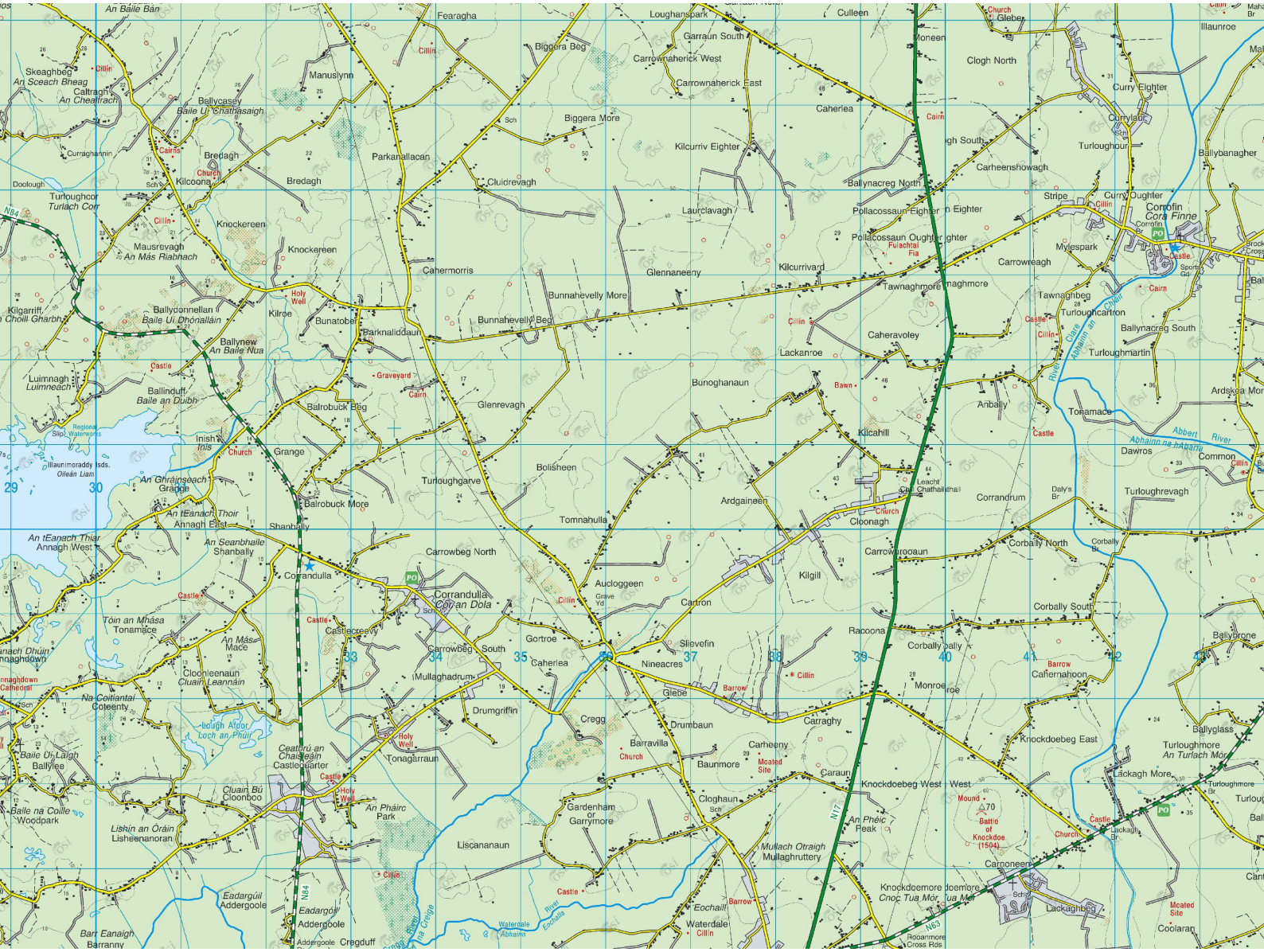
CHAPTER 3

PROJECT DESCRIPTION



QUARRY CONSULTING

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CHAPTER 3: PROJECT DESCRIPTION

Existing Environment

3.1 The existing operational limestone quarry extraction covers an area of approximately 10.55 hectares, with details of the site layout shown on Figure 1.2. The water level in the quarry sump located at the lowest point on the existing permitted quarry floor is at minus 12 mOD.

3.2 The existing operations at the site are currently regulated by conditions imposed under Section 261 (QY/55) along with conditions relating to various manufacturing activities at the site and the original quarry planning permission from the 1970's.

3.3 The existing quarry operations comprise extraction of limestone using blasting techniques, processing (crushing and screening) of the fragmented rock to produce aggregates for construction purposes. Existing manufacturing activities at the quarry include an asphalt plant and concrete (readymix and blocks) plant.

3.4 Ancillary facilities at the existing quarry include an office, weighbridge, canteen, toilets and a wheelwash (with side spray bars).

Proposed Development

Operational Phase (Extraction and Processing)

3.5 The proposed development being applied for under this current planning application is shown on Figure 2-1 and will consist of:

- Extraction of rock from an area consisting of 4.35 hectares which was previously subject to rock extraction and all associated facilities/works to a final floor level of 4 mOD;
- Lateral extension of the existing permitted quarry area over c.6.1 ha. area to a final floor level of 4 mOD;
- Restoration of the application area to natural habitat after uses following completion of extraction;
- all related ancillary development and associated site works including processing (crushing, screening and washing) and stockpiling of materials; provision of landscaped screening berms and all other related activities;
- The proposed development is within an overall application area of c. 12 hectares and is for a total period of 25 years.

3.6 Aggregate extracted from the application area will be processed using static and mobile crushing and screening plant within the quarry void – refer to Figure 3.1. Processed rock will be stored in the quarry area pending use in the ancillary manufacturing plants (asphalt, block, concrete) on site or sale off site.

3.7 Due to the nature of the proposed development, the construction stage—consisting primarily of the stripping of topsoil and overburden and the construction of screening berms—will proceed concurrently with initial operational activities. This approach is designed to optimise site preparation and resource use while minimising environmental disturbance.

Restoration (Reinstatement to Nature Conservation Habitat Areas)

3.8 Upon the cessation of extraction operations, it is proposed to return the worked lands to natural habitat after-uses – refer to Figure 3.2 and Chapter 5: Biodiversity.

3.9 Where feasible, restoration of exhausted and redundant areas will be carried out at the earliest opportunity. However, it is envisaged that the majority of the restoration proposals will be carried out after extraction operations at the site have ceased.

Aggregate Reserve Assessment

3.10 The total recoverable reserve of rock from within the proposed quarry extension area is assessed at c. 5.5 million tonnes.

Duration of Extraction

3.11 An outline of the proposed extraction plan and the final ground level contours is shown in Figure 3-1. Cross-sections through the final landform are shown in Figure 3-3.

Table 3-1: Material Quantities

Material	Quantity
Topsoil	c. 20,000 m³ (est. assuming 0.3 metres depth)
Overburden	61,000 m³ (est. assuming 1 metres depth)
Rock	Approx. 2.1 million m³ or 5.5 million tonnes

3.12 The duration of quarrying activities at the application site will largely be dictated by market demand and as a result the rate of extraction . There are many factors which will influence this, including, but not limited to the:

- Prevailing economic climate and related construction industry output;
- Distance of construction projects from the facility (and scale of activity).

3.13 In light of these and other variables, calculation of output rates and duration is not an exact science. The **maximum** quarry extraction rate at the existing quarry is up to **400,000 tonnes per annum** to allow the applicant respond to demand for aggregates for large infrastructure projects in the Region.

3.14 A planning permission duration of 25 years is sought for the extraction and processing period and a further 2 years to complete final restoration of the site.

3.15 The 25-year planning permission period, followed by 2 years for site restoration, is a pragmatic approach that balances the operational realities of quarrying with the need for environmental conservation and community engagement. It acknowledges the complexities of predicting market demand over time while providing a structured timeline for resource extraction and site rehabilitation.

Site Screening

3.16 Screening of the proposed development will be implemented through a combination of design and phasing of the workings; existing external hedgerows; existing and proposed landscaped screening berms and the surrounding topography – refer to Figure 3.1 and Chapter 12: Landscape.

Removal of Topsoil and Overburden Soils

3.17 Topsoil and overburden stripped within the proposed quarry extension area will be used directly for constructing landscaped screening embankments and landscaping works or incorporated into the site as needed for the final restoration of the quarry (refer to Figure 2.2). Additionally, some of the overburden material, where suitable, may be removed from the site and sold as an engineering fill product, supporting sustainable resource utilisation.

3.18 There is no requirement for a dedicated storage area for topsoil or overburden, as these materials will be used on an ongoing basis for site development or restoration purposes.

3.19 All berms and storage areas will have slope angles not greater than 1:1.5 and will be re-vegetated as quickly as possible to avoid soil erosion by air and water. The outer slopes will be 1:2 and will be planted with native tree species to reduce the visual impact of the proposed development (refer to EIAR Chapter 12: Visual and Landscape). These issues are discussed in greater detail in the relevant EIAR Chapters (Biodiversity / Land, Soils and Geology / Landscape).

Wall, Tree and Hedgerow Removal

3.20 All walls, trees, shrubs, and ground vegetation will be removed in accordance with good practice. To avoid destruction of nests, vegetation removal will be planned to occur outside the bird breeding season (March to August).

3.21 Where feasible, any reusable materials such as stone from walls will be retained on-site for use in landscape features or for constructing boundary walls. In cases where reuse on-site is not possible, these materials will be removed off-site to an authorised waste location.

3.22 Vegetation that cannot be retained on site will be processed in an environmentally sensitive manner. Wood and plant material will be either:

- Chipped and repurposed as mulch for use in landscaping around the site, or
- Removed off-site and sent to an appropriate recycling or composting facility.

Site Drainage

3.23 A hydrological / hydrogeological assessment has been carried out taking into consideration the existing and proposed water regime at the site. It addresses mitigation measures to eliminate and/or minimise the potential impacts, if any, on surface water and groundwater – refer to Chapter 8 (Water).

Stability of the Quarry

3.24 Industry standard slope angles, bench heights, and bench widths will be used for extraction operations at the site and within the application area.

Method of Extraction

3.25 Blasting is, and will continue to be, used within the quarry area including the application area to fragment the stone prior to processing (crushing / screening / washing, etc.).

3.26 Blasting is undertaken approximately one day per month, potentially increasing to two – three times per month during periods of high demand.

3.27 Blasting will continue to be undertaken by a third party operator, as currently occurs on site. Drill rigs on the existing quarry floor will be used to drill the charge holes ready for blasting to begin the process of lowering the floor. The rigs will be equipped with dust suppression equipment.

3.28 The recovered rock from the active face will be processed in a similar manner to that already occurring on site using existing site infrastructure and plant. The blasted rock will be crushed and screened and conveyed to stockpiles for subsequent loading to trucks by loading shovels.

Processing Methods

3.29 The processing of the extracted rock, into aggregate products, will consist of crushing and screening using fixed and mobile processing plant within the quarry void / application area.

Quarry Working Hours

3.30 In accordance with condition 6 of the existing quarry planning conditions (Plan File Ref. No. QY/55) the hours of quarry operations will be confined to between 07.00 – 20.00 hrs Monday to Friday with crushing to take place from 08.00 – 20.00; and from 08.00 – 16.00 hrs Saturday. The quarry will not operate on Sundays or Bank Holidays, except in emergency situations.

Employment

3.31 The proposed development will provide continued employment of up to 30 people directly on site, in addition to a number of indirect employees such as crushing contractors, HGV drivers, maintenance contractors, etc..

3.32 The continued development of the site is consistent with the policies set out in the National Planning Guidelines for the sector; the Regional Planning Guidelines and the Galway County Development plan which recognise the requirement for:

- A secure supply of construction aggregates and related products is necessary for the continued development of the region;
- Proven aggregate reserves need to be safeguarded for future extraction;
- 'Best environmental management practice' to be implemented within quarry developments.

SITE INFRASTRUCTURE

Site Access

3.33 The Access to the site is provided via a paved access road over 200m in length, which joins the L6182 at a gated entrance. In the immediate vicinity of the site the L6182 comprises a marked, single carriageway road with an 80km/hour (which will be reduced to 60 kmph). The L6182 joins the N83 approx. 1.3km to the east of the site.

Site Security

3.34 Vehicular access to the application site is from the existing site entrance only. There is no other vehicular access to the application site. The access gate is locked outside operational hours.

3.35 At the present time, the property boundary is secured by ditches, screening berms, post and wire fencing, walls and hedgerows.

3.36 The existing boundary fencing has been installed in accordance with Health and Safety Authority (HSA) guidelines to prevent unauthorised access and protect public safety. In line with these guidelines, areas accessible to the public have been secured with child-proof fencing to prevent entry. For other boundary areas where public access is unlikely, stock-proof fencing has been installed to secure the site perimeter effectively.

3.37 This fencing approach ensures that the site meets both safety and operational requirements. Regular inspections are conducted to maintain fencing integrity, and immediate repairs are carried out if breaches or weaknesses are identified. This proactive management aligns with HSA guidance, ensuring that the fencing remains fit for purpose and minimises risk to the public and animals in adjacent areas.

Site Roads, Parking and Hardstanding Areas

3.38 All HGVs utilising the quarry will be confined within the Applicant's landholding.

3.39 Adequate car parking provision for employees and visitors is provided at the existing weighbridge office as indicated in Figure 1.3.

Wheelwash

3.40 In order to prevent the transport of any clay or dust onto the public road network, a wheelwash (with side spray bars) has been installed along the access road to the site (as per condition no. 7 of QY/55). All HGV traffic exiting the quarry are required to pass through the existing wheelwash, the location of which is indicated on the site infrastructure layout in Figure 3-1.

Weighbridge

3.41 In order to track and record the amount of material exiting the quarry, all HGV traffic is directed across the existing weighbridge, the location of which is also indicated on the site infrastructure layout in Figure 3 .1.

Offices and Ancillary Facilities

3.42 Existing permitted ancillary facilities at the site include a wheelwash, weighbridge, car park area, site office, maintenance garage, storage shed staff facilities/canteen, laboratory, pump house and bunded fuel storage tanks.

Utilities and Services

3.43 The company has invested significantly in 3-phase electricity at the quarry, and has also invested in a wheel wash, asphalt entrance and weighbridge facilities (Figure 3.1).

3.44 The requirement for water on the subject site is limited and confined mainly to dust suppression during crushing activities and suppression of dust in the quarry floor and access route by means of sprinklers and also a water bowser during dry weather. Water is supplied from the existing water management system at the site.

3.45 Potable water supply is provided by Irish Water.

3.46 There is an existing effluent treatment system in place at the existing permitted quarry. The loading on the system will remain unchanged as a result of this application for deepening of the existing quarry.

3.47 All of the aforementioned infrastructure will remain in place to facilitate the proposed development.

3.48 Given the lack of combustible waste materials at this site, it is considered highly unlikely that a fire will break out during quarry operations. A range of fire extinguishers (water, foam and CO2) are kept at the site office to deal with any localised small scale fires which might occur. Additional fire-fighting capacity can be provided by storing water in a mobile bowser.

Lighting

3.49 Sufficient lighting is provided at the existing quarry site to ensure safe operations during winter periods.

Fuel and Oil Storage

3.50 Fuel and various products and admixtures required for the day to day operation at the site are stored at locations around the manufacturing area of the existing working quarry. Fuel is delivered to site by fuel companies and dispensed directly into plant and equipment. A small volume of fuel is stored at the working quarry which is used in the event that deliveries from fuel companies cannot be met. No fuel, chemicals or admixtures will be stored at the application site. Fuel storage tanks located at the working quarry are bunded to ensure that potential leakages are contained within the bunded area.

Landscape and Boundary Treatment

3.51 As stated above, the boundaries of the site are secured with ditches, screening berms, post and wire fencing, walls and hedgerows. The site boundary will continue to be inspected on a regular basis and maintained as required under the Mines and Quarries Legislation.

3.52 It is proposed to construct landscaped screening berms along the northern and southern boundary of the proposed quarry extension area – refer to Figure 3.1. In addition the eastern boundary of the proposed quarry extension area will be planted with a native hedgerow and tree mix.

3.53 The existing entrance to the site has lockable gates to prevent unauthorised access outside of the working hours.

Waste management

Extractive Waste Management

3.54 Almost all products and by-products arising from the aggregate processing have commercial value. Any waste materials from the site are stored, collected, recycled and/or disposed of in accordance with any requirements of the Waste Management Regulations.

General Waste Management

3.55 Harrington Concrete and Quarries are a member of the Irish Concrete Federation and commit themselves to the principles of the Federations Environmental Code. The code states:-

"ICF members will minimise production of waste and where appropriate consider its beneficial use including recycling. They will deal with all waste in accordance with the relevant legislation and other controls in place, including using waste contractors with valid Waste Collection Permits"

3.56 Potential waste produced and the measures used to control it are described as follows:

- Scrap metal – these materials are chiefly produced from the maintenance of the processing plants and can cause a nuisance if allowed to build up in an uncontrolled manner. A designated scrap metal area is and will continue to be controlled by the regular removal by licensed scrap metal dealers.
- Used Oil and Oil Filters – any waste oil/oil filters that may arise from servicing of fixed or mobile plant is removed from the site by a licensed waste contractor.
- Used Batteries – similarly all used batteries are removed from site for collection and recycling by a licensed waste contractor in accordance with the Waste Management Regulations.
- Domestic Type Waste (Canteen Waste) – domestic waste generated at the offices and employee's facility is collected by a licensed waste collection contractor.

EXISTING ENVIRONMENTAL CONTROLS

General

3.57 Extraction, processing and ultimately restoration activities at the application site require a number of environmental controls to eliminate or minimise the potential nuisance to the public arising from the extraction and processing operations. The environmental control measures in place at the site are outlined in the relevant EIAR Chapters.

3.58 The existing operations at the site are currently regulated by conditions imposed under Section 261 (QY/55).

3.59 Any additional control measures, over and above those already in place and/or outlined below, which may be instructed on foot of this planning application, will also be implemented.

Bird Control

3.60 As the process of stone extraction is free of putrescible (food / kitchen) waste, site activities are unlikely to attract scavenging birds such as gulls and crows for the duration of works. Accordingly, it is not intended to implement any specific bird control measures at the site as is the case at present.

Traffic Control

3.61 As the planning application relates to the lateral extension of the existing quarry operation, the proposed development will continue to utilise the existing site entrance and established haul routes.

Litter Control

3.62 As the proposed development will be largely free of litter, the daily operational activities are unlikely to give rise to problems with windblown litter. Accordingly, there is no requirement to implement any specific litter control measures at the site.

3.63 In the unlikely event that any litter waste is identified, it will be immediately removed off-site to an authorised waste disposal or recovery site.

Odour Control

3.64 As the extraction activities at the site are not biodegradable and do not therefore emit odorous gases, site activities do not give rise to odour nuisance. No odour control is required.

Vermin Control

3.65 As the proposed development is free of putrescible (food / kitchen) waste, on-site activities will not attract vermin for the duration of the extraction or subsequent restoration operations. Accordingly, no specific vermin control measures are required.

Fire Control

3.66 In the unlikely event that a fire does occur, the local fire station will be contacted and emergency response procedures will be implemented. Fire extinguishers (water and foam) are provided at all offices to deal with any small outbreaks which may occur.

3.67 A range of fire extinguishers (water, foam and CO2) are kept at the site office to deal with any localised small scale fires which might occur and on quarry vehicles. Additional fire-fighting capacity can be provided by storing water in a mobile bowser.

Surface Water and Groundwater Management

3.68 Incidental rainwater and groundwater seepages entering the proposed quarry extension area will drain across the quarry floor to a sump located in the south-eastern corner of the existing quarry extraction area and be managed in the existing water management system for the quarry.

3.69 Surface water would be managed in accordance with the 2023 discharge licence granted by Galway County Council under reference w/502/22.

Dust Generation and Control

3.70 In dry, windy weather conditions, site activities may give rise to dust blows across and beyond the existing or planned development site areas.

3.71 The incidence of fugitive dust outside of the operation is reduced by the crushing and screening plant being located within the quarry void. Generation of fugitive dust is generally limited to periods of very low rainfall (refer to Chapter 10 – Air Quality). Dust generation occurs from three main sources:

- Point sources – such as operating plant and machinery.
- Line sources – such as roads and conveyors.
- Dispersed Sources– such as quarry floors and stockpiles.

3.72 In order to control dust emissions, the following measures will continue to be implemented:-

- Water will continue to be sprayed from a tractor drawn bowser on dry exposed surfaces and stockpiles (paved roads, unsealed haul roads and hardstand areas);
- Areas of bare or exposed soils will, insofar as practicable, be kept to a minimum;
- The amount of dust or fines carried onto the public road network will be reduced by periodic sweeping of internal paved site roads and surrounding public roads as required;
- All HGVs exiting the quarry site will pass through the wheel wash facility;
- Emission of fugitive dust from machinery such as processing plant will be minimised by utilising dust suppression and by locating such plant within the quarry area, where possible.

3.73 Dust deposition monitoring is currently carried out as part of the environmental monitoring programme carried out at the quarry site, and the monitoring will be extended to include the application area. Dust deposition monitoring results will continue to be submitted to Galway County Council on a regular basis - refer to EIAR Chapter 10 – Air Quality.

3.74 Mitigation measures are provided in accordance with the DoEHLG (2004) guidelines for the sector and EPA (2006), refer to EIAR Chapters 10 & 17.

Noise Generation and Control

3.75 The sources of noise located within the planning application area will primarily be related to machinery / plant operation.

3.76 The potential for noise generation from the planning application area will be reduced by locating the crushing and screening plant within the quarry void. This means that the potential for noise generation from activities associated with the operation of the plant such as the movement of vehicles and maintenance will be reduced – refer to Chapter 11.

3.77 In addition to the above the following good housekeeping measures are in place and will be extended to include the application area, where applicable, in order to reduce noise emitted from plant and machinery as much as possible:

- All machinery used is CE certified for compliance with EU noise control limits;
- The machinery will continue to be regularly maintained. This includes regularly checking any muffler systems and servicing or replacing as required. It also ensures any loose or damaged panels or covers that suppress noise are fixed or replaced immediately;
- If there are further noise-reducing modifications available for any machinery, they will be fitted wherever practical (e.g. rubber-decked screens, rubber chute linings etc.)
- Haul road grades are kept as low as possible to reduce engine / brake noise from heavy vehicles.

3.78 Mitigation measures are provided in accordance with the DoEHLG (2004) and EPA (2006) guidelines for the sector.

3.79 There is an existing noise monitoring programme at the quarry site and ongoing noise monitoring is carried out as part of the environmental monitoring programme. The noise monitoring programme will be extended to include the application area. Noise monitoring results will continue to be submitted to Galway County Council on a regular basis.

Blasting Control

3.80 Blasting mitigation measures relate to blasting procedures such as the quantity of explosive and charge-hole spacing along the quarry face. Additional mitigation measures currently carried out at the quarry site and extended to include the application area include:

- Include geological considerations in blast design;
- There will be no blasting outside the hours of 11:00 and 18:00 during Monday to Friday and none taking place at the weekend or public holidays;
- Optimise blast design along the rock-face with adequately spaced charges;
- Minimise air overpressure through proper blast design, spacing and timing of multiple charges;
- Blast monitoring will be undertaken at the nearest occupied dwelling for each blast carried out on site;
- Inform nearby residents on day prior to planned blasting schedule using house-calls, telephone and written note/signage at the quarry entrance (or combination).

EXISTING ENVIRONMENTAL MONITORING

General

3.81 The quarry site has an established environmental management system in operation. Noise, dust and blast monitoring is carried out on a regular basis, to demonstrate that the development is not having an adverse impact on the surrounding environment.

3.82 The site is subject to on-going environmental monitoring, with annual reports submitted to Galway County Council to ensure compliance with planning conditions: refer to Appendix 3.1 for the Annual Environmental Report (2024).

Dust Monitoring: (Condition 3 of QY/55)

3.83 Dust deposition monitoring is currently carried out at the quarry site – refer to Chapter 10. Dust monitoring locations shall be reviewed and revised where necessary to include the application area. The results of the dust monitoring will be submitted to Galway County Council on a regular basis for review and record purposes.

Noise Monitoring: (Condition 2 of QY/55)

3.84 Noise monitoring is currently carried out at the quarry site – refer to Chapter 11. Noise monitoring locations shall be reviewed and revised where necessary to include the application area. The results of the noise monitoring will be submitted to Galway County Council on a regular basis for review and record purposes.

Water Monitoring

3.85 Water monitoring at the quarry site will continue in line with the water discharge licence (w/502/22) for the site.

Vibration: (Condition 4 of QY/55)

3.86 Monitoring of blasts (both for groundborne vibration and air overpressure) is carried out for all blasts carried out at the quarry site and will be extended to include the application area - refer to Chapter 11. The blast monitoring results will continue to be submitted on a regular basis to Galway County Council for record purposes.

PROPOSED FINAL RESTORATION

Proposed Restoration Scheme

3.87 The proposed restoration scheme for the planning application area is detailed in the restoration plan, Figure 3-2.

3.88 From the outset of the development, landscaped screening berms will be constructed along the northern and southwestern boundaries of the quarry extension area to provide visual and noise mitigation, with the eastern boundary planted with a native hedgerow and tree mix to enhance biodiversity and contribute to long-term ecological benefits (refer to Figure 3.1).

3.89 Upon completion of all extraction operations, the remaining application area will be restored to a natural habitat, consistent with beneficial after-uses recommended in the EPA Guidelines: *'Environmental Management in the Extractive Industry'* (2006). This final restoration phase will involve the following measures:

- All plant and machinery will be removed from the quarry void.
- The quarry pumps will be turned off, and all associated discharge pipe infrastructure will be removed, allowing the quarry void to fill naturally with water, creating a lake-like restoration.
- The area will be left for natural recolonisation by locally occurring grass and shrub/scrub species.
- All existing boundary fences and hedgerows will be retained to ensure site security.

3.90 The restoration works will be carried out in accordance with the EPA Guidelines (2006).

Site Management and Supervision

3.91 The Applicant will clearly define the management responsibility for the site restoration work and ensure that this person has the necessary information (from the planning application) and authority to manage the entire restoration process. Relevant staff will be briefed on the scheme and supervised accordingly. A system of record-keeping for key restoration activities will be implemented.

Long-Term Safety and Security

3.92 Existing hedges surrounding the development will be filled and thickened where needed. Combined with the existing fencing and secure, locked entrance gates, this will prevent unauthorised third-party access.

Long-Term Surface Water and Groundwater Management

3.93 Surface water will either percolate to the ground or be directed into the water body formed within the quarry void (refer to EIAR Chapter 8).

Decommissioning of Plant and Machinery

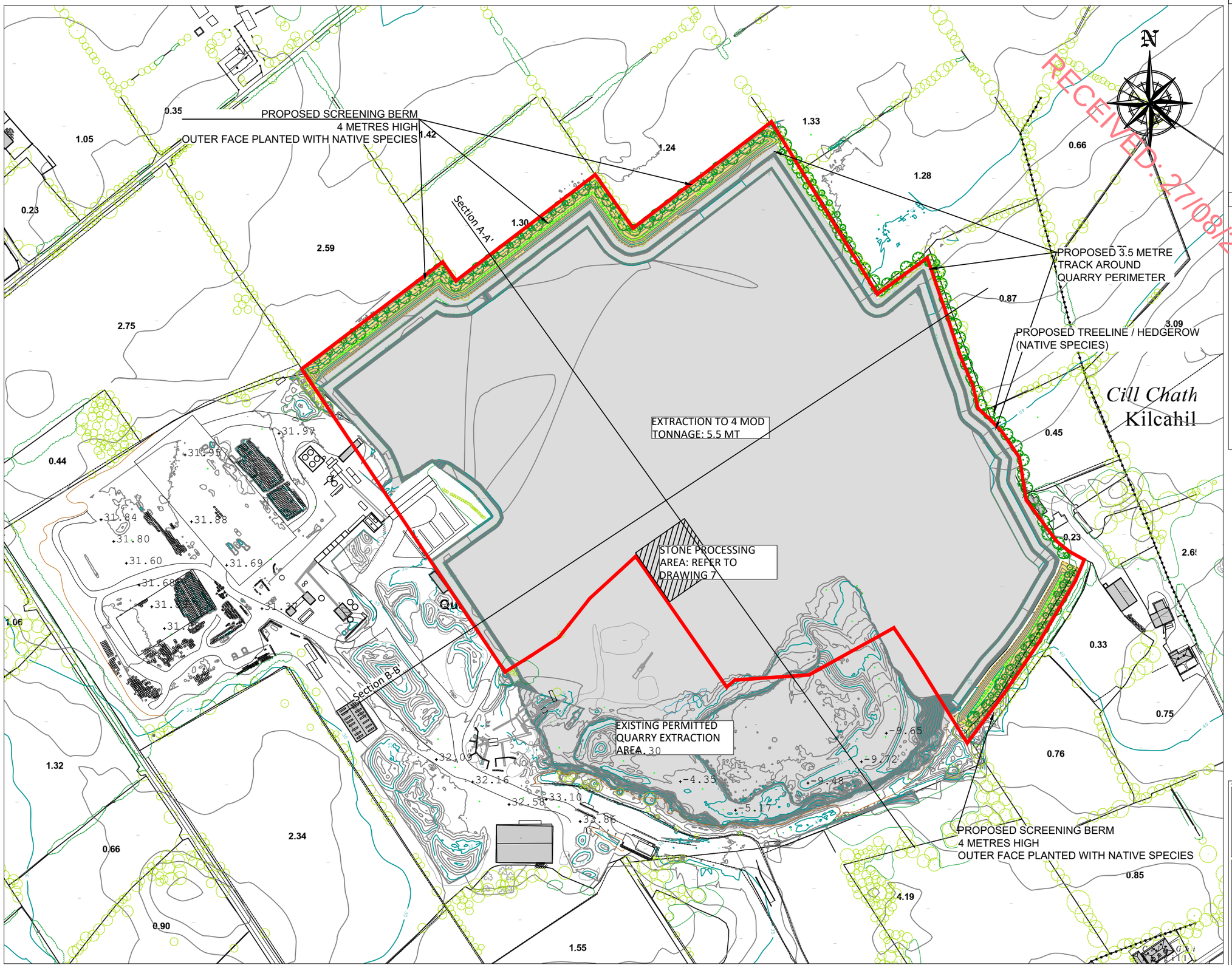
3.94 Redundant structures, plant, equipment, and stockpiles will be removed from the site upon cessation of extraction activities. Machinery and buildings will either be reused on other sites by the Applicant or sold for scrap or resale.

Aftercare and Monitoring

3.95 No aftercare or monitoring is required for the restoration proposals for the application area or quarry site.

FIGURES

03.23.FIGURE 3.1 Proposed Site Layout FINAL.dwg



RECEIVED: 27/08/2025

NOTES

Extract from Ordnance Survey 25 Inch Mapping - **Map No. 3087-A & 3087-B**

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REFER TO FIGURE 3.3 FOR CROSS SECTIONS

LEGEND

APPLICATION AREA
12 Ha.

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HARRINGTON CONCRETE AND QUARRIES

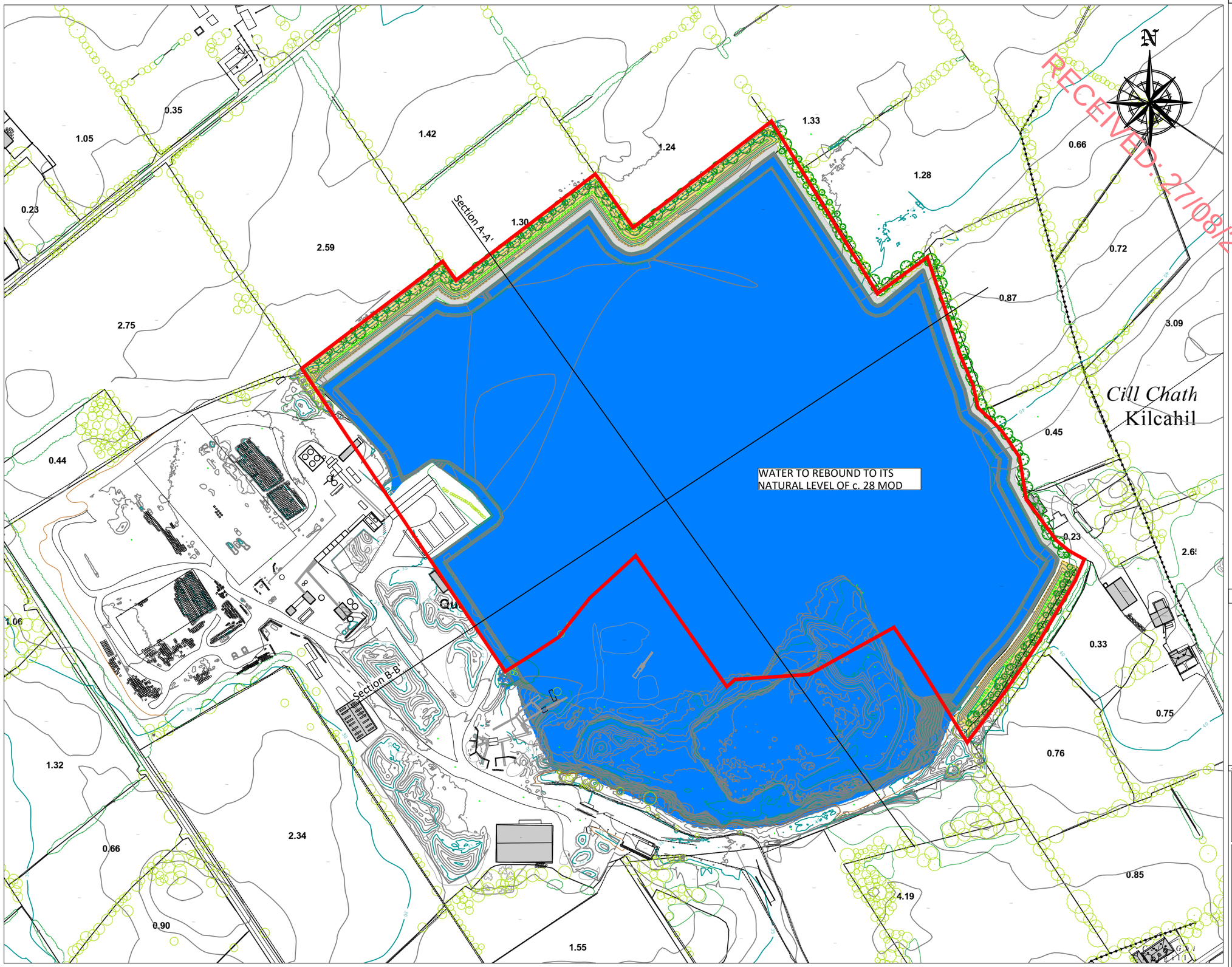
PROPOSED QUARRY EXTENSION
ARDGAINEEN, CLAREGALWAY,
CO. GALWAY

PROPOSED SITE LAYOUT

FIGURE 3.1

Scale	Date
1:2,500	AUG 2025

03.23.FIGURE 3.1 Proposed Site Layout FINAL.dwg



NOTES

Extract from Ordnance Survey 25 Inch Mapping - **Map No. 3087-A & 3087-B**

REFER TO FIGURE 2.3 FOR CROSS SECTIONS

Proposed Landscaping and Restoration Scheme

- Landscaped screening berms will be constructed along the northern and southwestern boundaries of the quarry extension area to provide visual and noise mitigation.
- The eastern boundary of the extension area will be planted with a native hedgerow and tree mix, further enhancing biodiversity and contributing to long-term ecological benefits.Once all extraction operations have been completed, the application area will be restored to a natural habitat. This will be achieved through the following measures:
  - All plant and machinery will be removed from the quarry void
  - The quarry pumps will be turned off, and all associated discharge pipe infrastructure will be removed, allowing the quarry void to fill naturally with water, creating a lake-like restoration.
  - The area will be left for natural recolonisation by locally occurring grass and shrub/scrub species.
  - All existing boundary fences and hedgerows will be retained to ensure site security.
- The restoration works will be carried out in accordance with the EPA Guidelines (2006).

LEGEND

APPLICATION AREA
12 Ha.

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HARRINGTON CONCRETE AND QUARRIES

PROPOSED QUARRY EXTENSION
ARDGAINEEN, CLAREGALWAY,
CO. GALWAY

PROPOSED LANDSCAPING & RESTORATION PLAN

FIGURE 3.2

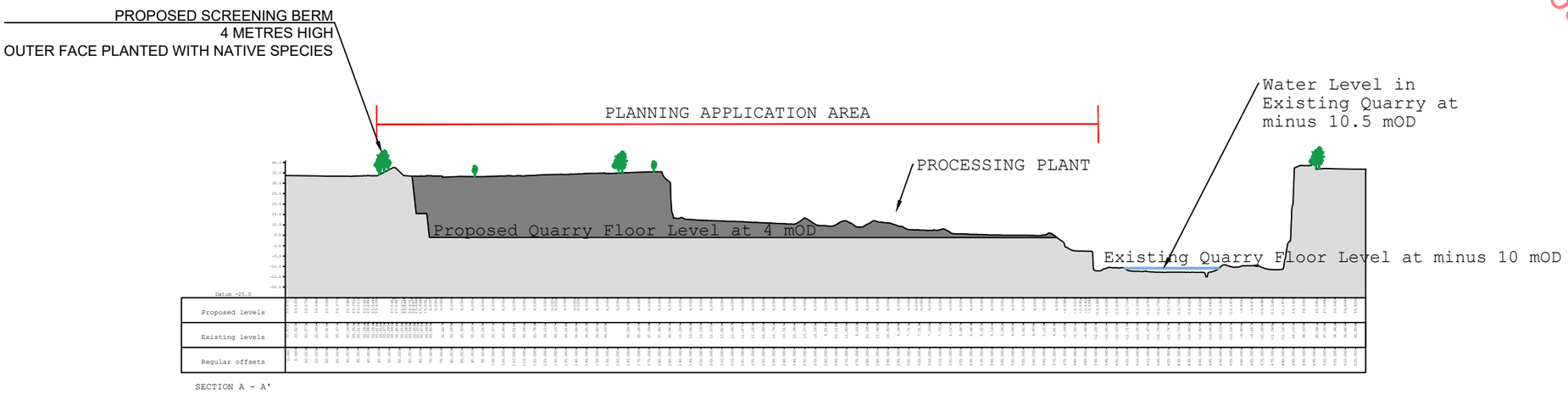
Scale 1:2,500

Date AUG 2025

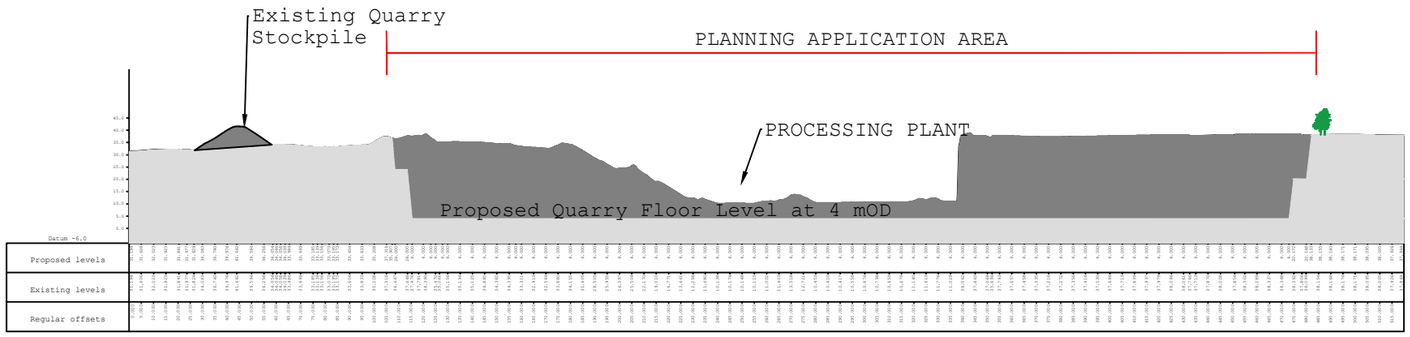
03.23.FIGURE 3.3 Cross Sections.dwg

NOTES

REFER TO FIGURES 1.3 & 3.1 FOR CROSS SECTION LOCATIONS



SECTION A - A'



SECTION B - B'

0 80m 200

Metres 1:2500

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HARRINGTON CONCRETE AND QUARRIES

PROPOSED QUARRY EXTENSION
ARDGAINEEN, CLAREGALWAY,
CO. GALWAY

EXISTING AND PROPOSED CROSS SECTIONS

FIGURE 3.3

Scale	Date
1:2,500	AUG 2025

Appendix 3.1: Annual Environmental Report (2024)

COYLE ENVIRONMENTAL LTD.

2024 Annual Environmental Report

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Coyle ENVIRONMENTAL

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Our reputation is built on innovative work practices, cost-effective solutions, and unwavering client dedication.

Operating nationwide from our base in the West of Ireland we pride ourselves on delivering consistently high-quality services, ensuring that projects are completed on time and within budget. Our commitment to Continuous Professional Development (CPD) and investment in the latest technology keeps us at the forefront of the industry.

We deliver to our valued clients a consistently excellent quality of service.

We offer a specialist range of services comprising:

- Environmental Monitoring
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- Environmental Project Management

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Document Control

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Revision History

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0		DD/MM/YY

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1.0 Introduction

Coyle Environmental Ltd were commissioned by Harrington Concrete and Quarries - Galway to comprise their Annual Environmental Report for 2024. This document provides details of the environmental monitoring undertaken in relation to air, noise, dust, water emissions and vibration monitoring that was carried out during the period January to December 2024. Ms Amanda Tarpey is the Planning and Environmental Officer for Harrington Concrete and is responsible for the routine environmental monitoring.

Harrington Concrete and Quarries were granted an air emissions licence (AP10/13) by Galway County Council on 15th November 2013 in relation to the operation of the macadam/asphalt manufacturing plant located within the quarry at Ardgaineen near Claregalway, Co. Galway. The licence conditions specify limits on air emissions from the exhaust stack.

On the 7th of June 2023, Galway County Council granted a discharge licence to Harrington Concrete and Quarries, Cloughvalley, Kilkelly, Co. Mayo for the discharge of trade effluent emanating from Harrington Concrete and Quarries at Ardgaineen, Claregalway, Co. Galway from an attenuation sump to a wetland vegetation area via a petrol/oil interceptor to groundwater subject to the conditions set out in the Licence W/502/22.

Noise results are represented to comply with Condition no. 4 of PL 7/5/88667 & PL 7/5/88665.

Vibration results are represented to comply under Condition 4 of their Planning Permission.

Dust analysis results are represented to comply with Condition 4 of their Planning Permission.

2.0 Site Location & Monitoring Locations

Figure 1: Monitoring Locations

Legend:

- **Dust Monitoring Locations**
- **Water Discharge Monitoring Location**
- **Asphalt Plant Emissions**
- **Noise Monitoring Locations**

3.0 Noise

3.1 Condition no. 4 of PL 7/5/88667 & PL 7/5/88665

Quarry Consulting were commissioned by Harrington Concrete and Quarries Ltd. to undertake noise surveys at its existing quarry which includes an asphalt plant and concrete block production plant at Ardgaineen, Claregalway, Co. Galway. The purpose of the survey was to provide Harrington Concrete and Quarries Ltd. with the noise data and analysis required as part of their regulatory requirements. Environmental noise surveys have been carried out by Quarry Consulting to assess the ambient noise levels in the vicinity of the quarry.

Noise monitoring was carried out for each Quarter period in 2024. The noise monitoring locations N1, N2, N3, N4 and N5 are shown in Figure 1. The reports detailing the results of this survey are included in Appendix 1. Results in 2024 indicate that the LAeq did not exceed the level of 55 dB(A) specified in Condition 4 of Planning Permission PL 7/5/88667 & PL 7/5/88665. All the noise surveys were carried out between 07:00-20:00 during normal production at the quarry.

Noise levels measured at Monaghans House (N1) during 2024 gave a maximum of 52 dB(A) and an LA90 result of 40.7 dB(A). Sources of noise at this location near the east corner of the site included the N17 road traffic and rock breaker being very audible, the crusher being slightly audible, birds chirping and a breeze at times. At site N2, which is situated in a field behind Berminghams House, south of the quarry, the dominant noise source was coming from the traffic on the N17 road resulting in a maximum LAeq of 57.6 dB(A). Sprinklers had also contributed to an increase in noise levels at this site, along with birds chirping and cattle grazing. The maximum LAeq at the third site (N3) was 42.6 dB(A) and a LA90 of 32.2 dB(A). N3 is located west of the boundary. During Q3, the noise monitor at N3 had malfunctioned during monitoring.

LAeq levels of 45.7-51.4 dB(A) occurred to the north of the quarry boundary at O'Neills house (N4). The LA90 at this location ranged between 30.9-42.5 dB(A). It was noted that the heavy machinery being moved on the yard was quite loud and that the quarry noise was audible, especially the crushing and processing plant. Site N5 is located to the north-east of the quarry boundary. Here, the quarry operations were not audible. The maximum LAeq level was 46.0 dB(A) and an LA90 of 38.4 dB(A). During quarter 3, the road traffic from the N14 was audible. There was no noise monitoring during Q4 as the weather conditions were not suitable during periods of crushing.

4.0 Dust

4.1 Total Dust Emissions

A dust deposition survey was undertaken during 2024 over an 11-month period from January to November with a network of four monitoring sites located near the quarry boundary (Figure 1). The results of this survey are given in Appendix 2. The Bergerhoff sampling procedure that is recommended by the Environmental Protection Agency was used for monitoring monthly dust-fall rates. The results indicate that the monthly average dust-fall at all of the monitoring locations was below the German TA Luft limit value of 350 milligrams per square metre per day (mg/m^2.day).

Overall, 86% of the valid results obtained from the monitoring network were below the monthly limit value, with a range in the monthly dust-fall rate from 21-1532 mg/m^2.day. March had the highest monthly rate of 1532 mg/m^2.day, which was measured at site D1, and February had the lowest dust-fall rate of 21 mg/m^2.day, measured at site D3. The lowest overall dust-fall rates in 2024 were reported at Site D4, located near the north-western boundary (Figure 2), where monthly rates ranged from 49-277 mg/m^2.day over the year with an average rate of 147 mg/m^2.day.

In order to control and reduce dust emissions, the automatic fixed sprinkler system along the access road is effective in controlling and reducing the potential for fugitive dust emissions from trucks travelling along the access road to and from the quarry floor.

5.0 Vibration

5.1 Condition 4

Under condition 4 of planning permission, vibration monitoring must be carried out during blasting.

- Ground vibration arising from any blast carried out on site shall not exceed a peak particle velocity of 12 millimetres per second (mm/s) in any of the three mutually orthogonal planes at the threshold of any house in the vicinity of the site.

- The air over-pressure arising from the blasts carried out on site shall not exceed 125 dB (Linear) maximum peak when measured outside the nearest house to the blast.

- Monitoring for ground vibration and air over pressure shall be carried out by the operator during each blast.

- Residents within 500m of the quarry boundary shall be given advance notice in writing when blasting operations are due to take place. Residents shall be informed that the blasting operation has been completed by appropriate means.

- Blasting shall only take place between the hours of 09:00 and 18:00, Monday to Friday.

Vibration measurements were taken at one location, V1. Locations can be seen in Figure 1. Vibration and air over-pressure were monitored by Irish Industrial Explosives (IIE) during each blasting operation conducted in 2024. There were 4 blasts during the year with the first carried out on the 12th of March, 2nd of September, 16th of October and the 12th of November. The results of vibration and air over-pressure measurements at the one location (Main Gate - V1) which is indicated in Figure 1, are given in Appendix 2.

The maximum peak particle velocity at location V1 was 3.5 mm/s. All peak particle measurements at V1 during 2024 were below 4 mm/s.

The recorded air overpressure values at the one location were below the limit values specified in Condition 4.

6.0 Air Emissions

6.1 Licence AP 10/13

Harrington Concrete and Quarries was granted an air emissions licence (AP10/13) by Galway County Council on 15th November 2013 in relation to the operation of the macadam/asphalt manufacturing plant located within the quarry at Ardgaineen near Claregalway, Co. Galway.

The licence conditions specify limits on air emissions from the exhaust stack. The emission limits specified in the Licence are as follows (Appendix A.2 of Licence AP 10/13):

- Sulphur dioxide (SO2) - 500 mg/Nm3
- NOx (as NO2) - 400 mg/Nm3
- Dust (PM) - 50 mg/Nm3

Results are to be found in Appendix 3 of this AER.

Figure 2: Stack Diagram

7.0 Water Quality

7.0 Licence W/502/22

This Licence refers to the attenuation sump discharge of Harrington Concrete and Quarries located at Ardgaineen, Claregalway, Co. Galway. Surface water run-off and ground water collected in the quarry attenuation sump are pumped to a Wetland Vegetation Area, via a petrol/oil interceptor, where water percolates to the ground. This Licence is for the existing extraction are of 4.35ha granted under Substitute Consent (Ref SU0053) in February 2017. If planning permission is granted for an extension to the quarry, or there is an increase in quarry discharge, a full review of this Licence will be required. The maximum permitted discharge is 1,483m3 per day. As is required by License W/502/22, the site monitors water quality of the final discharge from the site on a Quarterly basis.

Condition 4 of the Licence states that “Quarterly analysis of groundwater monitoring wells will be carried out be an approved accredited laboratory”. However, there are no wells on the operational quarry to which the Discharge Licence relates. Hydro-G has previously reported 11 Site Investigation boreholes on the floor of the quarry and none of those boreholes encountered groundwater strike. There are site investigations of greenfield boreholes for the lands to the east of the quarry, but they are not within the operational quarry. The “1. Scope” detail of the Opening of W/502/22 Discharge License states that:

“This license is for the exiting extraction are of 4.35ha granted under Substitute Consent (Ref SU0053) in February 2017. If planning permission is granted for an extension to the quarry, or there is an increase in quarrying discharge, a full review of this licence will be required.”

Given that there have been no successful groundwater strikes in 11 boreholes attempted within this quarry because the limestone is the competent Burren Formation Limestone. The aquifer is mapped as a Regionally Important Karst Conduit Aquifer. No groundwater transmissive conduits were discovered in the drilling completed on the floor of the operational quarry. Therefore, there is nothing to report with respect to this Condition of the Licence. The site’s discharge is now instrumented with a continuous flow meter with physiochemical sensors for parameters as specified in the Licence.

The following water quality parameters were analysed:

- Hydrogen
- Biochemical Oxygen Demand
- Suspended Solids
- Ammonium
- Nitrate
- Nitrite
- Chemical Oxygen Demand
- Benzo(a)pyrene
- Total Hydrocarbons
- Total PAHs

7.0.1 Q1 Discharge Results

Ardgaineen Quarry Final Discharge Quality Q1 2024.

Green Highligt in Cells = Compliant			
			Q1 2024 February
Parameter:	Units	W/502/22 Emission Limit Value	06 February 2024
Hydrogen Ion (pH)	pH units	6 to 9	8.0
Biological Oxygen Demand (BOD)	mg/L	10.0	< 1.0
Suspended Solids	mg/L	10	<4
Ammonium	mg/L N	0.03	0.04
Nitrate	mg/L N	18.00	not reported
Nitrite	mg/L N	0.05	not reported
Chemical Oxygen Demand (COD)	mg/L	15	<10
Benzo(a)pyrene	µg/L	0.1	not reported
Total Hydrocarbons	µg/L	10	not reported
Total PAHs	µg/L	0.1	not reported
Southern Scientific Laboratory Reference			118896 (24-38390)

7.0.2 Q2 Discharge Results

Ardgaineen Quarry Final Discharge Quality Q2 2024.

Green Highlight in Cells = Compliant			
			Q2 2024 May
Parameter:	Units	W/502/22 Emission Limit Value	03 May 2024
Hydrogen Ion (pH)	pH units	6 to 9	8.1
Biological Oxygen Demand (BOD)	mg/L	10.0	<0.1
Suspended Solids	mg/L	10	< 4
Ammonium	mg/L N	0.03	0.02
Nitrate	mg/L N	18.00	10.24
Nitrite	mg/L N	0.05	0.020
Chemical Oxygen Demand (COD)	mg/L	15	< 10
Benzo(a)pyrene	µg/L	0.1	< 0.003
Total Hydrocarbons	µg/L	10	not reported
Total PAHs	µg/L	0.1	not reported
Southern Scientific Laboratory Reference			129163 (24-41909)

7.0.3 Q3 Discharge Results

Ardgaineen Quarry Final Discharge Quality Q3 2024.

Green Highligt in Cells = Compliant			
			Q3 2024
Parameter:	Units	W/502/22 Emission Limit Value	05 September 2024
Hydrogen Ion (pH)	pH units	6 to 9	7.7
Biological Oxygen Demand (BOD)	mg/L	10.0	<0.1
Suspended Solids	mg/L	10	16
Ammonium	mg/L N	0.03	6.30
Nitrate	mg/L N	18.00	1.56
Nitrite	mg/L N	0.05	0.03
Chemical Oxygen Demand (COD)	mg/L	15	11.00
Benzo(a)pyrene	µg/L	0.1	< 0.005
Total Hydrocarbons	µg/L	10	< 10.0
Total PAHs	µg/L	0.1	< 0.005
Southern Scientific Laboratory Reference			143769 (24-47350)

7.0.4 Q4 Discharge Results

Ardgaineen Quarry Final Discharge Quality Q4 2024.

Green Highligt in Cells = Compliant			
			Q4 2024
Parameter:	Units	W/502/22 Emission Limit Value	13 November 2024
Hydrogen Ion (pH)	pH units	6 to 9	7.8
Biological Oxygen Demand (BOD)	mg/L	10.0	<0.1
Suspended Solids	mg/L	10	12
Ammonium	mg/L N	0.03	0.03
Nitrate	mg/L N	18.00	11.38
Nitrite	mg/L N	0.05	0.05
Chemical Oxygen Demand (COD)	mg/L	15	< 10
Benzo(a)pyrene	µg/L	0.1	< 0.005
Total Hydrocarbons	µg/L	10	< 10.0
Total PAHs	µg/L	0.1	< 0.005
Southern Scientific Laboratory Reference			153060 (24-50550)

In Q1, all of the parameters were compliant except for Ammonium which had a slight exceedance. It was noted that Nitrate, Nitrite, Benzo(a)pyrene, PAHs, and Hydrocarbons were not analysed by the lab. All parameters were compliant in Q2. Total Hydrocarbons and Total PAHs were not tested in the lab during this quarter. In Q3, all parameters were compliant except for Suspended Solids and Ammonium. However, Suspended Solids were reported to be elevated and there is a certain gross laboratory error in the 6.3 mg/l Ammonium value reported by the laboratory. The fact that BOD is reported at <0.1 mg/l suggests that there is zero biochemical loading in the water. If there actually was 6 mg/l of Ammonium, there would be BOD at greater than 0.01mg/l. In Q4, there was a slight exceedance in Suspended Solids, however, no environmental impact is expected from a 12 mg/l Suspended Solids concentration because the discharge passes over a vegetated wetland type system after the discharge sampling location and interception will further treat the water before infiltration to ground.

8.0 Environmental Incidents

Q1 – Apart from issues with the lab – no serious incidents

Q2 – Apart from issues with the lab - no serious incidents

Q3 – Apart from gross reporting for Ammonia – no serious incidents

Q4 – Apart from gross for Ammonia – asserted to be a laboratory error – no serious incidents

Appendix 1

Noise Monitoring Report

EXISTING QUARRY AT ARDGAINEEN, CLAREGALWAY, CO. GALWAY

CLIENT NAME: HARRINGTON CONCRETE AND QUARRIES LTD.
REFERENCE: 03.24

MAY 2024

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INTRODUCTION

Quarry Consulting were commissioned by Harrington Concrete and Quarries Ltd. to undertake a noise survey at Its existing quarry which includes an asphalt plant and concrete block production plant at Ardgaineen, Claregalway, Co. Galway

The purpose of the survey was to provide Harrington Concrete and Quarries Ltd. with the noise data and analysis required as part of their regulatory requirements.

Noise Measurements Methodology

Environmental noise survey has been carried out by Quarry Consulting to assess the ambient noise levels in the vicinity of the quarry. The methodology of the surveys and the results are set out below. The weather conditions during the survey's periods were acceptable for noise monitoring.

The measurements were carried out using a Larson Davis SoundExpert LxT sound level meter (serial number 0007036). The sound level meter was calibrated before the measurements, and its calibration checked after, using a Larson Davis Cal200 field calibrator (serial number 20011). No calibration drifts were found to have occurred during surveys. All noise equipment had been calibrated to a traceable standard by UKAS (United Kingdom Accreditation Service) accredited laboratories within 12 months preceding the surveys.

At the measurement positions, the following noise level indices were recorded:

- $L_{Aeq,T}$ is the A-weighted equivalent continuous noise level over the measurement period, effectively represents an "average" value.
- $L_{A90,T}$ is the A-weighted noise level exceeded for 90% of the measurement period. This parameter is often used to describe the background noise.
- $L_{A10,T}$ is the A-weighted noise level exceeded for 10% of the measurement period. This parameter is often used to describe road traffic noise.

Environmental noise survey at the existing site (N1, N2, N3, N4, N5) was undertaken by Quarry Consulting at the nearest noise sensitive receptors to the site on the 3rd of April 2024; see **Table 3** and **Figure 1.**

Noise measurements were undertaken over one-hour periods during the daytime. The monitoring periods chosen are considered to give representative daytime noise levels at noise sensitive locations.

During the surveys, the sound level meter was located in free-field conditions (i.e. at least 3.5 m from the nearest vertical reflecting surface, with the microphone approximately 1.5 m above ground level).

A-weighting is the process by which noise levels are corrected to account for the non-linear frequency response of the human ear. All noise levels are quoted in dB(A) relative to a sound pressure of 20µPa.

The locations of the noise monitoring points are indicated on **Figure 1**.

Existing Noise Conditions at Glencastle

The noise monitoring locations used, shown in **Figure 1**, consist of the following:

- N1 to the east of the quarry;
- N2 to the south of the quarry;
- N3 to the southwest of the quarry;
- N4 to the north of the quarry;
- N5 to the northwest of the quarry.

The noise monitoring locations listed above are considered representative of the nearest noise sensitive locations (receptors) to the existing development site as described below[1]:

- Location N1 is representative of the residential properties located to the east of the development;
- Location N2 is representative of the residential properties located to the south of the development.
- Location N3 is representative of the residential properties located to the southwest of the development.
- Location N4 is representative of the residential properties located to the north of the development.
- Location N5 is representative of the residential properties located to the northwest of the development.

Noise monitoring results are provided in **Table 3**; noise monitoring notes and noise climate notes are provided in **Table 2.**

Table 1
Summary of Noise Climate 3rd April 2024

Weather Conditions During Survey:	
03/04/24 **N1**	Dry; Wind Speed: 3.1 m/s
03/04/24 **N2**	Dry; Wind Speed: 0m/s
03/04/24 **N3**	Dry; Wind Speed: 0 m/s Temperature: 18°C
03/04/24 **N4**	Dry; Wind Speed: 0 m/s Temperature: 18°C
03/04/24 **N5**	Dry; Wind Speed: 1.6 m/s

[1] Note: Noise levels were not taken at the exact locations of the noise sensitive properties as access could not be gained to privately owned land.

Table 2
Summary of Measured Noise Levels, Free Field dB

Monitoring Location	Date	Time	$L_{Aeq,T}$	L_{A10}	L_{A90}	Notes
N1	03/04/24	11:01 – 11:51	49.6	53.3	39.5	Quarry operations not audible Rock breaker on road audible at 50 dBA
N2	03/04/24	11:57 – 12:52	49.4	52.9	40.3	Quarry operations not audible Birds chirping audible at 55 dBA
N3	03/04/24	12:57 – 13:52	40.9	43.7	32.2	Asphalt plant or concrete batching plant audible at 43dBA
N4	03/04/24	13:56 – 14:55	48.3	44.0	30.9	Asphalt plant or concrete batching plant audible at 45dBA
N5	03/04/24	14:58 – 15:55	42.1	41.9	28.3	Quarry operations not audible

There was no evidence of a tonal or impulsive component to the noise attributable to the site operation.

Noise Criteria / Limits

Planning Permission

Condition no. 4 **Plan File Ref. No. 21169, PL 7/5/88667 & PL 7/5/88665** states the following in relation to noise limits:

4. During the operational phase of the proposed development, the noise level from within the boundaries of the site measured at noise sensitive locations in the vicinity, shall not exceed-

   (a) an LArT value of 55dB(A) during the period 0700 to 2000 hours from Monday to Friday (inclusive) and 0800 to 1600 hours on Saturdays.

   (b) an LAeqT value of 45 dB(A) at any other time. The T value shall be 15 minutes.

   Reason: In order to protect the residential amenities of property in the vicinity.

Conclusions

As can be seen in Table 2, noise levels at the noise monitoring location are less than the daytime limit of 55dBA at locations N1 - N5.

FIGURES

Figure 1: Monitoring Locations

APPENDIX 1: GLOSSARY OF TERMINOLOGY

dB (decibel)

The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2x10^{-5}$ Pa).

B(A) A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

L_{Aeq}

L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

L_{10} & L_{90}

If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.

$L_{Amax}L_{Amax}$

is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

Cirrus Research plc

Measurement Summary Report

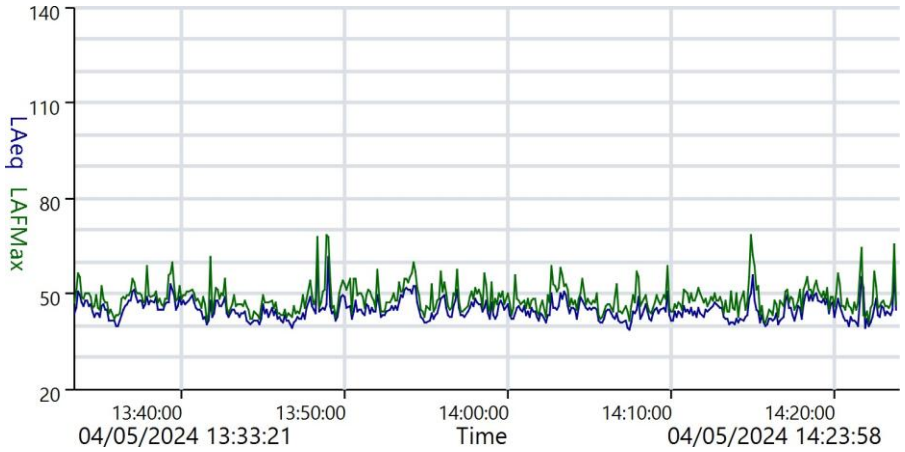
Name	N1 - Monaghans Hosue			
Time	04/05/2024 13:33:21	**Person**	**Place**	**Project**
Duration	00:50:37	Amanda Tarpey	Ardgaineen	Quarter 2
Instrument	G066433, CR:1710			

Calibration

Before 04/05/2024 13:31 Offset -0.09 dB **After** Offset

Basic Values	
LAeq	46.5 dB
LAE	81.3 dB
LAFMax	68.2 dB

Statistical Levels (Ln)	
LAF1	53.4 dB
LAF5	49.8 dB
LAF10	48.5 dB
LAF50	44.2 dB
LAF90	40.7 dB
LAF95	39.9 dB
LAF99	38.5 dB



Cirrus Research plc

Measurement Summary Report

Notes
Breezy at times. windspeed 1.2m/s

ReportId

Cirrus Research plc

Measurement Summary Report

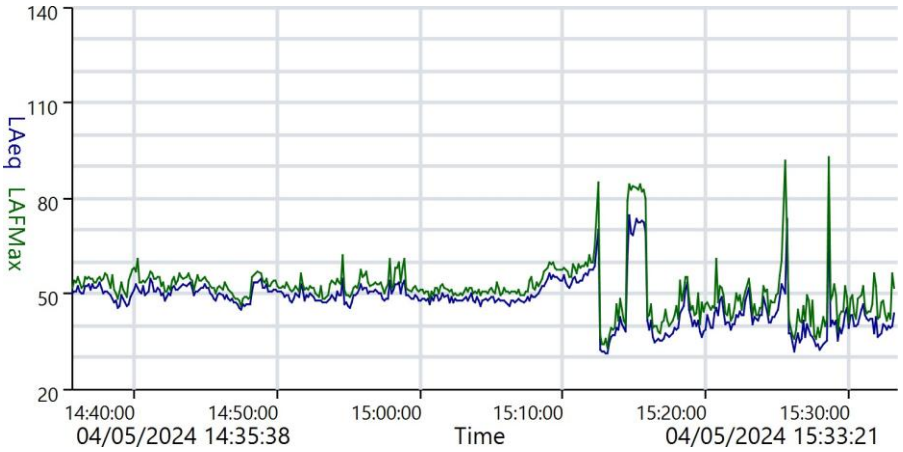
Name	N2 Field behind Berminghams House			
Time	04/05/2024 14:35:38	**Person**	**Place**	**Project**
Duration	00:57:43	Amanda Tarpey	Ardgaineen	Quarter 2
Instrument	G066433, CR:1710			

Calibration

Before	04/05/2024 13:31	Offset	-0.09 dB	**After**	Offset

Basic Values	
LAeq	57.6 dB
LAE	93.0 dB
LAFMax	93.0 dB

Statistical Levels (Ln)	
LAF1	66.0 dB
LAF5	55.4 dB
LAF10	53.3 dB
LAF50	47.9 dB
LAF90	36.7 dB
LAF95	34.6 dB
LAF99	31.4 dB



Cirrus Research plc

Measurement Summary Report

Notes

Quarry and traffic noise eveident, breezy gusts through the trees. Sprnklers also contributing to the noise.

ReportId

Cirrus Research plc

Measurement Summary Report

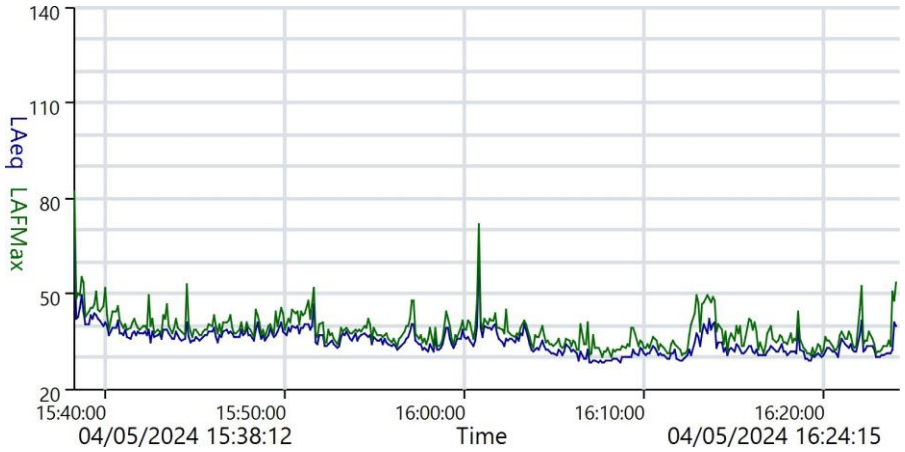
Name	N3 West Boundary			
Time	04/05/2024 15:38:12	**Person**	**Place**	**Project**
Duration	00:46:03	Amanda Tarpey	Ardgaineen	Quarter 2
Instrument	G066433, CR:1710			

Calibration

Before 04/05/2024 13:31 Offset -0.09 dB **After** Offset

Basic Values	
LAeq	42.6 dB
LAE	77.0 dB
LAFMax	82.1 dB

Statistical Levels (Ln)	
LAF1	46.1 dB
LAF5	40.9 dB
LAF10	39.3 dB
LAF50	34.2 dB
LAF90	29.7 dB
LAF95	28.9 dB
LAF99	27.7 dB



Cirrus Research plc

Measurement Summary Report

Notes
Wind blowing from a SW direction

ReportId

Cirrus Research plc

Measurement Summary Report

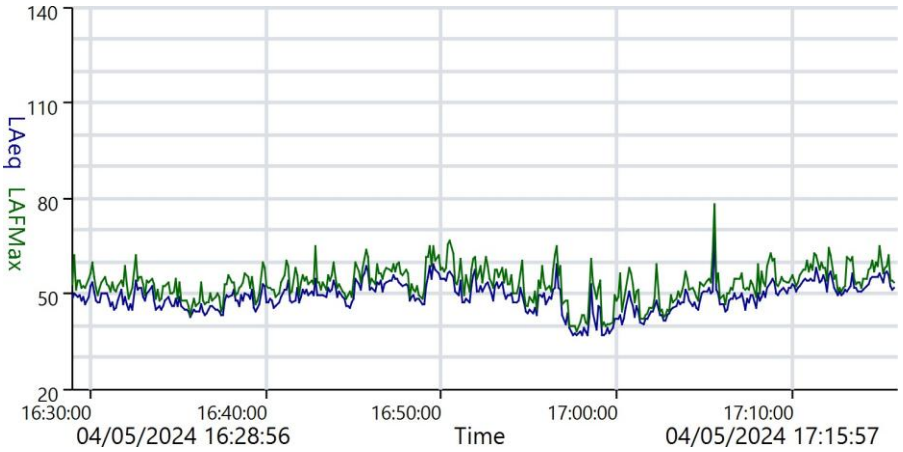
Name	N4 O Niells House			
Time	04/05/2024 16:28:56	**Person**	**Place**	**Project**
Duration	00:47:01	Amanda Tarpey	Ardgaineen	Quarter 2
Instrument	G066433, CR:1710			

Calibration

Before	04/05/2024 13:31	Offset	-0.09 dB	**After**	Offset

Basic Values	
LAeq	51.4 dB
LAE	85.9 dB
LAFMax	78.2 dB

Statistical Levels (Ln)	
LAF1	59.4 dB
LAF5	55.8 dB
LAF10	54.1 dB
LAF50	48.4 dB
LAF90	42.5 dB
LAF95	39.7 dB
LAF99	36.5 dB



Cirrus Research plc

Measurement Summary Report

Notes

Haevy machinery being moved on the yard, quite loud.

ReportId

Cirrus Research plc

Measurement Summary Report

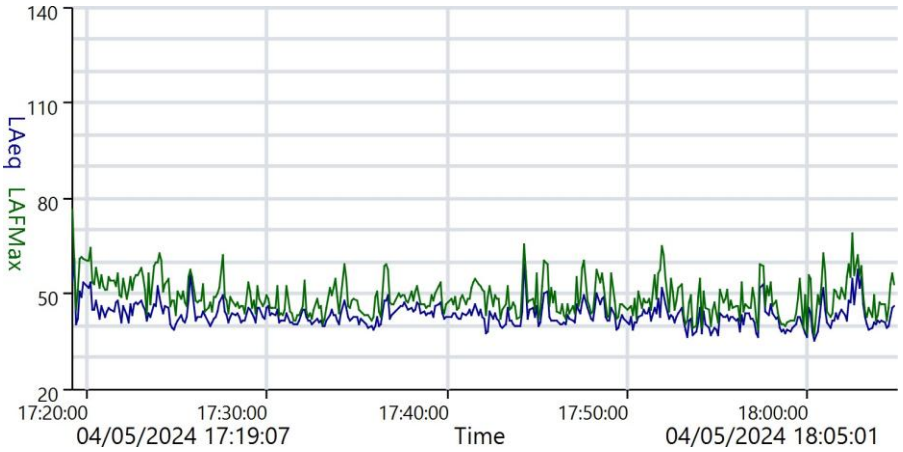
Name	N5 North East Corner			
Time	04/05/2024 17:19:07	**Person**	**Place**	**Project**
Duration	00:45:54	Amanda Tarpey	Ardgaineen	Quarter 2
Instrument	G066433, CR:1710			

Calibration

Before	04/05/2024 13:31	Offset	-0.09 dB	**After**	Offset

Basic Values	
LAeq	45.7 dB
LAE	80.1 dB
LAFMax	76.4 dB

Statistical Levels (Ln)	
LAF1	56.2 dB
LAF5	50.0 dB
LAF10	47.2 dB
LAF50	41.9 dB
LAF90	38.4 dB
LAF95	37.2 dB
LAF99	35.7 dB



ReportId

Measurement Summary Report

Cirrus Research plc

Measurement Summary Report

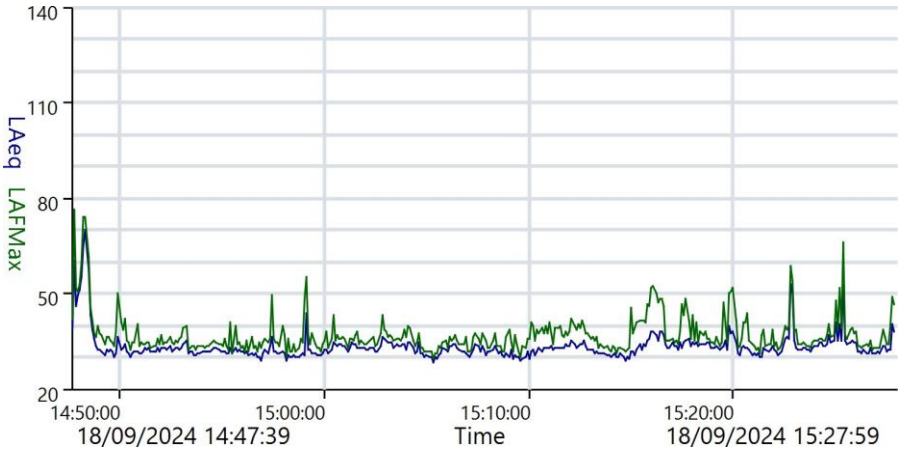
Name	N5 Skeritts Corner			
Time	18/09/2024 14:47:39	**Person**	**Place**	**Project**
Duration	00:40:20	Amanda Tarpey	Ardgaineen	Quarter 3
Instrument	G066433, CR:1710			

Calibration

Before	Offset	**After**	Offset

Basic Values	
LAeq	46.0 dB
LAE	79.8 dB
LAFMax	76.0 dB

Statistical Levels (Ln)	
LAF1	52.4 dB
LAF5	37.6 dB
LAF10	35.1 dB
LAF50	32.0 dB
LAF90	29.8 dB
LAF95	29.3 dB
LAF99	28.3 dB



Cirrus Research plc

Measurement Summary Report

Notes

Quarry noise not audible
N14 Road traffic audible
Lorry passed at 14.48pm

ReportId

Cirrus Research plc

Measurement Summary Report

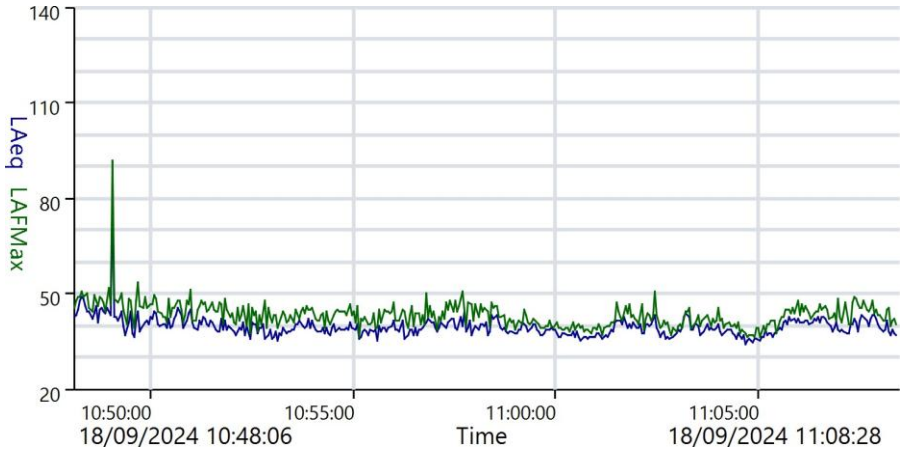
Name	N1 Monaghans			
Time	18/09/2024 10:48:06	**Person**	**Place**	**Project**
Duration	00:20:22	Amanda Tarpey	Ardgaineen	Quarter 3
Instrument	G066433, CR:1710			

Calibration

Before	Offset	**After**	Offset

Basic Values	
LAeq	52.0 dB
LAE	82.9 dB
LAFMax	91.4 dB

Statistical Levels (Ln)	
LAF1	47.6 dB
LAF5	44.4 dB
LAF10	43.1 dB
LAF50	38.5 dB
LAF90	35.5 dB
LAF95	34.8 dB
LAF99	33.8 dB



Cirrus Research plc

Measurement Summary Report

Notes

crushing slightly audible
birds chirping
N17 road traffic very audible

ReportId

Cirrus Research plc

Measurement Summary Report

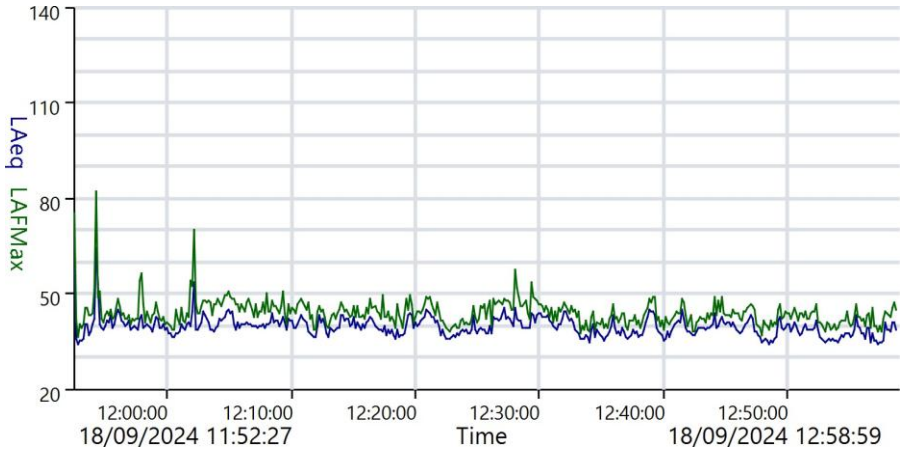
Name	N2 Berminghams			
Time	18/09/2024 11:52:27	**Person**	**Place**	**Project**
Duration	01:06:32	Amanda Tarpey	Ardgaineen	Quarter 3
Instrument	G066433, CR:1710			

Calibration

Before	Offset	**After**	Offset

Basic Values	
LAeq	42.8 dB
LAE	78.8 dB
LAFMax	82.1 dB

Statistical Levels (Ln)	
LAF1	46.4 dB
LAF5	44.1 dB
LAF10	43.0 dB
LAF50	38.8 dB
LAF90	35.4 dB
LAF95	34.5 dB
LAF99	33.1 dB



Cirrus Research plc

Measurement Summary Report

Notes

Crushing slightly audible
birds chirping and cattle grazing at monitoring location
N17 road traffic audible

ReportId

Cirrus Research plc

Measurement Summary Report

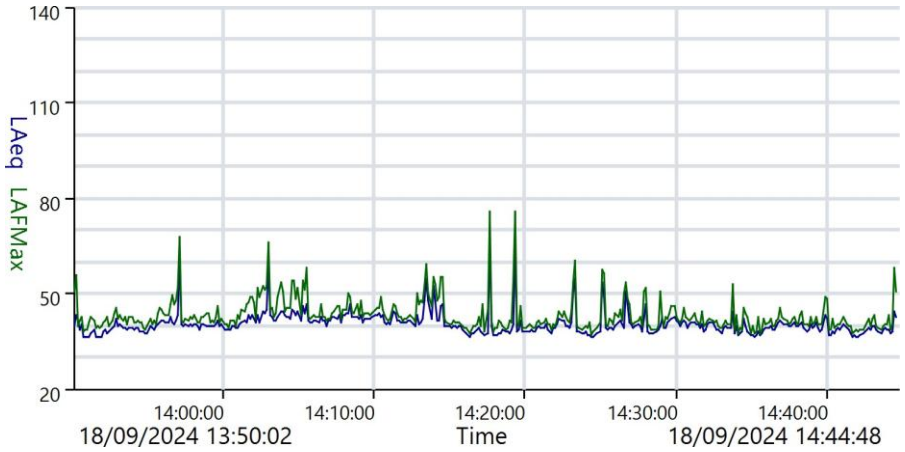
Name	N4 O Niells			
Time	18/09/2024 13:50:02	**Person**	**Place**	**Project**
Duration	00:54:46	Amanda Tarpey	Ardgaineen	Quarter 3
Instrument	G066433, CR:1710			

Calibration

Before	Offset	**After**	Offset

Basic Values	
LAeq	45.7 dB
LAE	80.9 dB
LAFMax	75.7 dB

Statistical Levels (Ln)	
LAF1	53.5 dB
LAF5	44.7 dB
LAF10	42.8 dB
LAF50	39.5 dB
LAF90	37.1 dB
LAF95	36.5 dB
LAF99	35.5 dB



Cirrus Research plc

Measurement Summary Report

Notes

Quarry noise audible, in particular the crushing and processing plant.

ReportId

Cirrus Research plc

Measurement Summary Report

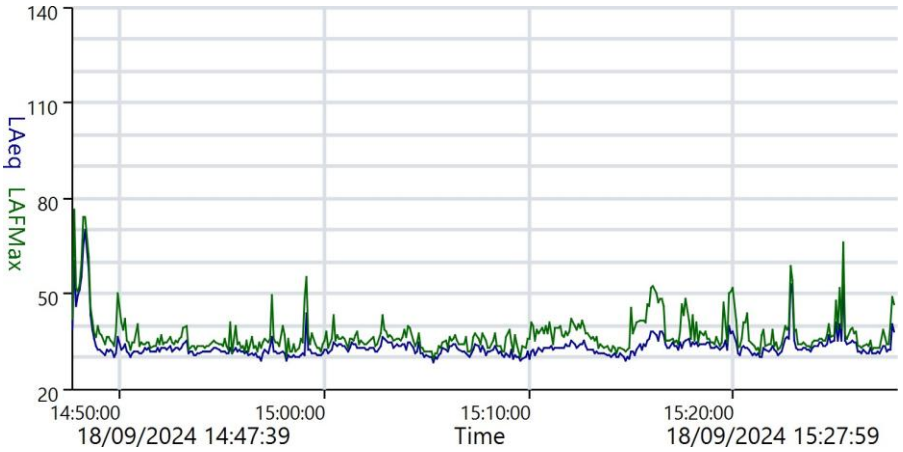
Name	N5 Skeritts Corner			
Time	18/09/2024 14:47:39	**Person**	**Place**	**Project**
Duration	00:40:20	Amanda Tarpey	Ardgaineen	Quarter 3
Instrument	G066433, CR:1710			

Calibration

Before	Offset	**After**	Offset

Basic Values	
LAeq	46.0 dB
LAE	79.8 dB
LAFMax	76.0 dB

Statistical Levels (Ln)	
LAF1	52.4 dB
LAF5	37.6 dB
LAF10	35.1 dB
LAF50	32.0 dB
LAF90	29.8 dB
LAF95	29.3 dB
LAF99	28.3 dB



Cirrus Research plc

Measurement Summary Report

Notes

Quarry noise not audible
N14 Road traffic audible
Lorry passed at 14.48pm

ReportId

Appendix 2

Galway Dust Results 2024						
Date	Unit	D1	D2	D3	D4	Limit Value
Jan 2024	Mg/m^2 /day	170	137	184	233	350
Feb 2024	Mg/m^2 /day	31	24	21	38	350
Mar 2024	Mg/m^2 /day	1532	71	94	97	350
Date	Unit	D1	D2	D3	D4	Limit Value
Apr 2024	Mg/m^2 /day	302	134	357	151	350
May 2024	Mg/m^2 /day	70	71	65	277	350
Jun 2024	Mg/m^2 /day	143	230	390	180	350
Date	Unit	D1	D2	D3	D4	Limit Value
Jul 2024	Mg/m^2 /day	338	328	266	99	350
Aug 2024	Mg/m^2 /day	433	562	131	75	350
Sep 2024	Mg/m^2 /day	264	342	336	49	350
Date	Unit	D1	D2	D3	D4	Limit Value
Oct 2024	Mg/m^2 /day	269	326	278	272	350
Nov 2024	Mg/m^2 /day	429	213	157	146	350

Galway Vibration Results 2024			
12th of March 2024			
		V1	
Velocity Radial	12mm/s	1.524	12-03-2024
Velocity Transverse	12mm/s	1.524	12-03-2024
Velocity Vertical	12mm/s	1.334	12-03-2024
Air over-pressure	125 dB	124.3	12-03-2024
2nd of September 2024			
		V1	
Velocity Radial	12mm/s	2.032	02-09-2024
Velocity Transverse	12mm/s	2.032	02-09-2024
Velocity Vertical	12mm/s	2.159	02-09-2024
Air over-pressure	125 dB	124.3	02-09-2024
16th of October 2024			
		V1	
Velocity Radial	12mm/s	3.366	16-10-2024
Velocity Transverse	12mm/s	3.556	16-10-2024
Velocity Vertical	12mm/s	2.921	16-10-2024
Air over-pressure	125 dB	124.3	16-10-2024
12th of November 2024			
		V1	
Velocity Radial	12mm/s	3.175	12-11-2024
Velocity Transverse	12mm/s	2.032	12-11-2024
Velocity Vertical	12mm/s	2.286	12-11-2024
Air over-pressure	125 dB	123.0	12-11-2024

Discharge Water Quality Results 2024

Parameters	Hydrogen	BOD	Suspended Solids	Ammonium	Nitrate	Nitrite	COD	Benzo(a)pyrene	Total Hydrocarbons	Total PAHs
Units	Ph Units	mg/L	mg/L	mg/L N	mg/L N	mg/L N	mg/L	µg/L	µg/L	µg/L
Result Q1 06/02/2024	8.0	<1.0	<4	0.04	Not Reported	Not Reported	<10	Not Reported	Not Reported	Not Reported
Result Q2 03/05/2024	8.1	<0.1	<4	0.02	10.24	0.020	<10	<0.003	Not Reported	Not Reported
Result Q3 05/09/2024	7.7	<0.1	16	6.30	1.56	0.03	11.00	<0.005	<10.0	<0.005
Result Q4 13/11/2024	7.8	<0.1	12	0.03	11.38	0.05	<10	<0.005	<10.0	<0.005
Emission Limit Value	6 to 9	10.0	10	0.03	18.00	0.05	15	0.1	10	0.1

Appendix 3

AXIS

2024

Air Emissions REPORT

RECEIVED: 27/08/2025

PREPARED FOR

Harrington's Concrete & Quarry

Report Title	Air Emissions Compliance Monitoring Report
Company address	Axis Environmental Services Ltd., Unit 3 Westlink Business Park, Clondrinagh, Limerick, V94 K6XK
Contact Details	Phone: 061 324587, info@axisenv.ie
Stack Emissions Testing Report Commissioned by	Harrington's Concrete & Quarry
Facility Name	Harrington's Concrete & Quarry
EPA Licence Number	N/A
Licence Holder	Harrington's Concrete & Quarry
Stack Reference Number	AP1
Dates of the Monitoring Campaign	27/03/2024
Job Reference Number	HACLAC270324
Report Written By	Mr Anderson Carneiro
Report Approved by	Ruana Souza
Stack Testing Team	Mr Anderson Carneiro & Mr Thomas Moran
Report Date	26/04/2024
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Ruana Souza Environmental Technician

Contents

1.0 Executive Summary

1.1 Overall aim of the monitoring campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

1.2 Summary of substances to be monitored at each emission point

Stack Name:	AP1
Total Particulate Matter	
Volumetric Flow Rate (Ref)	

1.3 Special Requirements

There were no special requirements

1.4 Summary of Results

Emission Point Number: AP1

Parameter	Method	Units	Result	MU +/-	Limit	O_2 Ref. (%)	Moisture Ref. (%)	Blanks	Date	Time on	Time off	Accreditation	
												Sampling	Analysis
Total Particulate Matter (TPM)	EN13284	$mg.m^{-3}$	4.97	0.28	50	17	Dry	<0.38	27/03/2024	09:45	10:15	Yes	Yes
Volumetric Flow Rate (Ref)	EN 16911	$m^3.hr^{-1}$	38,300	1,740	100,000	17	Dry	N/a	27/03/2024	09:45	10:15	Yes	N/a

Note 1: All results are normalised to standard temperature and pressure ($0^{O}C$ and 101.3kPa)
Note 2: All results are reported in the format as defined by the EPA in guidance note AG2:2021.

1.5 Operating Information

Please reference Process Details as per Appendix III attached.

1.6 Monitoring Deviations

Stack Name: AP1	
Parameter	Deviation
Total Particulate Matter	None
Volumetric Flow Rate (Ref)	Required no. of ports not accessible/ available. EN 16911 - in accordance with AG2 Index of Preferred Methods

1.7 Reference Documents

Risk Assessment (RA)	SOP 1011
Site Review (SR)	SOP 1019
Site Specific Protocol (SSP)	SOP 1019

1.8 Version History

Version Number	Changes to the report
1	Original version of the report

Appendix I

1.1 Monitoring Personnel

Team Leader	Name	Anderson Carneiro
	System approval	Team Leader Approved
Technician	Name	Thomas Moran
	System approval	Technician Approved

1.2 Equipment Inventory

ID	Item of Equipment	Used	ID	Item of Equipment	Used	ID	Item of Equipment	Used
12EQ500	Pump		12EQ525	Horiba (PG-250) X		13EQ501	Vernier Callipers	
12EQ532	Pump		16EQ508	Horiba- PG250z		14EQ503	Vernier Callipers	
12EQ536	Pump		14EQ501	Horiba-PG 350	x	14EQ507	Vernier Callipers	
12EQ537	Pump		17EQ515	Horiba 350		17EQ533	Vernier Callipers	
12EQ538	Pump		20EQ506	Horiba 350		18EQ506	Vernier Callipers	
12EQ542	Pump		21EQ503	Horiba 350		20EQ516	Vernier Callipers	x
12EQ543	Pump		21EQ522	Horiba 350				
13EQ514	Pump							
16EQ518	Pump					13EQ503	1kg weight	
16EQ519	Pump		12EQ526	Chiller		13EQ508	500g Hafner weight	
17EQ509	Pump		14EQ513	Chiller		13EQ509	500g Hafner weight	
17EQ510	Pump		16EQ509	Chiller	x	14EQ515	500g Weight	x
17EQ522	Pump		18EQ505	Chiller		15EQ511	1kg Weight	x
17EQ523	Pump		21EQ504	Chiller		15EQ512	1kg weight	
17EQ524	Pump		22EQ509	Chiller		16EQ511	1kg weight	
17EQ525	Pump					16EQ512	500g weight	
17EQ526	Pump					17EQ529	500g weight	
18EQ517	Pump		14EQ518	Velocity Meter		17EQ530	1kg weight	
18EQ518	Pump		16EQ501	Velocity Meter		19EQ513	500g weight	
21EQ507	Pump		17EQ508	Velocity Meter	x	19EQ514	1kg Weight	
21EQ508	Pump		17EQ514	Velocity Meter		19EQ519	1kg weight	
21EQ509	Pump		18EQ504	Velocity Meter		19EQ520	500g weight	
21EQ510	Pump		19EQ502	Velocity Meter				
21EQ511	Pump		20EQ504	Velocity Meter				
22EQ500	Pump					17EQ534	ST5	
22EQ501	Pump					18EQ503	ST5	
22EQ502	Pump		21EQ528	TSI (Vane)		18EQ513	ST5	
22EQ503	Pump		23EQ500	TSI (Vane)		19EQ509	ST5	
22EQ504	Pump					20EQ500	ST5	x
22EQ505	Pump		16EQ502	FID		21EQ519	ST5	
22EQ508	HF Pump	x	17EQ517	FID		22EQ508	ST5	
			19EQ508	FID				
21EQ500	MF Meter		20EQ507	FID				
21EQ501	MF Meter		20EQ508	FID		14EQ510	Digital Protractor	
21EQ502	MF Meter		17EQ535	Signal Cutter		14EQ511	Digital Protractor	
21EQ526	MF Meter					17EQ528	Digital Protractor	
21EQ530	MF Meter					18EQ507	Digital Protractor	x
21EQ531	MF Meter		16EQ510	Measuring Tape		20EQ514	Digital Protractor	
21EQ532	MF Meter		17EQ527	Measuring Tape		20EQ515	Digital Protractor	
			18EQ508	Measuring Tape	x			
14EQ514	Heated Line		19EQ516	Measuring Tape				
17EQ502	Heated Line		20EQ509	Measuring Tape		12EQ522	Balance	
17EQ503	Heated Line		21EQ521	Measuring Tape		15EQ509	Balance	
17EQ539	Heated Line (5m)					15EQ510	Balance	
19EQ523	Heated Line					17EQ537	Balance	
20EQ520	Heated Line		20EQ519	PCDD Thermometer		19EQ515	Balance	x
20EQ521	Heated Line					21EQ505	Balance	
21EQ523	Heated Line (5m)		16EQ515	Thermocouple K type		21EQ506	Balance	
21EQ524	Heated Line (5m)		16EQ516	Thermocouple K type		21EQ525	Balance	
22EQ510	Heated Line (40m)		21EQ513	K type Thermocouple		21EQ529	Balance	
22EQ512	Heated Line (5m)	x	21EQ514	K type Thermocouple				
22EQ513	Heated Line (5m)		21EQ515	K type Thermocouple				
			21EQ516	K type Thermocouple				
12EQ518	S type Pitot Tube		21EQ517	K type Thermocouple				
12EQ520	L Type Pitot tube		21EQ518	K type Thermocouple				
13EQ506	S type Pitot Tube		21EQ520	K type Thermocouple				
14EQ506	1m S type & K type							
16EQ506	S type Pitot Tube							
16EQ517	S type Pitot Tube Long		17EQ519	Stopwatch				
17EQ507	1m S type & K type		17EQ520	Stopwatch				
17EQ536	S type Pitot Tube		17EQ521	Stopwatch				
18EQ514	S type Pitot Tube		18EQ509	Stopwatch	x			
18EQ515	S type Pitot Tube		19EQ518	Stopwatch				
19EQ510	S type pitot tube		21EQ512	Stopwatch				
19EQ511	S type pitot tube							
19EQ521	1m S type & K type							
19EQ522	Pitot							
22EQ506	S type pitot tube							
22EQ507	S type pitot tube							
22EQ511	S type pitot tube							
23EQ509	1.5M S Type	x						

Appendix II

2.1 Stack Emission Point Reference: AP1

2.1.1 Suitability of Sample Location:

General Information	AP1
Permanent/Temporary	Permanent
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / EN 15259 Platform Requirements	Value	Comment
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self-closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	Yes	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-
Sampling Location / Platform Improvement Recommendations		
None		
EN 15259 Homogeneity Test Requirements		
1.		
Select Option: 1: There is no requirement to perform a EN15259 Homogeneity Test on this stack 2: Test results were obtained from previous Homogeneity test carried out by AXIS 3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor 4: Homogeneity Test is required on this stack and the client has been informed of this requirement		

2.1.2 Stack Diagram

Figure 1: AP1

2.1.3 Stack Raw Data

Title:	**Determination of Total Particulates**				
Method:	EN 13284-1				
Client:	Harringtons				
Test Date:	27/03/2024		**Air Volume at Pump**	1.0732	m^3
Test Time	09:45		**Temperature at Pump**	7.75	Deg C
Laboratory Used:	AXIS		**Pressure at Pump**	81.39	kPa
Stack Name	AP1		**Humidity at Pumps**	0	%
Run I.D.	1		**Filter Weight**	3.56	mg
Filter I.D.	1559		**Front End Weight**	3.06	mg
Moisture Content	7.7	%			
Reference Oxygen	17	%	**Flow Uncertainty**	1,740	m^3/hr
Measured Oxygen	14.7	%	**Flow Uncertainty**	4.5	%
Stack Flow Rate	26102	Nm^3/hr			
Adjusted Stack Flow Rate	38300.33467	Nm^3/hr, dry @ % Oxygen			
Volume of Air Sampled	0.8383	Nm^3			

Leak Check Results	**Result**		**% Leak**
Before Sample 1	0	l/min	0.0
Average Flow Rate	27.90	l/min	0.0
Standard Maximum	0.558	l/min	2%
Back Pressure	45.5	kPa	

Standard Criteria to be Met	**Result**	**Std. Requirement**		
Angle of Flow	Yes	<15 Degrees	**Probe material**	Stainless Steel
Negative Flow in the Stack	Yes	None	**Filter housing**	Stainless Steel
Pitot Pressure Difference	Yes	>5Pa	**Positioning of filter**	In Stack
Ratio of Flow Measurement	Yes	<3:1	**Filter Size & Material**	47mm Quartz
Stagnation Test	Yes	<10Pa		
Pitot Tube Leak Check	**Result**			
Positive Pressure	Pass	-		
Negative Pressure	Pass	-		
Number of Ports	1	2		
Straight length before sample point	Yes	> 5 Hydraulic Diameters		
Straight length after sample point	Yes	> 5 Hydraulic Diameters to Stack Outlet or 2HD to Fan/ Bend		

Sample Calculations				
Blank (Filter and Front Wash Combined)	0.5	mg		
Sample 1 (Filter and Front Combined)	6.62	mg		
Volume of Air Sampled	0.8383	Nm^3		
Blank Result	0.60	mg/$Nm^{3,}$ dry	0.38	mg/$Nm^{3,}$ dry @ Ref O_2
Sample Result	7.90	mg/$Nm^{3,}$ dry	4.97	mg/$Nm^{3,}$ dry @ Ref O_2
Uncertainty of Measurement	0.28	mg/Nm^3		
Emission Limit Value	50	mg/Nm^3		
Blank as Percentage of ELV	1.2	%	**Requirement <10% ELV or <0.5 mg/m³**	

Isokinetic Criterion Compliance		
Isokinetic Variation	0	%
Allowable Isokinetic Range	-5 to + 15%	%
Isokinetic Acceptable	Yes	

DUCT AND GAS SPECIFICATION			
Name			ap1
Section			Circular
Diameter		[m]	1.2
Area		[m2]	1.130973
Ports		[#]	1
Points	P	[#]	8
Density	ρn	[kg/Nm3]	1.309
Carbon Dioxide	CO2	[%]	4.73
Oxygen	O2	[%]	14.7
Water Vapor Ratio	rw	[0;1]	0.077
Nozzle	nz	[mm]	10
Turbolence factor	ft	[sec]	1
Wall Adjustment Factor	waf		

PITOT DATA SPECIFICATION			
Name			
Velocity	[m/sec]	5	0.834
Velocity	[m/sec]	10	0.834
Velocity	[m/sec]	20	0.834
Velocity	[m/sec]	30	0.834
Velocity	[m/sec]	40	0.834

NORMALIZATION FACTOR			
Tnorm		[K]	273
Pnorm		[kPa]	101.3

DUCT FLOW RATE			
Dry actual	QVa	[m3/h]	31960
Moist actual	Q'Va	[m3/h]	34625
Moist norm. [Tnorm Pnorm]	Q'Vn	[Nm3/h]	26102
Dry norm. [Tnorm Pnorm]	QVn	[Nm3/h]	24092

AVERAGE VALUES			
Total Points		[#]	1
Velocity	v'a	[m/sec]	8.55
Stack temperature	tstack	[°C]	70.34
Stack Pressure	Pa	[kPa]	96.04
Isokinetic Rate	DI	[%]	0
Velocity at nozzle	v'N	[m/sec]	8.554
Probe temperature	tprobe	[°C]	116.5
Filter temperature	tfilter	[°C]	79.7
Outlet temperature	toutlet	[°C]	21.1
Aux temperature	taux	[°C]	18.9
Ambient Pressure	Pamb	[kPa]	96.04

GAS METER SAMPLED VOLUMES		
Elapsed time	et	00:30:00
Norm. Volume [Tnorm Pnorm]	Vgn	0.8383
Moist Volume at stack conditions	V'ga	1.205
Volume at dgm conditions	Vdgm	1.0732
Gas meter temperature	tdgm	7.75
Gas Meter Pressure	Pdgm	81.39

start ts [timestamp]	port [###]	point [###]	Probe pos [cm]	tstack avg [°C]	Pa avg [kPa]	dP Pitot avg [Pa]	velocity avg [m/sec]
27/03/2024	1	1	3.9	85.14	96	63.42	9.88
09:37:00	-	-	-	-	-	-	-
27/03/2024	1	2	12.6	83.57	95.99	63.45	9.86
09:37:32	-	-	-	-	-	-	-
27/03/2024	1	3	23.3	82.02	95.99	67.63	10.16
09:38:04	-	-	-	-	-	-	-
27/03/2024	1	4	38.8	81.02	95.99	63.38	9.82
09:38:36	-	-	-	-	-	-	-
27/03/2024	1	5	81.3	79.39	96	36.13	7.4
09:39:08	-	-	-	-	-	-	-
27/03/2024	1	6	96.8	77.72	96.01	31.84	6.93
09:39:41	-	-	-	-	-	-	-
27/03/2024	1	7	107.5	76.81	96.01	33.12	7.06
09:40:14	-	-	-	-	-	-	-
27/03/2024	1	8	116.2	76	96.01	31.18	6.84
09:40:48	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Uncertainty calculation for EN 13284					
	Symbol	**Unit**	**Values**	**UOM as %**	**Std Requirement**
Sampled Volume	V_m	m^3	0.001	0.09	<=5%
Sampled gas Temperature	T_m	k	2.00	0.71	<=2%
Sampled gas Pressure	ρ_m	kPa	1.00	1.23	<=2%
Sampled gas Humidity	H_m	% by volume	1.00	1.00	<=1%
Oxygen content	$O_{2,m}$	% by volume	0.10	-	<=5%
Mass particulate	m	mg	0.107	1.62	<5% of limit value
Leak	L		-	0.00	<=2%
Uncollected Mass	UCM		-	0.00	<10% of limit value
Corrected Volume (STP)	V	m^3	0.84	1.74	-
Mass	m	mg	6.62	1.62	-
Factor for O2 Correction	fc		0.63	1.59	-
Leak	L	$mg.m^{-3}$	0.00	0.00	-
Uncollected mass	UCM	mg	0.00	0.00	-
Combined measurement uncertainty			**0.14**	-	-
Expanded uncertainty as percentage of measured value				**5.71**	% measured of value
Expanded uncertainty in units of measurement				**0.28**	mg.m-3
Expanded uncertainty as percentage of limit value				**0.57**	% ELV

Uncertainty calculation for Velocity and Volume Flow Rate Measurement by Pitot tube EN ISO 16911-1					
	Unit	**Values**	**as %**	**Std Requirement**	
Range of Delta P transducer	Pa	2500	-		-
Resolution of Delta P transducer	Pa	10	-		-
Repeatability of Delta P transducer	% of value	0.01	-		-
Drift of Delta P transducer	% of range	0.32	-		-
Lack of fit of measurement system	% of range	0.25	-		-
Uncertainty in Delta P transducer	Pa	2.5	-		-
Uncertainty of pitor coefficient		0.03	-		-
Enter uncertainties as (95%,k=2) where relevant					
Uncertainty in temperature readout system	°C	1	-		-
Uncertainty in atmospheric pressure transducer	Pa	160.5	-		-
Uncertainty in duct area measurement	%	1.0	-		-
Uncertainty of Molar Mass	kg/mol	0.00001	0.04		-
Uncertainty of Temperature	K	0.5	0.15		-
Uncertainty of Stack Static Pressure	Pa	9.60	0.01		-
Uncertainty of Stack Pressure	Pa	160.8	0.08		-
Uncertainty of Gas Density	kg/m3	0.0033	0.17		-
Uncertainty in velocity	m/sec	0.17	2.0		-
Expanded Uncertainty in velocity	m/sec	0.33	3.9		-
Uncertainty of Volumetric Flow Rate	m^3/hour	870	-		-
Expanded Uncertainty of Volumetric Flow Rate	m^3/hour	**1740**	**4.5**	<10% of ELV	

Title:	**Determination of Moisture Content**			
Method	EN 14790			
Stack Name	AP1			
Test Time	08:05:00			
Leak Check Results				
Prior to test:	0			
Post Test:	0			
Sample Volume Flow Rate:	2.3			
Standard Requirement:	<2%			
Test Result:	0			
Test Status	Pass			
Calibration Details				
Pump Number	18EQ517			
Calibrator Number	23EQ539			
Calibration Rate Before	2.3	N Litres per Minute		
Calibration Rate After	2.3	N Litres per Minute		
Air Volume at Pump	2.3	N Litres per Minute		
Sample Time	30	Minutes		
Temperature at Pump	6	Deg C		
Pressure at Pump	101	kPa		
Volume from Mass Flow Meter	0.064	Nm^3		
Balance Calibration	**Weight**			
0.0	0.0	g	Eccentric load indication carried out - Balance Ok	Yes
500.0	500.0	g		
1000.0	1000.0	g		
Impinger Weights	**Initial**	**Final**	**Difference**	
Total Impinger Weight	551.2	555.5	4.3	
Volume of Air Sampled	0.064	Nm^3	4.3	
Moisture Content (EN 14790)	7.68	%		
Uncertainty	0.39	%		

Impinger Weights	**Pre**	**Post**	
1	551.2	555.5	g
2	551.2	555.5	g
3	551.2	555.5	g
4	551.2	555.5	g
5	551.2	555.5	g
6	551.2	555.5	g
7	551.2	555.5	g
8	551.2	555.5	g
9	551.2	555.5	g
10	551.2	555.5	g
Average	**551.2**	**555.5**	

QGU-009-2013 Uncertainty calculation for EN 14791										
v2										
							Measurement Equation			
Limit value (ELV)		**mg.m $^{-3}$**								
Measured concentration	7.68	**mg.m $^{-3}$ (at reference conditions)**								
Measured Quantities	**Symbol**	**Value**	**Standard uncertainty**		**Units**		**Uncertainty as percentage**	**Uncertainty at lv**	**Requirement of std**	
Sampled Volume Gas	V_m	0.06429102	uV_m	0.001	**m ^{3}**		1.56		<=2%	
Sampled gas Temperature	T_m	279	uTm	2	k		2.00		<2.5 k	
Sampled gas Pressure	p_m	101	up_m	1	**kPa**		0.99		<=1%	
Sampled gas Humidity	H_m	0	uH_m	1	**% by volume**		1.00		<=1%	
Note - Sampled gas humidity, temperature and pressure are values at the gas meter										
Leak	L	2			**%**		2.00		<=2%	
Intermediate calculations										
Factor for std conds	fs	0.98								
uncertainty components	symbol	**sensitivity coeff**		**u (in units of fs)**						
	ρ_m	0.010		0.010						
	H_m	0.010		0.010						
	T_m	0.003		0.007						
	ufs			0.015			1.58			
Corrected volume	V	0.06	uV	0.001	**m ^{3}**		2.24			
Factor for O2 correction	fc	#REF!								
uncertainty components	symbol	**sensitivity coeff**		**u**						
	$O_{2,m}$	#REF!		#REF!						
Factor for O2 Correction	ufc	#REF!		#REF!			#REF!			
Parameter		**Value**	**Units**	**Sensitivity coeff**	**Uncertainty contribution**		**Uncertainty as %**			
Corrected Volume (standard conditio	V	0.06	m^3	122.51	0.17	mg.m $^{-3}$	2.24	%		
Leak	L	0.09	mg.m $^{-3}$	1.00	0.09	mg.m $^{-3}$	1.15	%		
Combined uncertainty					**0.19**	mg.m $^{-3}$				
Expanded uncertainty as percentage of measured value			**5.05**	**% measured of value**		**expressed with a level of confidence of 95%**				
						(Using a coverage factor k=2)				
Expanded uncertainty in units of measurement			**0.39**	**%**						

Appendix III: Certificates and Process Detail Form

Process details form information not made available from Licensee at time of reporting. Details can be obtained direct from the client.

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

CERTIFICATE OF ANALYSIS

Customer Name:	Harringtons Claregalway	Certificate number:	24-04045
		Issue number:	1
Customer order:	HACLAC270324	Date of issue:	11/04/2024
Date tested:	27/03/2024		
Date received:	02/04/2024		
Date started:	02/04/2024		
Date completed:	03/04/2024		

Description: 1 liquid sample, 1 solid sample

Test methods: Details available on request (refer to SOP code against relevant result/s)

Determinand	Filter number	LOD	Units	Code	SOP	Stack	Filter result	Wash Result
Particulates	1559	0.1	mg	I	2750	AP1	3.56	
Particulates		0.4	mg	I	2750	AP1		3.06

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.4087

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

DEVIATING SAMPLES

Report number: 24-04045

Customer order No : HACLAC270324

Date sampling:	Stack:	Deviating:	Accredited Test
27/03/2024	AP1	N/a	Yes

Samples submitted may be declared to be deviating.Where applicable the analysis method remains accredited, however results reported for a deviating sample may be compromised.Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submisson may be required.

Key code	Description
N	Not accreditated test
I	Inab accreditated test
SI	Subcontracted to approved laboratory INAB Accredited for the test

Determinand	Uncertainty
Particulates (Filter)	2.4%
Particulates (Wash)	7.5%

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

CERTIFICATE OF ANALYSIS

Customer Name:	Harringtons Claregalway	Certificate number:	24-04046
		Issue number:	1
Customer order:	HACLAC270324	Date of issue:	11/04/2024
Date tested:	27/03/2024		
Date received:	02/04/2024		
Date started:	02/04/2024		
Date completed:	03/04/2024		

Description: 1 liquid sample, 1 solid sample

Test methods: Details available on request (refer to SOP code against relevant result/s)

Determinand	Filter number	LOD	Units	Code	SOP	Stack	Filter result	Wash Result
Particulates	1560	0.1	mg	I	2750	Blank	<0.1	
Particulates		0.4	mg	I	2750	Blank		<0.4

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.4087

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

DEVIATING SAMPLES

Report number: 24-04046

Customer order No : HACLAC270324

Date sampling:	Stack:	Deviating:	Accredited Test
27/03/2024	Blank	N/a	Yes

Samples submitted may be declared to be deviating.Where applicable the analysis method remains accredited, however results reported for a deviating sample may be compromised.Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submisson may be required.

Key code	Description
N	Not accreditated test
I	Inab accreditated test
SI	Subcontracted to approved laboratory INAB Accredited for the test

Determinand	Uncertainty
Particulates (Filter)	2.4%
Particulates (Wash)	7.5%

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Unit 3,
Westlink Business Park,
Clondrinagh,
Ennis Road,
Limerick,
V94K6XK

DATE: 03-09-2024

RE: HACLAC270324 Air Emissions Monitoring Report

To Whom it may concern,

Axis Environmental Services Ltd. were commissioned by Harrington Concrete & Quarries, Currandrum, Co. Galway to conduct quarterly air emission monitoring on the AP1 stack which is part of the tarmacadam production process on site.

Quarter 1 monitoring of the AP1 stack was scheduled for completion on the 27th of March 2024. On the morning of the assessment, Axis technicians arrived on site and began setting up equipment in line with our general standard operation procedures. Unfortunately, approximately 40 minutes into the set up of the equipment, the transformer supplying power to the Hoirba PG-350E analyser tripped causing complete power loss to the analyser and required accessories. The Horiba PG-350E analyser is used to monitor the following stack gases in line with the relevant European standards, NO, NO2, NOx, CO, CO2, O2. Due to the particular requirements of each analysis system within the PG-350 unit, the analyser requires a default 30-minute warm up time before any calibration or measurements can occur. As the unit had already been through the initial default warm up period and subsequent calibration time, a further 30-minute warm up cycle unfortunately meant that the tar production on the day had been completed prior to Axis technicians obtaining the required flue gas data on the day (EN standards require a 30-minute minimum period over which averaged results are obtained).

As the end of the quarter occurred on the same week as the aforementioned issue, a lack of forecasted production and unavailability due to scheduling conflicts for Axis Environmental, scheduling a retest on site was unfortunately not possible.

We have spoken to site representatives on the matter and have proposed monitoring earlier in each quarter along with a review of the power source used on site going forward to prevent this issue from occurring in future.

If you have any further questions or queries, please do not hesitate to contact me.

Thanks very much,

Kind Regards,

Tim Casey

Field Services Director

Email: tcasey@axisenv.ie I Phone: 00353 851014118 I Landline: 00353 61 324587 I Website: www.axisenv.ie
Unit 3 I Westlink Business Park I Clondrinagh I Ennis Road I Limerick I V94K6XK

AXIS

2024

Air Emissions REPORT

RECEIVED: 27/08/2025

PREPARED FOR

Harrington's Concrete & Quarry

Report Title	Air Emissions Compliance Monitoring Report
Company address	Axis Environmental Services Ltd., Unit 3 Westlink Business Park, Clondrinagh, Limerick, V94 K6XK
Contact Details	Phone: 061 324587, info@axisenv.ie
Stack Emissions Testing Report Commissioned by	Harrington's Concrete & Quarry
Facility Name	Harrington's Concrete & Quarry
EPA Licence Number	N/A
Licence Holder	Harrington's Concrete & Quarry
Stack Reference Number	AP1
Dates of the Monitoring Campaign	26/06/2024
Job Reference Number	HACLTM260624
Report Written By	Mr Thomas Moran
Report Approved by	Ruana Souza
Stack Testing Team	Mr Thomas Moran & Anderson Carneiro
Report Date	06/09/2024
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Ruana Souza Environmental Technician

Contents

1.0 Executive Summary

1.1 Overall aim of the monitoring campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

1.2 Summary of substances to be monitored at each emission point

Stack Name:	AP1
Total Particulate Matter	
Carbon Monoxide	
Nitrogen Oxides (as NO_2)	
Oxygen	
Carbon Dioxide	
Sulphur Dioxide	
Volumetric Flow Rate (Ref)	

1.3 Special Requirements

There were no special requirements

1.4 Summary of Results

Emission Point Number: AP1

Parameter	Method	Units	Result	MU +/-	Limit	O_2 Ref. (%)	Moisture Ref. (%)	Blanks	Date	Time on	Time off	Accreditation	
												Sampling	Analysis
Total Particulate Matter (TPM)	EN13284	$mg.m^{-3}$	40.01	2.10	50	17	Dry	<0.28	26/06/2024	08:52	09:22	Yes	Yes
Nitrogen Oxides (as NO_2)	EN 14792	$mg.m^{-3}$	71.7	4.6	400	17	Dry	N/a	26/06/2024	08:50	09:20	Yes	N/a
Sulphur Dioxide (as SO_2)	EN/TS 17021	$mg.m^{-3}$	1.5	1.2	500	17	Dry	N/a	26/06/2024	08:50	09:20	Yes	N/a
Carbon Monoxide (as CO)	EN 15058	$mg.m^{-3}$	186.1	4.2	N/a	17	Dry	N/a	26/06/2024	08:50	09:20	Yes	N/a
Carbon Dioxide	EN/TS 17405	vol%	4.68	0.2	N/a	N/a	Dry	N/a	26/06/2024	08:50	09:20	Yes	N/a
Oxygen	EN 14789	vol%	15.13	0.3	N/a	N/a	Dry	N/a	26/06/2024	08:50	09:20	Yes	N/a
Volumetric Flow Rate (Ref)	EN 16911	$m^3.hr^{-1}$	54,844	2,367	100,000	17	Dry	N/a	26/06/2024	08:52	09:22	Yes	N/a

Note 1: All results are normalised to standard temperature and pressure ($0^{O}C$ and 101.3kPa)
Note 2: All results are reported in the format as defined by the EPA in guidance note AG2:2021.

1.5 Operating Information

Please reference Process Details as per Appendix III attached.

1.6 Monitoring Deviations

Stack Name:	
Parameter	Deviation
Total Particulate Matter	None
Carbon Monoxide	None
Nitrogen Oxides (as NO_2)	None
Oxygen	None
Carbon Dioxide	None
Sulphur Dioxide	None
Volumetric Flow Rate (Ref)	Required no. of ports not available. EN 16911 - in accordance with AG2 Index of Preferred Methods

1.7 Reference Documents

Risk Assessment (RA)	SOP 1011
Site Review (SR)	SOP 1019
Site Specific Protocol (SSP)	SOP 1019

1.8 Version History

Version Number	Changes to the report
1	Original version of the report

Appendix I

1.1 Monitoring Personnel

Technician	Name	Thomas Moran
	System approval	Team Leader Approved
Technician	Name	Anderson Carneiro
	System approval	Technician Approved

1.2 Equipment Inventory

ID	Item of Equipment	Used	ID	Item of Equipment	Used	ID	Item of Equipment	Used
12EQ500	Pump		12EQ525	Horiba (PG-250) X		13EQ501	Vernier Callipers	x
12EQ532	Pump		16EQ508	Horiba- PG250z		14EQ503	Vernier Callipers	
12EQ536	Pump		14EQ501	Horiba-PG 350		14EQ507	Vernier Callipers	
12EQ537	Pump		17EQ515	Horiba 350		17EQ533	Vernier Callipers	
12EQ538	Pump		20EQ506	Horiba 350	x	18EQ506	Vernier Callipers	
12EQ542	Pump		21EQ503	Horiba 350		20EQ516	Vernier Callipers	
12EQ543	Pump		21EQ522	Horiba 350				
13EQ514	Pump							
16EQ518	Pump					13EQ503	1kg weight	
16EQ519	Pump		12EQ526	Chiller		13EQ508	500g Hafner weight	
17EQ509	Pump		14EQ513	Chiller		13EQ509	500g Hafner weight	
17EQ510	Pump		16EQ509	Chiller		14EQ515	500g Weight	x
17EQ522	Pump		18EQ505	Chiller		15EQ511	1kg Weight	x
17EQ523	Pump		21EQ504	Chiller	x	15EQ512	1kg weight	
17EQ524	Pump		22EQ509	Chiller		16EQ511	1kg weight	
17EQ525	Pump					16EQ512	500g weight	
17EQ526	Pump					17EQ529	500g weight	
18EQ517	Pump		14EQ518	Velocity Meter		17EQ530	1kg weight	
18EQ518	Pump		16EQ501	Velocity Meter		19EQ513	500g weight	
21EQ507	Pump		17EQ508	Velocity Meter		19EQ514	1kg Weight	
21EQ508	Pump		17EQ514	Velocity Meter		19EQ519	1kg weight	
21EQ509	Pump		18EQ504	Velocity Meter		19EQ520	500g weight	
21EQ510	Pump		19EQ502	Velocity Meter				
21EQ511	Pump		20EQ504	Velocity Meter				
22EQ500	Pump					17EQ534	ST5	
22EQ501	Pump					18EQ503	ST5	
22EQ502	Pump		21EQ528	TSI (Vane)		18EQ513	ST5	
22EQ503	Pump		23EQ500	TSI (Vane)		19EQ509	ST5	x
22EQ504	Pump					20EQ500	ST5	
22EQ505	Pump		16EQ502	FID		21EQ519	ST5	
			17EQ517	FID		22EQ508	ST5	
			19EQ508	FID				
22EQ539	MF Meter		20EQ507	FID				
21EQ501	MF Meter		20EQ508	FID		14EQ510	Digital Protractor	x
21EQ502	MF Meter		17EQ535	Signal Cutter		14EQ511	Digital Protractor	
21EQ526	MF Meter					17EQ528	Digital Protractor	
21EQ530	MF Meter					18EQ507	Digital Protractor	
21EQ531	MF Meter		16EQ510	Measuring Tape		20EQ514	Digital Protractor	
21EQ532	MF Meter		17EQ527	Measuring Tape		20EQ515	Digital Protractor	
			18EQ508	Measuring Tape				
14EQ514	Heated Line		19EQ516	Measuring Tape				
17EQ502	Heated Line		20EQ509	Measuring Tape		12EQ522	Balance	
17EQ503	Heated Line		24EQ543	Measuring Tape	x	15EQ509	Balance	
17EQ539	Heated Line (5m)					15EQ510	Balance	
19EQ523	Heated Line					17EQ537	Balance	
20EQ520	Heated Line	x	20EQ519	PCDD Thermometer		19EQ515	Balance	
20EQ521	Heated Line					21EQ505	Balance	x
21EQ523	Heated Line (5m)		16EQ515	Thermocouple K type		21EQ506	Balance	
21EQ524	Heated Line (5m)		16EQ516	Thermocouple K type		21EQ525	Balance	
22EQ510	Heated Line (40m)		21EQ513	K type Thermocouple		21EQ529	Balance	
22EQ512	Heated Line (5m)		21EQ514	K type Thermocouple				
22EQ513	Heated Line (5m)		21EQ515	K type Thermocouple				
			21EQ516	K type Thermocouple				
12EQ518	S type Pitot Tube		21EQ517	K type Thermocouple				
12EQ520	L Type Pitot tube		21EQ518	K type Thermocouple				
13EQ506	S type Pitot Tube		21EQ520	K type Thermocouple				
14EQ506	1m S type & K type		23EQ510	K type Thermocouple	x			
16EQ506	S type Pitot Tube							
16EQ517	S type Pitot Tube Long		17EQ519	Stopwatch				
17EQ507	1m S type & K type		17EQ520	Stopwatch				
17EQ536	S type Pitot Tube		17EQ521	Stopwatch				
18EQ514	S type Pitot Tube		18EQ509	Stopwatch	x			
18EQ515	S type Pitot Tube		19EQ518	Stopwatch				
19EQ510	S type pitot tube		21EQ512	Stopwatch				
19EQ511	S type pitot tube							
19EQ521	1m S type & K type							
19EQ522	Pitot							
22EQ506	S type pitot tube							
22EQ507	S type pitot tube							
22EQ511	S type pitot tube							

Appendix II

2.1 Stack Emission Point Reference: AP1

2.1.1 Suitability of Sample Location:

General Information	AP1
Permanent/Temporary	Permanent
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / EN 15259 Platform Requirements	Value	Comment
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self-closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	Yes	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-
Sampling Location / Platform Improvement Recommendations		
None		
EN 15259 Homogeneity Test Requirements		
1.		
Select Option: 1: There is no requirement to perform a EN15259 Homogeneity Test on this stack 2: Test results were obtained from previous Homogeneity test carried out by AXIS 3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor 4: Homogeneity Test is required on this stack and the client has been informed of this requirement		

2.1.2 Stack Diagram

Figure 1: AP1

2.1.3 Stack Raw Data

Title:	**Determination of Total Particulates**				
Method:	EN 13284-1				
Client:	Harrlngtons Claregalway				
Test Date:	26/06/2024		**Air Volume at Pump**	1.1798	m^3
Test Time	08:52		**Temperature at Pump**	20.07	Deg C
Laboratory Used:	AXIS		**Pressure at Pump**	81.07	kPa
Stack Name	AP1		**Humidity at Pumps**	0	%
Run I.D.	1		**Filter Weight**	50.23	mg
Filter I.D.	1827		**Front End Weight**	1.82	mg
Moisture Content	5.33	%			
Reference Oxygen	17	%	**Flow Uncertainty**	2,367	m^3/hr
Measured Oxygen	15.13	%	**Flow Uncertainty**	4.3	%
Stack Flow Rate	39157	Nm^3/hr			
Adjusted Stack Flow Rate	54844.48899	Nm^3/hr, dry @ % Oxygen			
Volume of Air Sampled	0.8794	Nm^3			

Leak Check Results	**Result**		**% Leak**
Before Sample 1	0	l/min	0.0
Average Flow Rate	27.20	l/min	0.0
Standard Maximum	0.544	l/min	2%
Back Pressure	67.88	kPa	

Standard Criteria to be Met	**Result**	**Std. Requirement**		
Angle of Flow	Yes	<15 Degrees	**Probe material**	Stainless Steel
Negative Flow in the Stack	Yes	None	**Filter housing**	Stainless Steel
Pitot Pressure Difference	Yes	>5Pa	**Positioning of filter**	In Stack
Ratio of Flow Measurement	Yes	<3:1	**Filter Size & Material**	47mm Quartz
Stagnation Test	Yes	<10Pa		

Pitot Tube Leak Check	**Result**	
Positive Pressure	Pass	-
Negative Pressure	Pass	-
Number of Ports	1	2
Straight length before sample point	Yes	> 5 Hydraulic Diameters
Straight length after sample point	Yes	> 5 Hydraulic Diameters to Stack Outlet or 2HD to Fan/ Bend

Sample Calculations				
Blank (Filter and Front Wash Combined)	0.37	mg		
Sample 1 (Filter and Front Combined)	52.05	mg		
Volume of Air Sampled	0.8794	Nm^3		
Blank Result	0.42	$mg/Nm^{3,}$ dry	0.28	$mg/Nm^{3,}$ dry @ Ref O_2
Sample Result	59.19	$mg/Nm^{3,}$ dry	40.01	$mg/Nm^{3,}$ dry @ Ref O_2
Uncertainty of Measurement	2.10	mg/Nm^3		
Emission Limit Value	50	mg/Nm^3		
Blank as Percentage of ELV	0.8	%	**Requirement <10% ELV or <0.5 mg/m³**	

Isokinetic Criterion Compliance		
Isokinetic Variation	-0.3	%
Allowable Isokinetic Range	-5 to + 15%	%
Isokinetic Acceptable	Yes	

Balance Calibration	**Weight**	**0**		
0	0	g	Eccentric load indication carried out - Balance Ok	Yes
500	500	g		
1000	1000	g		

Impinger Weights	**Initial**	**Final**	**Difference**
Total Impinger Weight	2284.1	2323.9	39.8
Volume of Air Sampled	0.8794	Nm3	39.8
Moisture Content (EN 14790)	5.33	%	

DUCT AND GAS SPECIFICATION			
Name			ap1
Section			Circular
Diameter		[m]	n.a
Area		[m2]	1.130973
Ports		[#]	1
Points	P	[#]	8
Density	ρn	[kg/Nm3]	1.305
Carbon Dioxide	CO2	[%]	3.85
Oxygen	O2	[%]	16.35
Water Vapor Ratio	rw	[0;1]	0.008
Nozzle	nz	[mm]	8
Turbolence factor	ft	[sec]	1
Wall Adjustment Factor	waf		

PITOT DATA SPECIFICATION			
Name			
Velocity	[m/sec]	5	0.83
Velocity	[m/sec]	10	0.83
Velocity	[m/sec]	20	0.83
Velocity	[m/sec]	30	0.83
Velocity	[m/sec]	40	0.83

NORMALIZATION FACTOR			
Tnorm		[K]	273
Pnorm		[kPa]	101.3

DUCT FLOW RATE			
Dry actual	QVa	[m3/h]	51536
Moist actual	Q'Va	[m3/h]	51951
Moist norm. [Tnorm Pnorm]	Q'Vn	[Nm3/h]	39157
Dry norm. [Tnorm Pnorm]	QVn	[Nm3/h]	38843

AVERAGE VALUES			
Total Points		[#]	1
Velocity	v'a	[m/sec]	12.82
Stack temperature	tstack	[°C]	87.87
Stack Pressure	Pa	[kPa]	100.93
Isokinetic Rate	IR	[%]	-0.3
Velocity at nozzle	v'N	[m/sec]	12.795
Probe temperature	tprobe	[°C]	148
Filter temperature	tfilter	[°C]	135.6
Outlet temperature	toutlet	[°C]	26.2
Aux temperature	taux	[°C]	15.3
Ambient Pressure	Pamb	[kPa]	101.02

GAS METER SAMPLED VOLUMES		
Elapsed time	et	00:30:00
Norm. Volume [Tnorm Pnorm]	Vgn	0.8794
Moist Volume at stack conditions	V'ga	1.1763
Volume at dgm conditions	Vdgm	1.1798
Gas meter temperature	tdgm	20.07
Gas Meter Pressure	Pdgm	81.07

start ts [timestamp]	port [###]	point [###]	Probe pos [cm]	tstack avg [°C]	Pa avg [kPa]	dP Pitot avg [Pa]	velocity avg [m/sec]
26/06/2024	1	1	3.9	87.59	100.96	71.63	10.03
08:47:29	-	-	-	-	-	-	-
26/06/2024	1	2	12.6	87.39	100.96	72.53	10.09
08:48:03	-	-	-	-	-	-	-
26/06/2024	1	3	23.3	87.37	100.96	73.34	10.14
08:48:35	-	-	-	-	-	-	-
26/06/2024	1	4	38.8	87.15	100.96	68.97	9.83
08:49:06	-	-	-	-	-	-	-
26/06/2024	1	5	81.3	86.68	100.96	69.44	9.86
08:49:47	-	-	-	-	-	-	-
26/06/2024	1	6	96.8	86.4	100.96	73.34	10.13
08:50:24	-	-	-	-	-	-	-
26/06/2024	1	7	107.5	86.27	100.95	74.13	10.18
08:50:56	-	-	-	-	-	-	-
26/06/2024	1	8	116.2	86.04	100.95	75.28	10.26
08:51:33	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
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-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Uncertainty calculation for EN 13284					
	Symbol	**Unit**	**Values**	**UOM as %**	**Std Requirement**
Sampled Volume	V_m	m^3	0.001	0.08	<=5%
Sampled gas Temperature	T_m	k	2.00	0.68	<=2%
Sampled gas Pressure	ρ_m	kPa	1.00	1.23	<=2%
Sampled gas Humidity	H_m	% by volume	1.00	1.00	<=1%
Oxygen content	$O_{2,m}$	% by volume	0.10	-	<=5%
Mass particulate	m	mg	0.512	0.98	<5% of limit value
Leak	L		-	0.00	<=2%
Uncollected Mass	UCM		-	0.00	<10% of limit value
Corrected Volume (STP)	V	m^3	0.88	1.73	-
Mass	m	mg	52.04	0.98	-
Factor for O2 Correction	fc		0.68	1.70	-
Leak	L	$mg.m^{-3}$	0.00	0.00	-
Uncollected mass	UCM	mg	0.00	0.00	-
Combined measurement uncertainty			**1.05**	-	-
Expanded uncertainty as percentage of measured value				**5.24**	% measured of value
Expanded uncertainty in units of measurement				**2.10**	mg.m-3
Expanded uncertainty as percentage of limit value				**4.19**	% ELV

Uncertainty calculation for Velocity and Volume Flow Rate Measurement by Pitot tube EN ISO 16911-1					
	Unit	**Values**	**as %**	**Std Requirement**	
Range of Delta P transducer	Pa	2500	-		-
Resolution of Delta P transducer	Pa	10	-		-
Repeatability of Delta P transducer	% of value	0.01	-		-
Drift of Delta P transducer	% of range	0.32	-		-
Lack of fit of measurement system	% of range	0.25	-		-
Uncertainty in Delta P transducer	Pa	2.5	-		-
Uncertainty of pitor coefficient		0.03	-		-
Enter uncertainties as (95%,k=2) where relevant					
Uncertainty in temperature readout system	°C	1	-		-
Uncertainty in atmospheric pressure transducer	Pa	160.5	-		-
Uncertainty in duct area measurement	%	1.0	-		-
Uncertainty of Molar Mass	kg/mol	0.00001	0.03		-
Uncertainty of Temperature	K	0.5	0.14		-
Uncertainty of Stack Static Pressure	Pa	10.09	0.01		-
Uncertainty of Stack Pressure	Pa	160.8	0.08		-
Uncertainty of Gas Density	kg/m3	0.0031	0.16		-
Uncertainty in velocity	m/sec	0.23	1.8		-
Expanded Uncertainty in velocity	m/sec	0.47	3.6		-
Uncertainty of Volumetric Flow Rate	m^3/hour	1184	-		-
Expanded Uncertainty of Volumetric Flow Rate	m^3/hour	**2367**	**4.3**	<10% of ELV	

Title:	***Determination of Flue Gases***					
Method:	EN 14792 / TS 17021 / EN 15058 / TS 17405 / EN 14789					
Test Date:	26/06/2024					
Stack Name:	AP1		**Quality Assurance**			
Test Start Time:	08:50		Probe Material		Stainless Steel	
Reference Conditions			Filtration Type/size		Stainless Steel	
Measured Oxygen	15.1	%	Heated Filter used		Yes	
Reference Oxygen	17	%	No. of sampling lines		1	
Reference Moisture	-		No. of Sampling points		1	
			Sampling point I.D.s		1	
Parameter		**NO**	**SO2**	**CO**	**CO2**	**O2**
Emission Limit Values	$mg.m^{-3}$ ref	400	500	-	-	-
Instrument Range	ppm	500	200	200	30.00%	25.00%
Span Gas Value	ppm	428.6	158.8	147.7	16.09%	20.90%
Acceptable Gas Range	-	Yes	Yes	Yes	Yes	Yes
Calibration Gas Reference No.	-	24ING531	23ING528	24ING506	23ING535	-
Calibration Gas Uncertainty	%	1	0.6	0.5	0.5	0.35
Calibration Gas Start Bar	Bar	35	40	10	40	-
Expiry Date	-	Nov-24	Oct-24	30 JUN 2024	Oct-26	-
Quality Assurance	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Conditioning Unit Temperature	C	2	2	2	2	2
Average Temperature	< C	2	2	2	2	2
Allowable Temperature	-	4	4	4	4	4
Temperature Acceptable	-	Yes	Yes	Yes	Yes	Yes
Pump flow rate	l/min.	0.5	0.5	0.5	0.5	0.5
Instrument Zero Drift	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Instrument Zero (Ambient air or Nitrogen)		Nitrogen	Nitrogen	Nitrogen	Nitrogen	Nitrogen
Instrument Zero (Pre)	ppm	0	0	0	0.00%	0.00%
Instrument Zero (Check)	ppm	0	0.1	0	0.01%	0.02%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Instrument Zero (Post)	ppm	0.1	-0.2	-0.2	0.00%	0.03%
Zero Drift	ppm	0.1	-0.2	-0.2	0.00%	0.03%
Allowable Zero Drift (Less than 2%)	ppm equiv.	8.572	3.176	2.954	0.003218	0.42%
Adjustable Zero Drift (2 - 5%) / 5% CO_2	ppm equiv.	21.43	7.94	7.385	0.80%	1.05%
Zero Drift Failure (<5% / >5% CO_2)	ppm equiv.	21.43	7.94	7.385	0.80%	1.05%
Zero Drift Acceptable	-	Yes	Yes	Yes	Yes	Yes
Adjust for Zero Drift	-	No	No	No	No	No
Reject results	-	No	No	No	No	No
Calculated Drift	%	0.02%	-0.13%	-0.14%	0.00%	0.14%
Instrument Span Drift	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Instrument Span Down (Pre)	ppm	428.6	158.8	147.7	16.09%	20.90%
Instrument Check Span (Post)	ppm	428.7	157	146.3	16.01%	20.87%
Span Drift	ppm	0.1	-1.8	-1.4	-0.08%	-0.03%
Allowable Span Drift (less than 2%)	ppm equiv.	8.572	3.176	2.954	0.32%	0.42%
Adjustable Span Drift (2 - 5%)	ppm equiv.	21.43	7.94	7.385	0.008045	1.05%
Span Drift Failure (Greater than 5%)	ppm equiv.	21.43	7.94	7.385	0.80%	1.05%
Span Drift Acceptable (Y/N)	-	Yes	Yes	Yes	Yes	Yes
Adjust for Span Drift	-	No	No	No	No	No
Reject results	-	No	No	No	No	No
Calculated Drift	%	0.02%	-1.13%	-0.95%	-0.50%	-0.14%
Heated Line Check Including Leak Check		**NO**	**SO2**	**CO**	**CO2**	**O2**
Span Gas Conc.	ppm	428.6	158.8	147.7	16.09%	20.90%
Zero Check Acceptable Limit (+/-)	ppm	8.572	3.176	2.954	0.32%	0.42%
Heated Line Check Zero Gas	ppm	0	0.1	0.2	0.01%	0.00%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Heated Line Check Span Gas	ppm or %	424.9	155.7	145.9	15.97%	20.80%
Span Gas Leak Detected	ppm or %	-3.7	-3.1	-1.8	-0.12%	-0.10%
Leak check acceptable (< 2%)	ppm or %	8.572	3.176	2.954	0.32%	0.42%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Response Time (<200 seconds)		Yes	Yes	Yes	Yes	Yes

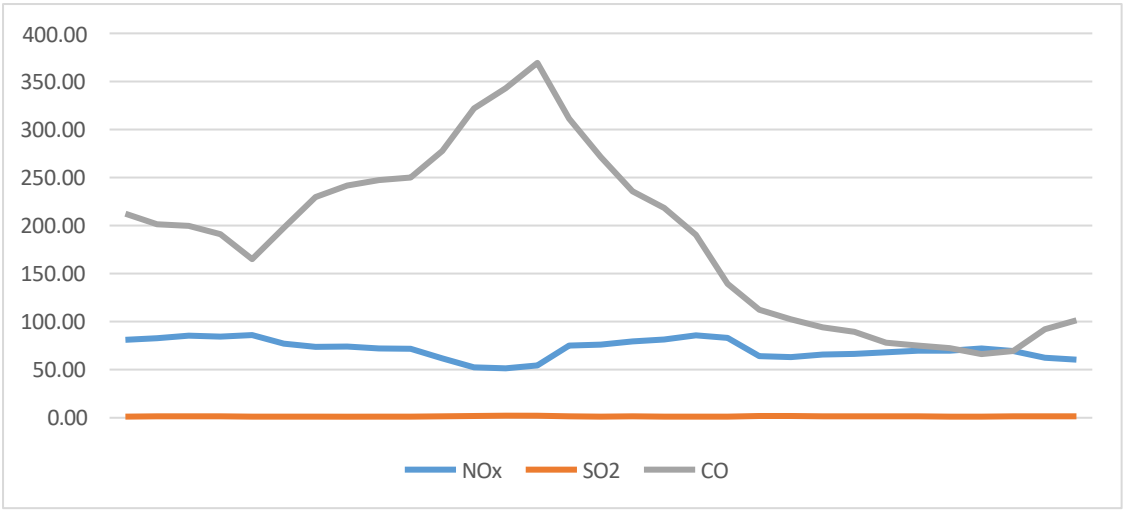
Test Conditions	Units	
Run Ambient Temperature Range	C	15

Raw Data

Date/Time	NOx	SO2	CO	CO2	O2
	ppm	ppm	ppm	vol%	vol%
26/06/2024 08:50	58.4	0.7	251.4	5.22	14.45
26/06/2024 08:51	59.8	0.8	238.2	5.30	14.39
26/06/2024 08:52	61.7	0.8	236.2	5.43	14.21
26/06/2024 08:53	60.8	0.7	226.1	5.38	14.32
26/06/2024 08:54	62.0	0.7	195.4	5.38	14.27
26/06/2024 08:55	55.6	0.7	233.9	5.09	14.61
26/06/2024 08:56	53.2	0.6	271.8	5.04	14.73
26/06/2024 08:57	53.4	0.6	286.1	5.07	14.72
26/06/2024 08:58	52.0	0.6	292.6	5.00	14.81
26/06/2024 08:59	51.8	0.7	295.8	5.01	14.83
26/06/2024 09:00	44.7	0.8	328.4	4.56	15.23
26/06/2024 09:01	37.8	0.9	380.9	4.29	15.65
26/06/2024 09:02	37.1	1.1	405.9	4.25	15.70
26/06/2024 09:03	39.3	1.1	437.0	4.49	15.55
26/06/2024 09:04	54.2	0.8	368.4	5.11	14.73
26/06/2024 09:05	54.8	0.6	321.2	5.07	14.69
26/06/2024 09:06	57.3	0.8	279.1	5.16	14.57
26/06/2024 09:07	58.6	0.7	258.5	5.20	14.46
26/06/2024 09:08	61.8	0.7	225.5	5.34	14.32
26/06/2024 09:09	59.9	0.7	165.2	4.98	14.60
26/06/2024 09:10	46.2	0.9	133.2	3.94	15.98
26/06/2024 09:11	45.6	0.9	121.1	3.89	16.09
26/06/2024 09:12	47.5	0.9	111.2	4.02	15.91
26/06/2024 09:13	47.8	0.8	105.7	4.04	15.87
26/06/2024 09:14	49.1	0.8	92.3	4.09	15.78
26/06/2024 09:15	50.2	0.7	88.8	4.17	15.69
26/06/2024 09:16	50.3	0.7	85.8	4.17	15.68
26/06/2024 09:17	52.1	0.7	78.4	4.29	15.57
26/06/2024 09:18	50.0	0.7	82.4	4.16	15.62
26/06/2024 09:19	45.0	0.9	109.2	3.94	15.95
26/06/2024 09:20	43.6	0.8	120.0	3.86	16.08
Average	**51.7**	**0.8**	**220.2**	**4.68**	**15.13**

Referenced Data

	NOx mg/Nm3	SO2 mg/Nm3	CO mg/Nm3	CO2 vol%	O2 vol%
26/06/2024 08:50	81.11	1.29	212.49	5.22	14.45
26/06/2024 08:51	82.93	1.61	201.28	5.30	14.39
26/06/2024 08:52	85.57	1.48	199.64	5.43	14.21
26/06/2024 08:53	84.46	1.40	191.03	5.38	14.32
26/06/2024 08:54	86.06	1.35	165.10	5.38	14.27
26/06/2024 08:55	77.23	1.35	197.64	5.09	14.61
26/06/2024 08:56	73.86	1.24	229.72	5.04	14.75
26/06/2024 08:57	74.07	1.14	241.77	5.07	14.72
26/06/2024 08:58	72.21	1.26	247.29	5.00	14.81
26/06/2024 08:59	71.94	1.27	249.98	5.01	14.83
26/06/2024 09:00	61.98	1.63	277.52	4.56	15.23
26/06/2024 09:01	52.46	1.84	321.89	4.29	15.65
26/06/2024 09:02	51.48	2.05	343.05	4.25	15.70
26/06/2024 09:03	54.56	2.16	369.29	4.49	15.55
26/06/2024 09:04	75.24	1.50	311.32	5.11	14.73
26/06/2024 09:05	76.12	1.22	271.45	5.07	14.69
26/06/2024 09:06	79.49	1.50	235.82	5.16	14.57
26/06/2024 09:07	81.33	1.32	218.44	5.20	14.46
26/06/2024 09:08	85.73	1.37	190.53	5.34	14.32
26/06/2024 09:09	83.09	1.35	139.57	4.98	14.60
26/06/2024 09:10	64.17	1.82	112.53	3.94	15.98
26/06/2024 09:11	63.24	1.77	102.32	3.89	16.09
26/06/2024 09:12	65.91	1.68	93.98	4.02	15.91
26/06/2024 09:13	66.35	1.58	89.34	4.04	15.87
26/06/2024 09:14	68.12	1.50	78.03	4.09	15.78
26/06/2024 09:15	69.67	1.39	75.01	4.17	15.69
26/06/2024 09:16	69.82	1.35	72.47	4.17	15.68
26/06/2024 09:17	72.24	1.26	66.29	4.29	15.57
26/06/2024 09:18	69.36	1.42	69.61	4.16	15.62
26/06/2024 09:19	62.42	1.68	92.26	3.94	15.95
26/06/2024 09:20	60.49	1.58	101.44	3.86	16.08
Average	**71.70**	**1.50**	**186.07**	**4.68**	**15.13**
Uncertainty of Measurement	**4.59**	**1.15**	**4.20**	**0.23**	**0.35**
Uncertainty as % of ELV	**1.15**	**0.23**	**-**	**-**	**-**
Standard Requirement	**<10%**	**<15%**	**<6%**	**<25%**	**<6%**



QGU-010-2013 Uncertainty calculation for Gaseous Measurement EN 14792 Nox

v4

Limit value	400	mg.m^{-3} (corrected) NO2	Gas	NO	
			Full Scale	500	ppm
Measured concentration	51.66	ppm	Cal gas conc	428.6	ppm
Measured concentration	106.06	mg.m^{-3} (corrected) NO2	Conversion	2.053	
Ratio NO/NO2	100.00		Full Scale	1026.5	mg.m^{-3} (NO2)
			Cal gas conc	879.916	mg.m^{-3} (NO2)

Correction for reference conditions					
		O2, %	Moisture, %	Pressure, KPa	Temperature, K
	ref	17.00	0.00	101.30	273.00
	measured	15.13	0.00	101.30	273.00
Factors		0.68	1.00	1.00	1.00
Correction Factor		0.68			

RECEIVED: 27/08/2025

Performance characteristics	Value				specification
Response time		30	seconds		180.000
Number of readings in measurement		30			
Repeatability at zero		0.03	% full scale		0.200
Repeatability at span level		0.06	% full scale		2.000
Deviation from linearity		0.2	% of value		2.000
Zero drift		0.02	% full scale		2.000
Span drift		0.02	% full scale		2.000
volume or pressure flow dependence		0	% of full scale/kPa		0.033
atmospheric pressure dependence		0	% of value/kPa		0.750
ambient temperature dependence		0.3	% full scale/10K		0.300
NH3 (20 mg/m3)		0	mg/m3		
CO2 (15%)		0.209	% by vol		
H2O (30%)		0.0	% by vol		4.000
dependence on voltage		0.1	% full scale/10V		2%fs/10V
converter efficiency		95	%		95%
losses in the line (leak)		0.863275782	% of value		2% of value
Uncertainty of calibration gas		1	% of value		

Effect of drift		
0.23	mg/m3	0.02241
0.21	% value	

	ranges		
	min	max	value at calib
flow	95	105	100
pressure	101.30	101.3	101.3
temp	289	289	283
NH3 range	0	0	0
CO2 range	0	15	0
H2O range	0	0	0
Instrument Voltage Rating			110
Voltage	93	121	110

Measurement performance related to stationary conditions

Performance characteristic			Uncertainty		Value of uncertainty quantity		
Standard deviation of repeatability at zero			u_{z0}		for mean		use rep at span
Standard deviation of repeatability at span level			u_{zs}		for mean		0.01
Lack of fit			u_{fit}				1.19
Drift			u_{drift}				0.13
volume or pressure flow dependence			u_{dypres}				0.00
atmopsheric pressure dependence			u_{dapres}				0.00
ambient temperature dependence			u_{dtemp}				0.18
NH3 (20 mg/m3)			$u_{dinterf}$				0.00
CO2 (15%)							0.12
H2O (30%)							0.00
Dependence on voltage			u_{dvolt}				0.09
Converter efficiency			u_{dcef}				3.06
losses in the line (leak)			u_{dleak}				0.53
Uncertainty of calibration gas			u_{dcalib}				0.61

Use largest negative or positive interferent effect	
0	0.00
0	0.12
0	0.00
0	0.12
Interference uncertainty	0.12

Measurement uncertainty		Result	106.06	mg/m^3
Combined uncertainty			3.39	mg/m^3
Expanded uncertainty	k =	2	6.78	mg/m^3
Uncertainty corrected to std conds			4.59	mg.m-3 (corrected)
Expanded uncertainty	**expressed with a level of confidence of 95%**		**1.15**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**4.59**	**mg.m^{-3} at ELV**

QGU-008-2013 Uncertainty calculation for Gaseous Measurement SO2 EN TS 17021

V2 Jul-08

Limit value	500	mg/m³ (corrected) SO2	Cal gas conc	454.168	mg.m⁻³
Measured concentration	2.21	mg/m3	Full Scale	572	mg/m³
Measured concentration	1.50	mg/m³ (Corrected)			

Correction for reference conditions

		O2, %	Moisture, %	Pressure, KPa	Temperature, K
	ref	17.00	0.00	101.30	273.00
	measured	15.13	0.00	101.30	273.00
	Uncert	0.35	1.00	0.00	1.00
Factors		0.68	1.00	1.00	1.00
Uncertainty in factor		0.04	0.01	0.00	0.00
Correction Factor		0.68	uf	0.04	

RECEIVED 27/05/2025

Performance characteristics	Value				specification
Response time		180	seconds		≤180.000
Logger sampling interval		30	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30			
Repeatability at zero		0.25	% full scale		<1 % range
Repeatability at span level		0.15	% full scale		<2 % range
Deviation from linearity		0.2	% of value		<2 % range
Zero drift		-0.1	% full scale		<2% range / 24hr
Span drift		-0.9	% full scale		<2% range/24hr
volume or pressure flow dependence		0.02	% of full scale/3 kPa		<2 % / 3 kPa
atmospheric pressure dependence		0.8	% of full scale/2 kPa		<3% / 2 kPa
ambient temperature dependence		0.01	% full scale/10K		<3% range / 10 K
N₂O (mg/m3)	20	0.2	mg/m3		
CO₂ (% vol)	15	0.2	mg/m3		
CH₄ (mg/m3)	40	0.7	mg/m3		
H2O (% vol)	20	0.2	mg/m3		
dependence on voltage		0.1	% full scale/10V		<2% range
losses in the line (leak)		1.952141058	% of value		< 0.1%vol /10 volt
Uncertainty of calibration gas		0.6	% of value		< 2% of value

Effect of drift

-0.10	mg/m3
-6.89	% value

	ranges min	max	value at calib	
flow	0.3	0.5	0.4	l/hr
pressure	100.76	100.92	100.88	kPa
temp	287	288.5	287.5	K
N2O range	0	0	0	mg/m3
CO2 range	0	30	0	%vol
CH4 range	0	57	0	mg/m3
H2O range	0	1	0	%vol
Voltage	89	121	110	V

Performance characteristic			Uncertainty		Value of uncertainty quantity		
Standard deviation of repeatability at zero			u_{ac}		for mean		use rep at span
Standard deviation of repeatability at span level			u_{as}		for mean		0.03
Lack of fit			u_{al}				0.66
Drift			u_{dz}				-0.06
volume or pressure flow dependence			u_{dpres}				0.00
atmospheric pressure dependence			u_{dpres}				0.14
ambient temperature dependence			u_{dtemp}				0.00
N2O (mg/m3)			u_{dref}				0.00
CO2 (% vol)			u_{dref}				0.31
CH4 (mg/m3)			u_{dref}				0.58
H2O (% vol)			u_{dref}				0.01
Dependence on voltage			u_{dcell}				0.49
losses in the line (leak)			u_{dleak}				0.02
Uncertainty of calibration gas			u_{dcalib}				0.01
Uncertianty in factor			uf				0.09

Use largest of sum of all positive or all negative influences

0.89	all +ves	Criteria
0	all -ves	sum <4% range
0.89	largest	0.044237742

Value to use for intereference uncertainty

u_{ir} 0.89

Measurement uncertainty			1.50	mg/m³
Combined uncertainty			0.84	mg/m³
Expanded uncertainty	k =	2	1.69	mg/m³
Uncertainty corrected to std conds			1.15	mg/m³
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.23**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**1.15**	**mg.m⁻³**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**76.93**	**% value**

Uncertainty calculation for Gaseous Measurement CO

Limit value	-	mg/m³ (corrected)	**Cal gas conc**	184.625	mg.m⁻³
Measured concentration	275.23	mg/m3	**Full Scale**	250	mg/m³
Measured concentration	186.07	mg/m³ (Corrected)			

Correction for reference conditions					
		O2, %	**Moisture, %**	**Pressure, KPa**	**Temperature, K**
	ref	17.00	0.00	101.30	**273.00**
	measured	15.13	0.00	101.30	**273.00**
	Uncert	0.35	1.00	0.00	**1.00**
Factors		0.68	1.00	1.00	1.00
Uncertainty in factor		0.04	0.01	0.00	0.00
Correction Factor		**0.68**	uf	**0.04**	

RECEIVED: 27/03/2025

Performance characteristics	**Value**				**specification**
Response time		60	seconds		≤80.000
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30			
Repeatability at zero		0.25	% full scale		<1 % range
Repeatability at span level		0.15	% full scale		<2 % range
Deviation from linearity(lack of fit)		0.7	% of value		<2 % range
Zero drift		-0.25	mg/m3		<2% range / 24hr
Span drift		-1.75	mg/m3		<2% range/24hr
volume or pressure flow dependence		0.02	% of full scale/3 kPa		<2 % / 3 kPa
atmospheric pressure dependence		0.8	% of full scale/2 kPa		<3% / 2 kPa
ambient temperature dependence		0.01	% full scale/10K		<3% range / 10 K
N₂O (mg/m3)	20	0.2	mg/m3		
CO₂ (% vol)	15	0.2	mg/m3		
CH₄ (mg/m3)	40	0.7	mg/m3		
H2O (% vol)	20	0.2	mg/m3		
dependence on voltage		0.1	% full scale/10V		<2% range
losses in the line (leak)		-1.22	% of value		< 0.1%vol /10 volt
Uncertainty of calibration gas		0.5	% of value		< 2% of value

Effect of drift	
2.98	mg/m3
1.19	% full scale

		ranges			
		min	max	value at calib	
flow	95.00	105	100	kPa	
pressure	100.76	100.92	100.88	kPa	
temp	287	288.5	287.5	K	
N2O range	0	40	0	mg/m3	
CO2 range	0	15	0	%vol	
CH4 range	0	57	0	mg/m3	
H2O range	0	0	0	%vol	
voltage	93	121	110	V	

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**mg/m3**
Standard deviation of repeatability at zero			u_{zr}		for mean		use rep at span
Standard deviation of repeatability at span level			u_{sr}		for mean		0.07
Lack of fit			u_{lf}				1.11
Drift			u_{drift}				-1.72
volume or pressure flow dependence			u_{pcorr}				0.05
atmopsheric pressure dependence			u_{pcorr}				0.06
ambient temperature dependence			u_{temp}				0.00
N2O (mg/m3)			u_{interf}				0.23
CO2 (% vol)			u_{interf}				0.12
CH4 (mg/m3)			u_{interf}				0.58
H2O (% vol)			u_{interf}				0.01
Dependence on voltage			u_{volt}				0.22
losses in the line (leak)			u_{leak}				-1.94
Uncertainty of calibration gas			u_{calib}				0.79

Use largest of sum of all positive or all negative influences

0.93	all +ves	Criteria
0	all -ves	sum <4% range
0.93	largest	5.504569888

Value to use for intereference uncertainty

u_{int} 0.93

Measurement uncertainty				
Combined uncertainty			0.08	mg/m³
Expanded uncertainty	k =	2	6.16	mg/m³
Uncertainty corrected to std conds			**4.20**	**mg/m³**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.00**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**4.20**	**mg.m⁻³**

QGU-007-2013 Uncertainty calculation for Gaseous Measurement Carbon Dioxide

V2.2 Jul-08

Limit value	n/a	%vol	**Calibration gas**	**0.161**	%vol
Measured concentration	4.68	%vol	**Full Scale**	**25**	%vol

Performance characteristics	**Value**				**specification**
Response time		30	seconds		< 200 s
Logger sampling interval		30	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30	Assuming 1 minute collected over 1 hour		
Repeatability at zero		0.015	% by volume	stdev	<0.2 % range
Repeatability at span level		0.014	% by volume	stdev	<0.4 % range
Deviation from linearity		0.13	% vol	+/-	<0.3 % volume
Zero drift (during measurement period)		0	% vol at zero level	+/-	<2% of volume / 24hr
Span drift (during measurement period)		0	% vol at span level	+/-	<2% volume/24hr
volume or pressure flow dependence		0	% of fs / 10l/h	+- 5 l/h	<1% range
atmospheric pressure dependence		0.3	% of fs/kPa	+- 2kPa	< 1.5 % range
ambient temperature dependence		-0.07	% by volume /10K	+- 15K	<0.3% volume 10 K
CO_2 (% vol)	15	0.07	% by volume per	15	
NO (mg/m3)	300	0.02	% by volume per	300	
NO_2 (mg/m3)	30	0	% by volume per	30	
Combined interference		0.56	% range		<2% range
Dependence on voltage		0.1	% by volume /10V	+- 5%	< 0.1%vol /10 volt
Losses in the line (leak)		0.745804848	% of value		< 2% of value
Uncertainty of calibration gas		0.5	% of value		

Effect of drift		
0.00	% vol	
0.00	% value	

	range of variation from conditions		at calibration	
	min	max	value at calib	
flow	5	15	10	l/h
pressure	99.00	101	100	kPa
temp	280	285	285	K
CO_2 range	0	15	0	% vol
NO range	100	150	0	mg/m3
NO_2 range	5	7.5	0	mg/m3
Voltage	105	115	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**% vol**
Standard deviation of repeatability at zero			u_{rz}		for mean		Only use rep at span
Standard deviation of repeatability at span level			u_{rs}		for mean		0.00
Lack of fit			u_{lf}				0.08
Drift			u_{drift}				0.00
volume or pressure flow dependence			u_{pcorr}				0.00
atmospheric pressure dependence			u_{pcorr}				0.04
ambient temperature dependence			u_{temp}				-0.02
CO_2							0.05
NO							0.01
NO_2							0.00
Combined interference (from mcerts)							0.08
dependence on voltage			u_{volt}				0.03
losses in the line (leak)			u_{loss}				0.02
Uncertainty of calibration gas			u_{calib}				0.01

Use largest of sum of all positive or all negative influences

0.06	all +ves	Criteria
0	all -ves	sum <2% value
0.06	largest	0.093519892

Value to use for intereference uncertainty

u_{int} 0.06

Measurement uncertainty			4.68	%vol
Combined uncertainty			0.12	%vol
% of value			2.47	%
Coverage factor k =	2			
Expanded uncertainty	**expressed with a level of confidence of 95%**		**4.93**	**% of value**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.23**	**% vol**

QGU-007-2013 Uncertainty calculation for Gaseous Measurement Oxygen EN14789

V2.2 Jul-08

Limit value	n/a	%vol	**Calibration gas**	**0.209**	%vol
Measured concentration	15.13	%vol	**Full Scale**	**0.25**	%vol

Performance characteristics	**Value**				**specification**
Response time		30	seconds		< 200 s
Logger sampling interval		30	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30	Assuming 1 minute collected over 1 hour		
Repeatability at zero		0.015	% by volume	stdev	<0.2 % range
Repeatability at span level		0.014	% by volume	stdev	<0.4 % range
Deviation from linearity		0	% vol	+/-	<0.3 % volume
Zero drift (during measurement period)		0.0003	% vol at zero level	+/-	<2% of volume / 24hr
Span drift (during measurement period)		-0.0003	% vol at span level	+/-	<2% volume/24hr
volume or pressure flow dependence		0	% of fs / 10l/h	+- 5 l/h	<1% range
atmospheric pressure dependence		0.3	% of fs/kPa	+- 2kPa	< 1.5 % range
ambient temperature dependence		-0.07	% by volume /10K	+- 15K	<0.3% volume 10 K
CO_2 (% vol)	15	0.07	% by volume per	15	
NO (mg/m3)	300	0.02	% by volume per	300	
NO_2 (mg/m3)	30	0	% by volume per	30	
Combined interference		0.56	% range		<2% range
Dependence on voltage		0.1	% by volume /10V	+- 5%	< 0.1%vol /10 volt
Losses in the line (leak)		0.4784689	% of value		< 2% of value
Uncertainty of calibration gas		0.35	% of value		

Effect of drift		
0.00	% vol	
0.00	% value	

	range of variation from conditions at calibration			
	min	max	value at calib	
flow	5	15	10	l/h
pressure	99.00	101	100	kPa
temp	280	285	285	K
CO_2 range	0	15	0	% vol
NO range	100	150	0	mg/m3
NO_2 range	5	7.5	0	mg/m3
Voltage	105	115	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**% vol**
Standard deviation of repeatability at zero			u_{rz}		for mean		Only use rep at span
Standard deviation of repeatability at span level			u_{rs}		for mean		0.00
Lack of fit			u_{lf}				0.08
Drift			u_{drift}				0.00
volume or pressure flow dependence			u_{pcorr}				0.00
atmospheric pressure dependence			u_{pcorr}				0.04
ambient temperature dependence			u_{temp}				-0.02
CO_2							0.05
NO							0.01
NO_2							0.00
Combined interference (from mcerts)							0.08
dependence on voltage			u_{volt}				0.03
losses in the line (leak)			u_{loss}				0.13
Uncertainty of calibration gas			u_{calib}				0.03

Use largest of sum of all positive or all negative influences			
0.06	all +ves		Criteria
0	all -ves		sum <2% value
0.08	largest		0.22
Value to use for intereference uncertainty			
u_{int}	0.06		

Measurement uncertainty			15.13	%vol
Combined uncertainty			0.17	%vol
% of value			1.14	%
Coverage factor k =	2			
Expanded uncertainty	**expressed with a level of confidence of 95%**		**2.28**	**% of value**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.35**	**% vol**

Appendix III: Certificates and Process Detail Form

Process details form information not made available from Licensee at time of reporting. Details can be obtained direct from the client.

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

CERTIFICATE OF ANALYSIS

Customer Name:	Harringtons Claregalway	Certificate number:	24-09003
		Issue number:	1
Customer order:	HACLTM260624	Date of issue:	06/09/2024
Date tested:	26/06/2024		
Date received:	01/07/2024		
Date started:	01/07/2024		
Date completed:	02/07/2024		

Description: 1 liquid sample, 1 solid sample
Test methods: Details available on request (refer to SOP code against relevant result/s)

Determinand	Filter number	LOD	Units	Code	SOP	Stack	Filter result	Wash Result
Particulates	1826	0.07	mg	I	2750	Blank	0.08	
Particulates		0.3	mg	I	2750			<0.3

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.408T

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

DEVIATING SAMPLES

Report number: 24-09003

Customer order No : HACLTM260624

Date sampling:	Stack:	Deviating:	Accredited Test
26/06/2024	Blank	N/a	Yes

Samples submitted may be declared to be deviating.Where applicable the analysis method remains accredited, however results reported for a deviating sample may be compromised.Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submisson may be required.

Key code	Description
N	Not accreditated test
I	Inab accreditated test
SI	Subcontracted to approved laboratory INAB Accredited for the test

Determinand	Uncertainty
Particulates (Filter)	2.52%
Particulates (Wash)	2.52%

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

CERTIFICATE OF ANALYSIS

Customer Name:	Harringtons Claregalway	Certificate number:	24-09004
		Issue number:	1
Customer order:	HACLTM260624	Date of issue:	06/09/2024
Date tested:	26/06/2024		
Date received:	01/07/2024		
Date started:	01/07/2024		
Date completed:	02/07/2024		

Description: 1 liquid sample, 1 solid sample
Test methods: Details available on request (refer to SOP code against relevant result/s)

Determinand	Filter number	LOD	Units	Code	SOP	Stack	Filter result	Wash Result
Particulates	1827	0.07	mg	I	2750	AP1	50.23	
Particulates		0.3	mg	I	2750			1.82

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.408T

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

DEVIATING SAMPLES

Report number: 24-09004

Customer order No : HACLTM260624

Date sampling:	Stack:	Deviating:	Accredited Test
26/06/2024	AP1	N/a	Yes

Samples submitted may be declared to be deviating.Where applicable the analysis method remains accredited, however results reported for a deviating sample may be compromised.Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submisson may be required.

Key code	Description
N	Not accreditated test
I	Inab accreditated test
SI	Subcontracted to approved laboratory INAB Accredited for the test

Determinand	Uncertainty
Particulates (Filter)	2.52%
Particulates (Wash)	2.52%

AXIS

RECEIVED: 27/08/2025

2024

Air Emissions REPORT

PREPARED FOR

Harrington's Concrete & Quarry

Report Title	Air Emissions Compliance Monitoring Report
Company address	Axis Environmental Services Ltd., Unit 3 Westlink Business Park, Clondrinagh, Limerick, V94 K6XK
Contact Details	Phone: 061 324587, info@axisenv.ie
Stack Emissions Testing Report Commissioned by	Harrington's Concrete & Quarry
Facility Name	Harrington's Concrete & Quarry
EPA Licence Number	N/A
Licence Holder	Harrington's Concrete & Quarry
Stack Reference Number	AP1
Dates of the Monitoring Campaign	24/09/2024
Job Reference Number	HACLDB240924
Report Written By	Mr. Dualtha Beardon
Report Approved by	Joanne Murray
Stack Testing Team	Mr. Dualtha Beardon & Mr. Stephen Finn
Report Date	04/10/2024
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Joanne Murray Environmental Consultant

Contents

Opinions and interpretations expressed herein are outside any scope of accreditation.
This test report shall not be reproduced, without the written approval of Axis Environmental Services Limited.
The monitoring campaign and results are confidential between Axis Environmental Services Ltd. and its client and shall not be disclosed to any other third party without the written permission from the client.
All sampling and reporting are completed in accordance with Environmental Protection Agency Air Guidance Note 2 requirements.

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.408T

1.0 Executive Summary

1.1 Overall aim of the monitoring campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site permit.

1.2 Summary of substances to be monitored at each emission point

Stack Name:	AP1
Total Particulate Matter	
Carbon Monoxide	
Nitrogen Oxides (as NO_2)	
Oxygen	
Carbon Dioxide	
Sulphur Dioxide	
Volumetric Flow Rate (Ref)	

1.3 Special Requirements

There were no special requirements

1.4 Summary of Results

Emission Point Number: AP1

Parameter	Method	Units	Result	MU +/-	Limit	O_2 Ref. (%)	Moisture Ref. (%)	Blanks	Date	Time on	Time off	Accreditation	
												Sampling	Analysis
Total Particulate Matter (TPM)	EN13284	$mg.m^{-3}$	21.37	1.31	50	17	Dry	<0.64	24/09/2024	07:50	08:20	Yes	Yes
Nitrogen Oxides (as NO_2)	EN 14792	$mg.m^{-3}$	68.0	4.5	400	17	Dry	N/a	24/09/2024	08:47	09:17	Yes	N/a
Sulphur Dioxide (as SO_2)	EN/TS 17021	$mg.m^{-3}$	<0.5	7.5	500	17	Dry	N/a	24/09/2024	08:47	09:17	Yes	N/a
Carbon Monoxide (as CO)	EN 15058	$mg.m^{-3}$	209.9	3.0	-	17	Dry	N/a	24/09/2024	08:47	09:17	Yes	N/a
Carbon Dioxide	EN/TS 17405	vol%	3.34	0.2	-	N/a	Dry	N/a	24/09/2024	08:47	09:17	Yes	N/a
Oxygen	EN 14789	vol%	16.54	0.3	-	N/a	Dry	N/a	24/09/2024	08:47	09:17	Yes	N/a
Volumetric Flow Rate (Ref)	EN 16911	$m^3.hr^{-1}$	46,096	1,980	100,000	17	Dry	N/a	24/09/2024	07:50	08:20	Yes	N/a

Note 1: All results are normalised to standard temperature and pressure ($0^{O}C$ and 101.3kPa)
Note 2: All results are reported in the format as defined by the EPA in guidance note AG2:2021.

1.5 Operating Information

Please reference Process Details as per Appendix III attached.

1.6 Monitoring Deviations

Stack Name: AP1	
Parameter	Deviation
Total Particulate Matter	None
Carbon Monoxide	None
Nitrogen Oxides (as NO_2)	None
Oxygen	None
Carbon Dioxide	None
Sulphur Dioxide	None
Volumetric Flow Rate (Ref)	EN 16911 - in accordance with AG2 Index of Preferred Methods

1.7 Reference Documents

Risk Assessment (RA)	SOP 1011
Site Review (SR)	SOP 1019
Site Specific Protocol (SSP)	SOP 1019

1.8 Version History

Version Number	Changes to the report
1	Original version of the report

Appendix I

1.1 Monitoring Personnel

Team Leader	Name	Dualtha Beardon
	System approval	Team Leader Approved
Technician	Name	Stephen Finn
	System approval	Technician Approved

1.2 Equipment Inventory

ID	Item of Equipment	Used	ID	Item of Equipment	Used	ID	Item of Equipment	Used
12EQ500	Pump		23EQ504	L type Pitot Tube		13EQ501	Vernier Callipers	✓
12EQ532	Pump		23EQ505	S type pitot tube		14EQ503	Vernier Callipers	
12EQ536	Pump		24EQ514	S type pitot tube		14EQ507	Vernier Callipers	
12EQ537	Pump		24EQ515	S type pitot tube		17EQ533	Vernier Callipers	
12EQ538	Pump		24EQ516	S type pitot tube		18EQ506	Vernier Callipers	
12EQ542	Pump		24EQ517	S type pitot tube		20EQ516	Vernier Callipers	
12EQ543	Pump		24EQ518	S type pitot tube				
13EQ514	Pump		24EQ519	S type pitot tube				
16EQ518	Pump		24EQ520	S type pitot tube		13EQ503	1kg weight	✓
16EQ519	Pump		24EQ532	S type pitot tube		14EQ515	500g Weight	
17EQ509	Pump		24EQ546	S type pitot tube		15EQ511	1kg Weight	
17EQ510	Pump		24EQ547	S type pitot tube		15EQ512	1kg weight	
17EQ522	Pump		24EQ548	S type pitot tube		16EQ511	1kg weight	
17EQ523	Pump					16EQ512	500g weight	
17EQ524	Pump					17EQ529	500g weight	✓
17EQ525	Pump					19EQ513	500g weight	
17EQ526	Pump					19EQ514	1kg Weight	
18EQ517	Pump					19EQ519	1kg weight	
18EQ518	Pump		14EQ501	Horiba 350	✓	19EQ520	500g weight	
21EQ507	Pump		16EQ508	Horiba- PG250z				
21EQ508	Pump		17EQ515	Horiba 350				
21EQ509	Pump		20EQ506	Horiba 350				
21EQ510	Pump	✓	21EQ503	Horiba 350		17EQ534	ST5	
21EQ511	Pump		21EQ522	Horiba 350		18EQ503	ST5	✓
22EQ500	Pump		23EQ522	Horiba 350		18EQ513	ST5	
22EQ501	Pump		24EQ563	Horiba 350		19EQ509	ST5	
22EQ502	Pump					20EQ500	ST5	
22EQ503	Pump		14EQ513	Condenser		21EQ519	ST5	
22EQ504	Pump		16EQ509	Condenser		22EQ508	ST5	
22EQ509	Pump	✓	18EQ505	Condenser				
24EQ510	Pump		21EQ504	Condenser				
24EQ526	Pump		22EQ509	Condenser		14EQ510	Digital Protractor	
24EQ527	Pump		24EQ512	Condenser	✓	14EQ511	Digital Protractor	
24EQ528	Pump		24EQ558	Condenser		15EQ505	Digital Protractor	
						17EQ528	Digital Protractor	
23EQ537	MF Meter		14EQ518	Velocity Meter		18EQ507	Digital Protractor	
23EQ538	MF Meter	✓	17EQ514	Velocity Meter		20EQ514	Digital Protractor	✓
23EQ539	MF Meter		18EQ504	Velocity Meter		20EQ515	Digital Protractor	
23EQ540	MF Meter		19EQ502	Velocity Meter				
23EQ541	MF Meter		20EQ504	Velocity Meter				
23EQ542	MF Meter		24EQ503	Velocity Meter		12EQ522	Balance	
24EQ537	MF Meter					12EQ544	Balance	
24EQ538	MF Meter					15EQ510	Balance	
24EQ539	MF Meter					17EQ537	Balance	
24EQ540	MF Meter		21EQ528	TSI (Vane)		17EQ538	Balance	
24EQ541	MF Meter		23EQ500	TSI (Vane)		19EQ515	Balance	
						21EQ505	Balance	
17EQ503	Heated Line (10m)		16EQ502	FID		21EQ506	Balance	
17EQ516	Heated Line		17EQ517	FID		21EQ529	Balance	✓
19EQ523	Heated Line (20m)		19EQ508	FID		23EQ508	Balance	
20EQ520	Heated Line (15m)		20EQ507	FID		23EQ521	Balance	
20EQ521	Heated Line (15m)		20EQ508	FID				
21EQ523	Heated Line (5m)					17EQ519	Stopwatch	
21EQ524	Heated Line (5m)		16EQ510	Measuring Tape		17EQ520	Stopwatch	✓
22EQ510	Heated Line (40m)		17EQ527	Measuring Tape		18EQ509	Stopwatch	
22EQ512	Heated Line (5m)		20EQ509	Measuring Tape		19EQ518	Stopwatch	
22EQ513	Heated Line (5m)		23EQ511	Measuring Tape	✓	23EQ501	Stopwatch	
23EQ517	Heated Line		24EQ543	Measuring Tape				
23EQ518	Heated Line	✓						
23EQ519	Heated Line		24EQ501	PCDD Thermometer				
23EQ543	Heated Line (1.5m)		24EQ502	PCDD Thermometer				
23EQ544	Heated Line (1.5m)							
			16EQ516	Thermocouple and probe				
12EQ520	L type Pitot Tube		21EQ513	Thermocouple and probe				
12EQ521	L Type Pitot tube		21EQ514	Thermocouple and probe				
16EQ506	S type Pitot Tube		21EQ516	Thermocouple and probe				
16EQ517	S type Pitot Tube		21EQ517	Thermocouple and probe				
17EQ507	S type Pitot Tube		21EQ518	Thermocouple and probe				
17EQ536	S type Pitot Tube		21EQ533	Thermocouple and probe				
19EQ510	S type Pitot Tube		23EQ512	Thermocouple and probe	✓			
19EQ511	S type pitot tube		24EQ551	Thermocouple and probe				
22EQ506	S type pitot tube		24EQ552	Thermocouple and probe				
22EQ511	S type pitot tube		24EQ553	Thermocouple and probe				
22EQ520	S type pitot tube		24EQ554	Thermocouple and probe				
22EQ525	S type pitot tube		24EQ555	Thermocouple and probe				
23EQ502	L type Pitot Tube		24EQ556	Thermocouple and probe				
23EQ503	L type Pitot Tube							

Appendix II

2.1 Stack Emission Point Reference:

2.1.1 Suitability of Sample Location: AP1

General Information	AP1
Permanent/Temporary	Permanent
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / EN 15259 Platform Requirements	Value	Comment
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self-closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	Yes	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-
Sampling Location / Platform Improvement Recommendations		
None.		
EN 15259 Homogeneity Test Requirements		
1.		
Select Option: 1: There is no requirement to perform a EN15259 Homogeneity Test on this stack 2: Test results were obtained from previous Homogeneity test carried out by AXIS 3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor 4: Homogeneity Test is required on this stack and the client has been informed of this requirement		

2.1.2 Stack Diagram

Figure 1: AP1

2.1.3 Stack Raw Data

Title:	**Determination of Total Particulates**				
Method:	EN 13284-1				
Client:	Harringtons Clare Galway				
Test Date:	24/09/2024		**Air Volume at Pump**	0.6378	m^3
Test Time	07:50		**Temperature at Pump**	12.4	Deg C
Laboratory Used:	AXIS		**Pressure at Pump**	85.76	kPa
Stack Name	AP1		**Humidity at Pumps**	0	%
Run I.D.	1		**Filter Weight**	10.52	mg
Filter I.D.	2149		**Front End Weight**	1.77	mg
Moisture Content	8.9	%			
Reference Oxygen	17	%	**Flow Uncertainty**	1,980	m^3/hr
Measured Oxygen	16.54	%	**Flow Uncertainty**	4.3	%
Stack Flow Rate	45263	Nm^3/hr			
Adjusted Stack Flow Rate	46096.41912	Nm^3/hr, dry @ % Oxygen			
Volume of Air Sampled	0.5144	Nm^3			

Leak Check Results	**Result**		**% Leak**
Before Sample 1	0.127	l/min	0.7
Average Flow Rate	17.22	l/min	0.7
Standard Maximum	0.34444	l/min	2%
Back Pressure	58.29	kPa	

Standard Criteria to be Met	**Result**	**Std. Requirement**		
Angle of Flow	Yes	<15 Degrees	**Probe material**	Stainless Steel
Negative Flow in the Stack	No	None	**Filter housing**	Stainless Steel
Pitot Pressure Difference	Yes	>5Pa	**Positioning of filter**	In Stack
Ratio of Flow Measurement	Yes	<3:1	**Filter Size & Material**	47mm Quartz
Stagnation Test	Yes	<10Pa		
Pitot Tube Leak Check	**Result**			
Positive Pressure	Pass	-		
Negative Pressure	Pass	-		
Number of Ports	1	2		
Straight length before sample point	Yes	> 5 Hydraulic Diameters		
Straight length after sample point	Yes	> 5 Hydraulic Diameters to Stack Outlet or 2HD to Fan/ Bend		

Sample Calculations				
Blank (Filter and Front Wash Combined)	0.37	mg		
Sample 1 (Filter and Front Combined)	12.29	mg		
Volume of Air Sampled	0.5144	Nm^3		
Blank Result	0.72	$mg/Nm^{3,}$ dry	0.64	$mg/Nm^{3,}$ dry @ Ref O_2
Sample Result	23.89	$mg/Nm^{3,}$ dry	21.37	$mg/Nm^{3,}$ dry @ Ref O_2
Uncertainty of Measurement	1.31	mg/Nm^3		
Emission Limit Value	50	mg/Nm^3		
Blank as Percentage of ELV	1.4	%	**Requirement <10% ELV or <0.5 mg/m^3**	

Isokinetic Criterion Compliance		
Isokinetic Variation	-0.1	%
Allowable Isokinetic Range	-5 to + 15%	%
Isokinetic Acceptable	Yes	

Balance Calibration	**Weight**	**0**		
0	0	g	Eccentric load indication carried out - Balance Ok	Yes
500	500	g		
1000	1000	g		

Impinger Weights	**Initial**	**Final**	**Difference**
Total Impinger Weight	2250.4	2290.8	40.4
Volume of Air Sampled	0.5144	Nm3	40.4
Moisture Content (EN 14790)	8.90	%	

DUCT AND GAS SPECIFICATION			
Name			ap1
Section			Circular
Diameter		[m]	1.2
Area		[m2]	1.130973
Ports		[#]	1
Points	P	[#]	12
Density	ρn	[kg/Nm3]	1.302
Carbon Dioxide	CO2	[%]	3.27
Oxygen	O2	[%]	16.57
Water Vapor Ratio	rw	[0;1]	0.084
Nozzle	nz	[mm]	6
Turbolence factor	ft	[sec]	1
Wall Adjustment Factor	waf		

PITOT DATA SPECIFICATION			
Name			
Velocity	[m/sec]	5	0.83
Velocity	[m/sec]	10	0.83
Velocity	[m/sec]	20	0.83
Velocity	[m/sec]	30	0.83
Velocity	[m/sec]	40	0.83

NORMALIZATION FACTOR			
Tnorm		[K]	273
Pnorm		[kPa]	101.3

DUCT FLOW RATE			
Dry actual	QVa	[m3/h]	64054
Moist actual	Q'Va	[m3/h]	69926
Moist norm. [Tnorm Pnorm]	Q'Vn	[Nm3/h]	45263
Dry norm. [Tnorm Pnorm]	QVn	[Nm3/h]	41461

AVERAGE VALUES			
Total Points		[#]	1
Velocity	v'a	[m/sec]	17.26
Stack temperature	tstack	[°C]	144.11
Stack Pressure	Pa	[kPa]	100.19
Isokinetic Rate	IR	[%]	99.9
Velocity at nozzle	v'N	[m/sec]	17.244
Probe temperature	tprobe	[°C]	106
Filter temperature	tfilter	[°C]	107.2
Outlet temperature	toutlet	[°C]	32.8
Aux temperature	taux	[°C]	20.2
Ambient Pressure	Pamb	[kPa]	100.2

GAS METER SAMPLED VOLUMES			
Elapsed time	et		00:30:00
Norm. Volume [Tnorm Pnorm]	Vgn		0.5144
Moist Volume at stack conditions	V'ga		0.8712
Volume at dgm conditions	Vdgm		0.6378
Gas meter temperature	tdgm		12.4
Gas Meter Pressure	Pdgm		85.76

start ts [timestamp]	port [###]	point [###]	Probe pos [cm]	tstack avg [°C]	Pa avg [kPa]	dP Pitot avg [Pa]	velocity avg [m/sec]
24/09/2024	1	1	2.6	138.96	100.18	190.24	17.82
07:39:54	-	-	-	-	-	-	-
24/09/2024	1	2	8.1	139.96	100.18	187.17	17.69
07:40:27	-	-	-	-	-	-	-
24/09/2024	1	3	14.2	140.97	100.18	186.86	17.7
07:40:59	-	-	-	-	-	-	
24/09/2024	1	4	21.3	142.08	100.19	190.65	17.9
07:41:30	-	-	-	-	-	-	-
24/09/2024	1	5	30	143.3	100.19	192.75	18.03
07:42:03	-	-	-	-	-	-	-
24/09/2024	1	6	42.7	144.45	100.18	198.04	18.3
07:42:35	-	-	-	-	-	-	-
24/09/2024	1	7	77.4	145.51	100.19	186.26	17.77
07:43:07	-	-	-	-	-	-	-
24/09/2024	1	8	90	146.64	100.19	193.58	18.14
07:43:38	-	-	-	-	-	-	-
24/09/2024	1	9	98.8	147.73	100.19	189.58	17.97
07:44:10	-	-	-	-	-	-	-
24/09/2024	1	10	105.9	149.39	100.19	198.94	18.45
07:44:57	-	-	-	-	-	-	-
24/09/2024	1	11	112	150.96	100.19	197.71	18.42
07:45:44	-	-	-	-	-	-	-
24/09/2024	1	12	117.5	151.95	100.19	203.05	18.69
07:46:15	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Uncertainty calculation for EN 13284					
	Symbol	**Unit**	**Values**	**UOM as %**	**Std Requirement**
Sampled Volume	V_m	m^3	0.001	0.16	<=5%
Sampled gas Temperature	T_m	k	2.00	0.70	<=2%
Sampled gas Pressure	ρ_m	kPa	1.00	1.17	<=2%
Sampled gas Humidity	H_m	% by volume	1.00	1.00	<=1%
Oxygen content	$O_{2,m}$	% by volume	0.10	-	<=5%
Mass particulate	m	mg	0.144	1.17	<5% of limit value
Leak	L		-	0.74	<=2%
Uncollected Mass	UCM		-	0.00	<10% of limit value
Corrected Volume (STP)	V	m^3	0.52	1.70	-
Mass	m	mg	12.29	1.17	-
Factor for O2 Correction	fc		0.90	2.24	-
Leak	L	$mg.m^{-3}$	0.09	0.43	-
Uncollected mass	UCM	mg	0.00	0.00	-
Combined measurement uncertainty			**0.66**	-	-
Expanded uncertainty as percentage of measured value				**6.15**	% measured of value
Expanded uncertainty in units of measurement				**1.31**	mg.m-3
Expanded uncertainty as percentage of limit value				**2.63**	% ELV

Uncertainty calculation for Velocity and Volume Flow Rate Measurement by Pitot tube EN ISO 16911-1					
	Unit	**Values**	**as %**	**Std Requirement**	
Range of Delta P transducer	Pa	2500	-		-
Resolution of Delta P transducer	Pa	10	-		-
Repeatability of Delta P transducer	% of value	0.01	-		-
Drift of Delta P transducer	% of range	0.32	-		-
Lack of fit of measurement system	% of range	0.25	-		-
Uncertainty in Delta P transducer	Pa	2.5	-		-
Uncertainty of pitor coefficient		0.03	-		-
Enter uncertainties as (95%,k=2) where relevant					
Uncertainty in temperature readout system	°C	1	-		-
Uncertainty in atmospheric pressure transducer	Pa	160.5	-		-
Uncertainty in duct area measurement	%	1.0	-		-
Uncertainty of Molar Mass	kg/mol	0.00001	0.04		-
Uncertainty of Temperature	K	0.5	0.12		-
Uncertainty of Stack Static Pressure	Pa	10.02	0.01		-
Uncertainty of Stack Pressure	Pa	160.8	0.08		-
Uncertainty of Gas Density	kg/m3	0.0024	0.15		-
Uncertainty in velocity	m/sec	0.31	1.8		-
Expanded Uncertainty in velocity	m/sec	0.63	3.6		-
Uncertainty of Volumetric Flow Rate	m^3/hour	990	-		-
Expanded Uncertainty of Volumetric Flow Rate	m^3/hour	**1980**	**4.3**	<10% of ELV	

Title:	***Determination of Flue Gases***					
Method:	EN 14792 / TS 17021 / EN 15058 / TS 17045 / EN 14789					
Test Date:	24/09/2024					
Stack Name:	AP1		**Quality Assurance**			
Test Start Time:	08:47		Probe Material		Stainless Steel	
Reference Conditions			Filtration Type/size		Stainless Steel	
Measured Oxygen	16.5	%	Heated Filter used		Yes	
Reference Oxygen	17	%	No. of sampling lines		1	
Reference Moisture	-		No. of Sampling points		1	
			Sampling point I.D.s		1	
Parameter		**NO**	**SO2**	**CO**	**CO2**	**O2**
Emission Limit Values	$mg.m^{-3}$ ref	400	500	-	-	-
Instrument Range	ppm	500	1000	200	20.00%	25.00%
Span Gas Value	ppm	426.4	875	152	16.16%	20.90%
Acceptable Gas Range	-	Yes	Yes	Yes	Yes	Yes
Calibration Gas Reference No.	-	24ing502	24ing589	22ing253	24ing558	-
Calibration Gas Uncertainty	%	0.5	0.3	0.6	0.5	0.35
Calibration Gas Start Bar	Bar	10	60	15	18	-
Expiry Date	-	Nov-24	Nov-24	Oct-25	May-29	-
Quality Assurance	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Conditioning Unit Temperature	C	2	2	2	2	2
Average Temperature	< C	2	2	2	2	2
Allowable Temperature	-	4	4	4	4	4
Temperature Acceptable	-	Yes	Yes	Yes	Yes	Yes
Pump flow rate	l/min.	0.5	0.5	0.5	0.5	0.5
Instrument Zero Drift	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Instrument Zero (Ambient air or Nitrogen)		Nitrogen	Nitrogen	Nitrogen	Nitrogen	Nitrogen
Instrument Zero (Pre)	ppm	0	0	0	0.00%	0.00%
Instrument Zero (Check)	ppm	0.2	0	-1	0.00%	0.01%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Instrument Zero (Post)	ppm	0	-0.4	0.2	0.01%	0.00%
Zero Drift	ppm	0	-0.4	0.2	0.01%	0.00%
Allowable Zero Drift (Less than 2%)	ppm equiv.	8.528	17.5	3.04	0.003232	0.42%
Adjustable Zero Drift (2 - 5%) / 5% CO_2	ppm equiv.	21.32	43.75	7.6	0.81%	1.05%
Zero Drift Failure (<5% / >5% CO_2)	ppm equiv.	21.32	43.75	7.6	0.81%	1.05%
Zero Drift Acceptable	-	Yes	Yes	Yes	Yes	Yes
Adjust for Zero Drift	-	No	No	No	No	No
Reject results	-	No	No	No	No	No
Calculated Drift	%	0.00%	-0.05%	0.13%	0.06%	0.00%
Instrument Span Drift	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Instrument Span Down (Pre)	ppm	426.4	875	152	16.16%	20.90%
Instrument Check Span (Post)	ppm	425.7	869.9	151.8	16.15%	20.84%
Span Drift	ppm	-0.7	-5.1	-0.2	-0.01%	-0.06%
Allowable Span Drift (less than 2%)	ppm equiv.	8.528	17.5	3.04	0.32%	0.42%
Adjustable Span Drift (2 - 5%)	ppm equiv.	21.32	43.75	7.6	0.00808	1.05%
Span Drift Failure (Greater than 5%)	ppm equiv.	21.32	43.75	7.6	0.81%	1.05%
Span Drift Acceptable (Y/N)	-	Yes	Yes	Yes	Yes	Yes
Adjust for Span Drift	-	No	No	No	No	No
Reject results	-	No	No	No	No	No
Calculated Drift	%	-0.16%	-0.58%	-0.13%	-0.06%	-0.29%
Heated Line Check Including Leak Check		**NO**	**SO2**	**CO**	**CO2**	**O2**
Span Gas Conc.	ppm	426.4	875	152	16.16%	20.90%
Zero Check Acceptable Limit (+/-)	ppm	8.528	17.5	3.04	0.32%	0.42%
Heated Line Check Zero Gas	ppm	0	0	0.1	0.02%	0.07%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Heated Line Check Span Gas	ppm or %	425.9	868	151.4	16.13%	20.56%
Span Gas Leak Detected	ppm or %	-0.5	-7	-0.6	-0.03%	-0.34%
Leak check acceptable (< 2%)	ppm or %	8.528	17.5	3.04	0.32%	0.42%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Response Time (<200 seconds)		Yes	Yes	Yes	Yes	Yes

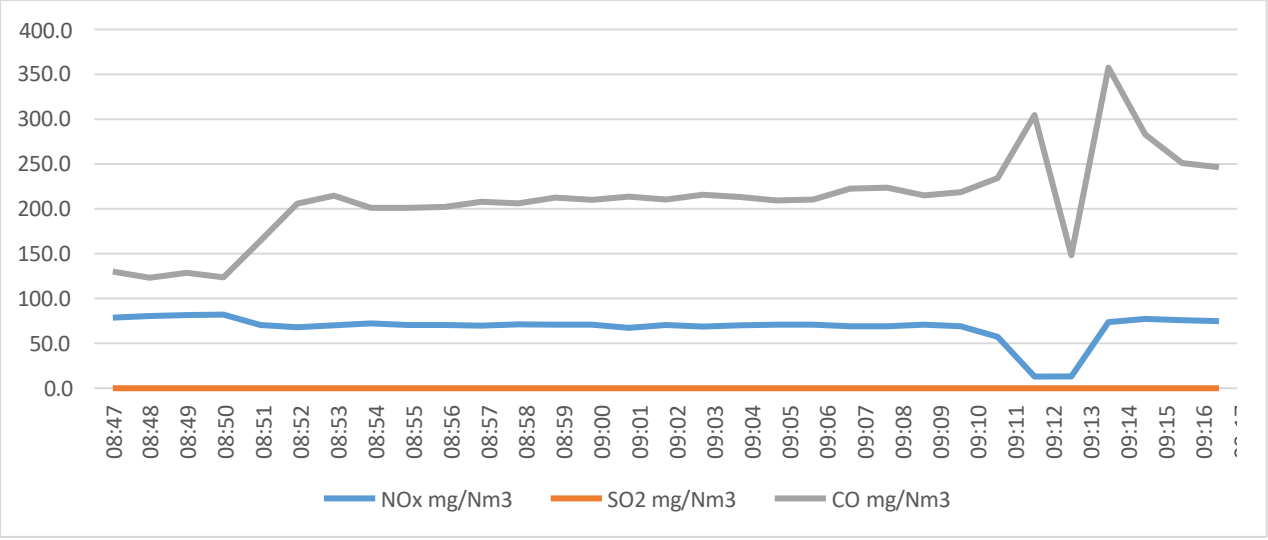
Test Conditions	Units	
Run Ambient Temperature Range	C	11

Raw Data

Date/Time	NOx	SO2	CO	CO2	O2
	ppm	ppm	ppm	vol%	vol%
24/09/2024 08:47	42.7	0.0	116.3	3.63	16.03
24/09/2024 08:48	43.8	0.0	110.1	3.65	16.01
24/09/2024 08:49	44.4	0.0	115.1	3.73	16.00
24/09/2024 08:50	44.7	0.0	110.4	3.69	16.06
24/09/2024 08:51	38.4	0.0	146.8	3.44	16.41
24/09/2024 08:52	36.9	0.0	183.8	3.38	16.43
24/09/2024 08:53	38.2	0.0	191.8	3.45	16.41
24/09/2024 08:54	39.2	0.0	179.8	3.50	16.36
24/09/2024 08:55	38.3	0.0	179.7	3.43	16.46
24/09/2024 08:56	38.3	0.0	180.7	3.42	16.44
24/09/2024 08:57	38.0	0.0	185.8	3.40	16.42
24/09/2024 08:58	38.7	0.0	184.3	3.45	16.43
24/09/2024 08:59	38.5	0.0	190.0	3.45	16.41
24/09/2024 09:00	38.6	0.0	187.5	3.49	16.44
24/09/2024 09:01	36.6	0.0	190.9	3.43	17.78
24/09/2024 09:02	38.4	0.0	188.1	3.49	16.40
24/09/2024 09:03	37.3	0.0	192.8	3.39	16.49
24/09/2024 09:04	38.1	0.0	190.5	3.44	16.41
24/09/2024 09:05	38.6	0.0	187.1	3.48	16.40
24/09/2024 09:06	38.5	0.0	187.9	3.43	16.38
24/09/2024 09:07	37.5	0.0	198.7	3.42	16.47
24/09/2024 09:08	37.5	0.0	199.8	3.41	16.44
24/09/2024 09:09	38.5	0.0	192.1	3.45	16.43
24/09/2024 09:10	37.6	0.0	195.2	3.39	16.44
24/09/2024 09:11	31.1	0.0	209.4	2.90	16.75
24/09/2024 09:12	7.1	0.0	272.2	1.58	18.67
24/09/2024 09:13	7.1	0.0	132.5	1.59	18.54
24/09/2024 09:14	40.1	0.0	319.5	3.82	16.41
24/09/2024 09:15	42.0	0.0	252.9	3.50	16.12
24/09/2024 09:16	41.2	0.0	224.3	3.41	16.19
24/09/2024 09:17	40.7	0.0	220.2	3.38	16.22
Average	**37.0**	**0.0**	**187.6**	**3.34**	**16.54**

Referenced Data

	NOx mg/Nm3	SO2 mg/Nm3	CO mg/Nm3	CO2 vol%	O2 vol%
24/09/2024 08:47	78.56	0.00	130.15	3.63	16.03
24/09/2024 08:48	80.41	0.00	123.18	3.65	16.01
24/09/2024 08:49	81.68	0.00	128.78	3.73	16.00
24/09/2024 08:50	82.08	0.00	123.52	3.69	16.06
24/09/2024 08:51	70.50	0.00	164.24	3.44	16.41
24/09/2024 08:52	67.89	0.00	205.71	3.38	16.43
24/09/2024 08:53	70.24	0.00	214.61	3.45	16.41
24/09/2024 08:54	72.10	0.00	201.20	3.50	16.36
24/09/2024 08:55	70.41	0.00	201.10	3.43	16.46
24/09/2024 08:56	70.45	0.00	202.20	3.42	16.44
24/09/2024 08:57	69.91	0.00	207.93	3.40	16.42
24/09/2024 08:58	71.09	0.00	206.23	3.45	16.43
24/09/2024 08:59	70.83	0.00	212.58	3.45	16.41
24/09/2024 09:00	70.87	0.00	209.84	3.49	16.44
24/09/2024 09:01	67.30	0.00	213.61	3.43	17.78
24/09/2024 09:02	70.63	0.00	210.52	3.49	16.40
24/09/2024 09:03	68.64	0.00	215.77	3.39	16.49
24/09/2024 09:04	70.09	0.00	213.14	3.44	16.41
24/09/2024 09:05	70.98	0.00	209.33	3.48	16.40
24/09/2024 09:06	70.70	0.00	210.24	3.43	16.38
24/09/2024 09:07	68.99	0.00	222.39	3.42	16.47
24/09/2024 09:08	68.99	0.00	223.62	3.41	16.44
24/09/2024 09:09	70.74	0.00	214.99	3.45	16.43
24/09/2024 09:10	69.02	0.00	218.42	3.39	16.44
24/09/2024 09:11	57.16	0.00	234.35	2.90	16.75
24/09/2024 09:12	13.11	0.00	304.54	1.58	18.67
24/09/2024 09:13	13.10	0.00	148.21	1.59	18.54
24/09/2024 09:14	73.70	0.00	357.49	3.82	16.41
24/09/2024 09:15	77.15	0.00	282.94	3.50	16.12
24/09/2024 09:16	75.72	0.00	250.94	3.41	16.19
24/09/2024 09:17	74.86	0.00	246.40	3.38	16.22
Average	**68.00**	**0.00**	**209.94**	**3.34**	**16.54**
Uncertainty of Measurement	**4.50**	**7.50**	**2.98**	**0.23**	**0.35**
Uncertainty as % of ELV	**1.13**	**1.50**	**-**	**-**	**-**
Standard Requirement	**<10%**	**<15%**	**<6%**	**<25%**	**<6%**



QGU-010-2013 Uncertainty calculation for Gaseous Measurement EN 14792 Nox

v4

Limit value	400	mg.m-3 (corrected) NO2	**Gas**	NO	
			Full Scale	500	ppm
Measured concentration	37.00	ppm	**Cal gas conc**	426.4	ppm
Measured concentration	75.96	mg.m-3 (corrected) NO2	**Conversion**	2.053	
Ratio NO/NO2	100.00		**Full Scale**	1026.5	mg.m-3 (NO2)
			Cal gas conc	875.3992	mg.m-3 (NO2)

Correction for reference conditions					
		O2 %	**Moisture, %**	**Pressure, KPa**	**Temperature, K**
	ref	17.00	0.00	101.30	**273.00**
	measured	16.54	0.00	101.30	**273.00**
Factors		0.90	1.00	1.00	1.00
Correction Factor		**0.90**			

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Performance characteristics	**Value**				**specification**
Response time		30	seconds		180.000
Number of readings in measurement		30			
Repeatability at zero		0.03	% full scale		0.200
Repeatability at span level		0.06	% full scale		2.000
Deviation from linearity		0.2	% of value		2.000
Zero drift		0	% full scale		2.000
Span drift		-0.14	% full scale		2.000
volume or pressure flow dependence		0	% of full scale/kPa		0.033
atmospheric pressure dependence		0	% of value/kPa		0.750
ambient temperature dependence		0.3	% full scale/10K		0.300
NH3 (20 mg/m3)		0	mg/m3		
CO2 (15%)		0.209	% by vol		
H2O (30%)		0.0	% by vol		4.000
dependence on voltage		0.1	% full scale/10V		2%fs/10V
converter efficiency		95	%		95%
losses in the line (leak)		0.117260788	% of value		2% of value
Uncertainty of calibration gas		0.5	% of value		

Effect of drift		
-0.11	mg/m3	0.012148
-0.14	% value	

	ranges		
	min	max	value at calib
flow	95	105	100
pressure	101.30	101.3	101.3
temp	289	289	283
NH3 range	0	0	0
CO2 range	0	15	0
H2O range	0	0	0
Instrument Voltage Rating			110
Voltage	93	121	110

Measurement performance related to stationary conditions

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		
Standard deviation of repeatability at zero			U_{zo}		for mean		use rep at span
Standard deviation of repeatability at span level			U_{rs}		for mean		0.01
Lack of fit			U_{lf}				1.19
Drift			U_{dz}				-0.06
volume or pressure flow dependence			U_{dpress}				0.00
atmospheric pressure dependence			U_{dpress}				0.00
ambient temperature dependence			U_{dtemp}				0.18
NH3 (20 mg/m3)			$U_{dinterf}$				0.00
CO2 (15%)							0.12
H2O (30%)							0.00
Dependence on voltage			U_{dvolt}				0.09
Converter efficiency			U_{dcef}				2.19
losses in the line (leak)			U_{dleak}				0.05
Uncertainty of calibration gas			U_{dcalb}				0.22

Use largest negative or positive interferent effect	
0	0.00
0	0.12
0	0.00
0	0.12
Interference uncertainty	0.12

Measurement uncertainty		Result	75.96	mg/m³
Combined uncertainty			2.51	mg/m³
Expanded uncertainty	k =	2	5.03	mg/m³
Uncertainty corrected to std conds			4.50	mg.m-3 (corrected)
Expanded uncertainty	**expressed with a level of confidence of 95%**		**1.13**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**4.50**	**mg.m-3 at ELV**

QGU-008-2013 Uncertainty calculation for Gaseous Measurement SO2 EN TS 17021

V2 Jul-08

Limit value	500	mg/m³ (corrected) SO2	Cal gas conc	2502.5	mg.m⁻³
Measured concentration	0.00	mg/m3	Full Scale	2860	mg/m³
Measured concentration	0.00	mg/m³ (Corrected)			

Correction for reference conditions					
		O2 %	Moisture, %	Pressure, KPa	Temperature, K
	ref	17.00	0.00	101.30	273.00
	measured	16.54	0.00	101.30	273.00
	Uncert	0.35	1.00	0.00	1.00
Factors		0.90	1.00	1.00	1.00
Uncertainty in factor		0.07	0.01	0.00	0.00
Correction Factor		0.90	uf	0.07	

RECEIVED: 27/05/2025

Performance characteristics	Value				specification
Response time		160	seconds		180.000
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30			
Repeatability at zero		0.25	% full scale		<1 % range
Repeatability at span level		0.15	% full scale		<2 % range
Deviation from linearity		0.2	% of value		<2 % range
Zero drift		-0.04	% full scale		<2% range / 24hr
Span drift		-0.51	% full scale		<2% range/24hr
volume or pressure flow dependence		0.02	% of full scale/3 kPa		<2 % / 3 kPa
atmospheric pressure dependence		0.8	% of full scale/2 kPa		<3% / 2 kPa
ambient temperature dependence		0.01	% full scale/10K		<3% range / 10 K
N2O (mg/m3)	20	0.2	mg/m3		
CO_2 (% vol)	15	0.2	mg/m3		
CH_4 (mg/m3)	40	0.7	mg/m3		
H2O (% vol)	20	0.2	mg/m3		
dependence on voltage		0.1	% full scale/10V		<2% range
losses in the line (leak)		0.8	% of value		< 0.1%vol /10 volt
Uncertainty of calibration gas		0.3	% of value		< 2% of value

Effect of drift	
-0.04	mg/m3
#DIV/0!	% value
#DIV/0!	

		ranges		
	min	max	value at calib	
flow	0.3	0.5	0.4	l/hr
pressure	100.76	100.92	100.88	kPa
temp	287	288.5	287.5	K
N2O range	0	0	0	mg/m3
CO2 range	0	40	0	%vol
CH4 range	0	57	0	mg/m3
H2O range	0	1	0	%vol
Voltage	93	121	110	V

Performance characteristic			Uncertainty		Value of uncertainty quantity		
Standard deviation of repeatability at zero			U_{zo}		for mean		use rep at span
Standard deviation of repeatability at span level			U_{sv}		for mean		0.03
Lack of fit			U_{lf}				3.30
Drift			U_{drf}				-0.02
volume or pressure flow dependence			U_{dpres}				0.01
atmopsheric pressure dependence			U_{dpres}				0.70
ambient temperature dependence			U_{dtemp}				0.00
N2O (mg/m3)			U_{mref}				0.00
CO2 (% vol)			U_{mref}				0.31
CH4 (mg/m3)			U_{mref}				0.58
H2O (% vol)			U_{mref}				0.01
Dependence on voltage			U_{dvolt}				2.47
losses in the line (leak)			U_{leak}				0.00
Uncertainty of calibration gas			U_{calib}				0.00
Uncertainty in factor			uf				0.00

Use largest of sum of all positive or all negative influences			
0.89	all +ves	Criteria	
0	all -ves	sum <4% range	
0.89	largest	0	
Value to use for intereference uncertainty			
U_{int}	0.89		

Measurement uncertainty			0.00	mg/m³
Combined uncertainty			4.18	mg/m³
Expanded uncertainty	k =	2	8.36	mg/m³
Uncertainty corrected to std conds			7.50	mg/m³
Expanded uncertainty	expressed with a level of confidence of 95%		1.50	% ELV
Expanded uncertainty	expressed with a level of confidence of 95%		7.50	mg.m⁻³
Expanded uncertainty	expressed with a level of confidence of 95%		#DIV/0!	% value

Uncertainty calculation for Gaseous Measurement CO

Limit value	-	**mg/m³ (corrected)**	**Cal gas conc**	190	**mg.m-3**
Measured concentration	234.53	**mg/m3**	**Full Scale**	250	**mg/m³**
Measured concentration	209.94	**mg/m³ (Corrected)**			

Correction for reference conditions

		O2 /%	Moisture, %	Pressure, KPa	Temperature, K
	ref	17.00	0.00	101.30	**273.00**
	measured	16.54	0.00	101.30	**273.00**
	Uncert	0.35	1.00	0.00	**1.00**
Factors		0.90	1.00	1.00	1.00
Uncertainty in factor		0.07	0.01	0.00	0.00
Correction Factor		**0.90**	uf	**0.07**	

RECEIVED: 27/05/2025

Performance characteristics	**Value**				**specification**
Response time		30	seconds		180.000
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30			
Repeatability at zero		0.25	% full scale		<1 % range
Repeatability at span level		0.15	% full scale		<2 % range
Deviation from linearity(lack of fit)		0.7	% of value		<2 % range
Zero drift		0.25	mg/m3		<2% range / 24hr
Span drift		-0.25	mg/m3		<2% range/24hr
volume or pressure flow dependence		0.02	% of full scale/3 kPa		<2 % / 3 kPa
atmospheric pressure dependence		0.8	% of full scale/2 kPa		<3% / 2 kPa
ambient temperature dependence		0.01	% full scale/10K		<3% range / 10 K
N_2O (mg/m3)	20	0.2	mg/m3		
CO_2 (% vol)	15	0.2	mg/m3		
CH_4 (mg/m3)	40	0.7	mg/m3		
H2O (% vol)	20	0.2	mg/m3		
dependence on voltage		0.1	% full scale/10V		<2% range
losses in the line (leak)		-0.39	% of value		< 0.1%vol /10 volt
Uncertainty of calibration gas		0.6	% of value		< 2% of value

Effect of drift	
0.00	mg/m3
0.00	% full scale

	ranges			
	min	max	value at calib	
flow	95.00	105	100	kPa
pressure	100.76	100.92	100.88	kPa
temp	287	288.5	287.5	K
N2O range	0	40	0	mg/m3
CO2 range	0	15	0	%vol
CH4 range	0	57	0	mg/m3
H2O range	0	1	0	%vol
Voltage	93	121	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**mg/m3**
Standard deviation of repeatability at zero			u_{ao}		for mean		use rep at span
Standard deviation of repeatability at span level			u_{as}		for mean		0.07
Lack of fit			u_a				0.95
Drift			u_{dor}				0.00
volume or pressure flow dependence			u_{dpres}				0.05
atmospheric pressure dependence			u_{dpres}				0.06
ambient temperature dependence			u_{temp}				0.00
N2O (mg/m3)			u_{mref}				0.23
CO2 (% vol)			u_{mref}				0.12
CH4 (mg/m3)			u_{mref}				0.58
H2O (% vol)			u_{mref}				0.01
Dependence on voltage			u_{volt}				0.22
losses in the line (leak)			u_{leak}				-0.53
Uncertainty of calibration gas			u_{calib}				0.81

Use largest of sum of all positive or all negative influences

0.93	all +ves	Criteria
0	all -ves	sum <4% range
0.93	largest	4.690513548

Value to use for intereference uncertainty

u_{int} 0.93

Measurement uncertainty				
Combined uncertainty			1.66	mg/m³
Expanded uncertainty	k =	2	3.32	mg/m³
Uncertainty corrected to std conds			**2.98**	**mg/m³**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.00**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**2.98**	**mg.m-3**

QGU-007-2013 Uncertainty calculation for Gaseous Measurement Carbon Dioxide

V2.2 Jul-08

Limit value	n/a	%vol	**Calibration gas**	**0.1616**	%vol
Measured concentration	3.34	%vol	**Full Scale**	**25**	%vol

Performance characteristics	**Value**				**specification**
Response time		30	seconds		< 200 s
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30	Assuming 1 minute collected over 1 hour		
Repeatability at zero		0.015	% by volume	stdev	<0.2 % range
Repeatability at span level		0.014	% by volume	stdev	<0.4 % range
Deviation from linearity		0.13	% vol	+/-	<0.3 % volume
Zero drift (during measurement period)		0	% vol at zero level	+/-	<2% of volume / 24hr
Span drift (during measurement period)		0	% vol at span level	+/-	<2% volume/24hr
volume or pressure flow dependence		0	% of fs / 10l/h	+- 5 l/h	<1% range
atmospheric pressure dependence		0.3	% of fs/kPa	+- 2kPa	< 1.5 % range
ambient temperature dependence		-0.07	% by volume /10K	+- 15K	<0.3% volume 10 K
CO_2 (% vol)	15	0.07	% by volume per	15	
NO (mg/m3)	300	0.02	% by volume per	300	
NO_2 (mg/m3)	30	0	% by volume per	30	
Combined interference		0.56	% range		<2% range
Dependence on voltage		0.1	% by volume /10V	+- 5%	< 0.1%vol /10 volt
Losses in the line (leak)		0.185643564	% of value		< 2% of value
Uncertainty of calibration gas		0.5	% of value		

Effect of drift	
0.00	% vol
0.00	% value

		range of variation from conditions at calibration			
		min	max	value at calib	
flow	5	15	10	l/h	
pressure	99.00	101	100	kPa	
temp	280	285	285	K	
CO_2 range	8	15	0	% vol	
NO range	100	150	0	mg/m3	
NO_2 range	5	7.5	0	mg/m3	
Voltage	105	115	110	V	

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**% vol**
Standard deviation of repeatability at zero			U_{ro}		for mean		Only use rep at span
Standard deviation of repeatability at span level			U_{rs}		for mean		0.00
Lack of fit			U_{lf}				0.08
Drift			U_{drift}				0.00
volume or pressure flow dependence			U_{dpress}				0.00
atmospheric pressure dependence			U_{dpress}				0.04
ambient temperature dependence			U_{dtemp}				-0.02
CO_2							0.05
NO							0.01
NO_2							0.00
Combined interference (from mcerts)							0.08
dependence on voltage			U_{dvolt}				0.03
losses in the line (leak)			U_{loss}				0.00
Uncertainty of calibration gas			U_{calib}				0.01

Use largest of sum of all positive or all negative influences

0.06	all +ves	Criteria
0	all -ves	sum <2% value
0.06	largest	0.066865066

Value to use for intereference uncertainty

U_{int} 0.06

Measurement uncertainty			3.34	%vol
Combined uncertainty			0.11	%vol
% of value			3.39	%
Coverage factor k =	2			
Expanded uncertainty	**expressed with a level of confidence of 95%**		**6.77**	**% of value**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.23**	**% vol**

QGU-007-2013 Uncertainty calculation for Gaseous Measurement Oxygen EN14789

V2.2 Jul-08

Limit value	n/a	%vol	**Calibration gas**	0.209	%vol
Measured concentration	16.54	%vol	**Full Scale**	0.25	%vol

Performance characteristics	**Value**				**specification**
Response time		30	seconds		< 200 s
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30	Assuming 1 minute collected over 1 hour		
Repeatability at zero		0.015	% by volume	stdev	<0.2 % range
Repeatability at span level		0.014	% by volume	stdev	<0.4 % range
Deviation from linearity		0	% vol	+/-	<0.3 % volume
Zero drift (during measurement period)		0	% vol at zero level	+/-	<2% of volume / 24hr
Span drift (during measurement period)		-0.0006	% vol at span level	+/-	<2% volume/24hr
volume or pressure flow dependence		0	% of fs / 10l/h	+- 5 l/h	<1% range
atmospheric pressure dependence		0.3	% of fs/kPa	+- 2kPa	< 1.5 % range
ambient temperature dependence		-0.07	% by volume /10K	+- 15K	<0.3% volume 10 K
CO_2 (% vol)	15	0.07	% by volume per	15	
NO (mg/m3)	300	0.02	% by volume per	300	
NO_2 (mg/m3)	30	0	% by volume per	30	
Combined interference		0.56	% range		<2% range
Dependence on voltage		0.1	% by volume /10V	+- 5%	< 0.1%vol /10 volt
Losses in the line (leak)		1.626794258	% of value		< 2% of value
Uncertainty of calibration gas		0.35	% of value		

Effect of drift	
0.00	% vol
0.00	% value

		range of variation from conditions		at calibration	
		min	max	value at calib	
flow	5	15	10	l/h	
pressure	99.00	101	100	kPa	
temp	280	285	285	K	
CO_2 range	8	15	0	% vol	
NO range	100	150	0	mg/m3	
NO_2 range	5	7.5	0	mg/m3	
Voltage	105	115	110	V	

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**% vol**
Standard deviation of repeatability at zero			u_{ro}		for mean		Only use rep at span
Standard deviation of repeatability at span level			u_{rs}		for mean		0.00
Lack of fit			u_{lf}				0.08
Drift			u_{drift}				0.00
volume or pressure flow dependence			u_{dpress}				0.00
atmospheric pressure dependence			u_{dpress}				0.04
ambient temperature dependence			u_{dtemp}				-0.02
CO_2							0.05
NO							0.01
NO_2							0.00
Combined interference (from mcerts)							0.08
dependence on voltage			u_{dvolt}				0.03
losses in the line (leak)			u_{loss}				0.13
Uncertainty of calibration gas			u_{calib}				0.03

Use largest of sum of all positive or all negative influences

0.06	all +ves	Criteria
0	all -ves	sum <2% value
0.06	largest	0.22

Value to use for intereference uncertainty

u_{int} 0.06

Measurement uncertainty			16.54	%vol
Combined uncertainty			0.17	%vol
% of value			1.04	%
Coverage factor k =	2			
Expanded uncertainty	**expressed with a level of confidence of 95%**		**2.09**	**% of value**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.35**	**% vol**

Appendix III: Certificates and Process Detail Form

Process details form information not made available from Licensee at time of reporting. Details can be obtained direct from the client.

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

CERTIFICATE OF ANALYSIS

Customer Name:	Harringtons Claregalway	Certificate number:	24-10025
		Issue number:	1
Customer order:	HACLDB240924	Date of issue:	04/10/2024
Date tested:	24/09/2024		
Date received:	30/09/2024		
Date started:	02/10/2024		
Date completed:	04/10/2024		

Description: 1 liquid sample, 1 solid sample

Test methods: Details available on request (refer to SOP code against relevant result/s)

Determinand	Filter number	LOD	Units	Code	SOP	Stack	Filter result	Wash Result
Particulates	2137	0.07	mg	I	2750	Blank	<0.07	
Particulates		0.3	mg	I	2750			<0.3

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.406T

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

DEVIATING SAMPLES

Report number: 24-10025

Customer order No : HACLDB240924

Date sampling:	Stack:	Deviating:	Accredited Test
24/09/2024	Blank	N/a	Yes

Samples submitted may be declared to be deviating.Where applicable the analysis method remains accredited, however results reported for a deviating sample may be compromised.Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submisson may be required.

Key code	Description
N	Not accreditated test
I	Inab accreditated test
SI	Subcontracted to approved laboratory INAB Accredited for the test

Determinand	Uncertainty
Particulates (Filter)	2.52%
Particulates (Wash)	2.52%

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

CERTIFICATE OF ANALYSIS

Customer Name:	Harringtons Claregalway	Certificate number:	24-10026
		Issue number:	1
Customer order:	HACLDB240924	Date of issue:	04/10/2024
Date tested:	24/09/2024		
Date received:	30/09/2024		
Date started:	02/10/2024		
Date completed:	04/10/2024		

Description: 1 liquid sample, 1 solid sample

Test methods: Details available on request (refer to SOP code against relevant result/s)

Determinand	Filter number	LOD	Units	Code	SOP	Stack	Filter result	Wash Result
Particulates	2149	0.07	mg	I	2750	AP1	10.52	
Particulates		0.3	mg	I	2750			1.77

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.408T

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

DEVIATING SAMPLES

Report number: 24-10026

Customer order No : HACLDB240924

Date sampling:	Stack:	Deviating:	Accredited Test
24/09/2024	AP1	N/a	Yes

Samples submitted may be declared to be deviating.Where applicable the analysis method remains accredited, however results reported for a deviating sample may be compromised.Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submisson may be required.

Key code	Description
N	Not accreditated test
I	Inab accreditated test
SI	Subcontracted to approved laboratory INAB Accredited for the test

Determinand	Uncertainty
Particulates (Filter)	2.52%
Particulates (Wash)	2.52%

AXIS

RECEIVED: 27/08/2025

2024

Air Emissions REPORT

PREPARED FOR

Harrington's Concrete & Quarry

Report Title	Air Emissions Compliance Monitoring Report
Company address	Axis Environmental Services Ltd., Unit 3 Westlink Business Park, Clondrinagh, Limerick, V94 K6XK
Contact Details	Phone: 061 324587, info@axisenv.ie
Stack Emissions Testing Report Commissioned by	Harringtons Concrete & Quarry
Facility Name	Harringtons Concrete & Quarry
EPA Licence Number	N/A
Licence Holder	Harringtons Concrete & Quarry
Stack Reference Number	AP1
Dates of the Monitoring Campaign	14/11/2024
Job Reference Number	HACLDB141124
Report Written By	Mr. Dualtha Beardon
Report Approved by	Ruana Souza
Stack Testing Team	Mr. Dualtha Beardon & Mr. Marc Eixeres
Report Date	03/12/2024
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Ruana Souza Environmental Technician

Contents

1.0 Executive Summary

1.1 Overall aim of the monitoring campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

1.2 Summary of substances to be monitored at each emission point

Stack Name:	AP1
Total Particulate Matter	
Carbon Monoxide	
Nitrogen Oxides (as NO_2)	
Oxygen	
Carbon Dioxide	
Sulphur Dioxide	
Volumetric Flow Rate (Ref)	

1.3 Special Requirements

There were no special requirements

1.4 Summary of Results

Emission Point Number: AP1

Parameter	Method	Units	Result	MU +/-	Limit	O_2 Ref. (%)	Moisture Ref. (%)	Blanks	Date	Time on	Time off	Accreditation	
												Sampling	Analysis
Total Particulate Matter (TPM)	EN13284	$mg.m^{-3}$	43.41	3.25	50	17	Dry	<0.84	14/11/2024	09:28	09:58	Yes	Yes
Nitrogen Oxides (as NO_2)	EN 14792	$mg.m^{-3}$	59.5	4.7	400	17	Dry	N/a	14/11/2024	08:35	09:05	Yes	N/a
Sulphur Dioxide (as SO_2)	EN/TS 17021	$mg.m^{-3}$	2.5	2.3	500	17	Dry	N/a	14/11/2024	08:35	09:05	Yes	N/a
Carbon Monoxide (as CO)	EN 15058	$mg.m^{-3}$	372.5	5.4	N/a	17	Dry	N/a	14/11/2024	08:35	09:05	Yes	N/a
Carbon Dioxide	EN/TS 17405	vol%	2.25	0.2	N/a	N/a	Dry	N/a	14/11/2024	08:35	09:05	Yes	N/a
Oxygen	EN 14789	vol%	17.87	0.3	N/a	N/a	Dry	N/a	14/11/2024	08:35	09:05	Yes	N/a
Volumetric Flow Rate (Ref)	EN 16911	$m^3.hr^{-1}$	18,458	870	100,000	17	Dry	N/a	14/11/2024	09:28	09:58	Yes	N/a

Note 1: All results are normalised to standard temperature and pressure ($0^{O}C$ and 101.3kPa)
Note 2: All results are reported in the format as defined by the EPA in guidance note AG2:2021.

1.5 Operating Information

Please reference Process Details as per Appendix III attached.

1.6 Monitoring Deviations

Stack Name: AP1	
Parameter	Deviation
Total Particulate Matter	None
Carbon Monoxide	None
Nitrogen Oxides (as NO_2)	None
Oxygen	None
Carbon Dioxide	None
Sulphur Dioxide	None
Volumetric Flow Rate (Ref)	Required number of ports not accessible/ available EN 16911 - in accordance with AG2 Index of Preferred Methods

1.7 Reference Documents

Risk Assessment (RA)	SOP 1011
Site Review (SR)	SOP 1019
Site Specific Protocol (SSP)	SOP 1019

1.8 Version History

Version Number	Changes to the report
1	Original version of the report

Appendix I

1.1 Monitoring Personnel

Team Leader	Name	Dualtha Beardon
	System approval	Team Leader Approved
Technician	Name	Marc Eixeres
	System approval	Technician Approved

1.2 Equipment Inventory

ID	Item of Equipment	Used	ID	Item of Equipment	Used	ID	Item of Equipment	Used
12EQ500	Pump		23EQ504	L type Pitot Tube		13EQ501	Vernier Callipers	✓
12EQ532	Pump		23EQ505	S type pitot tube		14EQ503	Vernier Callipers	
12EQ536	Pump		24EQ514	S type pitot tube		14EQ507	Vernier Callipers	
12EQ537	Pump		24EQ515	S type pitot tube		17EQ533	Vernier Callipers	
12EQ538	Pump		24EQ516	S type pitot tube		18EQ506	Vernier Callipers	
12EQ542	Pump		24EQ517	S type pitot tube		20EQ516	Vernier Callipers	
12EQ543	Pump		24EQ518	S type pitot tube				
13EQ514	Pump		24EQ519	S type pitot tube				
16EQ518	Pump		24EQ520	S type pitot tube		13EQ503	1kg weight	✓
16EQ519	Pump		24EQ532	S type pitot tube		14EQ515	500g Weight	
17EQ509	Pump		24EQ546	S type pitot tube		15EQ511	1kg Weight	
17EQ510	Pump		24EQ547	S type pitot tube		15EQ512	1kg weight	
17EQ522	Pump		24EQ548	S type pitot tube		16EQ511	1kg weight	
17EQ523	Pump					16EQ512	500g weight	
17EQ534	Pump					17EQ529	500g weight	✓
17EQ525	Pump					19EQ513	500g weight	
17EQ526	Pump					19EQ514	1kg Weight	
18EQ517	Pump					19EQ519	1kg weight	
18EQ518	Pump		12EQ525	Horiba (PG-250) X		19EQ520	500g weight	
21EQ507	Pump		16EQ508	Horiba- PG250z				
21EQ510	Pump	✓	17EQ515	Horiba 350				
21EQ509	Pump		20EQ506	Horiba 350				
22EQ508	Pump	✓	21EQ503	Horiba 350		17EQ534	ST5	
21EQ511	Pump		14EQ501	Horiba 350		18EQ503	ST5	✓
22EQ500	Pump		21EQ522	Horiba 350	✓	18EQ513	ST5	
22EQ501	Pump		24EQ563	Horiba 350		19EQ509	ST5	
22EQ502	Pump					20EQ500	ST5	
22EQ503	Pump		14EQ513	Condenser		21EQ519	ST5	
22EQ504	Pump		16EQ509	Condenser		22EQ508	ST5	
22EQ505	Pump		18EQ505	Condenser				
24EQ510	Pump		21EQ504	Condenser				
24EQ526	Pump		22EQ509	Condenser		14EQ510	Digital Protractor	
24EQ527	Pump		24EQ512	Condenser		14EQ511	Digital Protractor	
24EQ528	Pump		24EQ558	Condenser	✓	15EQ505	Digital Protractor	
						17EQ528	Digital Protractor	
23EQ537	MF Meter		14EQ518	Velocity Meter		18EQ507	Digital Protractor	
23EQ538	MF Meter	✓	17EQ514	Velocity Meter		20EQ514	Digital Protractor	✓
23EQ539	MF Meter		18EQ504	Velocity Meter		20EQ515	Digital Protractor	
23EQ540	MF Meter		19EQ502	Velocity Meter				
23EQ541	MF Meter		20EQ504	Velocity Meter				
23EQ542	MF Meter		24EQ503	Velocity Meter		12EQ522	Balance	
24EQ537	MF Meter					12EQ544	Balance	
24EQ538	MF Meter					15EQ510	Balance	
24EQ539	MF Meter					17EQ537	Balance	
24EQ540	MF Meter		21EQ528	TSI (Vane)		17EQ538	Balance	
24EQ541	MF Meter		23EQ500	TSI (Vane)		19EQ515	Balance	
						21EQ505	Balance	
17EQ503	Heated Line (10m)		16EQ502	FID		21EQ506	Balance	
17EQ516	Heated Line		17EQ517	FID		21EQ529	Balance	✓
19EQ523	Heated Line (20m)		19EQ508	FID		23EQ508	Balance	
20EQ520	Heated Line (15m)		20EQ507	FID		23EQ521	Balance	
20EQ521	Heated Line (15m)		20EQ508	FID				
21EQ523	Heated Line (5m)					17EQ519	Stopwatch	
21EQ524	Heated Line (5m)		16EQ510	Measuring Tape		17EQ520	Stopwatch	✓
22EQ510	Heated Line (40m)		17EQ527	Measuring Tape		18EQ509	Stopwatch	
22EQ512	Heated Line (5m)		20EQ509	Measuring Tape		19EQ518	Stopwatch	
22EQ513	Heated Line (5m)		23EQ511	Measuring Tape	✓	23EQ501	Stopwatch	
23EQ517	Heated Line		24EQ543	Measuring Tape				
24EQ567	Heated Line	✓						
23EQ519	Heated Line		24EQ501	PCDD Thermometer				
23EQ543	Heated Line (1.5m)		24EQ502	PCDD Thermometer				
23EQ544	Heated Line (1.5m)							
			16EQ516	Thermocouple and probe				
12EQ520	L type Pitot Tube		21EQ513	Thermocouple and probe				
12EQ521	L Type Pitot tube		21EQ514	Thermocouple and probe				
16EQ506	S type Pitot Tube		21EQ516	Thermocouple and probe				
16EQ517	S type Pitot Tube		21EQ517	Thermocouple and probe				
17EQ507	S type Pitot Tube		21EQ518	Thermocouple and probe				
17EQ536	S type Pitot Tube		21EQ533	Thermocouple and probe				
19EQ510	S type Pitot Tube		23EQ510	Thermocouple and probe	✓			
19EQ511	S type pitot tube		24EQ551	Thermocouple and probe				
22EQ506	S type pitot tube		24EQ552	Thermocouple and probe				
22EQ511	S type pitot tube		24EQ553	Thermocouple and probe				
22EQ520	S type pitot tube		24EQ554	Thermocouple and probe				
22EQ525	S type pitot tube		24EQ555	Thermocouple and probe				
23EQ502	L type Pitot Tube		24EQ556	Thermocouple and probe				
23EQ503	L type Pitot Tube							

Appendix II

2.1 Stack Emission Point Reference: AP1

2.1.1 Suitability of Sample Location:

General Information	AP1
Permanent/Temporary	Permanent
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / EN 15259 Platform Requirements	Value	Comment
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self-closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	Yes	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-
Sampling Location / Platform Improvement Recommendations		
None		
EN 15259 Homogeneity Test Requirements		
1.		
Select Option: 1: There is no requirement to perform a EN15259 Homogeneity Test on this stack 2: Test results were obtained from previous Homogeneity test carried out by AXIS 3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor 4: Homogeneity Test is required on this stack and the client has been informed of this requirement		

2.1.2 Stack Diagram

Figure 1: AP1

2.1.3 Stack Raw Data

Title:	**Determination of Total Particulates**				
Method:	EN 13284-1				
Client:	Harringtons Claregalway				
Test Date:	14/11/2024		**Air Volume at Pump**	0.7225	m^3
Test Time	09:28		**Temperature at Pump**	15.42	Deg C
Laboratory Used:	AXIS		**Pressure at Pump**	84.47	kPa
Stack Name	AP1		**Humidity at Pumps**	0	%
Run I.D.	1		**Filter Weight**	15.03	mg
Filter I.D.	2263		**Front End Weight**	4.2	mg
Moisture Content	8.34	%			
Reference Oxygen	17	%	**Flow Uncertainty**	870	m^3/hr
Measured Oxygen	17.87	%	**Flow Uncertainty**	4.7	%
Stack Flow Rate	25920	Nm^3/hr			
Adjusted Stack Flow Rate	18458.34978	Nm^3/hr, dry @ % Oxygen			
Volume of Air Sampled	0.5702	Nm^3			

Leak Check Results	**Result**		**% Leak**	
Before Sample 1	0	l/min	0.0	
Average Flow Rate	19.18	l/min	0.0	
Standard Maximum	0.383591429	l/min	2%	
Back Pressure	58.81	kPa		
Standard Criteria to be Met	**Result**	**Std. Requirement**		
Angle of Flow	Yes	<15 Degrees	**Probe material**	Stainless Steel
Negative Flow in the Stack	No	None	**Filter housing**	Stainless Steel
Pitot Pressure Difference	Yes	>5Pa	**Positioning of filter**	In Stack
Ratio of Flow Measurement	Yes	<3:1	**Filter Size & Material**	47mm Quartz
Stagnation Test	Yes	<10Pa		
Pitot Tube Leak Check	**Result**			
Positive Pressure	Pass	-		
Negative Pressure	Pass	-		
Number of Ports	1	2		
Straight length before sample point	Yes	> 5 Hydraulic Diameters		
Straight length after sample point	Yes	> 5 Hydraulic Diameters to Stack Outlet or 2HD to Fan/ Bend		

Sample Calculations				
Blank (Filter and Front Wash Combined)	0.37	mg		
Sample 1 (Filter and Front Combined)	19.23	mg		
Volume of Air Sampled	0.5702	Nm^3		
Blank Result	0.65	$mg/Nm^{3,}$ dry	0.84	$mg/Nm^{3,}$ dry @ Ref O_2
Sample Result	33.73	$mg/Nm^{3,}$ dry	43.41	$mg/Nm^{3,}$ dry @ Ref O_2
Uncertainty of Measurement	3.25	mg/Nm^3		
Emission Limit Value	50	mg/Nm^3		
Blank as Percentage of ELV	1.3	%	**Requirement <10% ELV or <0.5 mg/m³**	

Isokinetic Criterion Compliance		
Isokinetic Variation	8.9	%
Allowable Isokinetic Range	-5 to +15%	%
Isokinetic Acceptable	Yes	

Balance Calibration	**Weight**	**0**		
0	0	g	Eccentric load indication carried out - Balance Ok	Yes
500	500	g		
1000	1000	g		
Impinger Weights	**Initial**	**Final**	**Difference**	
Total Impinger Weight	2165.2	2201.2	36	
Volume of Air Sampled	0.5702	Nm3	36	
Moisture Content (EN 14790)	7.28	%		

DUCT AND GAS SPECIFICATION			
Name			ap1
Section			Circular
Diameter		[m]	1.2
Area		[m2]	1.130973
Ports		[#]	1
Points	P	[#]	8
Density	ρn	[kg/Nm3]	1.3
Carbon Dioxide	CO2	[%]	2.93
Oxygen	O2	[%]	16.99
Water Vapor Ratio	rw	[0;1]	0.084
Nozzle	nz	[mm]	8
Turbolence factor	ft	[sec]	1
Wall Adjustment Factor	waf		
PITOT DATA SPECIFICATION			
Name			
Velocity	[m/sec]	5	0.83
Velocity	[m/sec]	10	0.83
Velocity	[m/sec]	20	0.83
Velocity	[m/sec]	30	0.83
Velocity	[m/sec]	40	0.83
NORMALIZATION FACTOR			
Tnorm		[K]	273
Pnorm		[kPa]	101.3
DUCT FLOW RATE			
Dry actual	QVa	[m3/h]	29310
Moist actual	Q'Va	[m3/h]	32000
Moist norm. [Tnorm Pnorm]	Q'Vn	[Nm3/h]	25920
Dry norm. [Tnorm Pnorm]	QVn	[Nm3/h]	23742
AVERAGE VALUES			
Total Points		[#]	1
Velocity	v'a	[m/sec]	7.9
Stack temperature	tstack	[°C]	70.36
Stack Pressure	Pa	[kPa]	103.2
Isokinetic Rate	IR	[%]	8.9
Velocity at nozzle	v'N	[m/sec]	8.606
Probe temperature	tprobe	[°C]	125.9
Filter temperature	tfilter	[°C]	127.7
Outlet temperature	toutlet	[°C]	29.9
Aux temperature	taux	[°C]	29.7
Ambient Pressure	Pamb	[kPa]	103.19
GAS METER SAMPLED VOLUMES			
Elapsed time	et		00:30:00
Norm. Volume [Tnorm Pnorm]	Vgn		0.5702
Moist Volume at stack conditions	V'ga		0.7685
Volume at dgm conditions	Vdgm		0.7225
Gas meter temperature	tdgm		15.42
Gas Meter Pressure	Pdgm		84.47

start ts [timestamp]	port [###]	point [###]	Probe pos [cm]	tstack avg [°C]	Pa avg [kPa]	dP Pitot avg [Pa]	velocity avg [m/sec]
14/11/2024	1	1	3.9	71.76	103.17	77.52	10.26
09:18:38	-	-	-	-	-	-	-
14/11/2024	1	2	12.6	69.94	103.17	78.36	10.29
09:19:09	-	-	-	-	-	-	-
14/11/2024	1	3	23.3	67.09	103.17	79.1	10.29
09:19:58	-	-	-	-	-	-	-
14/11/2024	1	4	38.8	65.26	103.17	72.47	9.83
09:20:30	-	-	-	-	-	-	-
14/11/2024	1	5	81.3	63.87	103.17	100.87	11.57
09:21:01	-	-	-	-	-	-	-
14/11/2024	1	6	96.8	62.77	103.17	103.28	11.69
09:21:32	-	-	-	-	-	-	-
14/11/2024	1	7	107.5	61.62	103.17	94.39	11.15
09:22:04	-	-	-	-	-	-	-
14/11/2024	1	8	116.2	60.27	103.17	88.56	10.78
09:22:36	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
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Uncertainty calculation for EN 13284					
	Symbol	**Unit**	**Values**	**UOM as %**	**Std Requirement**
Sampled Volume	V_m	m^3	0.001	0.14	<=5%
Sampled gas Temperature	T_m	k	2.00	0.69	<=2%
Sampled gas Pressure	ρ_m	kPa	1.00	1.18	<=2%
Sampled gas Humidity	H_m	% by volume	1.00	1.00	<=1%
Oxygen content	$O_{2,m}$	% by volume	0.10	-	<=5%
Mass particulate	m	mg	0.183	0.95	<5% of limit value
Leak	L		-	0.00	<=2%
Uncollected Mass	UCM		-	0.00	<10% of limit value
Corrected Volume (STP)	V	m^3	0.57	1.71	-
Mass	m	mg	19.23	0.95	-
Factor for O2 Correction	fc		1.28	3.19	-
Leak	L	$mg.m^{-3}$	0.00	0.00	-
Uncollected mass	UCM	mg	0.00	0.00	-
Combined measurement uncertainty			**1.63**	-	-
Expanded uncertainty as percentage of measured value				**7.49**	% measured of value
Expanded uncertainty in units of measurement				**3.25**	mg.m-3
Expanded uncertainty as percentage of limit value				**6.50**	% ELV

Uncertainty calculation for Velocity and Volume Flow Rate Measurement by Pitot tube EN ISO 16911-1				
	Unit	**Values**	**as %**	**Std Requirement**
Range of Delta P transducer	Pa	2500	-	-
Resolution of Delta P transducer	Pa	10	-	-
Repeatability of Delta P transducer	% of value	0.01	-	-
Drift of Delta P transducer	% of range	0.32	-	-
Lack of fit of measurement system	% of range	0.25	-	-
Uncertainty in Delta P transducer	Pa	2.5	-	-
Uncertainty of pitor coefficient		0.03	-	-
Enter uncertainties as (95%,k=2) where relevant				
Uncertainty in temperature readout system	°C	1	-	-
Uncertainty in atmospheric pressure transducer	Pa	160.5	-	-
Uncertainty in duct area measurement	%	1.0	-	-
Uncertainty of Molar Mass	kg/mol	0.00001	0.04	-
Uncertainty of Temperature	K	0.5	0.15	-
Uncertainty of Stack Static Pressure	Pa	10.32	0.01	-
Uncertainty of Stack Pressure	Pa	160.8	0.08	-
Uncertainty of Gas Density	kg/m3	0.0034	0.17	-
Uncertainty in velocity	m/sec	0.16	2.1	-
Expanded Uncertainty in velocity	m/sec	0.32	4.1	-
Uncertainty of Volumetric Flow Rate	m^3/hour	435	-	-
Expanded Uncertainty of Volumetric Flow Rate	m^3/hour	**870**	**4.7**	<10% of ELV

Title:	**Determination of Moisture Content**		
Method	EN 14790		
Stack Name	AP1		
Test Time	08:00:00		
Leak Check Results			
Prior to test:	0		
Post Test:	0		
Sample Volume Flow Rate:	2.3		
Standard Requirement:	<2%		
Test Result:	0		
Test Status	Pass		
Calibration Details			
Pump Number	21EQ510		
Calibrator Number	23EQ538		
Calibration Rate Before	2.3	N Litres per Minute	
Calibration Rate After	2.3	N Litres per Minute	
Air Volume at Pump	2.3	N Litres per Minute	
Sample Time	30	Minutes	
Temperature at Pump	12	Deg C	
Pressure at Pump	100.2	kPa	
Volume from Mass Flow Meter	0.064	Nm^3	
Balance Calibration	**Weight**		
0.0	0.0	g	Eccentric load indication carried out: Yes
500.0	500.0	g	- Balance Ok
1000.0	1000.0	g	
Impinger Weights	**Initial**	**Final**	**Difference**
Total Impinger Weight	547.2	551.9	4.7
Volume of Air Sampled	0.064	Nm^3	4.7
Moisture Content (EN 14790)	8.34	%	
Uncertainty	0.43	%	

Impinger Weights	**Pre**	**Post**	
1	547.2	551.9	g
2	547.2	551.9	g
3	547.2	551.9	g
4	547.2	551.9	g
5	547.2	551.9	g
6	547.2	551.9	g
7	547.2	551.9	g
8	547.2	551.9	g
9	547.2	551.9	g
10	547.2	551.9	g
Average	**547.2**	**551.9**	

QGU-009-2013 Uncertainty calculation for EN 14791

v2

Measurement Equation

Limit value (ELV)		**mg.m $^{-3}$**							
Measured concentration	8.34	**mg.m $^{-3}$ (at reference conditions)**							
Measured Quantities	**Symbol**	**Value**	**Standard uncertainty**		**Units**		**Uncertainty as percentage**	**Uncertainty at iv**	**Requirement of std**
Sampled Volume Gas	V_m	0.064290102	uV_m	0.001	**m^3**		1.56		<=2%
Sampled gas Temperature	T_m	285	uTm	2	k		2.00		<2.5 k
Sampled gas Pressure	p_m	100.2	up_m	1	**kPa**		1.00		<=1%
Sampled gas Humidity	H_m	0	uH_m	1	**% by volume**		1.00		<=1%
Note - Sampled gas humidity, temperature and pressure are values at the gas meter									
Leak	L	2			%		2.00		<=2%
Intermediate calculations									
Factor for std conds	fs	0.95							
uncertainty components	symbol	**sensitivity coeff**		**u (in units of fs)**					
	ρ_m	0.009		0.009					
	H_m	0.009		0.009					
	T_m	0.003		0.007					
	ufs			0.015			1.58		
Corrected volume	V	0.06	uV	0.001	**m^3**		2.28		
Factor for O2 correction	fc	#REF!							
uncertainty components	symbol	**sensitivity coeff**		**u**					
	$O_{2,m}$	#REF!		#REF!					
Factor for O2 Correction	ufc	#REF!		#REF!			#REF!		

Parameter		**Value**	**Units**	**Sensitivity coeff**	**Uncertainty contribution**		**Uncertainty as %**	
Corrected Volume (standard conditio	V	0.06	m^3	136.90	0.19	$mg.m^{-3}$	2.28	%
Leak	L	0.10	$mg.m^{-3}$	1.00	0.10	$mg.m^{-3}$	1.15	%
Combined uncertainty					**0.21**	$mg.m^{-3}$		
Expanded uncertainty as percentage of measured value			**5.11**	**% measured of value**		**expressed with a level of confidence of 95%**		
						(Using a coverage factor k=2)		
Expanded uncertainty in units of measurement			**0.43**	**%**				

Title:	***Determination of Flue Gases***					
Method:	EN 14792 / TS 17021 / EN 15058 / TS 17405 / EN 14789					
Test Date:	14/11/2024					
Stack Name:	AP1		**Quality Assurance**			
Test Start Time:	08:35		Probe Material		Stainless Steel	
Reference Conditions			Filtration Type/size		Stainless Steel	
Measured Oxygen	17.9	%	Heated Filter used		Yes	
Reference Oxygen	17	%	No. of sampling lines		1	
Reference Moisture	-		No. of Sampling points		1	
			Sampling point I.D.s		1	
Parameter		**NO**	**SO2**	**CO**	**CO2**	**O2**
Emission Limit Values	$mg.m^{-3}$ ref	400	500	-	-	-
Instrument Range	ppm	500	200	200	30.00%	25.00%
Span Gas Value	ppm	442.1	139.5	152.4	16.09%	20.90%
Acceptable Gas Range	-	Yes	Yes	Yes	Yes	Yes
Calibration Gas Reference No.	-	24ING577	24ING588	24ING550	24ING556	-
Calibration Gas Uncertainty	%	0.4	1.4	0.4	0.5	0.35
Calibration Gas Start Bar	Bar	20	35	50	40	-
Expiry Date	-	Nov-25	Nov-24	May-29	May-29	-
Quality Assurance	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Conditioning Unit Temperature	C	2	2	2	2	2
Average Temperature	< C	2	2	2	2	2
Allowable Temperature	-	4	4	4	4	4
Temperature Acceptable	-	Yes	Yes	Yes	Yes	Yes
Pump flow rate	l/min.	0.5	0.5	0.5	0.5	0.5
Instrument Zero Drift	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Instrument Zero (Ambient air or Nitrogen)		Nitrogen	Nitrogen	Nitrogen	Nitrogen	Nitrogen
Instrument Zero (Pre)	ppm	0	0	0	0.00%	0.00%
Instrument Zero (Check)	ppm	0	0.2	-0.2	0.00%	0.01%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Instrument Zero (Post)	ppm	0.1	-0.3	0.2	0.03%	0.04%
Zero Drift	ppm	0.1	-0.3	0.2	0.03%	0.04%
Allowable Zero Drift (Less than 2%)	ppm equiv.	8.842	2.79	3.048	0.003218	0.42%
Adjustable Zero Drift (2 - 5%) / 5% CO_2	ppm equiv.	22.105	6.975	7.62	0.80%	1.05%
Zero Drift Failure (<5% / >5% CO_2)	ppm equiv.	22.105	6.975	7.62	0.80%	1.05%
Zero Drift Acceptable	-	Yes	Yes	Yes	Yes	Yes
Adjust for Zero Drift	-	No	No	No	No	No
Reject results	-	No	No	No	No	No
Calculated Drift	%	0.02%	-0.22%	0.13%	0.19%	0.19%
Instrument Span Drift	Units	**NO**	**SO2**	**CO**	**CO2**	**O2**
Instrument Span Down (Pre)	ppm	442.1	139.5	152.4	16.09%	20.90%
Instrument Check Span (Post)	ppm	441.4	138.4	151.4	16.03%	20.88%
Span Drift	ppm	-0.7	-1.1	-1	-0.06%	-0.02%
Allowable Span Drift (less than 2%)	ppm equiv.	8.842	2.79	3.048	0.32%	0.42%
Adjustable Span Drift (2 - 5%)	ppm equiv.	22.105	6.975	7.62	0.008045	1.05%
Span Drift Failure (Greater than 5%)	ppm equiv.	22.105	6.975	7.62	0.80%	1.05%
Span Drift Acceptable (Y/N)	-	Yes	Yes	Yes	Yes	Yes
Adjust for Span Drift	-	No	No	No	No	No
Reject results	-	No	No	No	No	No
Calculated Drift	%	-0.16%	-0.79%	-0.66%	-0.37%	-0.10%
Heated Line Check Including Leak Check		**NO**	**SO2**	**CO**	**CO2**	**O2**
Span Gas Conc.	ppm	442.1	139.5	152.4	16.09%	20.90%
Zero Check Acceptable Limit (+/-)	ppm	8.842	2.79	3.048	0.32%	0.42%
Heated Line Check Zero Gas	ppm	0.1	0.2	0.4	0.02%	0.01%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Heated Line Check Span Gas	ppm or %	441.8	138.7	151.5	16.09%	20.77%
Span Gas Leak Detected	ppm or %	-0.3	-0.8	-0.9	0.00%	-0.13%
Leak check acceptable (< 2%)	ppm or %	8.842	2.79	3.048	0.32%	0.42%
Compliance Statement	Pass / Fail	Pass	Pass	Pass	Pass	Pass
Response Time (<200 seconds)		Yes	Yes	Yes	Yes	Yes

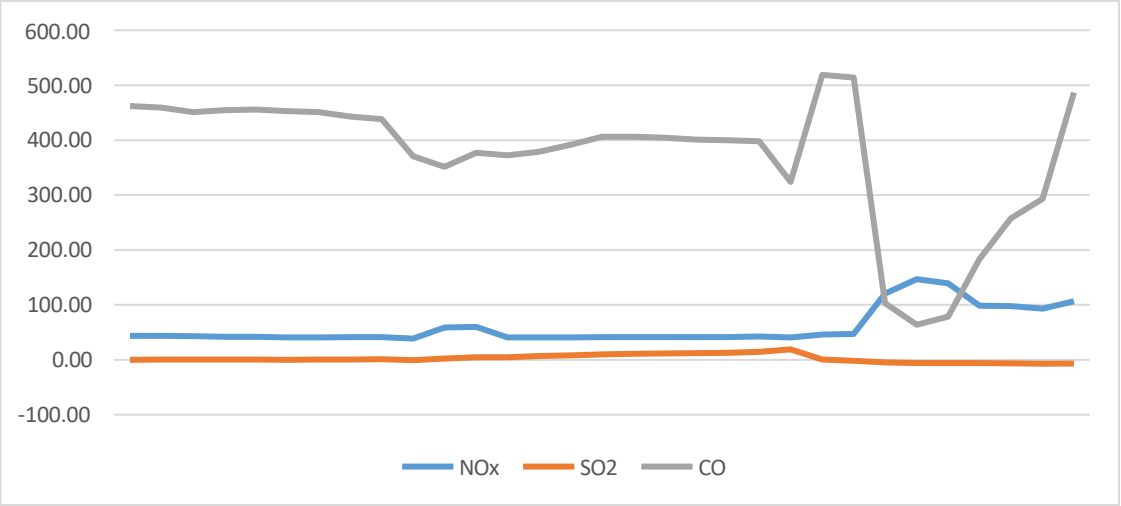
Test Conditions	Units	
Run Ambient Temperature Range	C	12

Raw Data

Date/Time	NOx	SO2	CO	CO2	O2
	ppm	ppm	ppm	vol%	vol%
14/11/2024 08:35	16.6	0.0	287.0	1.73	18.50
14/11/2024 08:36	16.4	0.2	285.0	1.73	18.60
14/11/2024 08:37	16.2	0.2	280.0	1.71	18.50
14/11/2024 08:38	15.9	0.2	282.0	1.71	18.60
14/11/2024 08:39	15.8	0.1	283.0	1.72	18.60
14/11/2024 08:40	15.5	0.0	281.0	1.70	18.60
14/11/2024 08:41	15.4	0.1	280.0	1.70	18.60
14/11/2024 08:42	15.6	0.1	275.0	1.68	18.60
14/11/2024 08:43	15.7	0.3	272.0	1.69	18.60
14/11/2024 08:44	14.6	-0.1	230.0	1.67	18.60
14/11/2024 08:45	22.2	0.6	218.0	2.18	18.00
14/11/2024 08:46	22.7	1.2	234.0	2.05	17.90
14/11/2024 08:47	15.5	1.3	231.0	1.58	18.70
14/11/2024 08:48	15.4	1.8	235.0	1.58	18.70
14/11/2024 08:49	15.3	2.2	243.0	1.57	18.70
14/11/2024 08:50	15.7	2.7	252.0	1.61	18.60
14/11/2024 08:51	15.7	3.0	252.0	1.61	18.60
14/11/2024 08:52	15.6	3.2	251.0	1.59	18.70
14/11/2024 08:53	15.6	3.3	249.0	1.59	18.70
14/11/2024 08:54	15.7	3.5	248.0	1.59	18.70
14/11/2024 08:55	16.1	3.9	247.0	1.57	18.70
14/11/2024 08:56	15.4	5.2	201.0	1.31	18.80
14/11/2024 08:57	17.4	0.1	322.0	2.37	17.80
14/11/2024 08:58	17.8	-0.5	319.0	2.52	17.60
14/11/2024 08:59	45.5	-1.3	64.1	4.01	15.90
14/11/2024 09:00	55.5	-1.6	39.6	4.59	15.00
14/11/2024 09:01	52.7	-1.6	48.7	4.42	15.20
14/11/2024 09:02	37.3	-1.7	114.0	3.60	16.20
14/11/2024 09:03	36.9	-1.8	160.0	3.66	16.20
14/11/2024 09:04	35.3	-1.8	182.0	3.59	16.30
14/11/2024 09:05	40.3	-1.9	302.0	4.19	15.30
Average	**22.5**	**0.7**	**231.2**	**2.25**	**17.87**

Referenced Data

	NOx mg/Nm3	SO2 mg/Nm3	CO mg/Nm3	CO2 vol%	O2 vol%
14/11/2024 08:35	43.93	0.15	462.40	1.73	18.50
14/11/2024 08:36	43.40	0.63	459.18	1.73	18.60
14/11/2024 08:37	42.87	0.63	451.12	1.71	18.60
14/11/2024 08:38	42.07	0.74	454.34	1.71	18.60
14/11/2024 08:39	41.81	0.44	455.95	1.72	18.60
14/11/2024 08:40	41.02	0.11	452.73	1.70	18.60
14/11/2024 08:41	40.75	0.26	451.12	1.70	18.60
14/11/2024 08:42	41.28	0.52	443.06	1.68	18.60
14/11/2024 08:43	41.54	1.22	438.23	1.69	18.60
14/11/2024 08:44	38.63	-0.41	370.56	1.67	18.60
14/11/2024 08:45	58.74	2.03	351.23	2.18	18.00
14/11/2024 08:46	60.07	4.46	377.01	2.05	17.90
14/11/2024 08:47	41.02	4.76	372.17	1.58	18.70
14/11/2024 08:48	40.75	6.67	378.62	1.58	18.70
14/11/2024 08:49	40.49	8.07	391.51	1.57	18.70
14/11/2024 08:50	41.54	9.81	406.01	1.61	18.60
14/11/2024 08:51	41.54	10.91	406.01	1.61	18.60
14/11/2024 08:52	41.28	11.76	404.40	1.59	18.70
14/11/2024 08:53	41.28	12.09	401.17	1.59	18.70
14/11/2024 08:54	41.54	12.98	399.56	1.59	18.70
14/11/2024 08:55	42.60	14.34	397.95	1.57	18.70
14/11/2024 08:56	40.75	19.02	323.84	1.31	18.80
14/11/2024 08:57	46.04	0.44	518.79	2.37	17.80
14/11/2024 08:58	47.10	-1.88	513.95	2.52	17.60
14/11/2024 08:59	120.40	-4.64	103.27	4.01	15.90
14/11/2024 09:00	146.86	-5.71	63.80	4.59	15.00
14/11/2024 09:01	139.45	-5.97	78.46	4.42	15.20
14/11/2024 09:02	98.70	-6.12	183.67	3.60	16.20
14/11/2024 09:03	97.64	-6.60	257.78	3.66	16.20
14/11/2024 09:04	93.41	-6.78	293.23	3.59	16.30
14/11/2024 09:05	106.64	-6.82	486.56	4.19	15.30
Average	**59.52**	**2.49**	**372.51**	**2.25**	**17.87**
Uncertainty of Measurement	**4.65**	**2.27**	**5.41**	**0.23**	**0.35**
Uncertainty as % of ELV	**1.16**	**0.45**	**-**	**-**	**-**
Standard Requirement	**<10%**	**<15%**	**<6%**	**<25%**	**<6%**



QGU-010-2013 Uncertainty calculation for Gaseous Measurement EN 14792 Nox

v4

Limit value	400	mg.m-3 (corrected) NO2	Gas	NO	
			Full Scale	500	ppm
Measured concentration	22.49	ppm	Cal gas conc	442.1	ppm
Measured concentration	46.18	mg.m-3 (corrected) NO2	Conversion	2.053	
Ratio NO/NO2	100.00		Full Scale	1026.5	mg.m-3 (NO2)
			Cal gas conc	907.631	mg.m-3 (NO2)

Correction for reference conditions				
		O2 %	Moisture, %	Pressure, KPa	Temperature, K
	ref	17.00	0.00	101.30	273.00
	measured	17.87	0.00	101.30	273.00
Factors		1.29	1.00	1.00	1.00
Correction Factor		1.29			

RECEIVED: 27/08/2025

Performance characteristics	Value				specification
Response time		30	seconds		180.000
Number of readings in measurement		30			
Repeatability at zero		0.03	% full scale		0.200
Repeatability at span level		0.06	% full scale		2.000
Deviation from linearity		0.2	% of value		2.000
Zero drift		0.02	% full scale		2.000
Span drift		-0.14	% full scale		2.000
volume or pressure flow dependence		0	% of full scale/kPa		0.033
atmospheric pressure dependence		0	% of value/kPa		0.750
ambient temperature dependence		0.3	% full scale/10K		0.300
NH3 (20 mg/m3)		0	mg/m3		
CO2 (15%)		0.209	% by vol		
H2O (30%)		0.0	% by vol		4.000
dependence on voltage		0.1	% full scale/10V		2%fs/10V
converter efficiency		95	%		95%
losses in the line (leak)		0.067857951	% of value		2% of value
Uncertainty of calibration gas		0.4	% of value		

Effect of drift		
0.14	mg/m3	0.01288
0.30	% value	

	ranges min	max	value at calib
flow	95	105	100
pressure	101.30	101.3	101.3
temp	289	289	283
NH3 range	0	0	0
CO2 range	0	15	0
H2O range	0	0	0
Instrument Voltage Rating			110
Voltage	93	121	110

Measurement performance related to stationary conditions

Performance characteristic			Uncertainty		Value of uncertainty quantity		
Standard deviation of repeatability at zero			U_{sc}		for mean		use rep at span
Standard deviation of repeatability at span level			U_{ss}		for mean		0.01
Lack of fit			U_{lf}				1.19
Drift			U_{Dd}				0.08
volume or pressure flow dependence			U_{Dpress}				0.00
atmopsheric pressure dependence			U_{Apress}				0.00
ambient temperature dependence			U_{Atemp}				0.18
NH3 (20 mg/m3)			U_{Interf}				0.00
CO2 (15%)							0.12
H2O (30%)							0.00
Dependence on voltage			U_{Volt}				0.09
Converter efficiency			U_{Conf}				1.33
losses in the line (leak)			U_{leak}				0.02
Uncertainty of calibration gas			U_{Calib}				0.11

Use largest negative or positive interferent effect	
0	0.00
0	0.12
0	0.00
0	0.12
Interference uncertainty	0.12

Measurement uncertainty		Result	46.18	mg/m³
Combined uncertainty			1.80	mg/m³
Expanded uncertainty	k =	2	3.61	mg/m³
Uncertainty corrected to std conds			4.65	mg.m-3 (corrected)
Expanded uncertainty	**expressed with a level of confidence of 95%**		**1.16**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**4.65**	**mg.m-3 at ELV**

QGU-008-2013 Uncertainty calculation for Gaseous Measurement SO2 EN TS 17021

V2 Jul-08

Limit value	500	**mg/m³ (corrected) SO2**	**Cal gas conc**	398.97	**mg.m⁻³**
Measured concentration	1.93	**mg/m3**	**Full Scale**	572	**mg/m³**
Measured concentration	2.49	**mg/m³ (Corrected)**			

Correction for reference conditions

		O2 %	Moisture, %	Pressure, KPa	Temperature, K
	ref	17.00	0.00	101.30	**273.00**
	measured	17.87	0.00	101.30	**273.00**
	Uncert	0.35	1.00	0.00	**1.00**
Factors		1.28	1.00	1.00	1.00
Uncertainty in factor		0.14	0.01	0.00	0.00
Correction Factor		**1.28**	uf	**0.14**	

Performance characteristics	**Value**				**specification**
Response time		160	seconds		180.000
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30			
Repeatability at zero		0.25	% full scale		<1 % range
Repeatability at span level		0.15	% full scale		<2 % range
Deviation from linearity		0.2	% of value		<2 % range
Zero drift		-0.15	% full scale		<2% range / 24hr
Span drift		-0.55	% full scale		<2% range/24hr
volume or pressure flow dependence		0.02	% of full scale/3 kPa		<2 % / 3 kPa
atmospheric pressure dependence		0.8	% of full scale/2 kPa		<3% / 2 kPa
ambient temperature dependence		0.01	% full scale/10K		<3% range / 10 K
N2O (mg/m3)	20	0.2	mg/m3		
CO_2 (% vol)	15	0.2	mg/m3		
CH_4 (mg/m3)	40	0.7	mg/m3		
H2O (% vol)	20	0.2	mg/m3		
dependence on voltage		0.1	% full scale/10V		<2% range
losses in the line (leak)		0.573476703	% of value		< 0.1%vol /10 volt
Uncertainty of calibration gas		1.4	% of value		< 2% of value

Effect of drift

-0.15	mg/m3
-6.17	% value

	ranges min	max	value at calib	
flow	0.3	0.5	0.4	l/hr
pressure	100.76	100.92	100.88	kPa
temp	287	288.5	287.5	K
N2O range	0	0	0	mg/m3
CO2 range	0	40	0	%vol
CH4 range	0	57	0	mg/m3
H2O range	0	1	0	%vol
Voltage	93	121	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		
Standard deviation of repeatability at zero			U_{zc}		for mean		use rep at span
Standard deviation of repeatability at span level			U_{rs}		for mean		0.03
Lack of fit			U_{lf}				0.66
Drift			U_{drf}				-0.09
volume or pressure flow dependence			U_{dpress}				0.00
atmopsheric pressure dependence			U_{dpress}				0.14
ambient temperature dependence			U_{dtemp}				0.00
N2O (mg/m3)			U_{mref}				0.00
CO2 (% vol)			U_{mref}				0.31
CH4 (mg/m3)			U_{mref}				0.58
H2O (% vol)			U_{mref}				0.01
Dependence on voltage			U_{dvolt}				0.49
losses in the line (leak)			U_{leak}				0.01
Uncertainty of calibration gas			U_{cstb}				0.02
Uncertainty in factor			uf				0.28

Use largest of sum of all positive or all negative influences

0.89	all +ves	Criteria	
0	all -ves	sum <4% range	
0.89	largest	0.038582323	

Value to use for intereference uncertainty

U_{int} 0.89

Measurement uncertainty		2.49	mg/m³
Combined uncertainty		0.89	mg/m³
Expanded uncertainty	k = 2	1.77	mg/m³
Uncertainty corrected to std conds		2.27	mg/m³
Expanded uncertainty	**expressed with a level of confidence of 95%**	**0.45**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**	**2.27**	**mg.m⁻³**
Expanded uncertainty	**expressed with a level of confidence of 95%**	**91.19**	**% value**

Uncertainty calculation for Gaseous Measurement CO

Limit value	-	**mg/m³ (corrected)**	**Cal gas conc**	190.5	**mg.m⁻³**
Measured concentration	289.01	**mg/m3**	**Full Scale**	250	**mg/m³**
Measured concentration	372.51	**mg/m³ (Corrected)**			

Correction for reference conditions

		O2 %	Moisture, %	Pressure, KPa	Temperature, K
	ref	17.00	0.00	101.30	**273.00**
	measured	17.87	0.00	101.30	**273.00**
	Uncert	0.35	1.00	0.00	**1.00**
Factors		1.28	1.00	1.00	1.00
Uncertainty in factor		0.14	0.01	0.00	0.00
Correction Factor		**1.28**	uf	**0.14**	

Performance characteristics	**Value**				**specification**
Response time		30	seconds		180.000
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30			
Repeatability at zero		0.25	% full scale		<1 % range
Repeatability at span level		0.15	% full scale		<2 % range
Deviation from linearity(lack of fit)		0.7	% of value		<2 % range
Zero drift		0.25	mg/m3		<2% range / 24hr
Span drift		-1.25	mg/m3		<2% range/24hr
volume or pressure flow dependence		0.02	% of full scale/3 kPa		<2 % / 3 kPa
atmospheric pressure dependence		0.8	% of full scale/2 kPa		<3% / 2 kPa
ambient temperature dependence		0.01	% full scale/10K		<3% range / 10 K
N_2O (mg/m3)	20	0.2	mg/m3		
CO_2 (% vol)	15	0.2	mg/m3		
CH_4 (mg/m3)	40	0.7	mg/m3		
H2O (% vol)	20	0.2	mg/m3		
dependence on voltage		0.1	% full scale/10V		<2% range
losses in the line (leak)		-0.59	% of value		< 0.1%vol /10 volt
Uncertainty of calibration gas		0.4	% of value		< 2% of value

Effect of drift	
-1.52	mg/m3
-0.61	% full scale

		ranges min	max	value at calib	
flow		95.00	105	100	kPa
pressure		100.76	100.92	100.88	kPa
temp		287	288.5	287.5	K
N2O range		0	40	0	mg/m3
CO2 range		0	15	0	%vol
CH4 range		0	57	0	mg/m3
H2O range		0	1	0	%vol
Voltage		93	121	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**mg/m3**
Standard deviation of repeatability at zero			U_{ao}		for mean		use rep at span
Standard deviation of repeatability at span level			U_{as}		for mean		0.07
Lack of fit			U_{lf}				1.17
Drift			U_{drift}				-0.88
volume or pressure flow dependence			U_{dpress}				0.05
atmospheric pressure dependence			U_{dpress}				0.06
ambient temperature dependence			U_{dtemp}				0.00
N2O (mg/m3)			U_{mref}				0.23
CO2 (% vol)			U_{mref}				0.12
CH4 (mg/m3)			U_{mref}				0.58
H2O (% vol)			U_{mref}				0.01
Dependence on voltage			U_{dvolt}				0.22
losses in the line (leak)			U_{dleak}				-0.99
Uncertainty of calibration gas			U_{calib}				0.67

Use largest of sum of all positive or all negative influences

0.93	all +ves	Criteria
0	all -ves	sum <4% range
0.93	largest	5.78016129

Value to use for intereference uncertainty

U_{int} 0.93

Measurement uncertainty				
Combined uncertainty			2.11	mg/m³
Expanded uncertainty	k =	2	4.23	mg/m³
Uncertainty corrected to std conds			**5.41**	**mg/m³**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.00**	**% ELV**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**5.41**	**mg.m⁻³**

QGU-007-2013 Uncertainty calculation for Gaseous Measurement Carbon Dioxide

V2.2 Jul-08

Limit value	n/a	%vol	**Calibration gas**	0.161	%vol
Measured concentration	2.25	%vol	**Full Scale**	25	%vol

Performance characteristics	**Value**				**specification**
Response time		30	seconds		< 200 s
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30	Assuming 1 minute collected over 1 hour		
Repeatability at zero		0.015	% by volume	stdev	<0.2 % range
Repeatability at span level		0.014	% by volume	stdev	<0.4 % range
Deviation from linearity		0.13	% vol	+/-	<0.3 % volume
Zero drift (during measurement period)		0	% vol at zero level	+/-	<2% of volume / 24hr
Span drift (during measurement period)		0	% vol at span level	+/-	<2% volume/24hr
volume or pressure flow dependence		0	% of fs / 10l/h	+- 5 l/h	<1% range
atmospheric pressure dependence		0.3	% of fs/kPa	+- 2kPa	< 1.5 % range
ambient temperature dependence		-0.07	% by volume /10K	+- 15K	<0.3% volume 10 K
CO_2 (% vol)	15	0.07	% by volume per	15	
NO (mg/m3)	300	0.02	% by volume per	300	
NO_2 (mg/m3)	30	0	% by volume per	30	
Combined interference		0.56	% range		<2% range
Dependence on voltage		0.1	% by volume /10V	+- 5%	< 0.1%vol /10 volt
Losses in the line (leak)		0	% of value		< 2% of value
Uncertainty of calibration gas		0.5	% of value		

Effect of drift	
0.00	% vol
0.00	% value

	range of variation from conditions at calibration			
	min	max	value at calib	
flow	5	15	10	l/h
pressure	99.00	101	100	kPa
temp	280	285	285	K
CO_2 range	8	15	0	% vol
NO range	100	150	0	mg/m3
NO_2 range	5	7.5	0	mg/m3
Voltage	105	115	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**% vol**
Standard deviation of repeatability at zero			U_{ro}		for mean		Only use rep at span
Standard deviation of repeatability at span level			U_{rs}		for mean		0.00
Lack of fit			U_{lf}				0.08
Drift			U_{drift}				0.00
volume or pressure flow dependence			U_{dpress}				0.00
atmospheric pressure dependence			U_{dpress}				0.04
ambient temperature dependence			U_{dtemp}				-0.02
CO_2							0.05
NO							0.01
NO_2							0.00
Combined interference (from mcerts)							0.08
dependence on voltage			U_{dvolt}				0.03
losses in the line (leak)			U_{loss}				0.00
Uncertainty of calibration gas			U_{calib}				0.01

Use largest of sum of all positive or all negative influences

0.06	all +ves	Criteria
0	all -ves	sum <2% value
0.06	largest	0.045045161

Value to use for intereference uncertainty

U_{int} 0.05

Measurement uncertainty			2.25	%vol
Combined uncertainty			0.11	%vol
% of value			5.01	%
Coverage factor k =	2			
Expanded uncertainty	**expressed with a level of confidence of 95%**		**10.03**	**% of value**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.23**	**% vol**

QGU-007-2013 Uncertainty calculation for Gaseous Measurement Oxygen EN14789

V2.2 Jul-08

Limit value	n/a	%vol	**Calibration gas**	**0.209**	%vol
Measured concentration	17.87	%vol	**Full Scale**	**0.25**	%vol

Performance characteristics	**Value**				**specification**
Response time		30	seconds		< 200 s
Logger sampling interval		60	seconds		
Measurement period		30	minutes		
Number of readings in measurement		30	Assuming 1 minute collected over 1 hour		
Repeatability at zero		0.015	% by volume	stdev	<0.2 % range
Repeatability at span level		0.014	% by volume	stdev	<0.4 % range
Deviation from linearity		0	% vol	+/-	<0.3 % volume
Zero drift (during measurement period)		0.0004	% vol at zero level	+/-	<2% of volume / 24hr
Span drift (during measurement period)		-0.0002	% vol at span level	+/-	<2% volume/24hr
volume or pressure flow dependence		0	% of fs / 10l/h	+- 5 l/h	<1% range
atmospheric pressure dependence		0.3	% of fs/kPa	+- 2kPa	< 1.5 % range
ambient temperature dependence		-0.07	% by volume /10K	+- 15K	<0.3% volume 10 K
CO_2 (% vol)	15	0.07	% by volume per	15	
NO (mg/m3)	300	0.02	% by volume per	300	
NO_2 (mg/m3)	30	0	% by volume per	30	
Combined interference		0.56	% range		<2% range
Dependence on voltage		0.1	% by volume /10V	+- 5%	< 0.1%vol /10 volt
Losses in the line (leak)		0.622009569	% of value		< 2% of value
Uncertainty of calibration gas		0.35	% of value		

Effect of drift	
0.00	% vol
0.00	% value

	range of variation from conditions at calibration			
	min	max	value at calib	
flow	5	15	10	l/h
pressure	99.00	101	100	kPa
temp	280	285	285	K
CO_2 range	8	15	0	% vol
NO range	100	150	0	mg/m3
NO_2 range	5	7.5	0	mg/m3
Voltage	105	115	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**% vol**
Standard deviation of repeatability at zero			u_{ro}		for mean		Only use rep at span
Standard deviation of repeatability at span level			u_{rs}		for mean		0.00
Lack of fit			u_{lf}				0.08
Drift			u_{drift}				0.00
volume or pressure flow dependence			u_{dpress}				0.00
atmospheric pressure dependence			u_{dpress}				0.04
ambient temperature dependence			u_{dtemp}				-0.02
CO_2							0.05
NO							0.01
NO_2							0.00
Combined interference (from mcerts)							0.08
dependence on voltage			u_{dvolt}				0.03
losses in the line (leak)			u_{loss}				0.13
Uncertainty of calibration gas			u_{calib}				0.03

Use largest of sum of all positive or all negative influences

0.06	all +ves	Criteria	
0	all -ves	sum <2% value	
0.06	largest		0.22

Value to use for intereference uncertainty

u_{int} 0.06

Measurement uncertainty			17.87	%vol
Combined uncertainty			0.17	%vol
% of value			0.97	%
Coverage factor k =	2			
Expanded uncertainty	**expressed with a level of confidence of 95%**		**1.93**	**% of value**
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.35**	**% vol**

Appendix III: Certificates and Process Detail Form

Process details form information not made available from Licensee at time of reporting. Details can be obtained direct from the client.

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

CERTIFICATE OF ANALYSIS

Customer Name:	Harringtons Claregalway	Certificate number:	24-10070
		Issue number:	1
Customer order:	HACLDB141124	Date of issue:	22/11/2024
Date tested:	14/11/2024		
Date received:	18/11/2024		
Date started:	19/11/2024		
Date completed:	20/11/2024		

Description: 1 liquid sample, 1 solid sample
Test methods: Details available on request (refer to SOP code against relevant result/s)

Determinand	Filter number	LOD	Units	Code	SOP	Stack	Filter result	Wash Result
Particulates	2263	0.07	mg	I	2750	AP1	15.03	
Particulates		0.3	mg	I	2750			4.20

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.408T

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

DEVIATING SAMPLES

Report number: 24-11070

Customer order No : HACLDB141124

Date sampling:	Stack:	Deviating:	Accredited Test
14/11/2024	AP1	N/a	Yes

Samples submitted may be declared to be deviating.Where applicable the analysis method remains accredited, however results reported for a deviating sample may be compromised.Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submisson may be required.

Key code	Description
N	Not accreditated test
I	Inab accreditated test
SI	Subcontracted to approved laboratory INAB Accredited for the test

Determinand	Uncertainty
Particulates (Filter)	2.52%
Particulates (Wash)	2.52%

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

CERTIFICATE OF ANALYSIS

Customer Name:	Harringtons Claregalway	Certificate number:	24-11071
		Issue number:	1
Customer order:	HACLDB141124	Date of issue:	22/11/2024
Date tested:	14/11/2024		
Date received:	18/11/2024		
Date started:	19/11/2024		
Date completed:	20/11/2024		

Description: 1 liquid sample, 1 solid sample
Test methods: Details available on request (refer to SOP code against relevant result/s)

Determinand	Filter number	LOD	Units	Code	SOP	Stack	Filter result	Wash Result
Particulates	2273	0.07	mg	I	2750	Blank	<0.07	
Particulates		0.3	mg	I	2750			<0.3

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.408T

Axis Environmental Services Ltd.
Unit 3
Westlink Business Park
Ennis Road
Clondrinagh
Limerick

DEVIATING SAMPLES

Report number: 24-11071

Customer order No : HACLDB141124

Date sampling:	Stack:	Deviating:	Accredited Test
14/11/2024	Blank	N/a	Yes

Samples submitted may be declared to be deviating.Where applicable the analysis method remains accredited, however results reported for a deviating sample may be compromised.Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submisson may be required.

Key code	Description
N	Not accreditated test
I	Inab accreditated test
SI	Subcontracted to approved laboratory INAB Accredited for the test

Determinand	Uncertainty
Particulates (Filter)	2.52%
Particulates (Wash)	2.52%

Data Report 4

Q1 (2024)

Section 4 Discharge Licence W/502/22

(issued 7th June 2023)

at

Harrington Concrete and Quarries Ltd

Ardgaineen, Claregalway, Co. Galway

Prepared by Consultant Dr. Pamela Bartley, Hydro-G

Hydro-G

50 Henry St.

Galway

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Project No.: 25-14 Harringtons Ardgaineen

Report Status: ISSUE_V1

Report Title: Data Report 4: Q1 (2024) Harringtons Concrete and Products Ltd. Discharge Licence W/502/22.

Prepared by: _____

Dr. Pamela Bartley B.Eng, M.SC., Ph.D.

NOTES:

This report is for the use solely of the party to whom it is addressed and no responsibility is accepted to any third party.

About the Author

Pamela Bartley is a water focussed civil engineer. She has 30 years of field-based practice in borehole drilling, groundwater monitoring and abstraction point management in limestone karst environments. Her Ph.D was a field based karst limestone environment study. She has also completed training with the GSI at their karst specialist course run in the Burren. Her primary qualification is a Diploma in Water and Wastewater Technology at Sligo RTC. She then completed her primary degree in Civil Engineering at Queens University, Belfast, followed by an M.Sc. in Environmental Engineering, followed by a field-based hydrogeologically focussed Ph.D. within the School of Civil Engineering at Trinity College, Dublin. Her key work areas are groundwater development from large scale water supply boreholes, hydrogeological assessment of quarries and the evaluation of discharges to groundwater and surface waters. Pamela Bartley's company is Bartley Hydrogeology ltd., registered to trade as Hydro-G.

Pamela has successfully completed post doctorate 'Professional Development' formal course training in the areas of:

- PSDP & PSCS (IOSH certified, 2016);
- Karst Hydrogeology (GSI, 2013);
- On Site Wastewater & Water Services Amendment Act 2012 (IE, Western Region 6-week programme 2012 & Dublin 2012);
- Zero Discharge Willow Wastewater Systems Design Courses (Denmark 2008 & 2011 & Ireland 2012);
- Expert Witness (IE, 2011);
- Planning & Development Act (IE, 2010);
- Surface Water Regulations 2009 (DoE, 2010 & 2011);
- Sustainable Drainage (Wallingford/CIRIA, 2005 & 2008);
- Source Protection Zone Delineation (IGI/GSI, 2007);
- Groundwater & Contaminant Microbiology (IGI/GSI, 2006);
- Applied Groundwater Modelling (ESI, UK, 2000);
- Site Suitability Assessment (FETAC, 2002).

As a result of work in evaluating planning appeals, Pamela has become specialist in planning evaluations in the context of enacted Irish Regulation and EU Directives concerning the water environment such as the Groundwater Regulations (S.I. No. 9 of 2010), Surface Water Regulations (S.I. No. 272 of 2009), Water Framework and Habitats' Directives. Pamela is a qualified and certified 'Site Assessor' and interviewer of examination candidates in respect of eligibility for the Site Suitability FETAC Qualification. In the past, she has lectured in third level institutions (WIT, CIT, 1996 – 1999), delivered practical laboratory instruction in the assessment of subsoils for the FETAC Site Assessor programme and demonstrated hydraulics laboratory modules at Trinity College Dublin (1996). She has been an invited guest speaker at An Board Pleanála, The Irish Concrete Federation, The Health Service Executive, Environmental Health Officers National Conference, The Irish Planning Institute's National Conference, The International Association of Hydrogeologists National Conference (Irish Branch) and has delivered hydrogeological lectures to the public during Science Week.

Hydro-G is the registered trading name of Pamela Bartley's company Bartley Hydrogeology Ltd., a company registered in Galway Ireland. The company holds requisiteemployer's and public liabilityinsurances. In addition, the company holds professional indemnity insurance of €2million.

Pamela is qualified and IOSH certified to act as PSDP (Project Supervisor Design Phase) & PSCS (Project Supervisor Construction Stage) as defined by the Construction Regulations. The company is a registered Irish Water Supplier (no. 1855) and Pamela Bartley is HSQE approved within Irish Water.

Contents

1.0 Introduction

Hydro G was commissioned by Harringtons Concrete and Products Ltd to prepare a Data Report for the **1st Quarter 2024** Discharge Licence in place for the quarry operation at Ardgaineen, Claregalway, Co. Galway (Galway County Council Licence Ref. No: W/502/22, issued 7th June 2023). This report has been prepared to fulfil this requirement and pertains to the **4th** reporting period since the Licence was issued.

It is acknowledged that Licence W/502/22 stipulates return of results on a Quarterly basis and this practice will be put in place going forward.

2.0 Discharge Licence Conditions

Licence conditions relevant to this report include the following:

1. Scope

This Licence refers to the attenuation sump discharge of Harrington Concrete and Quarries located at Ardgaineen, Claregalway, Co. Galway. Surface water run-off and ground water collected in the quarry attenuation sump are pumped to a Wetland Vegetation Area, *via* a petrol/oil interceptor, where water percolates to ground. This licence is for the exiting extraction are of 4.35ha granted under Substitute Consent (Ref SU0053) in February 2017. If planning permission is granted for an extension to the quarry, or there is an increase in quarrying discharge, a full review of this licence will be required. **The maximum permitted discharge is 1,483m3 per day.**

2. Attenuation Sump Discharge.

2.1 **Discharge:** The Licencee shall not discharge, cause or permit the discharge, of any contaminated surface water or process water directly to any surface water or groundwater without prior treatment.

2.2 **Treated Discharge:** The discharge shall be discharged to groundwater without posing a pollution risk.

2.3 **Discharge Performance Standards:** The treated discharge, **prior to its release** to the Wetland Vegetation Area, shall comply with the following standards:

(a) The **Total Suspended Solids** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 10 mg/l.

(b) The **Biochemical Oxygen Demand** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 10 mg/l.

(c) The **Chemical Oxygen Demand** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 15 mg/l.

(d) The **Nitrate (NO_3-)** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 18 mg/l.

(e) The **Nitrite (NO_2-)** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.05 mg/l.

(f) The **Total Hydrocarbon** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.01 mg/l.

(g) The **Total Ammonia** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.03mg/l.

(h) The **Benzo (a) pyrene** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.00001 mg/l.

(i) The **Total PAH** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.00001 mg/l.

(j) The **pH** of the Discharge from the attenuation sump and oil interceptor shall be in the range 6 - 9 pH units.

(k) The **Flow** of the Discharge from the attenuation sump and oil interceptor shall not exceed 1,483 m3/day.

(l) The **Colour** of the Discharge from the attenuation sump should not change significantly from day to day nor shall there be any evidence of oil or excess solids on visual inspection.

(m) The **Conductivity** of the Discharge from the attenuation sump and oil interceptor shall not change significantly from day to day.

(n) The **Turbidity** of the Discharge from the attenuation sump and oil interceptor shall not change significantly from day to day.

3. Discharge Analysis

Analysis of the treated water prior to discharge shall be carried out by an approved accredited laboratory where readings are not taken on site. The frequency of analysis and the parameters are outlined below. Quarterly results shall be forwarded to the environment section.

Parameter	Monitoring Frequency	Analysis to be performed by accredited laboratory
Flow	Continuous - Daily	
Colour and Visual inspection	Daily	
Conductivity	Continuous - Daily	
Turbidity	Continuous - Daily	
pH	Continuous - Daily	
Total Suspended Solids	Quarterly	√
Nitrates NO_3	Quarterly	√
Nitrites NO_2	Quarterly	√
Chemical Oxygen Demand	Quarterly	√
Biochemical Oxygen Demand	Quarterly	√
Total Ammonia	Quarterly	√
Total PAH	Quarterly	√
Benzo (a) Pyrene	Quarterly	√
Total Hydrocarbons including Diesel Range Organics and Petroleum Range Organics	Quarterly	√

4. Groundwater Analysis

Quarterly analysis of groundwater monitoring wells will be carried out be an approved accredited laboratory. The following parameters shall be measured and analysis of same forwarded to the Environment Section of Galway County Council:

Parameter	Units
(a) Water Level	mAOD
(b) pH	pH units
(c) Conductivity	uS/cm
(d) Suspended Solids	mg/l
(e) Nitrates	mg/l No_3^-
(f) Total Hydrocarbons	mg/l

Where quarrying activities are found to adversely affect local water supplies the provisions of the EPA Environmental Management Guidelines 'Environmental Management in the Extractive Industry (non-scheduled Minerals)', Section 3.3.1 shall apply, and the quarry shall provide a replacement water supply.

5. Petrol / Oil Interceptor

The petrol / oil interceptor should be inspected each working day to ensure it is operating correctly and daily records kept of this. These records should be made available to Galway County Council if requested.

Other matters in the licence include details about the following. Readers are referred to the Licence itself for specific detail.

6. Attenuation sump, petrol/oil interceptor & wetland area

6.1 Treatment Process – must be able to achieve the Treatment Standards of Condition 2.3.
6.2 Metering – Install Flow Meter, record Daily Discharge, report Quarterly. Limit 1,483m3/d.
6.3 Ready Access – must be allowed for Authorised Persons under the Water Pollution Acts.
6.4 Sampling – Sampling Chamber after treatment and before wetland. Plus access required.
6.5 Caretaker – Day to Day Inspection. Notified Person named and details supplied to GCC.
6.6 Notification of Non-Compliance – Make GCC aware, record details of noncompliance.

7. EPA Guidelines

All works must be carried out in accordance with the EPA Guidelines 'Environmental Management Guidelines 'Environmental Management in the Extractive Industry (non-scheduled Minerals)'.

8. Annual Contribution

€550 due annually. Shall be adjusted with the Customer Price Index value. GCC can increase.

9. Changes in Ownership

GCC to be notified in writing if change in company ownership or Trading Name.

3.0 Person Responsible for Caretaking at the Site

Mr. John Gibbons, the quarry manager, is responsible for inspections and maintenance of the infrastructure associated with the discharge. Mr. Gibbons' contact details are on file with Galway County Council.

4.0 Site Data - Monitoring Results

4.1 Flow Data

The site's flow was fully automated on the 7th of February 2024. Results are presented in Table 1.

Table 1 Daily discharge volumes (m3/d) Q1 2024 & Statistics: Max, Min, Mean Daily

2024	Q1 (m3/d) Totals			ELV MAX
Day	Jan-24	Feb-24	Mar-24	(m3/d)
1			364.56	1,438
2			380.31	1,438
3			380.01	1,438
4			355.74	1,438
5			351.85	1,438
6			350.39	1,438
7		21.24	351.63	1,438
8		203.22	357.42	1,438
9		287.87	377.74	1,438
10		289.96	375.97	1,438
11		289.77	343.63	1,438
12		291.96	347.18	1,438
13		296.01	339.32	1,438
14		290.89	347.79	1,438
15		289.83	340.46	1,438
16		287.16	357.00	1,438
17		328.01	358.05	1,438
18		328.52	359.58	1,438
19		302.88	354.14	1,438
20		341.22	354.44	1,438
21		362.79	355.21	1,438
22		364.72	355.07	1,438
23		365.56	358.72	1,438
24		381.46	358.27	1,438
25		381.32	353.60	1,438
26		353.21	351.05	1,438
27		345.99	347.74	1,438
28		356.41	346.40	1,438
29		350.04	349.54	1,438
30			348.01	1,438
31			346.26	1,438
MAX m3/d	Site Not Instrumented	381	380	m3/d
MIN m3/d		21	339	
AVERAGE m3/d		309	355	

4.2 Discharge Water's Quality Data

As is required by Licence W/502/22, the site monitors water quality of the final discharge from the site on a Quarterly basis. The laboratory Certificate of Analysis is presented in Appendix A.

Discharge water's quality results are presented in Table 2 with each parameter's ELV for the monitoring period.

Table 2 Ardgaineen Quarry Final Discharge Quality Q1 2024.

Green Highligt in Cells = Compliant			
			Q1 2024 February
Parameter:	**Units**	**W/502/22 Emission Limit Value**	**06 February 2024**
Hydrogen Ion (pH)	pH units	6 to 9	8.0
Biological Oxygen Demand (BOD)	mg/L	10.0	< 1.0
Suspended Solids	mg/L	10	<4
Ammonium	mg/L N	0.03	0.04
Nitrate	mg/L N	18.00	not reported
Nitrite	mg/L N	0.05	not reported
Chemical Oxygen Demand (COD)	mg/L	15	<10
Benzo(a)pyrene	µg/L	0.1	not reported
Total Hydrocarbons	µg/L	10	not reported
Total PAHs	µg/L	0.1	not reported
Southern Scientific Laboratory Reference			118896 (24-38390)

With reference to the results presented in Table 1, and the associated Certificates of Analysis in Appendix A, commentary is as follows:

- The pH of the Discharge is 8pH and this is within the 6 to 9 pH Emission Limit Value.
- The discharge's results are below the limit of detection of the laboratory analyser for BOD, Suspended Solids and COD. This suggests very good Discharge Quality. Therefore, the results are compliant with the Licence ELVs for BOD, SS and COD.
- Ammonium concentration was 0.04 mg/l, which is SLIGHTLY elevated above the Emission Limit Value of 0.03 mg/l. However given that BOD and COD were <LOD of the laboratory, no environmental impact is envisaged.
- The laboratory did not analyse all of the requested parameters: Nitrate, Nitrite, Benzo(a)pyrene, PAHs, Hydrocarbons parameters. The site continues to try to get the laboratory to analyse all parameters requested.

4.3 Continuous Data Recording

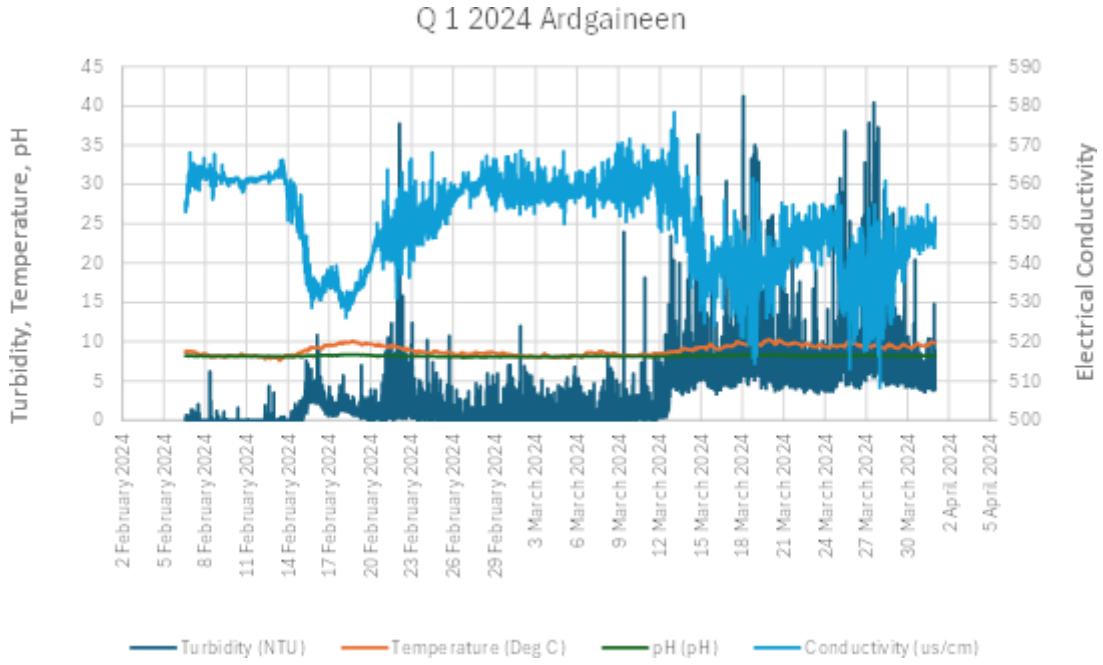
The site's discharge is now instrumented with a continuous flow meter with physiochemical sensors for parameters as specified in the Licence as follows:

- Flow
- pH
- Turbidity
- Conductivity

Data are collected at 5 minute intervals and reported to the service provider's telemetric data service HydroVU. The data service provider is Capital Water Solutions Limited, Co. Roscommon.

The quarry manager is responsible for daily log in to the telemetric system, visual inspections of the discharge and day to day management.

The full data record is held in excel file format in Hydro-G's offices because there are many rows associated with 5 minute intervals for excel rows of data for the reporting period. A graphical presentation of the data is shown in Graph 1, below.



Graph 1 Continuous record for field physiochemical parameters.

The results for continuous monitoring show, as follows:

- Turbidity increases when the pumps start and this is a normal and expected phenomenon associate with the turbid flow condition in pipes. There is no environmental significance to the range of results returned.
- Temperature signal is normal with an average concentration of <10oC.
- pH is relatively constant and within the 6 to 9 pH units ELV of the Licence.
- Electrical Conductivity is within the expected range for a limestone environment.
- The instruments naturally 'drift' but this is expected and will be routinely rectified.

4.4 Groundwater Data

Condition 4 of the Licence states that "Quarterly analysis of groundwater monitoring wells will be carried out be an approved accredited laboratory". However, there are no wells on the operational quarry to which the Discharge Licence relates. Hydro-G has previously

reported 11 Site Investigation boreholes on the floor of the quarry and none of those boreholes encountered groundwater strike.

There are site investigation greenfield boreholes for the lands to the east of the quarry but they are not within the operational quarry.

The "1. Scope" detail of the Opening of W/502/22 Discharge Licence states that:

> "*This licence is for the exiting extraction are of 4.35ha granted under Substitute Consent (Ref SU0053) in February 2017. If planning permission is granted for an extension to the quarry, or there is an increase in quarrying discharge, a full review of this licence will be required.*"

Given that there have been no successful groundwater strikes in 11 boreholes attempted within this quarry because the limestone is the competent Burren Formation Limestone. The aquifer is mapped as a Regionally Important Karst Conduit Aquifer. No groundwater transmissive conduits were discovered in the drilling completed on the floor of the operational quarry. Therefore there is nothing to report with respect to this Condition of the Licence.

5.0 Compliance with Licence Conditions

5.1 With respect to the Volumetric ELV Conditions: The site's flow is now fully recorded. Data presented in Table 1 suggests that the mean daily discharge is compliant with the specified ELV for mean daily volume of 1,483 m3/d, on an annual average basis. Discharge values ranged from 21m3/d to 381m3/d with an average of 325m3/d.

5.2 With respect to Water Quality ELVs: Results presented in Table 2 indicates that the prescribed ELVs were complied with for all parameters analysed except Ammonia, which was slightly elevated above the 0.03 mg/l ELV. However, given that the BOD and COD were less than the Limit of Detection of the Laboratory Analyser. Therefore, no potential for environmental impact is envisaged.

6.0 Difficulties Encountered

6.1 As part of previous evaluations, Hydro-G supervised the drilling of eleven boreholes on the floor of the quarry and no groundwater was encountered. Therefore, there is no groundwater quality to report.

6.3 The laboratory has still not accepted the requirement for analysis of the full list of parameters listed in the discharge Licence. Therefore, some parameters have not yet been analysed. The site continues to attempt to get the list analysed.

7.0 Register of Incidents

Apart from issues with the laboratory and the requested list of parameters, there were no 'serious incidents' to report with respect to this discharge during this reported period.

8.0 Conclusions

The site is in compliance with those Conditions of the Section 4 Discharge Licence W/502/22 that have been quantified at this time, with the exception of a small exceedance for Ammonium. The result reported by the laboratory was 0.04 mg/l when the ELV is 0.03 mg/l. However given that BOD and COD were both <LOD of the analyser, no environmental impact is envisaged. This parameter will be closely monitored going forward.

Pamela Bartley

Dr. Pamela Bartley B.Eng, M.SC., Ph.D. MIEI

Appendix A

Laboratory Certificates of Analysis

Routine Quarterly Monitoring at the Site

Certificate of Analysis

Customer:	Harrington Concrete and Quarries	**Project:**	Surface Water - GWD-1
Address:	Kilkelly Co Mayo	**Site**	
		Date Received:	07/02/2024
		Condition of Sample:	Satisfactory
Report to:	Amanda Tarpey	**Date Analysed:**	07/02/2024 - 14/02/2024
Customer PO		**Issue Date:**	22/02/2024
Quote No.		**BATCH NUMBER:**	**24-38390**

Jake Grunfield
Laboratory Analyst

Index to symbols used & Notes

*	Analysis is not INAB accredited
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	Customer specific limits
(F)	Analysis carried out at our Farranfore Laboratory.
(D)	Analysis carried out at our Dunrine Laboratory.
LOQ	Parameter Limit of Quantification
Note 6	Subcontracted Parameter.

Notes

- **The results relate only to the items tested.**
- **Opinions and interpretations expressed herein are outside the scope of INAB accreditation.**
- **The analysis report shall not be reproduced except in full without written approval of the laboratory.**
- **Sampling is outside the scope of the laboratory activities.**

Notes for Drinking Water samples

Note A	The water should not be aggressive
Note B	Compliance must be ensured with the conditions that [NO3]/50 + [NO2]/3 =1
Note C	Acceptable to customers and no abnormal change
Note D	In the case of surface water treatment, a parametric value not exceeding 1 NTU in the water ex treatment works must be strived for
Note F	Fluoridated supplies 0.8 mg/L; Natural supplies 1.5 mg/L

Customer Sample Ref:	GWD-1	**Customer Sample Code:**	
Project:	Surface Water - GWD-1	**Sampled By:**	Harrington Concrete
Our Reference:	118896 (24-38390)	**Sample Matrix:**	Surface Water
Date Sampled:	06/02/2024	**Time Sampled:**	15:00

Method:	Parameter:	Units	LOQ	Result
	Chemical Analysis: (F)			
SCP 052	Hydrogen Ion (pH)	pH units	*4.0*	8.0
SCP 015	Biological Oxygen Demand (BOD)	mg/L	*1.0*	< 1.0
SCP 010	Suspended Solids	mg/L	*2*	< 4
SCP 027A	Total Ammonia	mg/L N	*0.02*	0.04
SCP 027B	Chloride	mg/L	*0.5*	14.4
SCP 027D	Sulphate	mg/L	*0.5*	21.1
SCP 053A/053D	Calcium (Ca)	mg/L	*1.0*	105.0
SCP 053A/053D	Magnesium (Mg)	mg/L	*0.2*	7.5
SCP 053A/053D	Potassium (K)	mg/L	*1.0*	3.6
SCP 053A/053D	Sodium	mg/L	*1*	10
SCP 016	Chemical Oxygen Demand (COD)	mg/L	*10*	< 10
SCP 044	Total Phosphorus	mg/L P	*0.04*	< 0.04
SCP 065A	Total Nitrogen	mg/L	*0.5*	1.9
SCP 053B/053D	Iron	µg/L	*10*	< 10
SCP 053B/053D	Manganese	µg/L	*2*	3

Appendix B

Entire Record of Results Reported

Green Highligt in Cells = Compliant						
			Q2 2023	Q3 2023	Q4 2023	Q1 2024 February
Parameter:	**Units**	**W/502/22 Emission Limit Value**	**07 June 2023**	**04 July 2023**	**04 December 2023**	**06 February 2024**
Hydrogen Ion (pH)	pH units	**6 to 9**	8.0	8.1	7.8	8.0
Biological Oxygen Demand (BOD)	mg/L	**10.0**	< 1.0	< 1.0	1.2	< 1.0
Suspended Solids	mg/L	**10**	< 4	< 4	< 4	<4
Ammonium	mg/L N	**0.03**	0.03	< 0.02	0.03	**0.04**
Nitrate	mg/L N	**18.00**	1.47	1.22	1.73	not reported
Nitrite	mg/L N	**0.05**	0.012	< 0.005	< 0.005	not reported
Chemical Oxygen Demand (COD)	mg/L	**15**	< 10	< 10	< 10	<10
Benzo(a)pyrene	µg/L	**0.1**	not analysed	not analysed	not analysed	not reported
Total Hydrocarbons	µg/L	**10**	not analysed	not analysed	not analysed	not reported
Total PAHs	µg/L	**0.1**	not analysed	not analysed	not analysed	not reported
Southern Scientific Laboratory Reference			93347 (23-29240)	96104 (23-30235)	113177 (23-36432)	118896 (24-38390)

Data Report 5

Q2 (2024)

Section 4 Discharge Licence W/502/22

(issued 7th June 2023)

at

Harrington Concrete and Quarries Ltd

Ardgaineen, Claregalway, Co. Galway

Prepared by Consultant Dr. Pamela Bartley, Hydro-G

Hydro-G

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Project No.: 25-14 Harringtons Ardgaineen

Report Status: ISSUE_V1

Report Title: Data Report 5: Q2 (2024) Harringtons Concrete and Products Ltd. Discharge Licence W/502/22.

Pamela Bartley

Prepared by: _____

Dr. Pamela Bartley B.Eng, M.SC., Ph.D.

NOTES:

This report is for the use solely of the party to whom it is addressed and no responsibility is accepted to any third party.

About the Author

Pamela Bartley is a water focussed civil engineer. She has 30 years of field-based practice in borehole drilling, groundwater monitoring and abstraction point management in limestone karst environments. Her Ph.D was a field based karst limestone environment study. She has also completed training with the GSI at their karst specialist course run in the Burren. Her primary qualification is a Diploma in Water and Wastewater Technology at Sligo RTC. She then completed her primary degree in Civil Engineering at Queens University, Belfast, followed by an M.Sc. in Environmental Engineering, followed by a field-based hydrogeologically focussed Ph.D. within the School of Civil Engineering at Trinity College, Dublin. Her key work areas are groundwater development from large scale water supply boreholes, hydrogeological assessment of quarries and the evaluation of discharges to groundwater and surface waters. Pamela Bartley's company is Bartley Hydrogeology ltd., registered to trade as Hydro-G.

Pamela has successfully completed post doctorate 'Professional Development' formal course training in the areas of:

- PSDP & PSCS (IOSH certified, 2016);
- Karst Hydrogeology (GSI, 2013);
- On Site Wastewater & Water Services Amendment Act 2012 (IE, Western Region 6-week programme 2012 & Dublin 2012);
- Zero Discharge Willow Wastewater Systems Design Courses (Denmark 2008 & 2011 & Ireland 2012);
- Expert Witness (IE, 2011);
- Planning & Development Act (IE, 2010);
- Surface Water Regulations 2009 (DoE, 2010 & 2011);
- Sustainable Drainage (Wallingford/CIRIA, 2005 & 2008);
- Source Protection Zone Delineation (IGI/GSI, 2007);
- Groundwater & Contaminant Microbiology (IGI/GSI, 2006);
- Applied Groundwater Modelling (ESI, UK, 2000);
- Site Suitability Assessment (FETAC, 2002).

As a result of work in evaluating planning appeals, Pamela has become specialist in planning evaluations in the context of enacted Irish Regulation and EU Directives concerning the water environment such as the Groundwater Regulations (S.I. No. 9 of 2010), Surface Water Regulations (S.I. No. 272 of 2009), Water Framework and Habitats' Directives. Pamela is a qualified and certified 'Site Assessor' and interviewer of examination candidates in respect of eligibility for the Site Suitability FETAC Qualification. In the past, she has lectured in third level institutions (WIT, CIT, 1996 – 1999), delivered practical laboratory instruction in the assessment of subsoils for the FETAC Site Assessor programme and demonstrated hydraulics laboratory modules at Trinity College Dublin (1996). She has been an invited guest speaker at An Board Pleanála, The Irish Concrete Federation, The Health Service Executive, Environmental Health Officers National Conference, The Irish Planning Institute's National Conference, The International Association of Hydrogeologists National Conference (Irish Branch) and has delivered hydrogeological lectures to the public during Science Week.

Hydro-G is the registered trading name of Pamela Bartley's company Bartley Hydrogeology Ltd., a company registered in Galway Ireland. The company holds requisiteemployer's and public liabilityinsurances. In addition, the company holds professional indemnity insurance of €2million.

Pamela is qualified and IOSH certified to act as PSDP (Project Supervisor Design Phase) & PSCS (Project Supervisor Construction Stage) as defined by the Construction Regulations. The company is a registered Irish Water Supplier (no. 1855) and Pamela Bartley is HSQE approved within Irish Water.

Contents

1.0 Introduction

Hydro G was commissioned by Harringtons Concrete and Products Ltd to prepare a Data Report for the **2nd Quarter 2024** Discharge Licence in place for the quarry operation at Ardgaineen, Claregalway, Co. Galway (Galway County Council Licence Ref. No: W/502/22, issued 7th June 2023). This report has been prepared to fulfil this requirement and pertains to the 5th reporting period since the Licence was issued.

It is acknowledged that Licence W/502/22 stipulates return of results on a Quarterly basis and this practice will be put in place going forward.

2.0 Discharge Licence Conditions

Licence conditions relevant to this report include the following:

1. Scope

This Licence refers to the attenuation sump discharge of Harrington Concrete and Quarries located at Ardgaineen, Claregalway, Co. Galway. Surface water run-off and ground water collected in the quarry attenuation sump are pumped to a Wetland Vegetation Area, *via* a petrol/oil interceptor, where water percolates to ground. This licence is for the exiting extraction are of 4.35ha granted under Substitute Consent (Ref SU0053) in February 2017. If planning permission is granted for an extension to the quarry, or there is an increase in quarrying discharge, a full review of this licence will be required. **The maximum permitted discharge is 1,483m3 per day.**

2. Attenuation Sump Discharge.

2.1 **Discharge:** The Licencee shall not discharge, cause or permit the discharge, of any contaminated surface water or process water directly to any surface water or groundwater without prior treatment.

2.2 **Treated Discharge:** The discharge shall be discharged to groundwater without posing a pollution risk.

2.3 **Discharge Performance Standards:** The treated discharge, **prior to its release** to the Wetland Vegetation Area, shall comply with the following standards:

(a) The **Total Suspended Solids** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 10 mg/l.

(b) The **Biochemical Oxygen Demand** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 10 mg/l.

(c) The **Chemical Oxygen Demand** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 15 mg/l.

(d) The **Nitrate (NO_3-)** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 18 mg/l.

(e) The **Nitrite (NO_2-)** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.05 mg/l.

(f) The **Total Hydrocarbon** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.01 mg/l.

(g) The **Total Ammonia** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.03mg/l.

(h) The **Benzo (a) pyrene** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.00001 mg/l.

(i) The **Total PAH** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.00001 mg/l.

(j) The **pH** of the Discharge from the attenuation sump and oil interceptor shall be in the range 6 - 9 pH units.

(k) The **Flow** of the Discharge from the attenuation sump and oil interceptor shall not exceed 1,483 m3/day.

(l) The **Colour** of the Discharge from the attenuation sump should not change significantly from day to day nor shall there be any evidence of oil or excess solids on visual inspection.

(m) The **Conductivity** of the Discharge from the attenuation sump and oil interceptor shall not change significantly from day to day.

(n) The **Turbidity** of the Discharge from the attenuation sump and oil interceptor shall not change significantly from day to day.

3. Discharge Analysis

Analysis of the treated water prior to discharge shall be carried out by an approved accredited laboratory where readings are not taken on site. The frequency of analysis and the parameters are outlined below. Quarterly results shall be forwarded to the environment section.

Parameter	**Monitoring Frequency**	**Analysis to be performed by accredited laboratory**
Flow	Continuous - Daily	
Colour and Visual inspection	Daily	
Conductivity	Continuous - Daily	
Turbidity	Continuous - Daily	
pH	Continuous - Daily	
Total Suspended Solids	Quarterly	√
Nitrates NO_3^-	Quarterly	√
Nitrites NO_2^-	Quarterly	√
Chemical Oxygen Demand	Quarterly	√
Biochemical Oxygen Demand	Quarterly	√
Total Ammonia	Quarterly	√
Total PAH	Quarterly	√
Benzo (a) Pyrene	Quarterly	√
Total Hydrocarbons including Diesel Range Organics and Petroleum Range Organics	Quarterly	√

4. Groundwater Analysis

Quarterly analysis of groundwater monitoring wells will be carried out be an approved accredited laboratory. The following parameters shall be measured and analysis of same forwarded to the Environment Section of Galway County Council:

Parameter	Units
(a) Water Level	mAOD
(b) pH	pH units
(c) Conductivity	uS/cm
(d) Suspended Solids	mg/l
(e) Nitrates	mg/l No_3^-
(f) Total Hydrocarbons	mg/l

Where quarrying activities are found to adversely affect local water supplies the provisions of the EPA Environmental Management Guidelines 'Environmental Management in the Extractive Industry (non-scheduled Minerals)', Section 3.3.1 shall apply, and the quarry shall provide a replacement water supply.

5. Petrol / Oil Interceptor

The petrol / oil interceptor should be inspected each working day to ensure it is operating correctly and daily records kept of this. These records should be made available to Galway County Council if requested.

Other matters in the licence include details about the following. Readers are referred to the Licence itself for specific detail.

6. Attenuation sump, petrol/oil interceptor & wetland area

6.1 Treatment Process – must be able to achieve the Treatment Standards of Condition 2.3.
6.2 Metering – Install Flow Meter, record Daily Discharge, report Quarterly. Limit 1,483m3/d.
6.3 Ready Access – must be allowed for Authorised Persons under the Water Pollution Acts.
6.4 Sampling – Sampling Chamber after treatment and before wetland. Plus access required.
6.5 Caretaker – Day to Day Inspection. Notified Person named and details supplied to GCC.
6.6 Notification of Non-Compliance – Make GCC aware, record details of noncompliance.

7. EPA Guidelines

All works must be carried out in accordance with the EPA Guidelines 'Environmental Management Guidelines 'Environmental Management in the Extractive Industry (non-scheduled Minerals)'.

8. Annual Contribution

€550 due annually. Shall be adjusted with the Customer Price Index value. GCC can increase.

9. Changes in Ownership

GCC to be notified in writing if change in company ownership or Trading Name.

3.0 Person Responsible for Caretaking at the Site

Mr. John Gibbons, the quarry manager, is responsible for inspections and maintenance of the infrastructure associated with the discharge. Mr. Gibbons' contact details are on file with Galway County Council.

4.0 Site Data - Monitoring Results

4.1 Flow Data

The site's flow was fully automated on the 7th of February 2024. Results are presented in Table 1.

Table 1 Daily discharge volumes (m3/d) Q2 2024 & Statistics: Max, Min, Mean Daily

2024	Q2 (m3/d) Totals			ELV MAX
Day	Apr-24	May-24	Jun-24	(m3/d)
1	343.85	293.98	297.55	1,438
2	331.68	307.19	299.34	1,438
3	334.18	300.80	297.80	1,438
4	332.14	315.88	142.44	1,438
5	329.96	314.04	0.00	1,438
6	329.32	312.86	0.00	1,438
7	328.36	282.18	0.00	1,438
8	311.05	285.37	0.00	1,438
9	299.58	290.59	0.00	1,438
10	305.14	294.91	0.00	1,438
11	294.24	304.43	0.00	1,438
12	302.90	301.98	32.44	1,438
13	319.94	299.74	50.00	1,438
14	319.89	296.86	46.16	1,438
15	300.19	277.78	49.36	1,438
16	296.25	254.84	47.60	1,438
17	291.54	259.71	42.43	1,438
18	293.76	299.14	42.42	1,438
19	291.65	298.16	42.01	1,438
20	316.92	243.21	42.53	1,438
21	316.34	286.07	47.95	1,438
22	289.46	277.97	48.99	1,438
23	294.20	283.24	49.69	1,438
24	287.33	270.87	46.37	1,438
25	301.58	306.05	42.19	1,438
26	295.86	304.63	43.82	1,438
27	318.03	278.55	45.27	1,438
28	317.97	291.01	42.71	1,438
29	309.44	292.66	49.02	1,438
30	310.67	273.00	48.68	1,438
31		267.84		1,438
MAX m3/d	344	316	299	m3/d
MIN m3/d	287	243	0.00	
AVERAGE m3/d	310	289	63	

4.2 Discharge Water's Quality Data

As is required by Licence W/502/22, the site monitors water quality of the final discharge from the site on a Quarterly basis. The laboratory Certificate of Analysis is presented in Appendix A.

Discharge water's quality results are presented in Table 2 with each parameter's ELV for the monitoring period.

Table 2 Ardgaineen Quarry Final Discharge Quality Q2 2024.

Green Highlight in Cells = Compliant			
			Q2 2024 May
Parameter:	**Units**	**W/502/22 Emission Limit Value**	**03 May 2024**
Hydrogen Ion (pH)	pH units	6 to 9	8.1
Biological Oxygen Demand (BOD)	mg/L	10.0	<0.1
Suspended Solids	mg/L	10	< 4
Ammonium	mg/L N	0.03	0.02
Nitrate	mg/L N	18.00	10.24
Nitrite	mg/L N	0.05	0.020
Chemical Oxygen Demand (COD)	mg/L	15	< 10
Benzo(a)pyrene	µg/L	0.1	< 0.003
Total Hydrocarbons	µg/L	10	not reported
Total PAHs	µg/L	0.1	not reported
Southern Scientific Laboratory Reference			129163 (24-41909)

With reference to the results presented in Table 1, and the associated Certificates of Analysis in Appendix A, commentary is as follows:

- The pH of the Discharge is 8.1pH and this is within the 6 to 9 pH Emission Limit Value.
- The discharge's results are below the limit of detection of the laboratory analyser for BOD, COD and Benzo(a)pyrene. This suggests good Discharge Quality.
- All analysed parameters are within the Licence Limits (ELVs) including pH, BOD, Suspended Solids, Ammonium, Nitrates, Nitrites, COD and Benzo(a)pyrene.
- However, again, issues with the list analysed persist and neither Hydrocarbons nor PAHs were reported. The site continues to attempt to get this rectified.

4.3 Continuous Data Recording

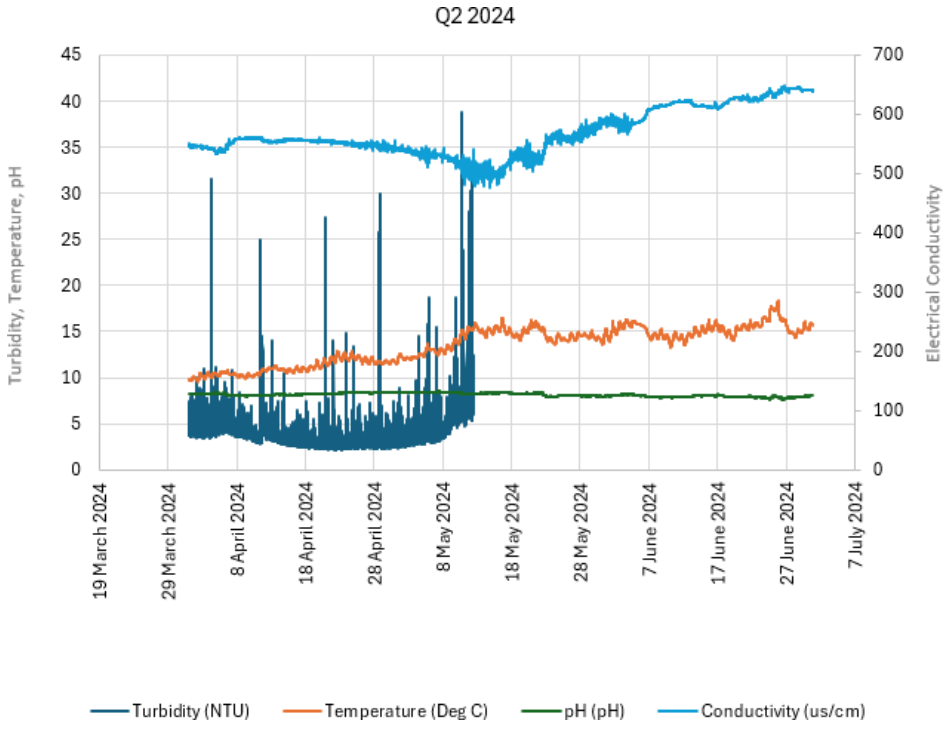
The site's discharge is now instrumented with a continuous flow meter with physiochemical sensors for parameters as specified in the Licence as follows:

- Flow
- pH
- Turbidity
- Conductivity

Data are collected at 5 minute intervals and reported to the service provider's telemetric data service HydroVU. The data service provider is Capital Water Solutions Limited, Co. Roscommon.

The quarry manager is responsible for daily log in to the telemetric system, visual inspections of the discharge and day to day management.

The full data record is held in excel file format in Hydro-G's offices because there are many rows associated with 5 minute intervals for excel rows of data for the reporting period. A graphical presentation of the data is shown in Graph 1, below.



Graph 1 Continuous record for field physiochemical parameters.

The results for continuous monitoring show, as follows:

- The Turbidity probe malfunctioned and was replaced in time.
- The Temperature probe drifted unreasonably and this was also replaced.
- pH is relatively constant and within the 6 to 9 pH units ELV of the Licence.
- Electrical Conductivity is within the expected range for a limestone environment and the instrument's 'drift' was rectified with a service call.
- No environmental impact is envisaged.

4.4 Groundwater Data

Condition 4 of the Licence states that "Quarterly analysis of groundwater monitoring wells will be carried out be an approved accredited laboratory". However, there are no wells on the operational quarry to which the Discharge Licence relates. Hydro-G has previously reported 11 Site Investigation boreholes on the floor of the quarry and none of those boreholes encountered groundwater strike.

There are site investigation greenfield boreholes for the lands to the east of the quarry but they are not within the operational quarry.

The "1. Scope" detail of the Opening of W/502/22 Discharge Licence states that

> "*This licence is for the exiting extraction are of 4.35ha granted under Substitute Consent (Ref SU0053) in February 2017. If planning permission is granted for an extension to the quarry, or there is an increase in quarrying discharge, a full review of this licence will be required.*"

Given that there have been no successful groundwater strikes in 11 boreholes attempted within this quarry because the limestone is the competent Burren Formation Limestone. The aquifer is mapped as a Regionally Important Karst Conduit Aquifer. No groundwater transmissive conduits were discovered in the drilling completed on the floor of the operational quarry. Therefore there is nothing to report with respect to this Condition of the Licence.

5.0 Compliance with Licence Conditions

5.1 With respect to the Volumetric ELV Conditions: The site's flow is now fully recorded. Data presented in Table 1 suggests that the mean daily discharge is compliant with the specified ELV for mean daily volume of 1,483 m3/d, on an annual average basis. Discharge values ranged from 0m3/d to 344m3/d.

5.2 With respect to Water Quality ELVs: Results presented in Table 2 indicates that the prescribed ELVs were complied with for all parameters analysed. However, issues persist with the laboratory and the full list was not analysed.

6.0 Difficulties Encountered

6.1 As part of previous evaluations, Hydro-G supervised the drilling of eleven boreholes on the floor of the quarry and no groundwater was encountered. Therefore, there is no groundwater quality to report.

6.3 The laboratory has still not accepted the requirement for analysis of the full list of parameters listed in the discharge Licence. Therefore, some parameters have not yet been analysed. The site continues to attempt to get the list analysed.

7.0 Register of Incidents

Apart from issues with the laboratory and the requested list of parameters, there were no 'serious incidents' to report with respect to this discharge during this reported period.

8.0 Conclusions

The site is in compliance with those Conditions of the Section 4 Discharge Licence W/502/22 that have been quantified at this time. In the Q1 2024 a slightly elevated Ammonium concentration was reported. However, in the Q2 2024 sampling Ammonium was 0.02 mg/l, which is fully compliant with the 0.03 mg/l Ammonium ELV.

Pamela Bartley

Dr. Pamela Bartley B.Eng, M.SC., Ph.D. MIEI

Appendix A

Laboratory Certificates of Analysis

Routine Quarterly Monitoring at the Site

Certificate of Analysis

Customer:	Harrington Concrete and Quarries	**Project:**	Surface Water - GWD-1
Address:	Kilkelly Co Mayo	**Site**	
		Date Received:	03/05/2024
		Condition of Sample:	Satisfactory
Report to:	Amanda Tarpey	**Date Analysed:**	03/05/2024 - 04/06/2024
Customer PO		**Issue Date:**	05/06/2024
Quote No.		**BATCH NUMBER:**	**24-41909**

Sadhbh O Brien

Sadhbh O Brien
Chemistry Team Lead

Index to symbols used & Notes

*	Analysis is not INAB accredited
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	Customer specific limits
(F)	Analysis carried out at our Farranfore Laboratory.
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LOQ	Parameter Limit of Quantification
Note 6	Subcontracted Parameter.

Notes

- **The results relate only to the items tested.**
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- **Sampling is outside the scope of the laboratory activities.**

Notes for Drinking Water samples

Note A	The water should not be aggressive
Note B	Compliance must be ensured with the conditions that [NO3]/50 + [NO2]/3 =1
Note C	Acceptable to customers and no abnormal change
Note D	In the case of surface water treatment, a parametric value not exceeding 1 NTU in the water ex treatment works must be strived for
Note F	Fluoridated supplies 0.8 mg/L; Natural supplies 1.5 mg/L.

Report No. 24-41909 Rev 0

Customer Sample Ref:	GWD-1	**Customer Sample Code:**	
Project:	Surface Water - GWD-1	**Sampled By:**	Amanda Tarpey
Our Reference:	129163 (24-41909)	**Sample Matrix:**	Surface Water
Date Sampled:	02/06/2024	**Time Sampled:**	:

Method:	Parameter:	Units	LOQ	Result
	Chemical Analysis: (F)			
SCP 052	Hydrogen Ion (pH)	pH units	*4.0*	8.1
SCP 015	Biological Oxygen Demand (BOD)	mg/L	*1.0*	< 1.0
SCP 010	Suspended Solids	mg/L	*2*	< 4
SCP 027A	Total Ammonia	mg/L N	*0.02*	0.02
SCP 027G	Nitrate	mg/L NO3	*1.11*	10.24
SCP 027F	Nitrite	mg/L NO2	*0.016*	0.020
SCP 016	Chemical Oxygen Demand (COD)	mg/L	*10*	< 10
SCP 060B	Benzo(a)pyrene	µg/L	*0.003*	< 0.003

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directors: K. Murphy, M. Murphy & C. Murphy
registered in ireland no 323196 | vat reg no IE 6343196 M

Appendix B

Entire Record of Results Reported

Green Highligt in Cells = Compliant							
			Q2 2023	Q3 2023	Q4 2023	Q1 2024 February	Q2 2024 May
Parameter:	**Units**	**W/502/22 Emission Limit Value**	**07 June 2023**	**04 July 2023**	**04 December 2023**	**06 February 2024**	**03 May 2024**
Hydrogen Ion (pH)	pH units	**6 to 9**	8.0	8.1	7.8	8.0	8.1
Biological Oxygen Demand (BOD)	mg/L	**10.0**	< 1.0	< 1.0	1.2	< 1.0	<0.1
Suspended Solids	mg/L	**10**	< 4	< 4	< 4	<4	< 4
Ammonium	mg/L N	**0.03**	0.03	< 0.02	0.03	**0.04**	0.02
Nitrate	mg/L N	**18.00**	1.47	1.22	1.73	not reported	10.24
Nitrite	mg/L N	**0.05**	0.012	< 0.005	< 0.005	not reported	0.020
Chemical Oxygen Demand (COD)	mg/L	**15**	< 10	< 10	< 10	<10	< 10
Benzo(a)pyrene	µg/L	**0.1**	not analysed	not analysed	not analysed	not reported	< 0.003
Total Hydrocarbons	µg/L	**10**	not analysed	not analysed	not analysed	not reported	not reported
Total PAHs	µg/L	**0.1**	not analysed	not analysed	not analysed	not reported	not reported
Southern Scientific Laboratory Reference			93347 (23-29240)	96104 (23-30235)	113177 (23-36432)	118896 (24-38390)	129163 (24-41909)

Data Report 6

Q3 (2024)

Section 4 Discharge Licence W/502/22

(issued 7th June 2023)

at

Harrington Concrete and Quarries Ltd

Ardgaineen, Claregalway, Co. Galway

Prepared by Consultant Dr. Pamela Bartley, Hydro-G

Hydro-G

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Project No.: 25-14 Harringtons Ardgaineen

Report Status: ISSUE_V1

Report Title: Data Report 6: Q3 (2024) Harringtons Concrete and Products Ltd. Discharge Licence W/502/22.

Prepared by: _____

Dr. Pamela Bartley B.Eng, M.SC., Ph.D.

NOTES:

This report is for the use solely of the party to whom it is addressed and no responsibility is accepted to any third party.

About the Author

Pamela Bartley is a water focussed civil engineer. She has 30 years of field-based practice in borehole drilling, groundwater monitoring and abstraction point management in limestone karst environments. Her Ph.D was a field based karst limestone environment study. She has also completed training with the GSI at their karst specialist course run in the Burren. Her primary qualification is a Diploma in Water and Wastewater Technology at Sligo RTC. She then completed her primary degree in Civil Engineering at Queens University, Belfast, followed by an M.Sc. in Environmental Engineering, followed by a field-based hydrogeologically focussed Ph.D. within the School of Civil Engineering at Trinity College, Dublin. Her key work areas are groundwater development from large scale water supply boreholes, hydrogeological assessment of quarries and the evaluation of discharges to groundwater and surface waters. Pamela Bartley's company is Bartley Hydrogeology ltd., registered to trade as Hydro-G.

Pamela has successfully completed post doctorate 'Professional Development' formal course training in the areas of:

- PSDP & PSCS (IOSH certified, 2016);
- Karst Hydrogeology (GSI, 2013);
- On Site Wastewater & Water Services Amendment Act 2012 (IE, Western Region 6-week programme 2012 & Dublin 2012);
- Zero Discharge Willow Wastewater Systems Design Courses (Denmark 2008 & 2011 & Ireland 2012);
- Expert Witness (IE, 2011);
- Planning & Development Act (IE, 2010);
- Surface Water Regulations 2009 (DoE, 2010 & 2011);
- Sustainable Drainage (Wallingford/CIRIA, 2005 & 2008);
- Source Protection Zone Delineation (IGI/GSI, 2007);
- Groundwater & Contaminant Microbiology (IGI/GSI, 2006);
- Applied Groundwater Modelling (ESI, UK, 2000);
- Site Suitability Assessment (FETAC, 2002).

As a result of work in evaluating planning appeals, Pamela has become specialist in planning evaluations in the context of enacted Irish Regulation and EU Directives concerning the water environment such as the Groundwater Regulations (S.I. No. 9 of 2010), Surface Water Regulations (S.I. No. 272 of 2009), Water Framework and Habitats' Directives. Pamela is a qualified and certified 'Site Assessor' and interviewer of examination candidates in respect of eligibility for the Site Suitability FETAC Qualification. In the past, she has lectured in third level institutions (WIT, CIT, 1996 – 1999), delivered practical laboratory instruction in the assessment of subsoils for the FETAC Site Assessor programme and demonstrated hydraulics laboratory modules at Trinity College Dublin (1996). She has been an invited guest speaker at An Board Pleanála, The Irish Concrete Federation, The Health Service Executive, Environmental Health Officers National Conference, The Irish Planning Institute's National Conference, The International Association of Hydrogeologists National Conference (Irish Branch) and has delivered hydrogeological lectures to the public during Science Week.

Hydro-G is the registered trading name of Pamela Bartley's company Bartley Hydrogeology Ltd., a company registered in Galway Ireland. The company holds requisiteemployer's and public liabilityinsurances. In addition, the company holds professional indemnity insurance of €2million.

Pamela is qualified and IOSH certified to act as PSDP (Project Supervisor Design Phase) & PSCS (Project Supervisor Construction Stage) as defined by the Construction Regulations. The company is a registered Irish Water Supplier (no. 1855) and Pamela Bartley is HSQE approved within Irish Water.

Contents

1.0 Introduction

Hydro G was commissioned by Harringtons Concrete and Products Ltd to prepare a Data Report for the **3rd Quarter 2024** Discharge Licence in place for the quarry operation at Ardgaineen, Claregalway, Co. Galway (Galway County Council Licence Ref. No: W/502/22, issued 7th June 2023). This report has been prepared to fulfil this requirement and pertains to the **6th** reporting period since the Licence was issued.

It is acknowledged that Licence W/502/22 stipulates return of results on a Quarterly basis and this practice will be put in place going forward.

2.0 Discharge Licence Conditions

Licence conditions relevant to this report include the following:

1. Scope

This Licence refers to the attenuation sump discharge of Harrington Concrete and Quarries located at Ardgaineen, Claregalway, Co. Galway. Surface water run-off and ground water collected in the quarry attenuation sump are pumped to a Wetland Vegetation Area, *via* a petrol/oil interceptor, where water percolates to ground. This licence is for the exiting extraction are of 4.35ha granted under Substitute Consent (Ref SU0053) in February 2017. If planning permission is granted for an extension to the quarry, or there is an increase in quarrying discharge, a full review of this licence will be required. **The maximum permitted discharge is 1,483m3 per day.**

2. Attenuation Sump Discharge.

2.1 **Discharge:** The Licencee shall not discharge, cause or permit the discharge, of any contaminated surface water or process water directly to any surface water or groundwater without prior treatment.

2.2 **Treated Discharge:** The discharge shall be discharged to groundwater without posing a pollution risk.

2.3 **Discharge Performance Standards:** The treated discharge, **prior to its release** to the Wetland Vegetation Area, shall comply with the following standards:

(a) The **Total Suspended Solids** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 10 mg/l.

(b) The **Biochemical Oxygen Demand** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 10 mg/l.

(c) The **Chemical Oxygen Demand** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 15 mg/l.

(d) The **Nitrate (NO_3-)** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 18 mg/l.

(e) The **Nitrite (NO_2-)** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.05 mg/l.

(f) The **Total Hydrocarbon** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.01 mg/l.

(g) The **Total Ammonia** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.03mg/l.

(h) The **Benzo (a) pyrene** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.00001 mg/l.

(i) The **Total PAH** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.00001 mg/l.

(j) The **pH** of the Discharge from the attenuation sump and oil interceptor shall be in the range 6 - 9 pH units.

(k) The **Flow** of the Discharge from the attenuation sump and oil interceptor shall not exceed 1,483 m3/day.

(l) The **Colour** of the Discharge from the attenuation sump should not change significantly from day to day nor shall there be any evidence of oil or excess solids on visual inspection.

(m) The **Conductivity** of the Discharge from the attenuation sump and oil interceptor shall not change significantly from day to day.

(n) The **Turbidity** of the Discharge from the attenuation sump and oil interceptor shall not change significantly from day to day.

3. Discharge Analysis

Analysis of the treated water prior to discharge shall be carried out by an approved accredited laboratory where readings are not taken on site. The frequency of analysis and the parameters are outlined below. Quarterly results shall be forwarded to the environment section.

Parameter	Monitoring Frequency	Analysis to be performed by accredited laboratory
Flow	Continuous - Daily	
Colour and Visual inspection	Daily	
Conductivity	Continuous - Daily	
Turbidity	Continuous - Daily	
pH	Continuous - Daily	
Total Suspended Solids	Quarterly	√
Nitrates NO_3	Quarterly	√
Nitrites NO_2	Quarterly	√
Chemical Oxygen Demand	Quarterly	√
Biochemical Oxygen Demand	Quarterly	√
Total Ammonia	Quarterly	√
Total PAH	Quarterly	√
Benzo (a) Pyrene	Quarterly	√
Total Hydrocarbons including Diesel Range Organics and Petroleum Range Organics	Quarterly	√

4. Groundwater Analysis

Quarterly analysis of groundwater monitoring wells will be carried out be an approved accredited laboratory. The following parameters shall be measured and analysis of same forwarded to the Environment Section of Galway County Council:

Parameter	Units
(a) Water Level	mAOD
(b) pH	pH units
(c) Conductivity	uS/cm
(d) Suspended Solids	mg/l
(e) Nitrates	mg/l No_3^-
(f) Total Hydrocarbons	mg/l

Where quarrying activities are found to adversely affect local water supplies the provisions of the EPA Environmental Management Guidelines 'Environmental Management in the Extractive Industry (non-scheduled Minerals)', Section 3.3.1 shall apply, and the quarry shall provide a replacement water supply.

5. Petrol / Oil Interceptor

The petrol / oil interceptor should be inspected each working day to ensure it is operating correctly and daily records kept of this. These records should be made available to Galway County Council if requested.

Other matters in the licence include details about the following. Readers are referred to the Licence itself for specific detail.

6. Attenuation sump, petrol/oil interceptor & wetland area

6.1 Treatment Process – must be able to achieve the Treatment Standards of Condition 2.3.
6.2 Metering – Install Flow Meter, record Daily Discharge, report Quarterly. Limit 1,483m3/d.
6.3 Ready Access – must be allowed for Authorised Persons under the Water Pollution Acts.
6.4 Sampling – Sampling Chamber after treatment and before wetland. Plus access required.
6.5 Caretaker – Day to Day Inspection. Notified Person named and details supplied to GCC.
6.6 Notification of Non-Compliance – Make GCC aware, record details of noncompliance.

7. EPA Guidelines

All works must be carried out in accordance with the EPA Guidelines 'Environmental Management Guidelines 'Environmental Management in the Extractive Industry (non-scheduled Minerals)'.

8. Annual Contribution

€550 due annually. Shall be adjusted with the Customer Price Index value. GCC can increase.

9. Changes in Ownership

GCC to be notified in writing if change in company ownership or Trading Name.

3.0 Person Responsible for Caretaking at the Site

Mr. John Gibbons, the quarry manager, is responsible for inspections and maintenance of the infrastructure associated with the discharge. Mr. Gibbons' contact details are on file with Galway County Council.

4.0 Site Data - Monitoring Results

4.1 Flow Data

The site's flow was fully automated on the 7th of February 2024. Results are presented in Table 1.

Table 1 Daily discharge volumes (m3/d) Q3 2024 & Statistics: Max, Min, Mean Daily

2024	Q3 (m3/d) Totals			ELV MAX
Day	Jul-24	Aug-24	Sept-24	(m3/d)
1	42.28	65.24	52.20	1,438
2	45.26	64.43	47.06	1,438
3	44.55	60.15	49.39	1,438
4	41.13	58.38	49.04	1,438
5	43.01	49.28	46.61	1,438
6	51.27	43.51	47.71	1,438
7	52.73	40.96	51.80	1,438
8	43.34	37.90	49.35	1,438
9	45.14	40.64	51.68	1,438
10	42.70	38.03	53.34	1,438
11	46.20	27.90	50.55	1,438
12	48.17	45.01	47.99	1,438
13	58.57	36.68	45.80	1,438
14	61.41	40.87	56.87	1,438
15	57.40	43.67	53.76	1,438
16	52.67	41.49	44.47	1,438
17	56.57	44.97	42.99	1,438
18	59.11	44.97	41.05	1,438
19	61.97	48.29	38.31	1,438
20	64.86	42.88	37.23	1,438
21	64.54	48.52	41.31	1,438
22	52.13	45.18	44.55	1,438
23	50.14	42.66	42.33	1,438
24	57.54	45.44	38.91	1,438
25	56.08	47.22	29.12	1,438
26	54.28	47.36	35.06	1,438
27	63.63	45.19	32.58	1,438
28	60.19	46.51	40.04	1,438
29	63.16	43.86	43.69	1,438
30	60.72	43.01	25.65	1,438
31	63.63	49.10		1,438
MAX m3/d	65	65	57	m3/d
MIN m3/d	41	28	26	
AVERAGE m3/d	54	46	44	

4.2 Discharge Water's Quality Data

As is required by Licence W/502/22, the site monitors water quality of the final discharge from the site on a Quarterly basis. The laboratory Certificate of Analysis is presented in Appendix A.

Discharge water's quality results are presented in Table 2 with each parameter's ELV for the monitoring period.

Table 2 Ardgaineen Quarry Final Discharge Quality Q3 2024.

Green Highligt in Cells = Compliant			
			Q3 2024
Parameter:	**Units**	**W/502/22 Emission Limit Value**	**05 September 2024**
Hydrogen Ion (pH)	pH units	6 to 9	7.7
Biological Oxygen Demand (BOD)	mg/L	10.0	<0.1
Suspended Solids	mg/L	10	16
Ammonium	mg/L N	0.03	6.30
Nitrate	mg/L N	18.00	1.56
Nitrite	mg/L N	0.05	0.03
Chemical Oxygen Demand (COD)	mg/L	15	11.00
Benzo(a)pyrene	µg/L	0.1	< 0.005
Total Hydrocarbons	µg/L	10	< 10.0
Total PAHs	µg/L	0.1	< 0.005
Southern Scientific Laboratory Reference			143769 (24-47350)

With reference to the results presented in Table 1, and the associated Certificates of Analysis in Appendix A, commentary is as follows:

- The pH of the Discharge is 7.7pH and this is within the 6 to 9 pH Emission Limit Value.

- The discharge's results are below the limit of detection of the laboratory analyser for BOD, Benzo(a)pyrene and Hydrocarbons. This suggests good Discharge Quality.

- All analysed parameters are within the Licence Limits (ELVs) for pH, BOD, Nitrates, Nitrites, COD, Benzo(a)pyrene, Total Hydrocarbons and Total PAHs.

- However, Suspended Solids were reported to be elevated and there is a certain gross laboratory error in the 6.3 mg/l Ammonium value reported by the laboratory. The fact that BOD is reported at <0.1 mg/l suggests that there is ZERO biochemical loading in the water. IF there actually was 6 mg/l of Ammonium, there would be BOD at greater than 0.01 mg/l.

4.3 Continuous Data Recording

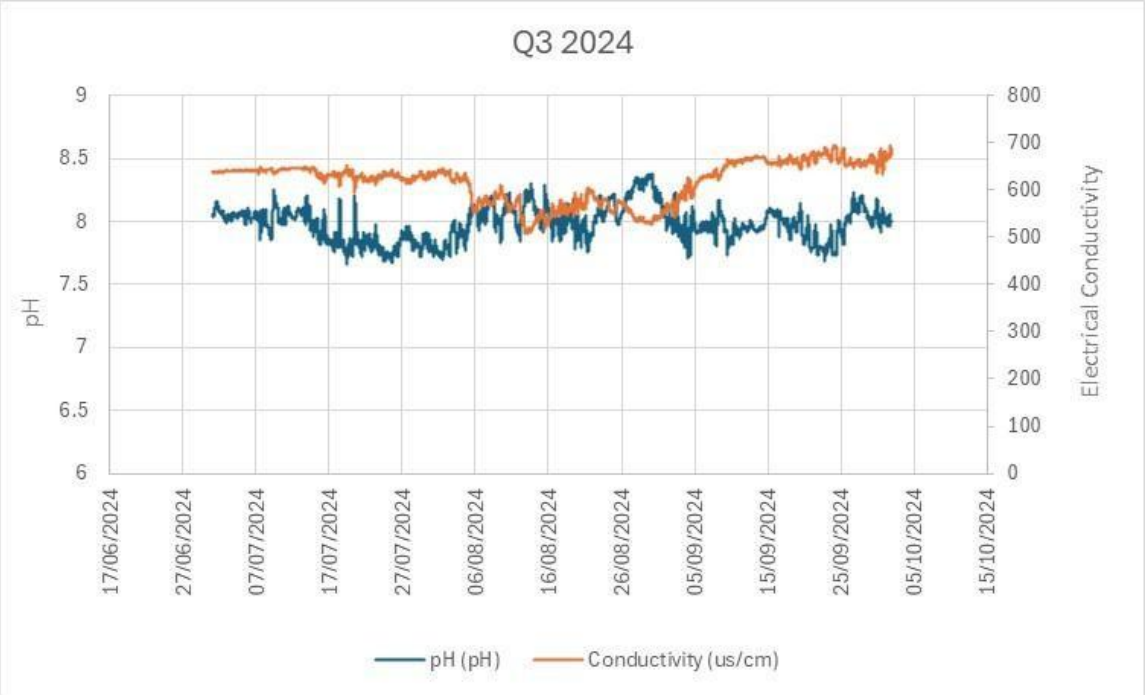
The site's discharge is now instrumented with a continuous flow meter with physiochemical sensors for parameters as specified in the Licence as follows:

- Flow
- pH
- Turbidity
- Conductivity

Data are collected at 5 minute intervals and reported to the service provider's telemetric data service HydroVU. The data service provider is Capital Water Solutions Limited, Co. Roscommon.

The quarry manager is responsible for daily log in to the telemetric system, visual inspections of the discharge and day to day management.

The full data record is held in excel file format in Hydro-G's offices because there are many rows associated with 5 minute intervals for excel rows of data for the reporting period. A graphical presentation of the data is shown in Graph 1, below.



Graph 1 Continuous record for field physiochemical parameters.

The results for continuous monitoring show, as follows:

- The Turbidity probe malfunctioned and although replaced, did not perform.
- The Temperature probe malfunctioned and although replaced, did not perform.
- pH is within the 6 to 9 pH units ELV of the Licence.
- Electrical Conductivity is within the expected range for a limestone environment.

4.4 Groundwater Data

Condition 4 of the Licence states that "Quarterly analysis of groundwater monitoring wells will be carried out be an approved accredited laboratory". However, there are no wells on the operational quarry to which the Discharge Licence relates. Hydro-G has previously reported 11 Site Investigation boreholes on the floor of the quarry and none of those boreholes encountered groundwater strike.

There are site investigation greenfield boreholes for the lands to the east of the quarry but they are not within the operational quarry.

The "1. Scope" detail of the Opening of W/502/22 Discharge Licence states that

> "*This licence is for the exiting extraction are of 4.35ha granted under Substitute Consent (Ref SU0053) in February 2017. If planning permission is granted for an extension to the quarry, or there is an increase in quarrying discharge, a full review of this licence will be required.*"

Given that there have been no successful groundwater strikes in 11 boreholes attempted within this quarry because the limestone is the competent Burren Formation Limestone. The aquifer is mapped as a Regionally Important Karst Conduit Aquifer. No groundwater transmissive conduits were discovered in the drilling completed on the floor of the operational quarry. Therefore there is nothing to report with respect to this Condition of the Licence.

5.0 Compliance with Licence Conditions

5.1 With respect to the Volumetric ELV Conditions: The site's flow is now fully recorded. Data presented in Table 1 suggests that the mean daily discharge is compliant with the specified ELV for mean daily volume of 1,483 m3/d, on an annual average basis. Discharge values ranged from 26m3/d to 65m3/d.

5.2 With respect to Water Quality ELVs: Results presented in Table 2 indicates that the prescribed ELVs were complied with for many parameters analysed. However, Suspended Solids were reported to be elevated and there is a certain gross laboratory error in the 6.3 mg/l Ammonium value reported by the laboratory. The fact that BOD is reported at <0.1 mg/l suggests that there is ZERO biochemical loading in the water. IF there actually was 6 mg/l of Ammonium, there would be BOD at greater than 0.01 mg/l.

6.0 Difficulties Encountered

6.1 As part of previous evaluations, Hydro-G supervised the drilling of eleven boreholes on the floor of the quarry and no groundwater was encountered. Therefore, there is no groundwater quality to report.

6.3 A gross laboratory error in the 6.3 mg/l Ammonium value reported by the laboratory. The fact that BOD is reported at <0.1 mg/l suggests that there is ZERO biochemical loading in the water. IF there actually was 6 mg/l of Ammonium, there would be BOD at greater than 0.01 mg/l. It was an oversight to have missed following up on this.

7.0 Register of Incidents

Apart from the gross reporting for Ammonia, which is confidently asserted to be a laboratory error, there were no 'serious incidents' to report with respect to this discharge during this reported period.

8.0 Conclusions

The site is in compliance with almost all Conditions of the Section 4 Discharge Licence W/502/22. The fact that BOD is reported at <0.1 mg/l suggests that there is ZERO biochemical loading in the water. IF there actually was 6 mg/l of Ammonium, there would be BOD at greater than 0.01 mg/l. It was an oversight to have missed following up on this.

Pamela Bartley

Dr. Pamela Bartley B.Eng, M.SC., Ph.D. MIEI

Appendix A

Laboratory Certificates of Analysis

Routine Quarterly Monitoring at the Site

Certificate of Analysis

Customer:	Harrington Concrete and Quarries	**Project:**	Water/Dust Monitoring
Address:	Kilkelly Co Mayo	**Site**	
		Date Received:	05/09/2024
		Condition of Sample:	Satisfactory
Report to:	Amanda Tarpey	**Date Analysed:**	06/09/2024 - 16/10/2024
Customer PO		**Issue Date:**	10/10/2024
Quote No.	Q24-00756	**BATCH NUMBER:**	**24-47350**

Natalia Zur

Natalia Zur
Laboratory Analyst

Index to symbols used & Notes

*	Analysis is not INAB accredited
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	Customer specific limits
(F)	Analysis carried out at our Farranfore Laboratory.
(D)	Analysis carried out at our Dunrine Laboratory.
LOQ	Parameter Limit of Quantification
Note 6	Subcontracted Parameter.

Notes

- **The results relate only to the items tested.**
- **Opinions and interpretations expressed herein are outside the scope of INAB accreditation.**
- **The analysis report shall not be reproduced except in full without written approval of the laboratory.**
- **Sampling is outside the scope of the laboratory activities.**

Notes for Drinking Water samples

Note A	The water should not be aggressive
Note B	Compliance must be ensured with the conditions that [NO3]/50 + [NO2]/3 =1
Note C	Acceptable to customers and no abnormal change
Note D	In the case of surface water treatment, a parametric value not exceeding 1 NTU in the water ex treatment works must be strived for
Note F	Fluoridated supplies 0.8 mg/L; Natural supplies 1.5 mg/L

Report No. 24-47350 Rev 1 (Reissue date 20241016)

Customer Sample Ref:	G-WD-1	**Customer Sample Code:**	
Project:	Water/Dust Monitoring	**Sampled By:**	Customer
Our Reference:	143769 (24-47350)	**Sample Matrix:**	Surface Water
Date Sampled:	05/09/2024	**Time Sampled:**	13:00

Method:		Parameter:	Units	LOQ	Result
		Chemical Analysis: (F)			
SCP 052		Hydrogen Ion (pH)	pH units	*4.0*	7.7
SCP 015		Biological Oxygen Demand (BOD)	mg/L	*1.0*	< 1.0
SCP 010		Suspended Solids	mg/L	*2*	16
SCP 027A		Total Ammonia	mg/L N	*0.02*	6.30
SCP 027G		Nitrate	mg/L N	*0.25*	1.56
SCP 027F		Nitrite	mg/L N	*0.005*	0.033
SCP 016		Chemical Oxygen Demand (COD)	mg/L	*10*	11
SCP 115A		Total Petroleum Hydrocarbons (C10 - C40)	µg/L	*10.0*	< 10.0
		PAH's Water (default)			
		Chemical Analysis: (F)			
SCP 060B		Acenaphthene	µg/L	*0.005*	< 0.005
SCP 060B		Acenaphthylene	µg/L	*0.005*	< 0.005
SCP 060B		Anthracene	µg/L	*0.005*	< 0.005
SCP 060B		Benz(a)anthracene	µg/L	*0.005*	< 0.005
SCP 060B		Benzo(a)pyrene	µg/L	*0.005*	< 0.005
SCP 060B		Benzo(b)fluoranthene	µg/L	*0.005*	< 0.005
SCP 060B		Benzo(k)fluoranthene	µg/L	*0.005*	< 0.005
SCP 060B		Sum Benzo (b)&(k) fluoranthene	µg/L	*0.005*	< 0.005
SCP 060B		Benzo(ghi)perylene	µg/L	*0.005*	< 0.005
SCP 060B		Chrysene	µg/L	*0.005*	< 0.005
SCP 060B		Dibenz(a,h)anthracene	µg/L	*0.005*	< 0.005
SCP 060B	*	Fluoranthene	µg/L	*0.005*	< 0.005
SCP 060B		Fluorene	µg/L	*0.005*	< 0.005
SCP 060B		Indeno(1,2,3-cd)pyrene	µg/L	*0.005*	< 0.005
SCP 060B		Naphthalene	µg/L	*0.005*	< 0.005
SCP 060B		Phenanthrene	µg/L	*0.005*	< 0.005
SCP 060B		Pyrene	µg/L	*0.005*	< 0.005
SCP 060B		Total PAH's (sum of 16)	µg/L	*0.078*	< 0.078

Sample Comments

Revised due to error in logging sample - required analysis added.

Appendix B

Entire Record of Results Reported

Green Highligt in Cells = Compliant								
			Q2 2023	Q3 2023	Q4 2023	Q1 2024 February	Q2 2024 May	Q3 2024
Parameter:	**Units**	**W/502/22 Emission Limit Value**	**07 June 2023**	**04 July 2023**	**04 December 2023**	**06 February 2024**	**03 May 2024**	**05 September 2024**
Hydrogen Ion (pH)	pH units	**6 to 9**	8.0	8.1	7.8	8.0	8.1	7.7
Biological Oxygen Demand (BOD)	mg/L	**10.0**	< 1.0	< 1.0	1.2	< 1.0	<0.1	<0.1
Suspended Solids	mg/L	**10**	< 4	< 4	< 4	<4	< 4	**16**
Ammonium	mg/L N	**0.03**	0.03	< 0.02	0.03	**0.04**	0.02	**6.30**
Nitrate	mg/L N	**18.00**	1.47	1.22	1.73	not reported	10.24	1.56
Nitrite	mg/L N	**0.05**	0.012	< 0.005	< 0.005	not reported	0.020	0.03
Chemical Oxygen Demand (COD)	mg/L	**15**	< 10	< 10	< 10	<10	< 10	11.00
Benzo(a)pyrene	µg/L	**0.1**	not analysed	not analysed	not analysed	not reported	< 0.003	< 0.005
Total Hydrocarbons	µg/L	**10**	not analysed	not analysed	not analysed	not reported	not reported	< 10.0
Total PAHs	µg/L	**0.1**	not analysed	not analysed	not analysed	not reported	not reported	< 0.005
Southern Scientific Laboratory Reference			93347 (23-29240)	96104 (23-30235)	113177 (23-36432)	118896 (24-38390)	129163 (24-41909)	143769 (24-47350)

Data Report 7

Q4 (2024)

Section 4 Discharge Licence W/502/22

(issued 7th June 2023)

at

Harrington Concrete and Quarries Ltd

Ardgaineen, Claregalway, Co. Galway

Prepared by Consultant Dr. Pamela Bartley, Hydro-G

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Project No.: 25-14 Harringtons Ardgaineen

Report Status: **ISSUE_V1**

Report Title: Data Report 7: Q4 (2024) Harringtons Concrete and Products Ltd. Discharge Licence W/502/22.

Pamela Bartley

Prepared by: _____

Dr. Pamela Bartley B.Eng, M.SC., Ph.D.

NOTES:

This report is for the use solely of the party to whom it is addressed and no responsibility is accepted to any third party.

About the Author

Pamela Bartley is a water focussed civil engineer. She has 30 years of field-based practice in borehole drilling, groundwater monitoring and abstraction point management in limestone karst environments. Her Ph.D was a field based karst limestone environment study. She has also completed training with the GSI at their karst specialist course run in the Burren. Her primary qualification is a Diploma in Water and Wastewater Technology at Sligo RTC. She then completed her primary degree in Civil Engineering at Queens University, Belfast, followed by an M.Sc. in Environmental Engineering, followed by a field-based hydrogeologically focussed Ph.D. within the School of Civil Engineering at Trinity College, Dublin. Her key work areas are groundwater development from large scale water supply boreholes, hydrogeological assessment of quarries and the evaluation of discharges to groundwater and surface waters. Pamela Bartley's company is Bartley Hydrogeology ltd., registered to trade as Hydro-G.

Pamela has successfully completed post doctorate 'Professional Development' formal course training in the areas of:

- PSDP & PSCS (IOSH certified, 2016);
- Karst Hydrogeology (GSI, 2013);
- On Site Wastewater & Water Services Amendment Act 2012 (IE, Western Region 6-week programme 2012 & Dublin 2012);
- Zero Discharge Willow Wastewater Systems Design Courses (Denmark 2008 & 2011 & Ireland 2012);
- Expert Witness (IE, 2011);
- Planning & Development Act (IE, 2010);
- Surface Water Regulations 2009 (DoE, 2010 & 2011);
- Sustainable Drainage (Wallingford/CIRIA, 2005 & 2008);
- Source Protection Zone Delineation (IGI/GSI, 2007);
- Groundwater & Contaminant Microbiology (IGI/GSI, 2006);
- Applied Groundwater Modelling (ESI, UK, 2000);
- Site Suitability Assessment (FETAC, 2002).

As a result of work in evaluating planning appeals, Pamela has become specialist in planning evaluations in the context of enacted Irish Regulation and EU Directives concerning the water environment such as the Groundwater Regulations (S.I. No. 9 of 2010), Surface Water Regulations (S.I. No. 272 of 2009), Water Framework and Habitats' Directives. Pamela is a qualified and certified 'Site Assessor' and interviewer of examination candidates in respect of eligibility for the Site Suitability FETAC Qualification. In the past, she has lectured in third level institutions (WIT, CIT, 1996 – 1999), delivered practical laboratory instruction in the assessment of subsoils for the FETAC Site Assessor programme and demonstrated hydraulics laboratory modules at Trinity College Dublin (1996). She has been an invited guest speaker at An Board Pleanála, The Irish Concrete Federation, The Health Service Executive, Environmental Health Officers National Conference, The Irish Planning Institute's National Conference, The International Association of Hydrogeologists National Conference (Irish Branch) and has delivered hydrogeological lectures to the public during Science Week.

Hydro-G is the registered trading name of Pamela Bartley's company Bartley Hydrogeology Ltd., a company registered in Galway Ireland. The company holds requisiteemployer's and public liabilityinsurances. In addition, the company holds professional indemnity insurance of €2million.

Pamela is qualified and IOSH certified to act as PSDP (Project Supervisor Design Phase) & PSCS (Project Supervisor Construction Stage) as defined by the Construction Regulations. The company is a registered Irish Water Supplier (no. 1855) and Pamela Bartley is HSQE approved within Irish Water.

Contents

1.0 Introduction

Hydro G was commissioned by Harringtons Concrete and Products Ltd to prepare a Data Report for the **4th Quarter 2024** Discharge Licence in place for the quarry operation at Ardgaineen, Claregalway, Co. Galway (Galway County Council Licence Ref. No: W/502/22, issued 7th June 2023). This report has been prepared to fulfil this requirement and pertains to the **7th** reporting period since the Licence was issued.

It is acknowledged that Licence W/502/22 stipulates return of results on a Quarterly basis and this practice will be put in place going forward.

2.0 Discharge Licence Conditions

Licence conditions relevant to this report include the following:

1. Scope

This Licence refers to the attenuation sump discharge of Harrington Concrete and Quarries located at Ardgaineen, Claregalway, Co. Galway. Surface water run-off and ground water collected in the quarry attenuation sump are pumped to a Wetland Vegetation Area, *via* a petrol/oil interceptor, where water percolates to ground. This licence is for the exiting extraction are of 4.35ha granted under Substitute Consent (Ref SU0053) in February 2017. If planning permission is granted for an extension to the quarry, or there is an increase in quarrying discharge, a full review of this licence will be required. **The maximum permitted discharge is 1,483m3 per day.**

2. Attenuation Sump Discharge.

2.1 **Discharge:** The Licencee shall not discharge, cause or permit the discharge, of any contaminated surface water or process water directly to any surface water or groundwater without prior treatment.

2.2 **Treated Discharge:** The discharge shall be discharged to groundwater without posing a pollution risk.

2.3 **Discharge Performance Standards:** The treated discharge, **prior to its release** to the Wetland Vegetation Area, shall comply with the following standards:

(a) The **Total Suspended Solids** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 10 mg/l.

(b) The **Biochemical Oxygen Demand** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 10 mg/l.

(c) The **Chemical Oxygen Demand** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 15 mg/l.

(d) The **Nitrate (NO_3-)** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 18 mg/l.

(e) The **Nitrite (NO_2-)** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.05 mg/l.

(f) The **Total Hydrocarbon** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.01 mg/l.

(g) The **Total Ammonia** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.03mg/l.

(h) The **Benzo (a) pyrene** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.00001 mg/l.

(i) The **Total PAH** concentration of the Discharge from the attenuation sump and oil interceptor shall not exceed 0.00001 mg/l.

(j) The **pH** of the Discharge from the attenuation sump and oil interceptor shall be in the range 6 - 9 pH units.

(k) The **Flow** of the Discharge from the attenuation sump and oil interceptor shall not exceed 1,483 m3/day.

(l) The **Colour** of the Discharge from the attenuation sump should not change significantly from day to day nor shall there be any evidence of oil or excess solids on visual inspection.

(m) The **Conductivity** of the Discharge from the attenuation sump and oil interceptor shall not change significantly from day to day.

(n) The **Turbidity** of the Discharge from the attenuation sump and oil interceptor shall not change significantly from day to day.

3. Discharge Analysis

Analysis of the treated water prior to discharge shall be carried out by an approved accredited laboratory where readings are not taken on site. The frequency of analysis and the parameters are outlined below. Quarterly results shall be forwarded to the environment section.

Parameter	Monitoring Frequency	Analysis to be performed by accredited laboratory
Flow	Continuous - Daily	
Colour and Visual inspection	Daily	
Conductivity	Continuous - Daily	
Turbidity	Continuous - Daily	
pH	Continuous - Daily	
Total Suspended Solids	Quarterly	√
Nitrates NO_3	Quarterly	√
Nitrites NO_2	Quarterly	√
Chemical Oxygen Demand	Quarterly	√
Biochemical Oxygen Demand	Quarterly	√
Total Ammonia	Quarterly	√
Total PAH	Quarterly	√
Benzo (a) Pyrene	Quarterly	√
Total Hydrocarbons including Diesel Range Organics and Petroleum Range Organics	Quarterly	√

4. Groundwater Analysis

Quarterly analysis of groundwater monitoring wells will be carried out be an approved accredited laboratory. The following parameters shall be measured and analysis of same forwarded to the Environment Section of Galway County Council:

Parameter	Units
(a) Water Level	mAOD
(b) pH	pH units
(c) Conductivity	uS/cm
(d) Suspended Solids	mg/l
(e) Nitrates	mg/l No_3^-
(f) Total Hydrocarbons	mg/l

Where quarrying activities are found to adversely affect local water supplies the provisions of the EPA Environmental Management Guidelines 'Environmental Management in the Extractive Industry (non-scheduled Minerals)', Section 3.3.1 shall apply, and the quarry shall provide a replacement water supply.

5. Petrol / Oil Interceptor

The petrol / oil interceptor should be inspected each working day to ensure it is operating correctly and daily records kept of this. These records should be made available to Galway County Council if requested.

Other matters in the licence include details about the following. Readers are referred to the Licence itself for specific detail.

6. Attenuation sump, petrol/oil interceptor & wetland area

6.1 Treatment Process – must be able to achieve the Treatment Standards of Condition 2.3.
6.2 Metering – Install Flow Meter, record Daily Discharge, report Quarterly. Limit 1,483m3/d.
6.3 Ready Access – must be allowed for Authorised Persons under the Water Pollution Acts.
6.4 Sampling – Sampling Chamber after treatment and before wetland. Plus access required.
6.5 Caretaker – Day to Day Inspection. Notified Person named and details supplied to GCC.
6.6 Notification of Non-Compliance – Make GCC aware, record details of noncompliance.

7. EPA Guidelines

All works must be carried out in accordance with the EPA Guidelines 'Environmental Management Guidelines 'Environmental Management in the Extractive Industry (non-scheduled Minerals)'.

8. Annual Contribution

€550 due annually. Shall be adjusted with the Customer Price Index value. GCC can increase.

9. Changes in Ownership

GCC to be notified in writing if change in company ownership or Trading Name.

3.0 Person Responsible for Caretaking at the Site

Mr. John Gibbons, the quarry manager, is responsible for inspections and maintenance of the infrastructure associated with the discharge. Mr. Gibbons' contact details are on file with Galway County Council.

4.0 Site Data - Monitoring Results

4.1 Flow Data

The site's flow was fully automated on the 7th of February 2024. Results are presented in Table 1.

Table 1 Daily discharge volumes (m3/d) Q4 2024 & Statistics: Max, Min, Mean Daily

2024	Q4 (m3/d) Totals			ELV MAX
Day	Oct-24	Nov-24	Dec-24	(m3/d)
1	23.33	0.00	0.00	1,438
2	17.58	0.00	0.00	1,438
3	10.66	0.00	0.00	1,438
4	24.06	0.00	0.00	1,438
5	40.11	0.00	0.00	1,438
6	41.01	0.00	0.00	1,438
7	32.29	0.00	0.00	1,438
8	31.92	0.00	0.00	1,438
9	26.36	0.00	0.00	1,438
10	25.59	0.00	0.00	1,438
11	23.28	0.00	0.00	1,438
12	27.67	0.00	3.11	1,438
13	27.83	0.79	0.00	1,438
14	22.61	2.54	0.00	1,438
15	22.02	15.37	0.00	1,438
16	10.71	1.54	0.00	1,438
17	3.39	0.00	0.00	1,438
18	3.53	0.00	0.00	1,438
19	0.00	0.06	0.00	1,438
20	0.50	0.00	0.00	1,438
21	0.00	0.00	0.00	1,438
22	13.06	0.00	0.00	1,438
23	0.00	0.00	0.00	1,438
24	0.00	0.06	0.00	1,438
25	0.00	0.00	0.00	1,438
26	0.00	0.00	0.00	1,438
27	0.00	0.00	0.00	1,438
28	0.00	0.00	0.00	1,438
29	0.00	0.00	0.00	1,438
30	0.00	0.00	0.00	1,438
31	0.00		0.00	1,438
MAX m3/d	41	15	3	
MIN m3/d	0.00	0.00	0.00	m3/d
AVERAGE m3/d	14	1	0	

It is noted that the site has ceased discharge because they need to conserve the water on the floor for dust suppression and site functioning.

4.2 Discharge Water's Quality Data

As is required by Licence W/502/22, the site monitors water quality of the final discharge from the settlement lagoons on a routine Quarterly basis. The laboratory Certificates of Analysis is presented in Appendix A.

Discharge water's quality results are presented in Table 2 with each parameter's ELV for the monitoring period.

Table 2 Ardgaineen Quarry Final Discharge Quality Q4 2024.

Green Highligt in Cells = Compliant			
			Q4 2024
Parameter:	**Units**	**W/502/22 Emission Limit Value**	**13 November 2024**
Hydrogen Ion (pH)	pH units	6 to 9	7.8
Biological Oxygen Demand (BOD)	mg/L	10.0	<0.1
Suspended Solids	mg/L	10	12
Ammonium	mg/L N	0.03	0.03
Nitrate	mg/L N	18.00	11.38
Nitrite	mg/L N	0.05	0.05
Chemical Oxygen Demand (COD)	mg/L	15	< 10
Benzo(a)pyrene	µg/L	0.1	< 0.005
Total Hydrocarbons	µg/L	10	< 10.0
Total PAHs	µg/L	0.1	< 0.005
Southern Scientific Laboratory Reference			153060 (24-50550)

With reference to the results presented in Table 1, and the associated Certificates of Analysis in Appendix A, commentary is as follows:

- The pH of the Discharge is 7.8pH and this is within the 6 to 9 pH Emission Limit Value.
- The discharge's results are below the limit of detection of the laboratory analyser for BOD, COD, Benzo(a)pyrene, Hydrocarbons and Total PAHs. This suggests good Discharge Quality.
- Parameters are within the Licence Limits (ELVs) for pH, BOD, Nitrates, Nitrites, COD, Benzo(a)pyrene, Total Hydrocarbons and Total PAHs. The exception is a small exceedance of Suspended Solids.
- No environmental impact is expected from a 12 mg/l Suspended Solids concentration because the discharge passes over a vegetated wetland type system after the discharge sampling location and interception will further treat the water before infiltration to ground.

4.3 Continuous Data Recording

The site's discharge is now instrumented with a continuous flow meter with physiochemical sensors for parameters as specified in the Licence as follows:

- Flow
- pH
- Turbidity
- Conductivity

Data are collected at 5 minute intervals and reported to the service provider's telemetric data service HydroVU. The data service provider is Capital Water Solutions Limited, Co. Roscommon.

The quarry manager is responsible for daily log in to the telemetric system, visual inspections of the discharge and day to day management.

Given the very low flow rates from the site, the probes are not reporting for continuously flowing water.

The results for continuous monitoring show, as follows:

- pH is within the 6 to 9 pH units ELV of the Licence.
- Electrical Conductivity is within the expected range for a limestone environment at 680 to 700 uS/cm.

4.4 Groundwater Data

Condition 4 of the Licence states that "Quarterly analysis of groundwater monitoring wells will be carried out be an approved accredited laboratory". However, there are no wells on the operational quarry to which the Discharge Licence relates. Hydro-G has previously reported 11 Site Investigation boreholes on the floor of the quarry and none of those boreholes encountered groundwater strike.

There are site investigation greenfield boreholes for the lands to the east of the quarry but they are not within the operational quarry.

The "1. Scope" detail of the Opening of W/502/22 Discharge Licence states that

> "*This licence is for the exiting extraction are of 4.35ha granted under Substitute Consent (Ref SU0053) in February 2017. If planning permission is granted for an extension to the quarry, or there is an increase in quarrying discharge, a full review of this licence will be required.*"

Given that there have been no successful groundwater strikes in 11 boreholes attempted within this quarry because the limestone is the competent Burren Formation Limestone. The aquifer is mapped as a Regionally Important Karst Conduit Aquifer. No groundwater transmissive conduits were discovered in the drilling completed on the floor of the operational quarry. Therefore there is nothing to report with respect to this Condition of the Licence.

5.0 Compliance with Licence Conditions

5.1 With respect to the Volumetric ELV Conditions: The site's flow is now fully recorded. Data presented in Table 1 suggests that the mean daily discharge is compliant with the specified ELV for mean daily volume of 1,483 m3/d, on an annual average basis. Discharge values ranged from 0m3/d

to 41m3/d. It is noted that the site has ceased discharge because they need to conserve the water on the floor for dust suppression and site functioning.

5.2 With respect to Water Quality ELVs: Results presented in Table 2 indicates that the prescribed ELVs were complied with for many parameters analysed. However, Suspended Solids were reported to be elevated slightly at 12 mg/l when the ELV is 10mg/l. No environmental impact is expected from a 12 mg/l Suspended Solids concentration because the discharge passes over a vegetated wetland type system after the discharge sampling location and interception will further treat the water before infiltration to ground. Parameters are within the Licence Limits (ELVs) for pH, BOD, Nitrates, Nitrites, COD, Benzo(a)pyrene, Total Hydrocarbons and Total PAHs. The exception is a small exceedance of Suspended Solids.

6.0 Difficulties Encountered

6.1 As part of previous evaluations, Hydro-G supervised the drilling of eleven boreholes on the floor of the quarry and no groundwater was encountered. Therefore, there is no groundwater quality to report.

6.3 A gross laboratory error in the 6.3 mg/l Ammonium value reported by the laboratory. The fact that BOD is reported at <0.1 mg/l suggests that there is ZERO biochemical loading in the water. IF there actually was 6 mg/l of Ammonium, there would be BOD at greater than 0.01 mg/l. It was an oversight to have missed following up on this.

7.0 Register of Incidents

Apart from the gross reporting for Ammonia, which is confidently asserted to be a laboratory error, there were no 'serious incidents' to report with respect to this discharge during this reported period.

8.0 Conclusions

The site is in compliance with almost all Conditions of the Section 4 Discharge Licence W/502/22.
It is noted that the site has ceased discharge because they need to conserve the water on the floor for dust suppression and site functioning. Parameters are within the Licence Limits (ELVs) for pH, BOD, Nitrates, Nitrites, COD, Benzo(a)pyrene, Total Hydrocarbons and Total PAHs. The exception is a small exceedance of Suspended Solids. There was a small exceedance of SS but no impact is expected.

Pamela Bartley

Dr. Pamela Bartley B.Eng, M.SC., Ph.D. MIEI

Appendix A

Laboratory Certificates of Analysis

Routine Quarterly Monitoring at the Site

RECEIVED: 27/08/2025

Certificate of Analysis

Customer:	Harrington Concrete and Quarries	**Project:**	G WD 1 Surface Water
Address:	Kilkelly Co Mayo	**Site**	Ardgainee
		Date Received:	13/11/2024
		Condition of Sample:	Satisfactory
Report to:	Amanda Tarpey	**Date Analysed:**	13/11/2024 - 06/12/2024
Customer PO		**Issue Date:**	06/12/2024
Quote No.	Q24-00756	**BATCH NUMBER:**	**24-50550**

Aoife Moriarty

Aoife Moriarty
Organics Laboratory Manager

Index to symbols used & Notes

*	Analysis is not INAB accredited
**	Adapted from Standard Methods for the Examination of Water and Wastewater.
***	Customer specific limits
(F)	Analysis carried out at our Farranfore Laboratory.
(D)	Analysis carried out at our Dunrine Laboratory.
LOQ	Parameter Limit of Quantification
Note 6	Subcontracted Parameter.

Notes

- **The results relate only to the items tested.**
- **Opinions and interpretations expressed herein are outside the scope of INAB accreditation.**
- **The analysis report shall not be reproduced except in full without written approval of the laboratory.**
- **Sampling is outside the scope of the laboratory activities.**

Notes for Drinking Water samples

Note A	The water should not be aggressive
Note B	Compliance must be ensured with the conditions that [NO3]/50 + [NO2]/3 =1
Note C	Acceptable to customers and no abnormal change
Note D	In the case of surface water treatment, a parametric value not exceeding 1 NTU in the water ex treatment works must be strived for
Note F	Fluoridated supplies 0.8 mg/L; Natural supplies 1.5 mg/L

Customer Sample Ref:	GWD-1	**Customer Sample Code:**	
Project:	G WD 1 Surface Water	**Sampled By:**	Amanda Tarpey
Our Reference:	153060 (24-50550)	**Sample Matrix:**	Surface Water
Date Sampled:	13/11/2024	**Time Sampled:**	13:00

Method:		Parameter:	Units	LOQ	Result
		Chemical Analysis: (F)			
SCP 052		Hydrogen Ion (pH)	pH units	*4.0*	7.8
SCP 015		Biological Oxygen Demand (BOD)	mg/L	*1.0*	< 1.0
SCP 010		Suspended Solids	mg/L	*2*	12
SCP 027A		Total Ammonia	mg/L N	*0.02*	0.03
SCP 027G		Nitrate	mg/L NO3	*1.11*	11.38
SCP 027F		Nitrite	mg/L NO2	*0.016*	0.053
SCP 016		Chemical Oxygen Demand (COD)	mg/L	*10*	< 10
SCP 060B		Benzo(a)pyrene	µg/L	*0.005*	< 0.005
SCP 115A		Total Petroleum Hydrocarbons (C10 - C40)	µg/L	*10.0*	< 10.0
		PAH's Water (default)			
		Chemical Analysis: (F)			
SCP 060B		Acenaphthene	µg/L	*0.005*	< 0.005
SCP 060B		Acenaphthylene	µg/L	*0.005*	< 0.005
SCP 060B		Anthracene	µg/L	*0.005*	< 0.005
SCP 060B		Benz(a)anthracene	µg/L	*0.005*	< 0.005
SCP 060B		Benzo(b)fluoranthene	µg/L	*0.005*	< 0.005
SCP 060B		Benzo(k)fluoranthene	µg/L	*0.005*	< 0.005
SCP 060B		Sum Benzo (b)&(k) fluoranthene	µg/L	*0.005*	< 0.005
SCP 060B		Benzo(ghi)perylene	µg/L	*0.005*	< 0.005
SCP 060B		Chrysene	µg/L	*0.005*	< 0.005
SCP 060B		Dibenz(a,h)anthracene	µg/L	*0.005*	< 0.005
SCP 060B	*	Fluoranthene	µg/L	*0.005*	< 0.005
SCP 060B		Fluorene	µg/L	*0.005*	< 0.005
SCP 060B		Indeno(1,2,3-cd)pyrene	µg/L	*0.005*	< 0.005
SCP 060B		Naphthalene	µg/L	*0.005*	< 0.005
SCP 060B		Phenanthrene	µg/L	*0.005*	< 0.005
SCP 060B		Pyrene	µg/L	*0.005*	< 0.005
SCP 060B		Total PAH's (sum of 16)	µg/L	*0.078*	< 0.078

Appendix B

Entire Record of Results Reported

Green Highligt in Cells = Compliant									
			Q2 2023	Q3 2023	Q4 2023	Q1 2024 February	Q2 2024 May	Q3 2024	Q4 2024
Parameter:	**Units**	**W/502/22 Emission Limit Value**	**07 June 2023**	**04 July 2023**	**04 December 2023**	**06 February 2024**	**03 May 2024**	**05 September 2024**	**13 November 2024**
Hydrogen Ion (pH)	pH units	6 to 9	8.0	8.1	7.8	8.0	8.1	7.7	7.8
Biological Oxygen Demand (BOD)	mg/L	10.0	< 1.0	< 1.0	1.2	< 1.0	<0.1	<0.1	<0.1
Suspended Solids	mg/L	10	< 4	< 4	< 4	<4	< 4	16	12
Ammonium	mg/L N	0.03	0.03	< 0.02	0.03	0.04	0.02	6.30	0.03
Nitrate	mg/L N	18.00	1.47	1.22	1.73	not reported	10.24	1.56	11.38
Nitrite	mg/L N	0.05	0.012	< 0.005	< 0.005	not reported	0.020	0.03	0.05
Chemical Oxygen Demand (COD)	mg/L	15	< 10	< 10	< 10	<10	< 10	11.00	< 10
Benzo(a)pyrene	µg/L	0.1	not analysed	not analysed	not analysed	not reported	< 0.003	< 0.005	< 0.005
Total Hydrocarbons	µg/L	10	not analysed	not analysed	not analysed	not reported	not reported	< 10.0	< 10.0
Total PAHs	µg/L	0.1	not analysed	not analysed	not analysed	not reported	not reported	< 0.005	< 0.005
Southern Scientific Laboratory Reference			93347 (23-29240)	96104 (23-30235)	113177 (23-36432)	118896 (24-38390)	129163 (24-41909)	143769 (24-47350)	153060 (24-50550)

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