Appendix 13B

General Quantitative Risk Assessment

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Tier 2 Generic Quantitative Risk Assessment

Tynagh North OCGT Development

EP Energy Developments

Project number: 60661667

12 January 2023

DRAFT

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Quality information

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The investigation itself was designed generally to meet the objectives of an exploratory / main investigation, as defined by BS10175:2011 Investigation of Potentially Contaminated Sites: Code of Practice (BSI) (check - 10 to 25 m centres for main phase of investigation; and 25 to 50 m centres for exploratory phase investigations). As an exploratory/ main investigation, the results may not provide sufficient data to make detailed estimates of the quantities involved in any remediation work, if required.

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.

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1. Introduction

AECOM Infrastructure & Environment UK Limited (hereafter referred to as "AECOM") was commissioned by EP Energy Developments Limited to prepare a Tier 2 Generic Quantitative Risk Assessment (GQRA) for the construction of a new Open Cycle Gas Turbine (OCGT) plant and ancillary connection infrastructure ('the Proposed Development') at Tynagh Power Station in Derryfrench, Loughrea, Co. Galway.

The Proposed Development is bordered to the south and south-east by the former Tynagh Mine complex and to the south by the proposed Tynagh OCGT Project 1 site and beyond that, the existing Tynagh Power Station Combined Cycle Gas Turbine (CCGT) Power Station. Sperrin Galvanisers Ltd., an Industrial Emissions (IE) licensed facility, is located adjacent to the western boundary of the Site.

In addition to the existing Tynagh Power Station, a planning application Ref. 21/2192 (submitted as an application to Galway County Council in November 2021, and currently awaiting determination by ABP under Ref. PL07.313538, and referred to in the EIAR as 'Submitted Development Ref: 21/2192') is a separate 299MW OCGT development and project to that of the Proposed Development which is for a 350MW facility. Submitted Development Ref: 21/2192 is to be located to the south of the Proposed Development, primarily to the west of the existing Tynagh Power Station. Subject to planning approval being obtained for the Submitted Development Ref: 21/2192, the Applicant intends to build out and operate both Submitted Development Ref: 21/2192 and the Tynagh North OCGT. With sections of this document and appendices the Submitted Development Ref: 21/2192 is referred to as such or as Tynagh 1.

Site investigation was required to assist with the identification of potentially significant pollutant linkages associated with soil and groundwater in relation to the Proposed Development.

1.1 Background

The Proposed Development is situated in Derryfrench, Loughrea, Co. Galway, Ireland (Irish Transverse Mercator (ITM) Reference X: 574431; Y: 713205) (Figure 1 in Appendix A). The entire Site is located within the administrative area of Galway County Council (GCC).

The Site on which the Proposed Development will be located is to the north of the proposed Submitted Development Ref: 21/2192 and the existing generation building at the Tynagh Power Station.

1.2 Proposed Development

The Proposed Development (also referred to as Tynagh North) relates to to the 1 no. Open Cycle Gas Turbine (OCGT) plant, acoustic barriers, secondary fuel storage and unloading facility, distillate fuel gantry, water storage tanks, surface water drainage system and all associated ancillary development, site works and services for which planning permission is being sought.

The Proposed Development will comprise of the following main components (refer to Environmental Impact Assessment Report (EIAR) Chapter 5: The Proposed Development for full details):

- Open Cycle Gas Turbine (OCGT) unit, 40m emissions stack and balance of plant;
- Acoustic barriers;
- Secondary fuel storage and unloading facility;
- Distillate fuel gantry;
- Water Storage Tanks; and
- Surface Water Drainage system.

The Proposed Development plan is included as Figure 2 in Appendix A.

1.3 Objectives

Based on the site background information detailed above, AECOM appreciates the objective of the GQRA is to determine whether potentially significant risks to human health or controlled waters exist in the context of the Proposed Development resulting from the pre-existing soil or groundwater chemistry at the Site. This GQRA will be submitted as part of the planning application and EIAR.

In order to achieve this objective, AECOM has completed the following:

- Three phases of intrusive site investigation works have been undertaken at the site. The first phase took place between 09 August and 20 August 2021 for the original proposed Submitted Development Ref: 21/2192 (Tynagh Project 1 OCGT development) to the south and a second phase of intrusive site investigation took place on 28 February 2022 in largely the same area as the first phase to further investigate ground conditions in this area. A third phase of intrusive works took place between 24 May and 23 June 2022, with locations across both the proposed Submitted Development Ref: 21/2192 and the Tynagh North development sites. AECOM have utilised a combination of the most recent site investigation information (third phase) and the historical information from the first and second phases where relevant. These phases are illustrated in Figure 3 Site Investigation Locations.
- The intrusive investigation findings carried out to obtain soil samples for chemical analysis have been summarised to assess the potential significance of any potentially complete pollutant linkages identified;
- A comparison of relevant soil analytical results with appropriate Generic Assessment Criteria (GAC), to assess potential risks to human health, controlled waters and the Proposed Development;
- A revised Conceptual Site Model (CSM) and risk assessment based on the findings of the site investigation with specific regard to the Proposed Development.

1.4 Scope of Works

The following provides a summary of the overall works undertaken for the preparation of this report:

- Review of previous GQRA reports undertaken for the Submitted Development Ref: 21/2192 to the south of the site, which covered part of the current Tynagh North site.
- Review of ground investigation data provided by the ground investigation contractor from the third phase of site investigation works.
- Screening and comparison of analytical soil and groundwater results against appropriate GAC protective of human health and controlled waters in a commercial/ industrial land use scenario appropriate to the Proposed Development;
- Quantitative risk assessment of potential source-pathway-receptor linkages following redevelopment;
- Development of a Risk Assessment CSM with due regard to the results of the Tier 2 ground investigation results and subsequent qualitative risk assessment;

Provide recommendations for further work, if required.

2. Tier 1 Preliminary Risk Assessment (PRA)

2.1 Desk Study Information

Table 1 provides information pertaining to the Site.

Table 1. Desk Study Information

Item	Description
Location	The Proposed Development is to be located in close proximity to the north of the existing CCGT Power Station at Derryfrench, Loughrea, Co. Galway, Ireland (ITM X: 574431; Y: 713205). The Tynagh Power Station Site is located on made ground (composed of imported fill and mining spoil) within the extensive former Tynagh Mine site, with the flooded former open mine pit and a spoil heap to the south of the existing CCGT power station and with the former mine tailings ponds and other spoil heaps to the east and south-east. Sperrin Galvanisers Ltd., an IE licensed metal plating facility, and several disused former mine buildings are located to the south-west of the Site. The Site is entirely located within the administrative area of GCC.
History	The historical land use of the site has been determined by examining the historical mapping for the Tynagh area available on the OSI map viewer and Google Earth aerial photography. The pre-mining historic land use is primarily agricultural and scrub land within the Site and wider surrounding area. There is a disused gravel pit within area of current flooded mine pit indicated on the OSI 25-inch:1-mile historical mapping series. The satellite image from 1985 shows evidence of mining in the area to the east and south of the Proposed Development and mining activity is known to have begun in the area in 1965. The mine was designed to handle 2000 tonnes of raw ore per day in the surface concentrator facility. The mine initially was open cast and the facilities constructed included a 48.5 ha tailings pond. The mine was worked as an open pit from 1965 until 1972 when production then continued from underground sources only. Mining continued until 1982 and the mining lease expired in November 1983. The existing CCGT Power Station and its associated power transmission infrastructure, AGI and natural gas pipeline were constructed on the western part of the former mine in 2003/2004. Sperrin Galvanisers Ltd, an IE licenced metal plating facility, was constructed adjacent to the western boundary of the Site in 2004. In November 2021, a planning application and EIAR were submitted to GCC for an OCGT plant on the western portion of the existing Tynagh Power Station site. Submitted Development Ref: 21/2192 proposed to demolish the existing Tynagh Power Station site workshop, administration building and car park and relocate these items to the brownfield lands to the immediate north of the Tynagh Power Station facility. Submitted Development Ref: 21/2192 is currently being determined by An Bord Pleanála following an appeal.
Geology	A review of GSI and Teagasc on-line map viewers indicates the following: **Made Ground**: The site is underlain by Urban surface soils (made ground), while the surrounding area is underlain by deep well drained mineral (mainly basic) soils. The site is predominantly composed of mining spoil/ waste from the former Tynagh mine operations, with elevated heavy metals contents (principally arsenic, cadmium, copper, nickel and zinc), and other impacts due to the previous industrial use of the

Item	Description
	Site and surrounding area (relating to historical fuel use, electrical switchgear and construction and demolition materials on the former Tynagh Mine site). There is a mound of mining spoil which rises steeply along the northern boundary. The southern part of the Site is relatively flat, falling from 66.4 m Ordnance Datum Malin Head (OD) in the west to 62.5 m OD in the east, however the large spoil mound rises to 73.4 m OD in the northern part of the Site. **Superficial Deposits:** The site is underlain mainly by Made Ground. There are/were outcrops of Bedrock at or close to the surface in parts of the existing CCGT site to the south. GSI mapping indicates Till subsoil (derived from limestone) is located to the west and north of the Site but is not mapped within the site boundaries. However, it is possible that this stratum underlies the mantle of made ground that covers the Site. **Bedrock:** The Site is underlain by Lucan Formation, comprising dark limestone and shale (often referred to as Calp). The formation comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are rare dark coarser grained calcarenitic limestones, sometimes graded, and interbedded dark-grey calcarenites. The formation ranges from 300 m to 800 m in thickness.
Hydrogeology	The Lucan Limestone fractured bedrock unit which underlies this site, and the Waulsortion Limestone to the south, are classified as Locally Important aquifers but are productive only in local zones. The Old Red Sandstone further to the south of the site is classified as a Poor bedrock aquifer. Groundwater in the area has elevated concentrations of heavy metals as a result of the extensive mineralisation of the limestone bedrock in the vicinity of the fault. The Lucan Limestone fractured bedrock unit beneath the entire Site, and the Waulsortian Limestone unit further to the south, are both assigned High to Extreme vulnerability to contamination, due to thin or absent subsoil cover. The Old Red Sandstone to the south of the former open cast mine pit is assigned similar vulnerability to contamination. The existing CCGT power station has an abstraction well in the east of the site, the Tynagh Power Station Raw Water well (EPA Abstraction APR000425), for Industrial use to generate demineralised water for steam generation for power plant and plant service water. This well is licenced to abstract up to 300 m^3/day but the abstracted water is not used for potable use; all drinking water on site is supplied as bottled water. The well is sampled 3-4 times per year and analysed for a suite of inorganic parameters and metals. The well is believed to be fed from the nearby mine pit, which was flooded after the previous mining operations ceased. The adjacent Sperrin Galvanisers Ltd. site (IE licence P0658-01) is required to monitor groundwater from 2 wells annually for a suite of metals and inorganic determinands. Zinc in well GW2 in 2021 was the only parameter to exceed the Groundwater Threshold Values (GTVs).
Hydrology	A watercourse known as the Lisduff Stream is approximately 515 m south of the Site, with the Barnacullia Stream 37 m north-west and the Mill Stream 260 m north of the Site. These three watercourses flow east into the Lisduff (Kilcrow) watercourse ultimately flowing south to Lough Derg into the River Shannon (11.1 km). The former Tynagh Mine open pit mine has been allowed to re-flood and is an enclosed open water body (code 25_303) which is approximately 280 m to the south-east of the Site boundary at its closest point.

Item	Description
	The enclosed former Tynagh Mine tailings ponds remain and form open water bodies (code 25_300) which are approximately 40 m to the east and north-east of the Site boundary at their closest point.
Historical existing CCGT Power Station Site Investigations	**2003[1]:** HGL O'Connor reported a site investigation in 2003 as part of the Environmental Impact Statement for the existing CCGT Power Station development, consisting of three rotary cored boreholes to depths of 11.80 m (BH-1), 7.00 m (BH-2) and 10.10 m (BH-3) below the then-ground levels (m bgl). All three boreholes were installed as groundwater monitoring wells (MW-1, MW-2 and MW-3). Fifteen trial pits (TP1 to TP-15) were dug to depths of up to 3.9 m bgl to inspect and sample soils on the site. **2003[2]:** Environmental Protection Agency (EPA) and GCC undertook an investigation surface water, stream sediments, mine wastes, mine tailings and soil the site and surrounding area in response to local concerns regarding the potential impact of the site on human and animal health and the environment, and in light of the need to obtain additional baseline environmental information on the former mine site. The study concluded that the Tynagh mines site is heavily contaminated with heavy metals, in particular lead and zinc. It stated that the most heavily contaminated mine waste is located in the west tailings pond, the mine waste deposit west of the Sperrin site and from waste sludge which was allegedly deposited on the mine site.
Land Use	The historical land use on the site of the Proposed Development and surrounding area (former Tynagh mine site) suggest there is potential over an extensive area for historical pollution and ground contamination related to the former mining operations.

[1] HGL O'Connor & co. (2003) "Environmental Impact Statement – Proposed 400MW Power Station at the former site of Tynagh Mines", report ref: 01072/EIS dated April 2003

[2] EPA (2003) "Report of the investigation into the presence of lead and other heavy metals in the Tynagh Mines Area, County Galway" Office of Environmental Enforcement, Environmental Protection Agency, Ireland

3. Preliminary Conceptual Site Model & Qualitative Risk Assessment

3.1 General

A conceptual model has been developed for the Site based on the information collated during the desktop review and is described in this section, identifying contaminant sources, contaminant migration pathways and potential receptors for the Site.

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

- A **source** of contamination, for example due to historical site operations;
- A **pathway**, a route by which receptors can become exposed to contaminants. Examples include vapour inhalation, soil ingestion and ground water migration;
- A **receptor,** a target that may be exposed to contaminants via the identified pathways. Examples include human occupiers/ users of the site, the water environment, property, or ecosystems.

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. The conceptual model was developed to describe viable SPR linkages for the Site.

The desktop study was used to conceptualise the potential contaminant source areas as well as the pathways and receptors.

3.2 Preliminary Conceptual Site Model (CSM)

At this stage, the preliminary CSM has been developed to identify potentially complete linkages and to identify potential linkages that require further investigation to assess their existence and/ or potential significance.

The potential sources of contamination on or in the vicinity of the Site, receptors on or near the Site, and pathways on or near the Site are discussed within this section.

3.2.1 Potential Sources of Contamination

The following potential sources of contamination have been identified during the desk study. The site walkover undertaken by AECOM on 29 June 2021 as part of the scoping for the initial intrusive site investigation did not note any obvious evidence of potentially contaminating activities, other than the remaining former Tynagh mine site elements, the existing CCGT Power Station and the adjacent Sperrin Galvanisers.

Table 2. Potential Sources

Potential Source	Detail
Existing soil contamination	Existing contamination in the made ground and superficial deposits, as a result of deposition of mining spoil and of potential historic pollution incidents could be exposed and disturbed during construction across the Site, depending on the depth of excavations.
Existing groundwater contamination	Existing contamination in the shallow groundwater (in the superficial deposits) and deep groundwater (in the limestone bedrock aquifers) from presence of the Tynagh ore body and from historical mining activities or pollution incidents.
Off-site sources	Pollution incidents at off-site sources could result in contamination reaching soil and/ or groundwater in direct contact with Power Station infrastructure or services.
On-site sources	Construction activities with the potential to contaminate soils and groundwater.

3.2.2 Potential Receptors

The following potential receptors have been identified which could potentially be adversely affected by any potential contamination at the Site:

Table 3. Potential Receptors

Potential Receptor	
Construction workers	• During construction stages of the Proposed Development; • Future on-site construction and maintenance workers (potential risk assumed to be mitigated with PPE and other measures).
Off-site industrial and residential land users	• From made ground derived dust, organic vapours or ground generated gas.
Surface watercourses	• Surface water in the surrounding streams and rivers.
Groundwater	• Groundwater within the underlying superficial deposits; • Groundwater within the underlying bedrock.
Known/ unknown water supplies	• Groundwater abstraction on site for process use only • In the residential areas surrounding the Proposed Development.

3.2.3 Potential Pathways

Potential pathways have been identified, which could link the potential sources with the potential receptors. These pathways are discussed by receptor type below, in consideration of the redevelopment of the Site.

Table 4. Potential Pathways

Potential Pathways	
Human health	• Future site users, by dermal contact with contaminated soil and/ or groundwater, inhalation of vapours/ ground gas, windblown dust, and ingestion; • On-site construction and maintenance workers by dermal contact with contaminated soil and/ or groundwater, inhalation of vapours/ ground gas, windblown dust, and ingestion.
Controlled waters	• Rainfall infiltration can mobilise contaminated groundwater further into the subsurface from there to other water environment receptors; • Vertical migration of contaminant groundwater through the superficial deposits; • Rainfall infiltration can generate and mobilise made ground soil/ mining spoil-derived leachate into groundwater within underlying aquifers and from there to other water environment receptors.
Construction materials	• Construction materials by direct contact with contaminative materials; and • Migration, accumulation, and explosion of flammable gases in buildings/ confined spaces.

3.3 Qualitative Assessment of Source-Pathway-Receptor Linkages

A preliminary qualitative risk assessment has been undertaken for these potential source-pathway-receptor linkages based on EPA contaminated site assessment[3] guidance – Stage 1 Site Characterisation & Assessment - Step 1 Preliminary Site Assessment.

This assessment is based on consideration of both:

- The likelihood of an event (probability – takes into account both the presence of the hazard and receptor and the integrity of the pathway); and
- The severity of the potential consequence – takes into account both the potential severity of the hazard and the sensitivity of the receptor.

Based on the information provided in this report, a preliminary risk assessment has been formulated, which identifies possible pollutants linkages at the Site.

The method of dealing with identified risks and the level of significance of those risks will be function of site use. The risk associated with each potential pollutant linkage under the proposed industrial end-use.

[3] EPA (2013) "Guidance On The Management Of Contaminated Land And Groundwater At EPA Licensed Sites" (ISBN: 978-1-84095-511-8), EPA 2013

Table 5. Summary of Environmental Risks Associated with the Site

Source	Potential Pollutants	Pathway	Receptor	Classification of consequence	Likelihood of occurrence	Classified risk	Mitigation
On-site sources: - Industrial land use activities - Pollution incidents - Dangerous substances -Historical use of site	Hydrocarbons PAHs Asbestos Heavy metals (arsenic, cadmium, copper, lead, mercury, nickel, and zinc)	Dermal/ ingestion/ inhalation of vapours and dust	Future site users (construction and maintenance workers)	Effect on human health [Medium]	Low likelihood: Presence of contamination is unknown. If present, construction workers may come into contact with contaminated soil during construction works.	Moderate/ low risk	Targeted site investigation, CEMP and appropriate PPE.
		Leaching of soil contamination into shallow groundwater	Superficial deposits aquifer	Pollution of groundwater [Medium]	Low likelihood: EPA,(2003) reported that leaching tests carried out on the mine wastes indicated that the potential for heavy metals (zinc, cadmium and to a lesser extent lead) to leach from the mine wastes is low. The shallow soil contamination is related to the mineralisation of soil and bedrock and the historical mining activities at the site. Where contaminants are present, there is the potential to pollute groundwater and superficial deposits.	Moderate/ low risk	Targeted site investigation, CEMP and Remediation Strategy (if required).
		Lateral migration of shallow groundwater migration	Designated sites (SPA, NHA, pNHA) WFD watercourses	Pollution of surface water bodies [Medium]	Given the distance to each of the surface water receptors and the potential for attenuation of any contaminants, there is a low likelihood of groundwater impact to surface water courses from the proposed OCGT site construction and operations, however, historical mining activities in the vicinity of the Site have resulted in impacts to the surface water courses in the area[2]. EPA (2003) concluded that surface water quality at the control sites and downstream of the Tynagh mine site was satisfactory and is unlikely to represent a risk to livestock in the area.	Moderate risk	None required

Source	Potential Pollutants	Pathway	Receptor	Classification of consequence	Likelihood of occurrence	Classified risk	Mitigation
		Vertical migration of contamination into deeper groundwater	Bedrock aquifer (onsite and offsite Lucan Formation and offsite Waulsortian Limestone)	Pollution of groundwater [Medium]	Unlikely: IE Licence groundwater monitoring at the Sperrin Galvanisers and existing CCGT sites indicates that zinc (potentially related to the galvanising operations) is the only substance analysed that is reported above GAC in groundwater, indicating little leaching of metals from the mining wastes and bedrock mineralisation via groundwater.	Low risk	None required
		Direct contact with contaminants in soil or migrating groundwater	Buildings, infrastructure, and underground services	Chemical attack on structures and services [Mild]	Low likelihood: Groundwater monitoring indicates that groundwater is present between 2.5 and 6.5 m below ground level and does not contain significantly elevated sulphate of anomalous pH, suggesting chemical attack on structures and services is unlikely.	Low risk	Targeted site investigation, building design, CEMP.
Ground gas associated with made ground	Potentially hazardous ground gas	Inhalation of ground gas	Future site users, including construction and maintenance workers	Effect on human health [Medium]	Unlikely: The proposed development involves the installation of an OCGT above grade in a site composed of vapour-permeable fill and granular made ground (reworked mine spoil).	Low risk	Targeted site investigation, ground gas monitoring, CEMP and building design).
		Vapour migration into buildings and structures	Buildings and structures	Fire and explosion [Severe]	Unlikely: The proposed development involves development of one OCGT to the existing power station on a site composed of vapour-permeable fill and granular made ground.	Moderate / low risk	

4. Ground Investigation Details

4.1 General

The potential significance of the potentially more significant pollutant linkages identified in the Tier 1 PRA was assessed by carrying out three phases of intrusive ground investigation. The investigations were undertaken to assess the ground conditions beneath the Site (geology and hydrogeology) and to allow samples of soil and groundwater to be obtained.

4.2 Ground Investigation Fieldworks

Causeway Geotech Limited (Causeway) carried out three phases of intrusive works on behalf of AECOM between August 2021 and June 2022.

- The first phase took place between 09 August and 20 August 2021 and was undertaken on the Submitted Development Ref: 21/2192 site, which comprised five trial pits and eleven boreholes. One of the boreholes (BH01) is located within the red-line boundary of the Tynagh North development.
- The second phase took place on 28 February 2022 and one of the four trial pits (TP-22-03) is located within the proposed Tynagh North development.
- The third phase of the site investigation works was undertaken by Causeway between 24 May and 23 June 2022 with site investigations located across both the Submitted Development Ref: 21/2192 and included the area of the Tynagh North development boundaries. The site investigation involved the drilling of ten boreholes and eight trial pits to a maximum depth of 13.5 m bgl. Of these site investigation locations, seven boreholes (BH101, BH102, BH102A, BH107A – BH107C, BH107) and four trial pits (TP101, TP101A, TP102 and TP103) were located within the Tynagh North proposed development boundary.

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R10 GPS system employing VRS and real time kinetic (RTK) techniques.

An AECOM field scientist was on-site periodically throughout the first and second phases of the site investigations to observe the drilling/excavation works. The intrusive investigation was designed and undertaken in general conformity with the principles set out in BS10175:2011+A1:2017 Investigation of Potentially Contaminated Land. Code of Practice.

Site Investigation locations are illustrated in Figure 3 and a site investigation plan showing trial pit and borehole locations is included within the contractor's factual site investigation reports, which are included in the EIAR as Appendix 13A.

4.2.1 Soil Sampling and Field Testing

During drilling, soil samples were obtained at regular intervals throughout the soil profile. Samples were obtained within made ground deposits (if present), in the underlying natural deposits, where visual or olfactory evidence of possible contamination was encountered and at any change in lithology. The samples were collected directly into clean, laboratory-supplied containers suitable for the analyses scheduled.

Causeway field scientists screened selected soil samples in the field for potentially ionisable vapours in the sample headspace using a photo-ionisation detector (PID). The results of the field vapour screening are included in the borehole logs (refer to EIAR Appendix 13A, EIAR Volume III).

The soil samples were transported to the AECOM approved laboratory, Chemtest, in cool boxes, under Chain of Custody documentation.

4.2.2 Laboratory Testing

Environmental testing was conducted on selected environmental soil samples by Chemtest at its laboratory in Newmarket, Suffolk.

The following schedule of analysis was completed for the soil and groundwater samples collected as part of the first and second phase of works (September 2021 – February 2022) and third phase of works (May and June 2022):

Table 6. Schedule of Analysis

Analysis	No. of Soil Samples (Sept 2021 – Feb 2022)	No. of Soil Samples (May – June 2022)	No. of Groundwater Samples (July - August 2022)
Heavy Metals*	3	8	4
Speciated total petroleum hydrocarbons (TPH)	4	-	4
Speciated polycyclic aromatic hydrocarbons (PAH)	3	8	4
Volatile Organic Compounds (VOCs)	4	8	4
Semi-Volatile Organic Compounds (SVOCs)	4	8	4
BTEX including MTBE	4	8	4
Polychlorinated Biphenyls (PCBs)	3	8	4
Cyanide	3	8	4
Phenol	3	8	4
Asbestos screen	3	8	-
pH. Organic matter content	3	8	4

5. Site Investigation Findings

5.1 Geology

Copies of the ground investigation borehole/trial pit logs are provided in the Contactor's factual reports (EIAR Appendix 13). The geological profile recorded during the investigation is discussed below. Table 7 shows the geological profile recorded from relevant site investigation locations within the Tynagh North development boundary. No surface material was encountered at any of the site investigation locations.

Table 7. Relevant Site Investigation Locations - Geology

Geological Strata	Locations	Range of Strata Depths (m bgl)	Description
Made Ground	TP-22-03, BH01, BH102, BH107, BH107A – BH107C, TP101A, TP101, TP102, TP103	0.0 – 7.5	Coarse grained Made Ground - Medium sub-angular to angular fine to coarse GRAVEL of limestone with a varying fine-grained component. Cobble and boulders also present.
	TP-22-03, BH101, BH102, BH102A, BH01	0.25 – 4.0	Fine grained Made Ground - stiff to very stiff sandy gravelly silty CLAY with varying cobble content.
	BH101, BH102, TP102	1.1 – 9.0	Dense grey BOULDERS with fragments of concrete slabs and rebar throughout.
Superficial Deposits	BH102	3.0 – 5.0	Glacial Till (fine grained) - Very stiff sandy slightly gravelly silty CLAY with large boulders.
	BH01	4.0 – 4.5	Very dense grey silty fine to medium SAND.
Bedrock	BH01, BH102	4.5 – 11.0	Lucan Formation - Weak to medium strong, thinly interbedded, dark grey LIMESTONE and light grey PACKSTONE

5.2 Hydrogeology

The following groundwater strikes / seepages were recorded during the second phase of the site investigation at TP-22-03 at a depth of 1.6 m bgl. Groundwater was encountered at 0.6 m bgl at TP103 and 2.1 m bgl at TP101A. No groundwater was encountered during the drilling of BH01 (first phase of site investigation works).

5.3 Observations of Potential Contamination

At the site investigation locations within the Tynagh North proposed development, the following pertinent observations were made by Causeway:

- Made ground encountered to a depth of up to 9.0 m bgl; which generally consisted of light grey to dark grey sub-angular to angular fine to coarse GRAVEL with a varying cobble and boulder content and including concrete and other demolition wastes. Made ground was thickest at BH101 on the spoil mound in the north of the Tynagh North site.
- No visual and/ or olfactory evidence of contamination was reported during the soil sampling.
- No significant putrescible organic material was encountered during the site investigation.

6. Quantitative Risk Assessment – Tier 2 Screening

6.1 Introduction

A preliminary qualitative risk assessment has been undertaken for these potential source-pathway-receptor linkages based on EPA contaminated site assessment guidance – Stage 1 Site Characterisation & Assessment - Step 1 Preliminary Site Assessment.

The EPA have guidance to managing land contamination at IE Licence sites in Ireland[3]. The EPA guidance considers that the most appropriate approach is a 'suitable for use' one, in which risks to human health and the wider environment are assessed within the context of the current or proposed use of the land in question. There is no Irish contaminated land risk assessment methodology, therefore the Tier 2 screening methodology adopted by AECOM is consistent with EPA guidance, which recommends a risk assessment approach aligned with the UK Environment Agency Report CLR11: Model Procedures for the Management of Land Contamination (and its successor Land Contamination: Risk Management (LCRM) guidance, which came into force in November 2019)[4].

Potentially contaminated land is assessed through the identification and assessment of pollutant linkages (source-pathway-receptor relationships). Implicit in the guidance is the use of risk assessment to assess whether identified pollutant linkages may be significant.

A preliminary Conceptual Site Model (CSM) was derived in Section 3, Preliminary Conceptual Site Model & Qualitative Risk Assessment for the Site and is summarised in Table 5. Summary of Environmental Risks Associated with the Site.

The CSM identifies potential pollutant linkages which may be present on the Site. In order to quantify the potentially more significant risks identified by the preliminary CSM, samples of soil and groundwater were scheduled to be tested for a range of chemical determinants based on the historical and current site use.

To assess the potential significance of the concentrations of substances detected, analytical results have initially been compared with appropriate Generic Assessment Criteria (GAC) selected from an AECOM-compiled database of currently applicable criteria.

6.2 Human Health

6.2.1 Justification of Selected GAC

The Proposed Development is outlined in detail in Section 1.2 (and Chapter 5) and the Proposed Development plan is included as Figure 2 in Appendix A.

For the majority of chemicals of potential concern (CoPC), GAC have been sourced from peer reviewed, UK-published sources utilising the general procedure described in technical information supporting the Environment Agency's Contaminated Land Exposure Assessment (CLEA) model. These sources include the LQM/CIEH[5], EIC/AGS/CL:AIRE[6] GAC and SoBRA Groundwater GAC[7]. For some chemicals where such criteria have not been published, the same methodology has been utilised by AECOM for the derivation of GAC. For a small number of CoPC with limited toxicological data, other European criteria were selected or Regional Screening Levels (RSLs) developed by the United States Environment Protection Agency (USEPA) were used.

Stage 1 Tier 2 tables summarising the available analytical data and exceedances of human health GAC for soil are presented in Appendix B Table 1.

[4] https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm/lcrm-stage-1-risk-assessment#tier-2-generic-quantitative-risk-assessment
[5] Land Quality Management. The LQM/CIEH S4Uls for Human Health Risk Assessment, 2015.
[6] CL:AIRE. Soil Generic Assessment Criteria for Human Health Risk Assessment. CL:AIRE in associated with The Environmental Industries Commission, January 2010.
[7] SoBRA. Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater. Society of Brownfield Risk Assessment. Version 1.0. February 2017.

6.2.2 Soil Screening

Soil data have been screened against human health (HH) GAC protective of:

- Current/ future users of the Site.

The human health soil GAC were typically derived assuming:

- Soil properties akin to “sandy loam” were present across the Site;
- Exposure pathways include ingestion of soil/ dust, inhalation of vapours, inhalation of fugitive dust and dermal contact; and
- Proposed end use – commercial/ industrial

Tables summarising the available analytical data screened against HH GAC for soil are presented as Appendix B Table 1. The laboratory analytical result reports are presented within EIAR Appendix 13A.

6.2.2.1 Asbestos Screening

A total of 11 soil samples were screened for asbestos containing materials (ACMs), across the three phases of investigation, considering the age of the former mine site and buildings. Asbestos was not identified by the laboratory in any of the 11 soil samples submitted for asbestos analysis.

6.2.2.2 Discussion of Screening Results

A review of the soil data analysed to date from the Site shows that soil results were either below laboratory detection limits or relevant generic assessment criteria, other than the following:

- Arsenic – Soil HH GAC (Comm/Ind) 640 mg/kg) – GAC exceeded in one of 12 soil samples – reported at 780 mg/kg in BH-01 (1.0 m).
- Cyanide – Soil HH GAC (Comm/Ind) 150 mg/kg) – GAC exceeded in one of 12 soil samples – reported at 190 mg/kg in BH102A (1.0 m)
- Lead – Soil HH GAC (Comm/Ind) 2,330 mg/kg) – GAC exceeded in ten of 12 soil samples – reported at:
  - 24,000 mg/kg in BH-01 (1.0 m)
  - 32,000 mg/kg in TP-22-03 (0.5 m)
  - 5,000 mg/kg in TP-22-03 (1.65 m)
  - 9,900 mg/kg in TP101A (0.5 m)
  - 11,000 mg/kg in TP101A (1.0 m)
  - 11,000 mg/kg in TP101A (2.0 m)
  - 12,000 mg/kg in TP102 (1.0 m)
  - 3,000 mg/kg in BH101 (0.5 m)
  - 4,000 mg/kg in BH101 (2.0 m)
  - 5,600 mg/kg in BH102A (1.0 m)

Arsenic, cyanide, and lead are elevated above GAC in certain soil samples at Site. The elevated concentration in soils is likely due to the background metal mineralisation associated within the overall Tynagh Ore Body underlying the site and surrounding area. It was also likely contributed to by the historical mining operations at the site and surrounding area.

6.3 Controlled Waters

Risk to the water environment is assessed using a tiered approach based on that described in the Environment Agency’s Remedial Targets Methodology (RTM). The RTM adopts a tiered approach

consistent with that described in Model Procedures for the UK Environment Agency Management of Land Contamination (CLR11) guidance.

The risk to controlled water has been considered based on concentrations recorded in groundwater directly beneath the Site.

Since this assessment utilises largely generic assumptions about both the characteristics and behaviour of contaminants and the pathways and receptors, this assessment is likely to be conservative for a wide range of site conditions and is equivalent to a GQRA.

6.3.1 Justification of Selected GAC

The key water environment receptors in the surrounding area are considered to be groundwater in the bedrock aquifers underlying the Site and the minor streams approximately 515 m to the south (Lisduff Stream) and 37 m to the north-east (Barnacullia Stream) of the Site, both entering the Kilcrow River approximately 4.6 km to the east of the Site, and ultimately Lough Derg and the River Shannon.

Other surface water features in the area include:

- A stream recorded as Cloonprask on EPA online surface water feature mapping – it is potentially culverted close to the east of the Site, before flowing into the Barnacullia Stream approximately 60 m to the east of the Site;
- The Mill Stream, approximately 250 m to the north of the Site, joins the Barnacullia Stream approximately 1.1 km to the north-east;
- The former Tynagh Mine open pit mine which has been allowed to re-flood and is an enclosed open water body (code 25_303) which is approximately 280 m to the south-east of the Site at its closest point; and
- The former Tynagh Mine tailings ponds remain and form open water bodies (code 25_300) which are approximately 40 m to the east of the Site at their closest point.

It is considered most appropriate to assess risks to the groundwater and surface water environment using GAC selected from hierarchies protective of these two water environment receptors. These GAC are derived from the Groundwater Threshold Values (GTV), Drinking Water Standards (DWS) and Environmental Quality Standards (EQS).

A Stage 1 Tier 2 table summarising the available analytical data and exceedances of controlled water GAC for groundwater data is presented in Table 2 in Appendix A. Within this table, individual GAC exceedances are highlighted.

Where the calculated GAC is below the minimum reporting limit (MRL) achievable by the analytical laboratory for a given matrix, the MRL was substituted for the calculated GAC for the following assessment. The screening tables do not therefore highlight potential exceedances where the MRL exceeds the literature GAC.

6.3.2 Groundwater Screening

Analysis of the groundwater data obtained has been compared against controlled water GAC consisting of Irish Groundwater Threshold Values (GTVs), Drinking Water Standards (DWS) and Ecological Quality Standards (EQS) presented in Table 2 in Appendix A.

A review of the groundwater data obtained from the site shows that nearly all CoPC analysed for were detected at concentrations below GTV, DWS and EQS GAC. Recorded exceedances of the GAC are summarised in Table 8, and the significance of the exceedances are discussed in Table 9.

Table 8. Groundwater Exceedances of Water Environment GAC

Determinand	DWS GAC (µg/L)	EQS GAC (µg/L)	GTV GAC (µg/L)	No. of samples	No. of exceedances	Exceedance Factor	Comments
Cadmium	5	0.08	3.75	4	2 (DWS, GTV & EQS) 1 (EQS)	30 – 462.5	Within three orders of magnitude
Chromium	50	37.5	3.4	4	1 (GTV)	1.5	Within one order of magnitude
Copper	2000	5	1500	4	2 (EQS)	2 – 3.2	Within one order of magnitude
Lead	10	1.2	7.5	4	1 (DWS, GTV & EQS) 2 (EQS)	1.4 – 18.3	Within two orders of magnitude
Nickel	20	4	15	4	3 (GTV, DWS & EQS) 1 (GTV & EQS)	5 – 15	Within two orders of magnitude
Zinc	75	8	75	4	4 (GTV, DWS & EQS)	34 – 1,750	Within four orders of magnitude

7. Ground Gas Risk Assessment

7.1 Background

Ground gas can be generated from natural soils, rocks or wastes containing biodegradable organic matter. The primary gases of concern are methane and carbon dioxide. Methane is lighter than air and is both a flammable and asphyxiating gas that can accumulate within buildings and explode on ignition when the concentrations of the gas in air fall within the explosive concentration range (5 to 15% by volume in air). Carbon dioxide is denser than air and is a non-flammable, asphyxiating and toxic gas.

The following potential sources of ground gas were identified within the Site:

- **Made ground:** consisted of layers of slightly sandy, slightly gravelly, silty clay.

Ground gas emissions can accumulate beneath the foundations/ floors of buildings and migrate through gaps and cracks in structure and accumulate within the buildings, resulting in a possible risk to both buildings constructed over gassing ground and users of those buildings.

To characterise the ground gas conditions at the site, 1no. monitoring round was undertaken at the site following the latest investigation works. The monitoring and risk assessment was undertaken in broad conformity with current good practice.

7.2 Ground Gas Characterisation

BS 8485[8] provides an approach to characterise ground gas risk and this approach has been adopted for the Site.

The Site is characterised as having a ground gas Characteristic Situation CS2 (Low Hazard Potential) for the following reasons:

- The site investigation identified potentially gas-generating ground materials;
- No putrescible waste materials were identified by the site investigation;
- Old mine workings (former Tynagh open cast and underground mine workings) are present in the vicinity of the Site;
- Gas flow rates of >0.07 L/hr were measured in gas monitoring wells;
- Made ground at the Site has a maximum depth in excess of >5.0 m and average depth of >3 m;
- Methane was reported as 0.1% across both monitoring rounds;
- Carbon dioxide concentrations in ground gas were recorded at up to 0.3% and are not considered to pose a ground gas risk[9]; and
- The Proposed Development involves the construction of a number of buildings and other structures on a permeable, granular, imported fill platform;

In conclusion, a BS 8485[8] ground gas assessment was applied to the Site and it is considered that there is Low hazard potential from ground gas at the Site, based on the thickness of vapour-permeable made ground at the site.

The proposed building designs should incorporate ground gas protection measures appropriate to the building use and a CS2 ground gas risk (typically provision of passive venting or positive pressurisation below the floor slab, combined with a gas resistant membrane (installed correctly and independently verified), is sufficient to mitigate the risk posed by the presence of gas in the ground in a CS2 scenario).

[8] British Standards Publication, 2015. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.
[9] CL:AIRE, 2012 “A pragmatic Approach to Ground Gas Risk assessment” Research Bulletin RB17 November 2012 claire.co.uk

8. Revised Qualitative Risk Assessment

Following the intrusive investigation works, the soil and groundwater monitoring undertaken by AECOM and the subsequent laboratory chemical analysis of soil samples from the Site, a revised qualitative risk assessment has been carried out.

The revised assessment has been undertaken for potential source-pathway-receptor linkages based on current EPA guidance. The guidance document describes a method for the classification of the severity and likelihood of identified risks. This assessment is based on consideration of both:

- The likelihood of an event (probability – takes into account both the presence of the hazard and receptor and the integrity of the pathway);
- The severity of the potential consequence (takes into account both the potential severity of the hazard and the sensitivity of the receptor).

The method of dealing with identified risks and the level of significance of those risks will be a function of site use. The risks associated with each potential pollutant linkage and take into account the findings of the site investigation works' undertaken at the Site.

A revised CSM, summarising potentially viable contaminant linkages with risk assessment, is provided below:

Table 9. Revised Quantitative Risk Assessment

Source	Potential Contaminants of Concern	Pathway	Receptor	Associated Hazard [Severity]	Likelihood of Occurrence	Potential Impact on site
On-site sources: - Industrial land use activities - Pollution incidents - Dangerous substances	Heavy metals (cyanide, arsenic, cadmium, chromium, copper, lead, nickel and zinc)	Dermal/ ingestion/ inhalation of vapours and dust	Future site users	Effect on human health [Medium]	Unlikely: Pathways for chemical exceedances would be broken by the presence of hardstanding/ imported fill/ building footprints over the Site.	Low risk
			Future construction / maintenance workers	Effect on human health [Medium]	Unlikely: Knowledge of potential risks combined with typical PPE and good working practices in accordance with the OCEMP/CEMP will reduce construction/maintenance exposure to localised sub-surface contaminants.	Low risk
		Migration of leachable contaminants through permeable strata	Shallow / perched groundwater	Pollution of groundwater within superficial deposits [Medium]	Unlikely: EPA,(2003) reported that leaching tests carried out on the mine wastes indicated that the potential for heavy metals (zinc, cadmium and to a lesser extent lead) to leach from the mine wastes is low. The shallow soil contamination is related to the mineralisation of soil and bedrock and the historical mining activities at the site. Where contaminants are present, there is the potential to pollute groundwater and superficial deposits. Superficial deposits are thin (3.0 – 5.0 m, generally) and frequently granular, with perched water only reported in the subsoils at TP-22-03.	Low risk
		Vertical migration through permeable deposits	Deeper bedrock aquifer (Lucan Formation and Waulsortian Limestones	Pollution of groundwater within bedrock [Medium]	Low likelihood: Minor soils contamination present at the Site, predominantly related to the local mineralised bedrock and former mining spoil. The superficial deposits underlying the Site largely comprise permeable granular material likely to be in hydraulic continuity with the underlying weathered and fractured bedrock units. Groundwater monitoring at the Proposed Development shows limited impacts close to GAC for heavy metals. The more distant IE Licence groundwater monitoring at the Sperrin Galvanisers and existing CCGT Power Station sites indicates that zinc (potentially related either to natural mineralisation or the galvanising operations) is the only substance analysed that is reported above GAC in groundwater, indicating little leaching of metals from the mining wastes and bedrock mineralisation via groundwater.	Moderate/ low risk

Source	Potential Contaminants of Concern	Pathway	Receptor	Associated Hazard [Severity]	Likelihood of Occurrence	Potential Impact on site
		Migration via groundwater and direct run-off to surface water	Designated sites (SPA, NHA, pNHA) Off-site surface waters (Mill Stream and the Kilcrow River upstream and downstream of the site)	Pollution of surface water [Medium]	Unlikely: Given the likelihood of dilution in the receiving watercourse, the retardation of contaminants in low permeability glacial till and the minor exceedances of GAC in groundwater, a potentially significant risk to surface waters is highly unlikely to be present.	Low risk
Ground gas associated with the made ground/ fill	Potentially hazardous ground gases	Inhalation	Site users and construction workers	Effect on human health [Severe]	Unlikely: The Proposed Development does not include significant below ground structures. Knowledge of potential ground gas risks combined with typical PPE and good working practices in accordance with the OCEMP/CEMP will reduce the exposure to minor, localised sub-surface contaminants.	Moderate/ low risk
		Ground gas accumulation	Buildings and structures	Fire and explosion [Severe]	Unlikely: The Proposed Development does not include significant below ground structures and the ground gas hazard is assessed as Low Hazard potential (CS2), therefore the proposed building design should incorporate ground gas protection measures appropriate to a CS2 ground gas risk, where appropriate.	Moderate/ low risk

9. Conclusions

A Tier 1 Preliminary Risk Assessment (PRA) is presented in Section 2 of this report. A Conceptual Site Model (CSM) based on the findings of the updated PRA for the Proposed Development is included in Section 3 of this report. The preliminary CSM included several identified potentially complete pollutant linkages.

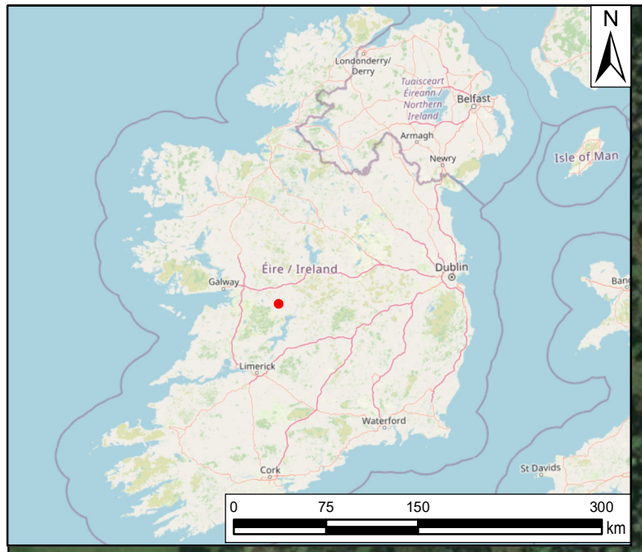
In order to refine the CSM, intrusive investigation were undertaken in August/September 2021, February 2022 and May/June 2022 and AECOM conducted a Tier 2 Generic Quantitative Risk Assessment (GQRA) based on these staged investigations to assess the soil and groundwater quality and ground gas potential at the site.

The conclusions reached following the site investigations and subsequent Tier 2 GQRA are summarised below:

- Made ground was present across the site to a maximum depth of 9.0 m bgl, thickest in the spoil mound forming the north of the proposed development.
- Asbestos fibres were not identified in any of the 11 soil samples analysed for asbestos to date.
- The potential significance of concentrations of contaminants of concern recorded in soil samples have been assessed with reference to Generic Assessment Criteria (GAC) applicable to the Site's potential future use (commercial/ industrial).
- A review of the soil data analysed to date from the Site shows that soil results were either below laboratory detection limits or relevant generic assessment criteria, other than the following:
    - Arsenic – Soil HH GAC (Comm/Ind) 640 mg/kg) – GAC exceeded in one of 12 soil samples.
    - Cyanide – Soil HH GAC (Comm/Ind) 150 mg/kg) – GAC exceeded in one of 12 soil samples.
    - Lead – Soil HH GAC (Comm/Ind) 2,330 mg/kg) – GAC exceeded in ten of 12 soil samples.
- Arsenic, cyanide, and lead are elevated above GAC in certain soil samples at the Site. The elevated concentrations in soils are likely due to the background metal mineralisation associated within the overall Tynagh Ore Body underlying the site and surrounding area. It was also likely contributed to by the historical mining operations of the site and surrounding area.
- Groundwater analysis recorded low GAC exceedances in most wells, generally within one or two orders of magnitude of controlled water GAC for heavy metals (chromium, copper, lead and nickel) and exceedances of between three and four orders of magnitude for cadmium and zinc. The exceedances are likely associated with the background metal sulphide mineralisation and historical mining operations of the surrounding area.
- The GAC exceedances for groundwater samples are not considered to pose a significant risk to the bedrock or surface water environment for the following reasons:
    - The exceedances are marginal (generally within two orders of magnitude of the relevant GAC);
    - The GAC exceedances are related to the extensive base metal mineralisation of the limestone bedrock and the former mining operations on the Site;
- Due to the presence of a significant thickness of the made ground present (up to 9.0 m thick), it is considered that the Site is within Characteristic Situation 2 (CS2) and therefore limited ground gas protection measures applicable to CS2 are required, where appropriate.

Appendix A – Figures

Figure 1 – Site Location



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LEGEND

Proposed Development Site

Notes:

Purpose of Issue:
ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR)

Client:
EP **Energy Developments**

Project Title:
TYNAGH NORTH OCGT

Drawing Title:
SITE LOCATION

Drawn:	Chk'd:	App'd:	Issue:
TS	SM	POC	Jan 2023

AECOM Internal Project No:	Scale at A3:
60661667	1:2,000

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FIGURE 1.1	**0**

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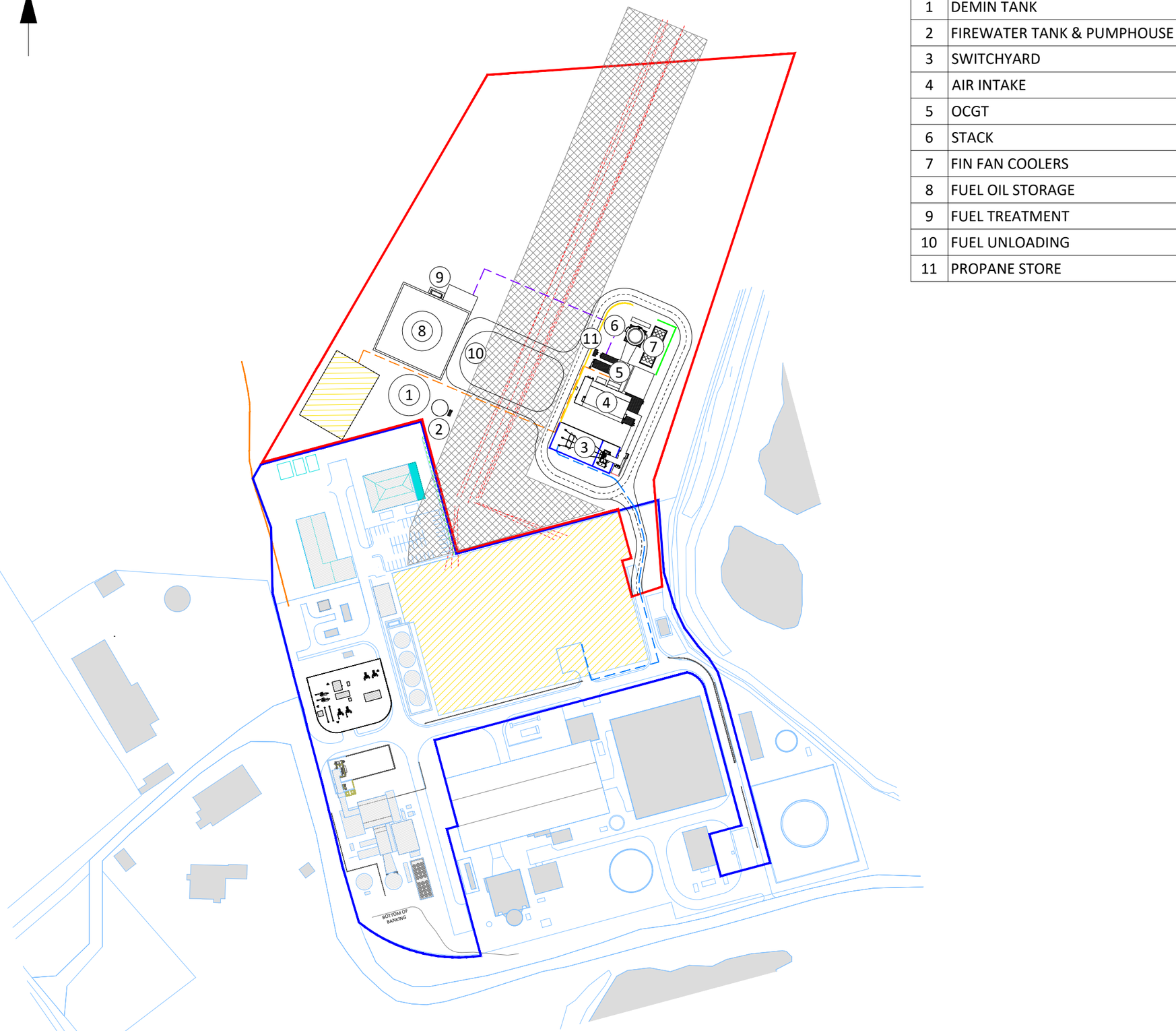
Figure 2 – Proposed Development

NORTH



REF	DESCRIPTION
1	DEMIN TANK
2	FIREWATER TANK & PUMPHOUSE
3	SWITCHYARD
4	AIR INTAKE
5	OCGT
6	STACK
7	FIN FAN COOLERS
8	FUEL OIL STORAGE
9	FUEL TREATMENT
10	FUEL UNLOADING
11	PROPANE STORE

0 80m 200

Metres 1:2500

ALL INFORMATION ON THIS DRAWING MAY BE SUBJECT TO FURTHER DESIGN DEVELOPMENT.

DO NOT SCALE

LEGEND

- AGI & SWITCHYARD SUBJECT TO DETAILED DESIGN BY OTHERS
- OVERHEAD LINES
- EXISTING GAS LINE
- REDLINE BOUNDARY
- REDLINE BOUNDARY FOR EXISTING OCGT APPLICATION
- PROPOSED FUEL OIL SUPPLY
- PROPOSED GAS SUPPLY FROM AGI TO OCGT
- PROPOSED HV CABLE ROUTE
- INDICATIVE EASEMENT AROUND HV CABLES
- ACOUSTIC BARRIER 7m HIGH
- ACOUSTIC BARRIER 10m HIGH
- ACOUSTIC BARRIER 8m HIGH

REV.	DETAILS OF REVISION	DRAWN	CHKD	APR	DATE
R3.0	ACOUSTIC BARRIERS ADDED	DTW	AO1	LM2	05.01.23
R2.0	PRELIMINARY	DTW	AO1	LM2	22.12.22
R1.0	PRELIMINARY	DTW	AO1	LM2	15.12.22

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CLIENT: EPED

SITE: TYNAGH NORTH

PROJECT: TYNAGH NORTH

TITLE: OCGT PLAN

DRAWING STATUS:	PRELIMINARY	
DRAWN BY:	DTW	DATE: 09.08.22
CHECKED BY:	AO1	DATE: 09.08.22
APPROVED BY:	LM2	DATE: 09.08.22
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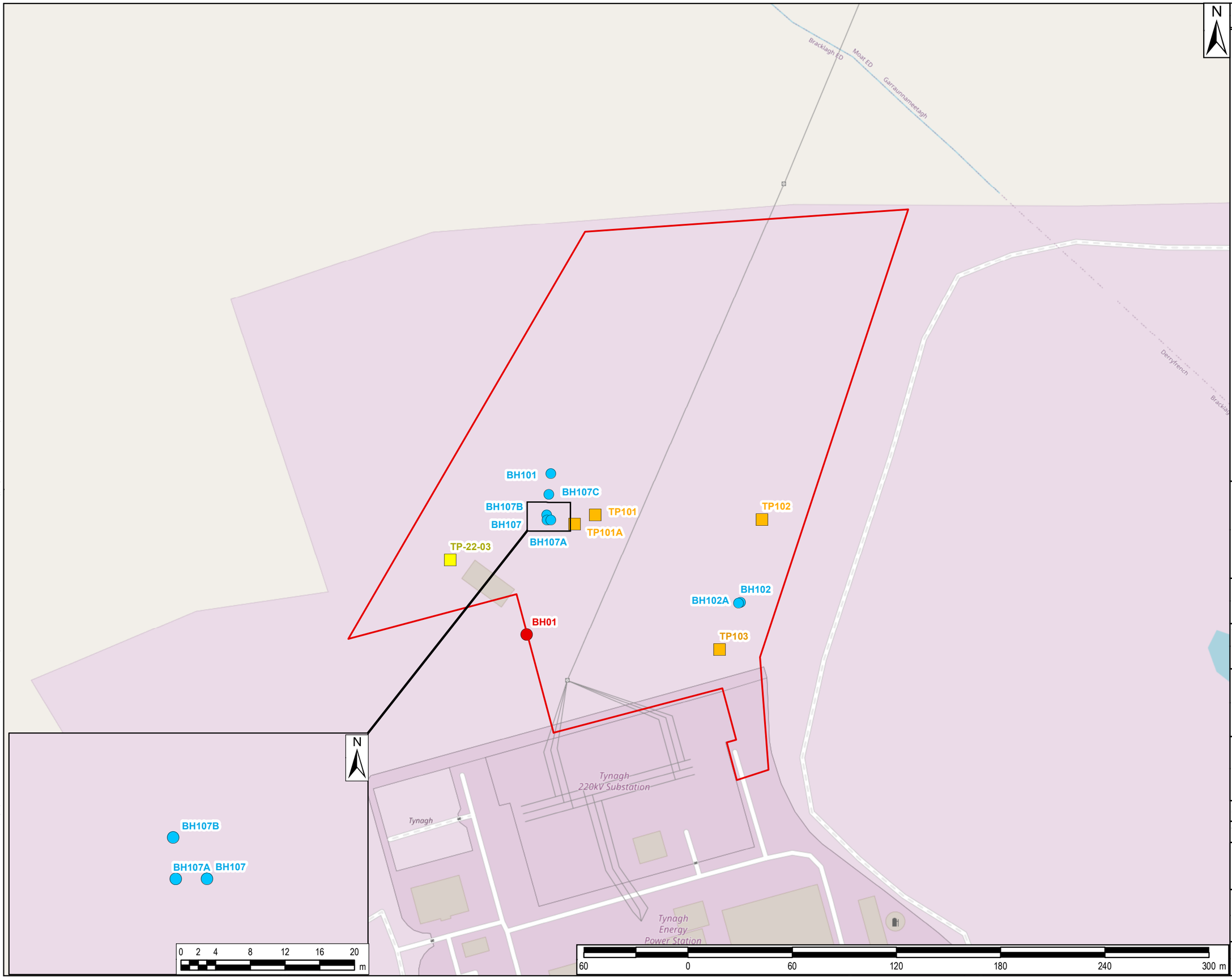
OFFICE OF ISSUE:	DUBLIN	
SHEET SIZE:	A3	SCALE: 1:2500

DRAWING No.: S3577-8310-0001 Sheet 1 Of 1

REVISION: R3.0

Figure 3 – Site Investigation Locations



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LEGEND

- Proposed Development Site

Site Invastigation Location

- Phase 1 – August 2021
- Phase 2 – February 2022
- Phase 3 – May – June 2022
- Phase 3 – May – JuneV2022

Purpose of Issue:
ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR)

Client:
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SITE INVASTIGATION LOCATIONS

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Appendix B – Tier 2 Soil and Groundwater Screening Tables

Tynagh North
Appendix B
Table 1 - Soil Human Health Screening Table

				Sample Location	BH01	BH01	TP-22-03	TP-22-03	TP101A	TP101A	TP101A	TP102	TP103	BH101	BH101	BH102A
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sample Depth	1.0	2.5	0.5	1.65	0.50	1.0	2.0	1.0	0.50	0.50	2.0	1.0
				Sample Date	09 August 2021	09 August 2021	28 February 2022	28 February 2022	24 May 2022	24 May 2022	24 May 2022	24 May 2022	24 May 2022	24 May 2022	24 May 2022	25 May 2022
Determinands	**Units**	**LOD**	**GAC**	**Source** HH Soil. Commercial/Industrial. Sandy Loam. TOC >=1.45 to <3.48%												
ACM Type		N/A			-	-	-	-	-	-	-	-	-	-	-	-
Asbestos Identification		N/A			NAD	-	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD
Moisture	%	0.020			11	14	6	12	6.9	8	12	5.3	2	11	9.6	13
pH		4			8.2	-	8.1	8.4	9.2	8.2	8.2	8.7	9.3	8.1	8	9.2
Boron (Hot Water Soluble)	mg/kg	0.40	240000	LQM/CIEH S4ULs 2015	0.42	-	0.78	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
Cyanide (Total)	mg/kg	0.50	150	USEPA RSL (NOV 2021)	<0.5	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	190
Arsenic	mg/kg	0.5	640	Defra C4SL (2014)	780	-	440	80	120	110	360	260	9.3	230	79	200
Beryllium	mg/kg	0.5	12	LQM/CIEH S4ULs 2015	<1.0	-	< 1.0	< 1.0	< 0.5	0.5	0.8	< 0.5	< 0.5	0.6	< 0.5	0.7
Cadmium	mg/kg	0.10	410	Defra C4SL (2014)	170	-	92	20	50	85	210	64	11	390	240	50
Chromium	mg/kg	0.5	8600	LQM/CIEH S4ULs 2015	41	-	56	54	6.5	6.7	7	3	1.8	3.2	2.3	5.9
Copper	mg/kg	0.50	68000	LQM/CIEH S4ULs 2015	1800	-	1200	200	520	450	1400	850	150	570	830	410
Mercury	mg/kg	0.05	350	USEPA RSL (NOV 2021)	9.8	-	10	1.7	0.22	0.16	0.41	0.31	0.13	0.14	0.11	3.5
Nickel	mg/kg	0.50	980	LQM/CIEH S4ULs 2015	90	-	59	45	69	84	130	54	22	110	100	27
Lead	mg/kg	0.50	2330	Defra C4SL (2014)	24000	-	32000	5000	9900	11000	11000	12000	2000	3000	4000	5600
Selenium	mg/kg	0.25	12000	LQM/CIEH S4ULs 2015	1.6	-	0.65	0.37	0.61	0.71	1.8	0.82	0.28	0.96	0.98	1.1
Vanadium	mg/kg	0.5	9000	LQM/CIEH S4ULs 2015	15	-	12	11	2.8	1.3	9.2	2.7	0.7	5.2	4.4	9
Zinc	mg/kg	0.50	730000	LQM/CIEH S4ULs 2015	20000	-	20000	3800	11000	33000	36000	13000	1800	41000	36000	6000
Chromium (Trivalent)	mg/kg	1	8600	LQM/CIEH S4ULs 2015	41	-	56	54	6.5	6.7	7	3	1.8	3.2	2.3	5.9
Chromium (Hexavalent)	mg/kg	0.50	49	Defra C4SL (2014)	< 0.50	-	< 0.50	<0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	%	0.40			0.81	-	1.2	0.47	1.2	4	1.2	0.98	4.1	0.88	1.5	2.1
Naphthalene	mg/kg	0.10	460	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	< 0.10	0.18	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	mg/kg	0.10	97000	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	< 0.10	0.12	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	mg/kg	0.10	97000	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	< 0.10	0.79	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	mg/kg	0.10	68000	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	< 0.10	0.84	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	mg/kg	0.10	22000	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	0.50	6.5	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	mg/kg	0.10	540000	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	0.10	1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	mg/kg	0.10	23000	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	0.73	6	0.25	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	mg/kg	0.10	54000	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	0.66	4.8	0.24	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	mg/kg	0.10	170	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	0.32	2.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	mg/kg	0.10	350	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	0.27	2.3	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzofluoranthene	mg/kg	0.10	44	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	0.24	2.3	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	mg/kg	0.10	1200	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	0.14	0.85	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	mg/kg	0.10	35	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	0.26	1.7	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	mg/kg	0.10	510	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	< 0.10	0.96	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	mg/kg	0.10	3.6	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	< 0.10	0.13	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	mg/kg	0.10	4000	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	< 0.10	0.96	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	mg/kg	2			< 2.0	-	< 2.0	< 2.0	3.2	32	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
VOCs					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TPHs					ND	ND	ND	ND	-	-	-	-	-	-	-	-
PCB 28	mg/kg	0.010			< 0.010	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	mg/kg	0.010			< 0.010	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	mg/kg	0.010			< 0.010	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	mg/kg	0.010	0.49	USEPA RSL (NOV 2021)	0.078	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	mg/kg	0.010			< 0.010	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	mg/kg	0.010			< 0.010	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	mg/kg	0.010			0.034	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	mg/kg	0.10	0.94	USEPA RSL (NOV 2021)	0.11	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Phenols	mg/kg	0.10	690	LQM/CIEH S4ULs 2015	< 0.10	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Notes:
LOD - Limit of Detection
VOCs - Volatile Organic Compounds
TPHs - Total Petroleum Hydrocarbons
mg/kg - milligrams per kilogram
GAC - Generic Assessment Criteria
- not scheduled
ND - not detected

Tynagh North
Appendix B
Table 2 - GW Controlled Waters Screening Table

								Sample Location	BH104	BH102	BH102	BH104
								Sample Type	GW	GW	GW	GW
								Water Level	-	-	-	-
								Sample Date	24 May 2022	24 May 2022	26 August 2022	26 August 2022
Determinands	**Units**	**LOD**	**GAC**	**CW/WE Water. DWS - Ireland**	GAC	**CW/WE Water. GTV - Ireland**	**GAC**	**CW/WE Water. Aquatic Toxicity - Ireland - Freshwater**				
pH		N/A							8	8.1	8.1	7.5
BOD	mg O2/l	4							< 4.0	< 4.0	9	14
COD	mg O2/l	10							17	19	36	54
Chloride	mg/l	1							18	35	18	20
Ammonia (Free)	mg/l	0.050							0.31	< 0.050	< 0.050	0.18
Ammoniacal Nitrogen	mg/l	0.050							6	0.16	0.20	10
Phosphate	mg/l	0.200							< 0.20	< 0.20	< 0.20	< 0.20
Orthophosphate as PO4	mg/l	0.050							< 0.050	< 0.050	0.054	< 0.050
Phosphorus (Dissolved)	mg/l	0.020							< 0.020	< 0.020	< 0.020	< 0.020
Sulphate	mg/l	1							370	590	620	320
Cyanide (Total)	mg/l	0.050	**0.05**	DWS Ireland 2014	0.05	DWS Ireland 2014	0.01	EU Env. Objectives Regs 2009. (Ire) AA-EQS Fresh	< 0.050	< 0.050	< 0.050	< 0.050
Total Hardness as CaCO3	mg/l	15							570	760	710	560
Arsenic (Dissolved)	µg/l	0.20	**10**	DWS Ireland 2014	7.5	Ireland GTVs 2016	25	EU Env. Objectives Regs 2009. (Ire) AA-EQS Fresh	4.9	< 0.20	0.83	2.1
Boron (Dissolved)	µg/l	10	**1000**	DWS Ireland 2014	750	Ireland GTVs 2010	2000	IGV Ireland 2003 (EQS)	41	24	34	44
Beryllium (Dissolved)	µg/l	1	**12**	WHO DWG 2017	12	WHO DWG 2017			< 1.0	< 1.0	< 1.0	< 1.0
Cadmium (Dissolved)	µg/l	0.11	**5**	DWS Ireland 2014	3.75	Ireland GTVs 2010	0.08	EU Env. Objectives Regs 2015. (Ire) AA-EQS Inland	< 0.11	**25**	**37**	2.4
Chromium (Dissolved)	µg/l	0.50	**50**	DWS Ireland 2014	37.5	Ireland GTVs 2016	3.4	EU Env. Objectives Regs 2009. (Ire) AA-EQS Fresh	< 0.50	5.3	3	2.3
Copper (Dissolved)	µg/l	0.50	**2000**	DWS Ireland 2014	1500	Ireland GTVs 2010	5	EU Env. Objectives Regs 2009. (Ire) AA-EQS Fresh	1.7	1.2	16	10
Mercury (Dissolved)	µg/l	0.05	**1**	DWS Ireland 2014	0.75	Ireland GTVs 2016	0.07	EU Env. Objectives Regs 2015. (Ire) MAC-EQS Inland	< 0.05	< 0.05	< 0.05	< 0.05
Nickel (Dissolved)	µg/l	0.50	**20**	DWS Ireland 2014	15	Ireland GTVs 2010	4	EU Env. Objectives Regs 2015. (Ire) AA-EQS Inland	**45**	**49**	**60**	20
Lead (Dissolved)	µg/l	0.50	**10**	DWS Ireland 2014	7.5	Ireland GTVs 2016	1.2	EU Env. Objectives Regs 2015. (Ire) AA-EQS Inland	< 0.50	1.7	**22**	4.9
Selenium (Dissolved)	µg/l	0.50	**10**	DWS Ireland 2014	10	DWS Ireland 2014			0.60	0.71	1.1	1.4
Vanadium (Dissolved)	µg/l	0.50	**86**	USEPA RSL (tapwater) [NOV 2021]	86	USEPA RSL (tapwater) [NOV 2021]	20	SEPA WAT-SG-53 Fresh EQS - AA - 2015	< 0.50	< 0.50	< 0.50	< 0.50
Zinc (Dissolved)	µg/l	2.5	**75**	Ireland GTVs 2016	75	Ireland GTVs 2016	8	EU Env. Objectives Regs 2009. (Ire) AA-EQS Fresh	**270**	**2400**	**14000**	**330**
Chromium (Trivalent)	µg/l	20	**50**	DWS Ireland 2014	37.5	Ireland GTVs 2016	4.7	EU Env. Objectives Regs 2009. (Ire) AA-EQS Fresh	< 20	< 20	< 20	< 20
Chromium (Hexavalent)	µg/l	20	**50**	DWS Ireland 2014	7.5	Ireland GTVs 2016	3.4	EU Env. Objectives Regs 2009. (Ire) AA-EQS Fresh	< 20	< 20	< 20	< 20
Total Organic Carbon	mg/l	2							8.7	2.2	< 2.0	11
TPHs									ND	ND	ND	ND
VOCs									ND	ND	ND	ND
PAHs									ND	ND	ND	ND
Total Phenols	mg/l	0.030							< 0.030	< 0.030	< 0.030	< 0.030

Notes:
LOD - Limit of Detection
VOCs - Volatile Organic Compounds
TPHs - Total Petroleum Hydrocarbons
PAHs - Polycyclic Aromatic Hydrocarbons
mg - milligrams
µg/l - microgram per liter
GAC - Generic Assessment Criteria
ND - not detected

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