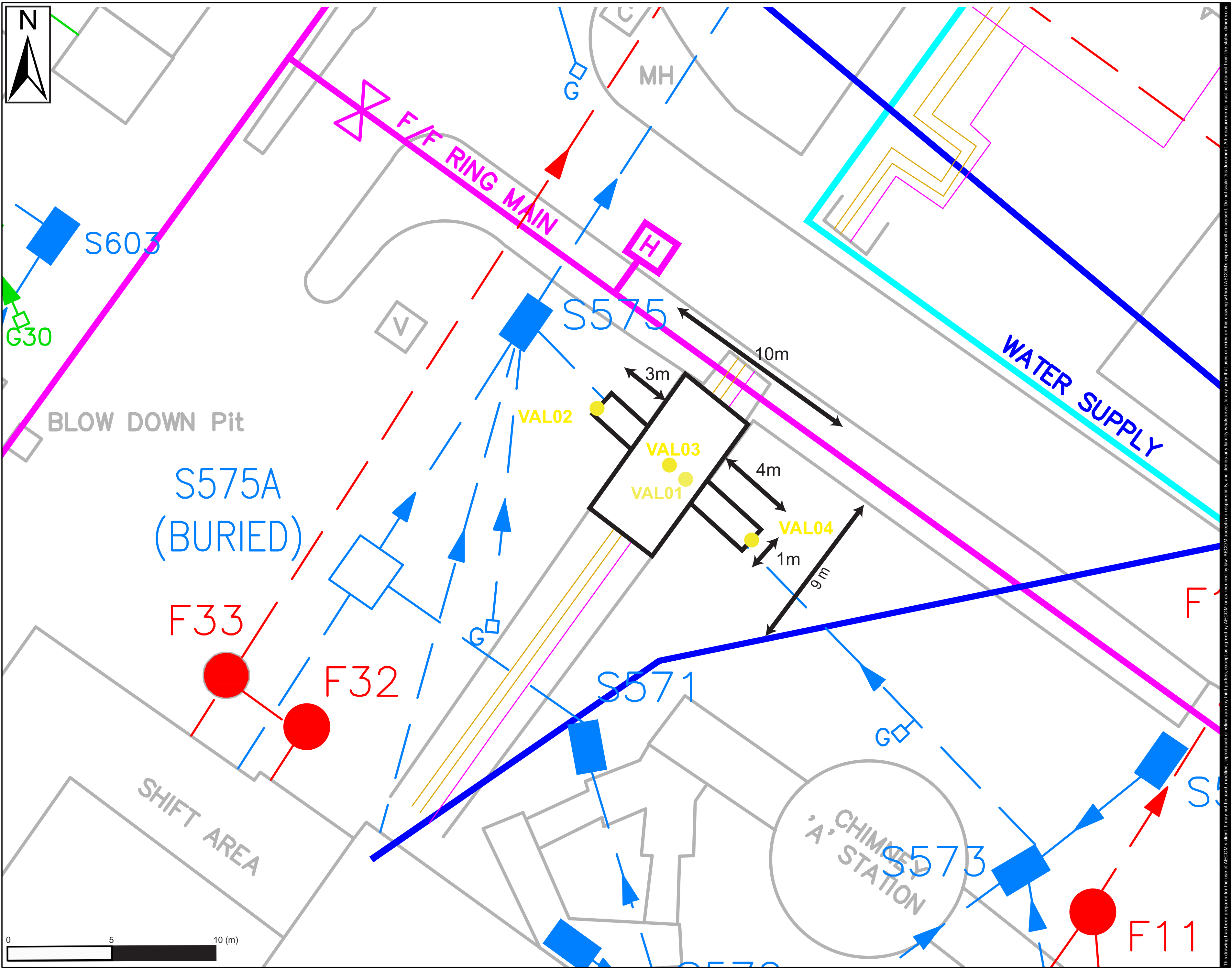
Designed	Date	Checked	Date
RMG	13.02.20	JS	13.02.20
Drawn	**Date**	**Approved**	**Date**
RMG	13.02.20	JS	13.02.20

Drg. No.
60673806

Rev.
0

LEGEND

▬	LICENCE BOUNDARY
⊕	EXISTING BOREHOLE / MONITORING WELL LOCATION
●	COULD NOT LOCATE WELL - PRESUME DESTROYED
—	CROSS SECTION LOCATIONS



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Project Title:
Heavy Fuel Oil Spill Response

Client:
SSE Generation Ireland
Limited

LEGEND

● Validation Sample Locations

SURFACE WATER DRAINS SHOWN THUS : — — —
PROCESS WATER DRAINS SHOWN THUS : — — —
FOUL WATER DRAINS SHOWN THUS : — — —
OIL LINES SHOWN THUS : —
DIESEL LINES SHOWN THUS : —
FIREFIGHTING RING MAIN SHOWN THUS : —
UNDERGROUND CABLES SHOWN THUS : —
DOMESTIC WATER MAIN SHOWN THUS : —
SUPPLY FROM RESERVIOR SHOWN THUS : —
LOCATION OF LAGOON/WATERCOURSE ▨

Source: SSE Drawing 845_0804_0009_00
(Site Services Layout)

Notes:

AECOM Internal Project No:
60673806

Drawing Title:
Figure 2: Excavation and soil sampling locations

Drawing No:
60673806_ACM_EN_DR_001

Drawn:	Chk'd:	App'd:	Date:
RE	AT	EOH	23/06/22

Filename: C:\Users\riccardo.ena\Desktop\first\AECOM Landscape Option 2 Template.mxd

Appendix B Photologs

Photo No. 1

Date: 28 April 2022

Description:

Location of HFO leak from above ground ring main to north of generation building and adjacent to car park.

Photo No. 2

Date: 28 April 2022

Description:

Beneath repaired HFO ring main.

Photo No. 3

Date: 28 April 2022

Description:

Concrete foundation on left hand side beneath support structure for above ground pipework.

Photo No. 4

Date: 28 April 2022

Description:

Heavy fuel oil contamination of fill material beneath the leak.

AECOM

PHOTOGRAPHIC LOG

Client Name: SSE Generation Limited

Site Location: Tarbert Generating Station

Project Number: 60673806

Photo No. 5

Date: 08 June 2022

Description:

Exposed siltstone (bedrock) after removal of overlying made ground in middle trench. Impact of oily product visible at top of bedrock.

Photo No. 6

Date: 09 June 2022

Description:

Excavation extension after completion of sitework. Above ground pipeline running in north-south alignment. Eastern trench showed to the left-hand side. Western trench showed to the right of the photo.

AECOM

PHOTOGRAPHIC LOG

Client Name: SSE Generation Limited	**Site Location: Tarbert Generating Station**	**Project Number: 60673806**

Photo No. 7

Date: 09 June 2022

Description:

Heavy fuel oil contamination and water standing on bottom of eastern trench.

Photo No. 8

Date: 09 June 2022

Description:

Heavy fuel oil contamination and water forming pools around concrete foundations on top of siltstone (bedrock)

Client Name: SSE Generation Limited	**Site Location: Tarbert Generating Station**	**Project Number: 60673806**

Photo No. 9

Date: 09 June 2022

Description:

Made ground encountered on top of bedrock in western trench. No evidence of visual/olfactory contamination was noted at the western end of trench.

Photo No. 10

Date: 09 June 2022

Description:

Minor sheen was noted in manhole S575 down gradient of the spill.

PHOTOGRAPHIC LOG

Client Name: SSE Generation Limited

Site Location: Tarbert Generating Station

Project Number: 60673806

Photo No. 11

Date: June 2022

Description:

Hazardous waste bund where excavated soil had been stored prior to removal off-site.

Appendix C Tables

Appendix C Table 1 - Sample Inventory
SSE Tarbert, HFO Spill Response

Date	Sample ID	Matrix	GRO	TPH CWG	BTEX	MTBE	Mineral Oil
28-Apr-2022	VAL01	Soil	x	x	x	x	x
09-Jun-2022	VAL02	Soil	x	x	x	x	x
09-Jun-2022	VAL03	Soil	x	x	x	x	x
09-Jun-2022	VAL04	Soil	x	x	x	x	x
09-Jun-2022	DUP01	Soil	~	~	~	~	x
05-May-2022	BH306	Groundwater	x	x	x	x	x
05-May-2022	BH309A	Groundwater	x	x	x	x	x
09-Jun-2022	BH309A	Groundwater	x	x	x	x	x
05-May-2022	BH319	Groundwater	x	x	x	x	x
05-May-2022	BH09	Groundwater	x	x	x	x	x
05-May-2022	BH12	Groundwater	x	x	x	x	x
05-May-2022	DUP01	Groundwater	~	~	~	~	x

GRO: Gasoline Range Organics

TPH CWG: total petroleum hydrocarbon criteria working group, speciated with aliphatic and aromatic split

BTEX: benzene, toluene, ethyl benzene, total xylenes

MTBE: methyl tert butyl ether

DUP01 Soil: field duplicate of VAL04

DUP01 Groundwater: field duplicate of BH319

x: indicates parameter analysed

~: indicates parameter not analysed

Appendix C Table 2 - Groundwater Field Observations
SSE Tarbert, HFO Spill Response

Monitoring Well	Sampling Date	Depth to Groundwater	Total Depth	Well Elevation	Groundwater Elevation	pH	Temperature	Electrical Conductivity	Dissolved Oxygen	Field ORP	Redox Potential	Observations
		m bct	m bct	m OD	m OD		°C	µS/cm	mg/L	mV	mV	
BH306	05-May-2022	6.109	7.33	6.68	0.571	~	~	~	~	~	~	Replaced footvalve, well purged dry, sampled on recovery, insufficient water for field measurements.
BH309A	05-May-2022	2.838	5.67	nr	~	5.9	11.9	463	0.6	-85	121	Replaced tubing, purged 20 L, cloudy grey water, no evidence of hydrocarbon contamination.
BH309A	09-Jun-2022	2.75	4.96	nr	~	~	~	~	~	~	~	Cloudy grey water, light sheen noted on top of water while purging. Hydrogen sulfide odour detected. Brown silt observed in water.
BH319	05-May-2022	2.291	5.35	4.04	1.749	6.8	12.0	16,400	2.5	-149	57	Purged 20 L, cloudy grey water, no evidence of hydrocarbon contamination.
BH09	05-May-2022	2.193	5.75	4.03	1.837	6.5	12.5	1,887	0.5	-148	58	Purged 25 L, slightly cloudy grey water, no evidence of hydrocarbon contamination.
BH12	05-May-2022	2.093	4.60	4.52	2.427	5.8	12.2	733	2.6	96	302	Replaced tubing, cloudy grey water, no evidence of hydrocarbon contamination.

m bct: metres below casing top

m OD: metres above Ordance Datum

°C: degress Celsius

µS/cm: microSiemens per centimetre

mg/L: milligrams per litre

mV: milliVolts

~: no field reading taken/not calculated

nr: not recorded

Appendix C Table 3 - Soil Analytical Results
SSE Tarbert, HFO Spill Response

			Soil Sample	**VAL01**	**VAL02**	**VAL03**	**VAL04**	**DUP01**
			Depth	-	0.7	1.1	1.0	
			Date	28-Apr-2022	09-Jun-2022	09-Jun-2022	09-Jun-2022	09-Jun-2022
			Lab Report Number	22-7038-1-090522	22-9755-1-170622	22-9755-1-170622	22-9755-1-170622	22-9755-1-170622
Parameter	**Unit**	**MDL**	**GAC Protective of Human Health Commercial / Industrial**					
Total Petroleum Hydrocarbons								
>C5-C6 Aliphatics	mg/kg	0.1	3,200[#1]	2.9	<0.1	1.1	<0.1	-
>C6-C8 Aliphatics	mg/kg	0.1	7,800[#1]	7.9	<0.1	3.6	<0.1	-
>C8-C10 Aliphatics	mg/kg	0.1	2,000[#1]	22.3	<0.1	14.4	3	-
>C10-C12 Aliphatics	mg/kg	0.2	9,700[#1]	1,067	<0.2	590	<0.2	-
>C12-C16 Aliphatics	mg/kg	4	59,000[#1]	2,778	<4	1,860	<4	-
>C16-C21 Aliphatics	mg/kg	7		5,405	<7	3,641	<7	-
>C21-C35 Aliphatics	mg/kg	7		10,519	<7	7,815	<7	-
>C5-C35 Aliphatics	mg/kg	19		19,802	<19	13,925	<19	-
>EC5-EC7 Aromatics	mg/kg	0.1	26,000[#1]	0.5	<0.1	0.2	<0.1	-
>EC7-EC8 Aromatics	mg/kg	0.1	56,000[#1]	1.2	<0.1	0.7	<0.1	-
>EC8-EC10 Aromatics	mg/kg	0.1	3,500[#1]	5.6	<0.1	3.2	0.5	-
>EC10-EC12 Aromatics	mg/kg	0.2	16,000[#1]	1,712	<0.2	889	<0.2	-
>EC12-EC16 Aromatics	mg/kg	4	36,000[#1]	7,957	<4	4,643	<4	-
>EC16-EC21 Aromatics	mg/kg	7	28,000[#1]	11,652	<7	7,172	<7	-
>EC21-EC35 Aromatics	mg/kg	7	28,000[#1]	18,752	<7	14,093	<7	-
>EC5-EC35 Aromatics	mg/kg	19		40,081	<19	26,801	<19	-
>C5-C35 Aliphatics & Aromatics	mg/kg	38		59,883	<38	40,726	<38	-
EPH C8-C40	mg/kg	30		59,725	<30	32,704	77	-
BTEX								
Benzene	mg/kg	0.005	27[#2]	0.483	<0.005	0.271	<0.005	-
Toluene	mg/kg	0.005	56,000[#1]	1.252	<0.005	0.656	0.022	-
Ethylbenzene	mg/kg	0.005	5,700[#1]	0.738	<0.005	0.403	0.045	-
Xylene (m & p)	mg/kg	0.005	5,900[#1]	2.652	<0.005	1.502	0.186	-
Xylene (o)	mg/kg	0.005	6,600[#1]	2.247	<0.005	1.316	0.214	-
Xylene (Total)	mg/kg	0.01	5,900[#1]	4.899	<0.010	2.818	0.400	-
Oxygenates								
MTBE	mg/kg	0.005	7,900[#3]	0.517	<0.005	0.163	<0.005	-
Mineral Oil								
Mineral Oil (C10-C40)	mg/kg	30	3,500,000[#4]	20,761	<30	14,788	<30	3,184
TOC	%	0.02		-	0.45	-	0.30	-
Moisture Content 105C	%	0.1		-	9.4	34.9	18.3	-

GAC Comments

#1:LQM/CIEH S4ULs 2015
#2:Defra C4SL (2014)
#3:EIC/AGS/CL:AIRE
#4:USEPA RSL (Nov 2021)

Key

GAC: Generic Assessment Criteria
(blank): No assessment criteria available
 - : Not analysed

🟨 Exceedance of HH Soil. Commercial/Industrial Sandy Loam TOC >=0.58 to <1.45%

Appendix C Table 4 - Soil TPH Hazard Index
SSE Tarbert, HFO Spill Response

TPH Analytical Fractions	**Assessment Criteria**	**Hazard Quotient**			
		VAL01	**VAL02**	**VAL03**	**VAL04**
>C5-C6 Aliphatics	3,200	0.001	-	0.000	-
>C6-C8 Aliphatics	7,800	0.001	-	0.000	-
>C8-C10 Aliphatics	2,000	0.011	-	0.007	0.0015
>C10-C12 Aliphatics	9,700	0.110	-	0.061	-
>C12-C16 Aliphatics	59,000	0.047	-	0.032	-
>EC5-EC7 Aromatics	26,000	0.00002	-	-	-
>EC7-EC8 Aromatics	56,000	0.00002	-	0.00001	-
>EC8-EC10 Aromatics	3,500	0.002	-	0.001	0.0001
>EC10-EC12 Aromatics	16,000	0.107	-	0.056	-
>EC12-EC16 Aromatics	36,000	0.221	-	0.129	-
>EC16-EC21 Aromatics	28,000	0.416	-	0.256	-
>EC21-EC35 Aromatics	28,000	0.670	-	0.503	-
Hazard Index		**1.586**	**0**	**1.045**	**0.0016**

xxx	Exceedence of Human Health Hazard Index of 1, Commercial/Industrial Sandy Loam TOC >=0.58 to <1.45%

Prepared by: AT/RE
Checked by: EOH

Appendix C Table 4 - Groundwater Analytical Results
SSE Tarbert, HFO Spill Response

					Monitoring Well	**BH306**	**BH309A**	**BH309A**	**BH319**	**BH09**	**BH12**	**DUP01**
					Sample Method	Grab	3 x well purge	3 x well purge	3 x well purge	3 x well purge	3 x well purge	-
					Date	05-May-2022	05-May-2022	09-Jun-2022	05-May-2022	05-May-2022	05-May-2022	05-May-2022
			GAC Protective of Human Health Commercial / Industrial	**GAC Protective of Controlled Waters - Aquatic Toxicity Transitional / Coastal**	**GAC Protective of Controlled Waters - Groundwater Trigger Values**							
Parameter	**Units**	**MDL**										
Total Petroleum Hydrocarbons												
>C5-C6 Aliphatics	µg/L	<10	Insufficiently volatile[#1]		**15,000[#2]**	<10	<10	<10	<10	<10	<10	~
>C6-C8 Aliphatics	µg/L	<10	Insufficiently volatile[#1]		**15,000[#2]**	<10	<10	<10	<10	<10	<10	~
>C8-C10 Aliphatics	µg/L	<10	Insufficiently volatile[#1]		**300[#2]**	<10	<10	<10	<10	<10	<10	~
>C10-C12 Aliphatics	µg/L	<5	Insufficiently volatile[#1]		**300[#2]**	<5	<5	<5	<5	<5	<5	~
>C12-C16 Aliphatics	µg/L	<10	Insufficiently volatile[#1]		**300[#2]**	<10	<10	<10	<10	<10	<10	~
>C16-C21 Aliphatics	µg/L	<10			**300[#2]**	<10	<10	<10	<10	<10	<10	~
>C21-C35 Aliphatics	µg/L	<10			**300[#2]**	<10	<10	<10	<10	<10	<10	~
>C5-C35 Aliphatics	µg/L	<10				<10	<10	<10	<10	<10	<10	~
>EC5-EC7 Aromatics	µg/L	<10	Insufficiently volatile[#1]	**8[#3]**	**0.75[#4]**	<10	<10	<10	<10	<10	<10	~
>EC7-EC8 Aromatics	µg/L	<10	Insufficiently volatile[#1]	**10[#5]**	**10[#6]**	<10	<10	<10	<10	<10	<10	~
>EC8-EC10 Aromatics	µg/L	<10	Insufficiently volatile[#1]		**300[#2]**	<10	<10	<10	<10	<10	<10	~
>EC10-EC12 Aromatics	µg/L	<5	Insufficiently volatile[#1]		**90[#2]**	<5	44	64	<5	<5	<5	~
>EC12-EC16 Aromatics	µg/L	<10	Insufficiently volatile[#1]		**90[#2]**	<10	**130**	**260**	<10	<10	<10	~
>EC16-EC21 Aromatics	µg/L	<10	Insufficiently volatile[#1]		**90[#2]**	<10	<10	**130**	<10	<10	<10	~
>EC21-EC35 Aromatics	µg/L	<10	Insufficiently volatile[#1]		**90[#2]**	<10	<10	<10	<10	<10	<10	~
>EC5-EC35 Aromatics	µg/L	<10				<10	174	454	<10	<10	<10	~
C5-C35 Aliphatics & Aromatics	µg/L	<10			**7.5[#4]**	<10	**174**	**454**	<10	<10	<10	~
EPH C8-C40	µg/L	<10				<10	440	780	<10	<10	<10	~
BTEX Hydrocarbons												
Benzene	µg/L	<5	20,000[#1]	**8[#3]**	**0.75[#4]**	<5	<5	<5	<5	<5	<5	~
Toluene	µg/L	<5	Insufficiently volatile[#1]	**10[#5]**	**525[#4]**	<5	<5	<5	<5	<5	<5	~
Ethylbenzene	µg/L	<5	Insufficiently volatile[#1]	**20[#8]**	**10[#6]**	<5	<5	<5	<5	<5	<5	~
Xylene (m & p)	µg/L	<5				<5	<5	<5	<5	<5	<5	~
Xylene (o)	µg/L	<5	Insufficiently volatile[#1]	**Use Xylene Total[#5]**	**Use Xylene Total[#6]**	<5	<5	<5	<5	<5	<5	~
Xylene Total	µg/L	<10		**10[#5]**	**10[#6]**	<10	<10	<10	<10	<10	<10	~
Oxygenates												
MTBE	µg/L		7,800,000[#1]	**260[#7]**	**10[#4]**	<5	<5	<5	<5	<5	<5	~
Mineral Oil												
Mineral Oil	µg/L	<10				<10	<10	<10	<10	<10	<10	<10

GAC Environmental Standards Comments

#1:SoBRA GW GAC 2017 (Comm.)
#2:WHO Petroleum DWG 2008
#3:EU Env. Objectives Regs 2015. (Ire) AA-EQS Coast
#4:Ireland GTVs 2016
#5:EU Env. Objectives Regs 2009. (Ire) AA-EQS Marine
#6:IGV Ireland 2003
#7:PNEC (EU REACH) - Coastal
#8:SEPA WAT-SG-53 Marine EQS - AA - 2015

GAC: Generic Assessment Criteria
EQS: Environmental Quality Standard
(blank): No assessment criteria available
~ : Not analysed
MDL: Laboratory method detection limit

Exceedance of GAC protective if Human Health, Groundwater, Commercial/Industrial, Sand

Exceedance of GAC Protective of Controlled Waters Aquatic Toxicity, Ireland, Transitional/Coastal Surface Water

Exceedance of GAC Protective of Controlled Waters Groundwater Threshold Value, Ireland, Groundwater

Exceedance of GACs Protective of Controlled Waters both Transitional/Coastal AND Groundwater

Appendix D Laboratory Reports

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AECOM
1st Floor, Montrose House
Carrigaline Road
Douglas
Cork
Ireland

Attention : Roman Puotkalis

Date : 9th May, 2022

Your reference : 60654865

Our reference : Test Report 22/7038 Batch 1

Location : Tarbert

Date samples received : 29th April, 2022

Status : Final Report

Issue : 1

One sample was received for analysis on 29th April, 2022 and was 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:

Simon Gomery BSc

Project Manager

Client Name:	AECOM	**Report :**	**Solid**
Reference:	60654865		
Location:	Tarbert	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Roman Puotkalis		
EMT Job No:	22/7038		

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3										LOD/LOR	Units	Method No.
Sample ID	VAL01												
Depth													
COC No / misc													
Containers	V J T												
Sample Date	28/04/2022												
Sample Type	Sand												
Batch Number	1												
Date of Receipt	29/04/2022												
EPH (C8-C40) (EH_1D_Total)$^{\#M}$	59725										<30	mg/kg	TM5/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	20761$_{AA}$										<30	mg/kg	TM5/PM8/PM16
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)$^{\#M}$	2.9^{SV}										<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)$^{\#M}$	7.9^{SV}										<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	22.3^{SV}										<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)$^{\#M}$	1067.2$_{AA}$										<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)$^{\#M}$	2778$_{AA}$										<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)$^{\#M}$	5405$_{AA}$										<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)$^{\#M}$	10519$_{AA}$										<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-35 (EH+HS_CU_1D_AL)	19802$_{AA}$										<19	mg/kg	TM5/TM36/PM8/PM12/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)$^{\#}$	0.5^{SV}										<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)$^{\#}$	1.2^{SV}										<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)$^{\#M}$	5.6^{SV}										<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)$^{\#}$	1712.2$_{AA}$										<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)$^{\#}$	7957$_{AA}$										<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)$^{\#}$	11652$_{AA}$										<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)$^{\#}$	18752$_{AA}$										<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-35 (EH+HS_CU_1D_AR)$^{\#}$	40081$_{AA}$										<19	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-35) (EH+HS_CU_1D_Total)	59883$_{AA}$										<38	mg/kg	TM5/TM36/PM8/PM12/PM16
MTBE$^{\#}$	517^{SV}										<5	ug/kg	TM36/PM12
Benzene$^{\#}$	483^{SV}										<5	ug/kg	TM36/PM12
Toluene$^{\#}$	1252^{SV}										<5	ug/kg	TM36/PM12
Ethylbenzene$^{\#}$	738^{SV}										<5	ug/kg	TM36/PM12
m/p-Xylene$^{\#}$	2652^{SV}										<5	ug/kg	TM36/PM12
o-Xylene$^{\#}$	2247^{SV}										<5	ug/kg	TM36/PM12
Total Organic Carbon$^{\#}$	NDP										<0.02	%	TM21/PM24
Sample Type	Sand											None	PM13/PM0
Sample Colour	Black											None	PM13/PM0
Other Items	oil, stones											None	PM13/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

EPH Interpretation Report

Client Name: AECOM
Reference: 60654865
Location: Tarbert
Contact: Roman Puotkalis

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
22/7038	1	VAL01		1-3	Degraded diesel & Possible degraded kerosene

Client Name: AECOM
Reference: 60654865
Location: Tarbert
Contact: Roman Puotkalis

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Method No.	NDP Reason
22/7038	1	VAL01		1-3	TM21/PM24	Oily sample unsuitable for this test

Notification of Deviating Samples

Client Name: AECOM
Reference: 60654865
Location: Tarbert
Contact: Roman Puotkalis

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/7038						

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.: 22/7038

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
AA	x27 Dilution

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: 22/7038

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
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	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
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	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	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	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	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
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details	Yes		AR	Yes
PM13	A visual examination of the solid sample is carried out to ascertain sample make up, colour and any other inclusions. This is not a geotechnical description.	PM0	No preparation is required.			AR	No
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.	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: 22/7038

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
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	Yes	AR	Yes

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AECOM
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Ireland

UKAS TESTING 4225

Attention :	Amy Turner
Date :	18th May, 2022
Your reference :	60673806
Our reference :	Test Report 22/7563 Batch 1
Location :	Tarbert
Date samples received :	10th May, 2022
Status :	Final Report
Issue :	1

Six samples were received for analysis on 10th May, 2022 of which six 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:

Boden

Paul Boden BSc

Senior Project Manager

Client Name: AECOM
Reference: 60673806
Location: Tarbert
Contact: Amy Turner
EMT Job No: 22/7563

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.	1-3	4-6	7-9	10-12	13-15	16-18					LOD/LOR	Units	Method No.
Sample ID	BH306	BH309A	BH319	BH9	BH12	DUP01							
Depth													
COC No / misc													
Containers	V G	V G	V G	V G	V G	V G							
Sample Date	05/05/2022	05/05/2022	05/05/2022	05/05/2022	05/05/2022	05/05/2022							
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water							
Batch Number	1	1	1	1	1	1							
Date of Receipt	10/05/2022	10/05/2022	10/05/2022	10/05/2022	10/05/2022	10/05/2022							
MTBE #	<5	<5	<5	<5	<5	-					<5	ug/l	TM36/PM12
Benzene #	<5	<5	<5	<5	<5	-					<5	ug/l	TM36/PM12
Toluene #	<5	<5	<5	<5	<5	-					<5	ug/l	TM36/PM12
Ethylbenzene #	<5	<5	<5	<5	<5	-					<5	ug/l	TM36/PM12
m/p-Xylene #	<5	<5	<5	<5	<5	-					<5	ug/l	TM36/PM12
o-Xylene #	<5	<5	<5	<5	<5	-					<5	ug/l	TM36/PM12
EPH (C8-C40) #	<10	440	<10	<10	<10	-					<10	ug/l	TM5/PM30
Mineral Oil (C10-C40)	<10	<10	<10	<10	<10	<10					<10	ug/l	TM5/PM16/PM30
TPH CWG													
Aliphatics													
>C5-C6 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM36/PM12
>C6-C8 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM36/PM12
>C8-C10 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM36/PM12
>C10-C12 #	<5	<5	<5	<5	<5	-					<5	ug/l	TM5/PM16/PM30
>C12-C16 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM5/PM16/PM30
>C16-C21 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM5/PM16/PM30
>C21-C35 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM5/TM36/PM12/PM16/PM30
Aromatics													
>C5-EC7 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM36/PM12
>EC7-EC8 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM36/PM12
>EC8-EC10 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM36/PM12
>EC10-EC12 #	<5	44	<5	<5	<5	-					<5	ug/l	TM5/PM16/PM30
>EC12-EC16 #	<10	130	<10	<10	<10	-					<10	ug/l	TM5/PM16/PM30
>EC16-EC21 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM5/PM16/PM30
>EC21-EC35 #	<10	<10	<10	<10	<10	-					<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35 #	<10	174	<10	<10	<10	-					<10	ug/l	TM5/TM36/PM12/PM16/PM30
Total aliphatics and aromatics(C5-35) #	<10	174	<10	<10	<10	-					<10	ug/l	TM5/TM36/PM12/PM16/PM30

Notification of Deviating Samples

Client Name: AECOM
Reference: 60673806
Location: Tarbert
Contact: Amy Turner

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/7563						

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.: 22/7563

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: 22/7563

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
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.				
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	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.	PM30	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			
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			

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AECOM
1st Floor, Montrose House
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Ireland

Attention : Amy Turner

Date : 16th June, 2022

Your reference : 60654865

Our reference : Test Report 22/9743 Batch 1

Location : Tarbert

Date samples received : 14th June, 2022

Status : Final Report

Issue : 1

Two samples were received for analysis on 14th June, 2022 of which one was 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:

Paul Boden BSc
Senior Project Manager

Client Name:	AECOM	**Report :**	**Liquid**
Reference:	60654865		
Location:	Tarbert		
Contact:	Amy Turner	**Liquids/products:**	V=40ml vial, G=glass bottle, P=plastic bottle
EMT Job No:	22/9743		$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-5												
Sample ID	BH309A												
Depth													
COC No / misc													
Containers	V P G												
Sample Date	09/06/2022												
Sample Type	Ground Water												
Batch Number	1										LOD/LOR	Units	Method No.
Date of Receipt	14/06/2022												
MTBE #	<5										<5	ug/l	TM36/PM12
Benzene #	<5										<5	ug/l	TM36/PM12
Toluene #	<5										<5	ug/l	TM36/PM12
Ethylbenzene #	<5										<5	ug/l	TM36/PM12
m/p-Xylene #	<5										<5	ug/l	TM36/PM12
o-Xylene #	<5										<5	ug/l	TM36/PM12
EPH (C8-C40) #	780										<10	ug/l	TM5/PM30
Mineral Oil (C10-C40)	<10										<10	ug/l	TM5/PM16/PM30
TPH CWG													
Aliphatics													
>C5-C6 #	<10										<10	ug/l	TM36/PM12
>C6-C8 #	<10										<10	ug/l	TM36/PM12
>C8-C10 #	<10										<10	ug/l	TM36/PM12
>C10-C12 #	<5										<5	ug/l	TM5/PM16/PM30
>C12-C16 #	<10										<10	ug/l	TM5/PM16/PM30
>C16-C21 #	<10										<10	ug/l	TM5/PM16/PM30
>C21-C35 #	<10										<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35 #	<10										<10	ug/l	TM5/TM36/PM12/PM16/PM30
Aromatics													
>C5-EC7 #	<10										<10	ug/l	TM36/PM12
>EC7-EC8 #	<10										<10	ug/l	TM36/PM12
>EC8-EC10 #	<10										<10	ug/l	TM36/PM12
>EC10-EC12 #	64										<5	ug/l	TM5/PM16/PM30
>EC12-EC16 #	260										<10	ug/l	TM5/PM16/PM30
>EC16-EC21 #	130										<10	ug/l	TM5/PM16/PM30
>EC21-EC35 #	<10										<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35 #	454										<10	ug/l	TM5/TM36/PM12/PM16/PM30
Total aliphatics and aromatics(C5-35) #	454										<10	ug/l	TM5/TM36/PM12/PM16/PM30

Client Name: AECOM
Reference: 60654865
Location: Tarbert
Contact: Amy Turner

Matrix : Liquid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
22/9743	1	BH309A		1-5	Dissolved phase aromatics

Notification of Deviating Samples

Client Name: AECOM
Reference: 60654865
Location: Tarbert
Contact: Amy Turner

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/9743						

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.: 22/9743

SOILS and ASH

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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: 22/9743

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
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.				
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	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.	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.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.				
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			
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			

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AECOM
4th Floor Adelphi Plaza
Adelphi Centre
Georges Street Upper
Dun Laoghaire, Co Dublin
Ireland

UKAS TESTING 4225

Attention :	Amy Turner
Date :	17th June, 2022
Your reference :	60654865
Our reference :	Test Report 22/9755 Batch 1
Location :	Tarbert
Date samples received :	14th June, 2022
Status :	Final Report
Issue :	1

Four samples were received for analysis on 14th June, 2022 of which four 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:

Paul Boden BSc
Senior Project Manager

Client Name: AECOM
Reference: 60654865
Location: Tarbert
Contact: Amy Turner
EMT Job No: 22/9755

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12	LOD/LOR	Units	Method No.
Sample ID	VAL02	VAL03	VAL04	DUP01			
Depth							
COC No / misc							
Containers	V J T	V J T	V J T	V J T			
Sample Date	09/06/2022	10/06/2022	10/06/2022	10/06/2022			
Sample Type	Clay	Clay	Clay	Soil			
Batch Number	1	1	1	1			
Date of Receipt	14/06/2022	14/06/2022	14/06/2022	14/06/2022			
EPH (C8-C40) (EH_1D_Total)$^{\#M}$	<30	32704$_{AD}$	77	-	<30	mg/kg	TM5/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	14788$_{AA}$	<30	3184	<30	mg/kg	TM5/PM8/PM16
TPH CWG							
Aliphatics							
>C5-C6 (HS_1D_AL)$^{\#M}$	<0.1	1.1^{SV}	<0.1	-	<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)$^{\#M}$	<0.1	3.6^{SV}	<0.1	-	<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	14.4^{SV}	3.0	-	<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)$^{\#M}$	<0.2	590.0$_{AA}$	<0.2	-	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)$^{\#M}$	<4	1860$_{AA}$	<4	-	<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)$^{\#M}$	<7	3641$_{AA}$	<7	-	<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)$^{\#M}$	<7	7815$_{AA}$	<7	-	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-35 (EH+HS_CU_1D_AL)	<19	13925$_{AA}$	<19	-	<19	mg/kg	TM5/TM36/PM8/PM12/PM16
Aromatics							
>C5-EC7 (HS_1D_AR)$^{\#}$	<0.1	0.2^{SV}	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)$^{\#}$	<0.1	0.7^{SV}	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)$^{\#M}$	<0.1	3.2^{SV}	0.5	-	<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)$^{\#}$	<0.2	888.6$_{AB}$	<0.2	-	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)$^{\#}$	<4	4643$_{AB}$	<4	-	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)$^{\#}$	<7	7172$_{AB}$	<7	-	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)$^{\#}$	<7	14093$_{AB}$	<7	-	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-35 (EH+HS_CU_1D_AR)$^{\#}$	<19	26801$_{AB}$	<19	-	<19	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-35) (EH+HS_CU_1D_Total)	<38	40726$_{AB}$	<38	-	<38	mg/kg	TM5/TM36/PM8/PM12/PM16
MTBE$^{\#}$	<5	163^{SV}	<5	-	<5	ug/kg	TM36/PM12
Benzene$^{\#}$	<5	271^{SV}	<5	-	<5	ug/kg	TM36/PM12
Toluene$^{\#}$	<5	656^{SV}	22	-	<5	ug/kg	TM36/PM12
Ethylbenzene$^{\#}$	<5	403^{SV}	45	-	<5	ug/kg	TM36/PM12
m/p-Xylene$^{\#}$	<5	1502^{SV}	186	-	<5	ug/kg	TM36/PM12
o-Xylene$^{\#}$	<5	1316^{SV}	214	-	<5	ug/kg	TM36/PM12
Total Organic Carbon$^{\#}$	0.45	NDP	0.30	-	<0.02	%	TM21/PM24
Sample Type	Clay	Clay	Clay	-		None	PM13/PM0
Sample Colour	Medium Brown	Medium Brown	Medium Brown	-		None	PM13/PM0
Other Items	stones	stones, oil	stones, sand	-		None	PM13/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: AECOM
Reference: 60654865
Location: Tarbert
Contact: Amy Turner
EMT Job No: 22/9755

Report : **CEN 10:1 1 Batch**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9								LOD/LOR	Units	Method No.
Sample ID	VAL02	VAL03	VAL04										
Depth													
COC No / misc													
Containers	V J T	V J T	V J T										
Sample Date	09/06/2022	10/06/2022	10/06/2022										
Sample Type	Clay	Clay	Clay										
Batch Number	1	1	1										
Date of Receipt	14/06/2022	14/06/2022	14/06/2022										
TPH CWG													
Aliphatics													
>C5-C6	<10	<10	<10								<10	ug/l	TM36/PM69
>C6-C8	<10	21	<10								<10	ug/l	TM36/PM69
>C8-C10	<10	48	<10								<10	ug/l	TM36/PM69
>C10-C12	<5	<35$_{AC}$	<5^{SV}								<5	ug/l	TM5/PM16/PM30
>C12-C16	<10	<70$_{AC}$	<10^{SV}								<10	ug/l	TM5/PM16/PM30
>C16-C21	<10	<70$_{AC}$	<10^{SV}								<10	ug/l	TM5/PM16/PM30
>C21-C35	<10	<70$_{AC}$	<10^{SV}								<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35	<10	<70$_{AC}$	<10								<10	ug/l	TM5/TM36/PM16/PM30/PM69
Aromatics													
>C5-EC7	<10	<10	<10								<10	ug/l	TM36/PM69
>EC7-EC8	<10	<10	<10								<10	ug/l	TM36/PM69
>EC8-EC10	<10	46	<10								<10	ug/l	TM36/PM69
>EC10-EC12	<5	1228$_{AC}$	258^{SV}								<5	ug/l	TM5/PM16/PM30
>EC12-EC16	<10	1100$_{AC}$	310^{SV}								<10	ug/l	TM5/PM16/PM30
>EC16-EC21	<10	<70$_{AC}$	<10^{SV}								<10	ug/l	TM5/PM16/PM30
>EC21-EC35	<10	<70$_{AC}$	<10^{SV}								<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35	<10	2374$_{AC}$	568								<10	ug/l	TM5/TM36/PM16/PM30/PM69
Total aliphatics and aromatics(C5-35)	<10	2374$_{AC}$	568								<10	ug/l	TM5/TM36/PM16/PM30/PM69
MTBE	<5	<5	<5								<5	ug/l	TM36/PM69
Benzene	<5	<5	<5								<5	ug/l	TM36/PM69
Toluene	<5	9	<5								<5	ug/l	TM36/PM69
Ethylbenzene	<5	5	<5								<5	ug/l	TM36/PM69
m/p-Xylene	<5	17	<5								<5	ug/l	TM36/PM69
o-Xylene	<5	24	<5								<5	ug/l	TM36/PM69

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: AECOM
Reference: 60654865
Location: Tarbert
Contact: Amy Turner

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Method No.	NDP Reason
22/9755	1	VAL03		4-6	TM21/PM24	Oily sample unsuitable for this test

Client Name: AECOM
Reference: 60654865
Location: Tarbert
Contact: Amy Turner

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/9755						

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.

EMT Job No.: 22/9755

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
AA	x2 Dilution
AB	x5 Dilution
AC	x7 Dilution
AD	x10 Dilution

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: 22/9755

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
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
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.			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	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	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	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	Yes	AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM16/PM30/PM69	please refer to PM16/PM30 and PM69 for method details			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
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details	Yes		AR	Yes
PM13	A visual examination of the solid sample is carried out to ascertain sample make up, colour and any other inclusions. This is not a geotechnical description.	PM0	No preparation is required.			AR	No

EMT Job No: 22/9755

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
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.	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
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
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	Yes	AR	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.	PM69	One part soil is mixed with 10 parts water in a vial leaving no headspace. The mixture is shaken and then left to leach for 24 hours before VOC analysis.			AR	Yes
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

Appendix E Site Service Drawing

LEGEND:

LINEWORK/HATCHING:

SURFACE WATER DRAINS SHOWN THUS : — — —
PROCESS WATER DRAINS SHOWN THUS : — — —
FOUL WATER DRAINS SHOWN THUS : — — —
OIL LINES SHOWN THUS : ———
DIESEL LINES SHOWN THUS : ———
FIREFIGHTING RING MAIN SHOWN THUS : ———

UNDERGROUND CABLES SHOWN THUS : ———
DOMESTIC WATER MAIN SHOWN THUS : ———
SUPPLY FROM RESERVOIR SHOWN THUS : ———
LOCATION OF LAGOON/WATERCOURSE ▨

SYMBOLS:

PIPE MANHOLES SHOWN THUS : P
VALVE MANHOLES SHOWN THUS : V
SUMP MANHOLES SHOWN THUS : S
MANHOLES SHOWN THUS : S525 🟩 S526 🟦
FOUL MANHOLES SHOWN THUS : ● F33
GULLY SHOWN THUS : □ G

ARMSTRONG JUNCTION SHOWN THUS : ◇ AJ
VALVE LOCATION SHOWN THUS: ⋈
SURFACE WATER DISCHARGE POINTS: SE
PROCESS WATER DISCHARGE POINTS: PE
FOUL WATER DISCHARGE POINTS: FE
BOREHOLE/MONITORING WELL LOCATION: ⊕

1:625
0 10 20 30 40[m]

10	–	–	–	–
09	–	–	–	–
08	–	–	–	–
07	–	–	–	–
06	–	–	–	–
05	–	–	–	–
04	–	–	–	–
03	–	–	–	–
02	10/03/2020	S.FRASER	C.O'CONNELL	DRAWING UPDATED FOLLOWING REVIEW.
01	01	LPS	CO	XREF UPDATED AS PER CHANGES TO RELATED DRAWINGS FOR C,O'CONNELL
REV	DATE	DRAWN BY	APPROVED BY	AMENDMENTS

sse generation

DRAWING STATUS
AS–BUILT

LOCATION
TARBERT POWER STATION

SCALE
1:625 @ A0

SSE PROJECT NUMBER

TITLE
SITE SERVICES LAYOUT
(MAIN POWER PLANT AREA)
(TARBERT DRG No. TAR–SSL–01–001)

DRAWN BY
C.RAMSAY

DRAWN DATE
07/11/2014

APPROVED BY
C.O'CONNELL

APPROVED DATE
07/11/2014

SSE DRAWING NUMBER
845_0804_0009

SHEET
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REV.
02

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