CHAPTER 8

WATER

FEBRUARY 2025

QUARRY CONSULTING

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CHAPTER 8: WATER

Statement of Authority

8.1 The evaluation of the Water (hydrological and hydrogeological) environment and the assessment of Effects and Potential Impacts, with Mitigation Measures and Residual Impacts, was completed by Dr. Pamela Bartley (Hydro-G) who is considered a karst hydrogeology and groundwater specialist with specific expertise in the assessments of quarries, Section 4 Discharge Licencing and Public Water Supply.

8.2 Pamela Bartley's Statement of Expertise is presented as Appendix 8.1.

8.3 This Water Chapter and the Lands, Soils & Geology Chapter were created by the same professional civil engineering hydrogeologist because understanding the science and engineering of quarries and the hydrogeological environment results in complimentary competencies in soils, geology and the interactions between hydrology and hydrogeology.

EIAR Structure

8.4 The Road Map for the EIAR was presented in Chapter 2.0 of this EIAR. Chapter 1.0 provided information on the Site location and Context, Chapter 3.0 provided the Description of the Proposed Development and Chapter 16.0 addresses the Interactions and Cumulative Impacts.

8.5 This Chapter of the EIAR assesses the impact of the proposed development on the hydrological and hydrogeological environment.

Overview

8.6 Coshla Quarries Ltd. is proposing to further develop the eastern part of an existing and permitted limestone quarry at Barrettspark, Athenry, Co. Galway.

8.7 The proposed total footprint of the site (i.e. the existing quarry site and the proposed site extension) will be referred to as "the site" for ease of reference throughout this chapter. The area under consideration in this application is already part of the quarry, with permission, and the proposal is to bring the lands to the south west of the void and to the eastern boundary deeper, but to the same elevation as permitted for the main central area of the site. This means that there are exposed walls of limestone bedrock that extend from the permitted floor to ground level all along the boundaries of the areas proposed for continued quarrying. Refer to Figure 3.1 of the associated Drawing Series.

8.8 The application site can be broadly divided into two main areas: the western side and the eastern side. The western side of the site primarily accommodates non-extraction activities, including stockpiles, storage areas, a licensed discharge to groundwater infiltration area, a concrete manufacturing facility and the quarry management area. The eastern side of the site is dedicated to limestone bedrock extraction activities and includes the existing quarry void. Within the eastern portion, the central area has already been extracted to the permitted elevation of -5 mOD. The proposed development seeks to laterally extend this extraction area further to the east into a strip of land along the eastern boundary, as well as to the southwest, integrating additional lands into the overall extraction footprint. These lateral extensions will maintain the same extraction methods

and depth as the central portion of the quarry, without introducing any new buildings, plant, or processes. The lateral expansion to the east and southwest will necessitate very small expansions of the excavation to the south and north of the working floor. The reason for this is safe quarry design.

8.9 The coordinates central to the overall quarry site are ITM 542,812, 728,565.

8.10 The natural land surface elevation of the entire quarry lands before excavations took place there was 20m OD in the west and 30m OD in the east, approximately.

8.11 The site's licenced Section 4 (W/469/13) water discharge point is in the western part of the site. Refer to **Appendix 8.2** for a copy of the Site's Discharge Licence. Refer to Figure 8.1 for the Site Layout and Discharge Location. Details relating to the Licence is presented in the following section of this Chapter.

8.12 The site lies within the Galway Bay South East Catchment (HA29) and Galway Bay has designation as a European Site (Galway Bay Complex SAC 000268, Inner Galway Bay SPA 004031, Galway Bay Complex proposed NHA 000268) and also has two Statutory Instruments associated: European Union Habitats (Galway Bay Complex Special Area Of Conservation 000268) Regulations 2021 [S.I. No. 548 of 2021] and European Union Conservation Of Wild Birds (Inner Galway Bay Special Protection Area 004031) Regulations 2019 [S.I. No. 515 of 2019]. Water is a supporting habitat. Therefore, this assessment considers water, ecological receptors and Conservation Objective Sites in an integrated way. There is therefore a hydrological link with the Galway Bay complex.

8.13 Although in relative proximity to Galway city, the site is NOT in the mapped catchment of Lough Corrib (HA30). Therefore, the Uisce Eireann asset Public Water Supply (PWS) of Lough Corrib is not linked to the site.

The Site's Section 4 Water Discharge Licence

8.14 The site's existing Section 4 Water Discharge Licence was issued in 2013 (W/469/13). The Licence is therefore current with legislative requirements as determined in the enactment of the Surface Water Regulations (2009, as amended).

8.15 The licence was granted in 2013 to accommodate waters arising over the entire landholding of the site and from the contributing lands. Therefore, the Water Management infrastructure is in place to serve the development currently under proposal.

8.16 As shown in Figure 8.1, rainfall arising and running off the quarry floor, in combination with any wall seeps, flows naturally by gravity from east to west to the Primary Floor Sump at the lowest elevation on the site. The quarry footprint will remain the same under this application i.e. the proposal is for lateral extension to the permitted quarry floor with no additional land take proposed outside the current overall boundary to the quarry. No deepening is proposed below the permitted floor level of -5m OD. The Water Management System is described after the sections describing the Application Site and Existing Development, below.

8.17 The site is permitted to discharge a maximum volumetric Emission Limit Values (ELV) of 360 m3/d to groundwater *via* a percolation lagoon **Figure 8.1 and Appendix 8.2.** The significance of such a small volume of waters arising is that the waters arising on the site can be directly related to the volume of rainfall falling over the site area and surrounding lands, with minimal or no subsurface water contribution. If there was groundwater contribution to the site, then the 360 m3/d ELV would not be enough to keep the site workable.

8.18 The other ELVs of the Section 4 licence (W/469/13) are as follows:

- 35 mg/l Suspended Solids
- 5 mg/l BOD
- 100 mg/l COD
- 50 mg/l NO3
- 1 mg/l Total Hydrocarbons
- <20°C temperature
- 6 to 9 pH range
- Colour & Electrical Conductivity & Turbidity = No Change day to day.

8.19 A Galway County Council letter, dated the 29th of January 2025, demonstrating compliance with the Licence Conditions is presented with a copy of the Licence in Appendix 8.2.

The Application Site

8.20 The application site is comprised of an existing operational quarry, which is broadly rectangular in shape within an overall site area of 27.5 ha.

8.21 The quarry is located approximately 155m to the north of the M6 Motorway connecting Galway to Dublin. The site is located between Junctions 18 and 19 on the M6. Refer to **Figure 1.1**.

8.22 Local towns are Athenry to the east, Oranmore to the southwest, Claregalway to the northwest. The coast and Oranmore Bay, which is a part of Galway Bay, are c. 6km to the southwest of the centre of the entire quarry landholding. The site is 13km, approximately east of Galway city.

8.23 The proposed development will allow for the continuation of quarrying, processing activities and concrete manufacturing at the site and the lateral extension of the quarry floor's permitted extraction area into lands to the east and southwest of the current working floor area. A more detailed description of the proposed development is presented later in the Development Description section of this chapter.

8.24 The site is permitted to work the floor to -5m OD and no deepening of the floor is proposed. It is only proposed to primarily deepen the eastern strip of land that has been stripped only, to date, and not quarried. In addition, there is a small triangle of land (<1ha) to the southwest of the excavated void and this will also be brought from its current elevation to the same elevation of -5m OD permitted for the current floor.

8.25 The application area 'Red Line' boundary and proposed extraction area are shown in Plate 8-1, which is a direct extract from Figure 1.3 of the Quarry Consulting Drawing Series of the 2025 application.

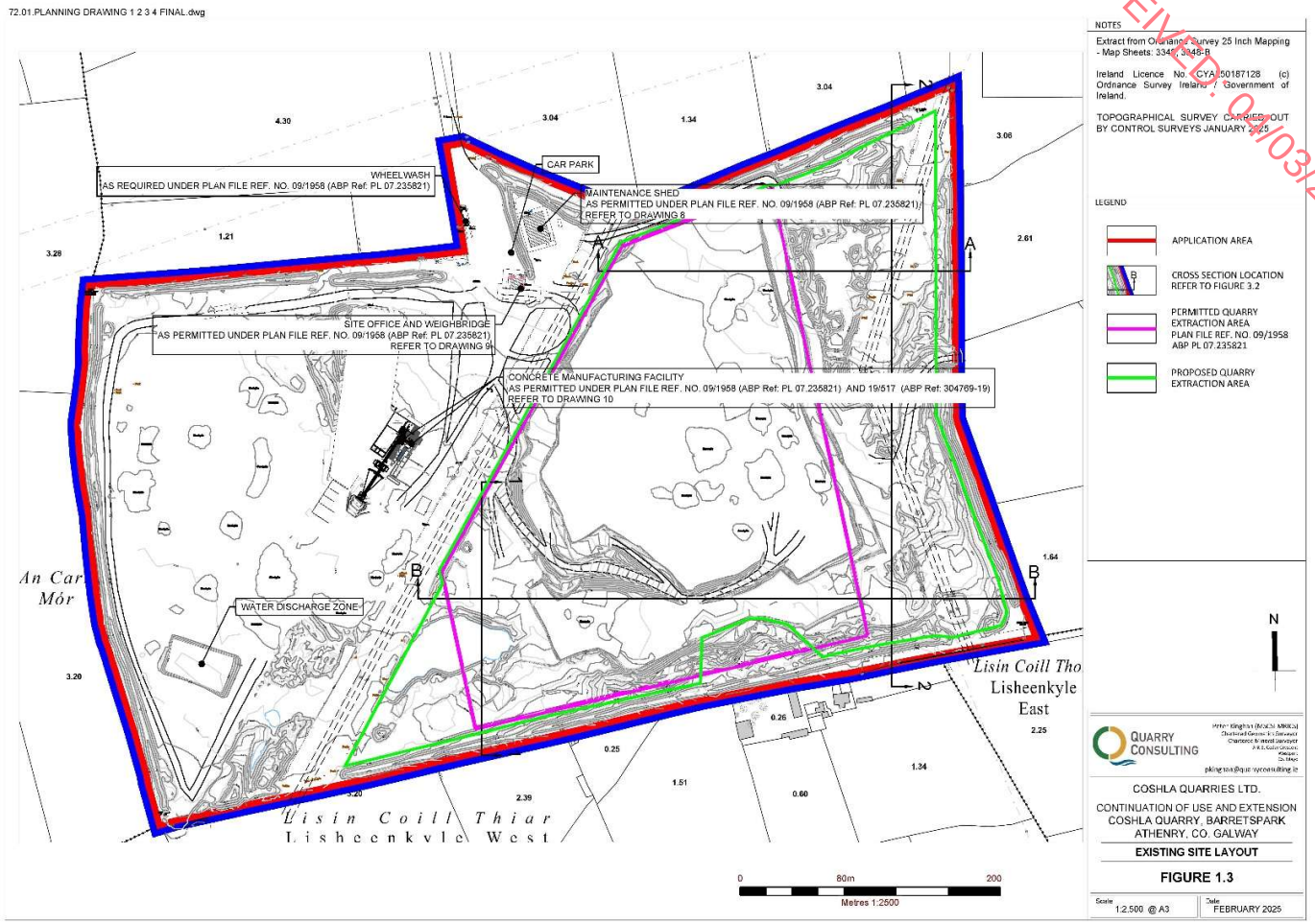

Plate 8-1 Coshla Quarries Ltd. overall Site with Red Line Planning Application Area, Existing and Proposed Layout.

8.26 Surface water features are absent from the area, with the nearest feature comprising the Clare (Galway) River, approximately 2.7km north-west of the site. The river flows broadly west, before entering Lough Corrib. The nearest coastal water body is Oranmore Bay, which is c.6km south-west of the site.

8.27 Residences within the general area typically consist of one-off rural houses and ribbon development along the local road network. The nearest properties to the site comprise one dwelling (uninhabited) situated to the south of the site boundary and three dwellings to the east of the site. There are two dwellings within 400m of the application site (Figure 5.1) and approximately 76 dwellings within 1km of the quarry. The closest settlement to the site is the village of Oranmore, which is situated approximately 5km south-west of the site.

8.28 Access to the site is provided via a 1km private access track that enters the site along its northern boundary. The access track joins the L7109, which in turn joins the R339 at a T-junction approximately 1.3km north of the site. Near the site the L7019 comprises a marked single carriage road with an 60km/hr speed limit.

The Existing Development

8.29 As stated, the quarry and concrete manufacturing facility cover an overall site of 27.5 ha, approximately, and the proposed extension area measures approximately 4.6 hectares and will bring the total extraction area up to c.13 hectares.

8.30 Details of the site layout shown on the Application's Drawing Series and Hydro-G Figure 8.1.

8.31 Details for all site infrastructure are presented in Chapter 3 of this EIAR.

8.32 The existing permitted quarry floor level is -5m OD, and this relates to the central portion of the eastern part of the application site.

8.33 The existing quarry operations involve extracting limestone through blasting and mechanical means, followed by processing with mobile crushing and screening equipment. The material is crushed, screened, graded and stockpiled before being transported off-site or used in the on-site concrete manufacturing facilities. Blasting occurs under licence at predetermined times, and processed material is sold as aggregates or used to produce concrete products on site. Quarried material is weighed on the weighbridge at the site entrance in the central northern section of the quarry, which is also occupied by the site office. Blasting is undertaken approximately once in a 5 week period, potentially increasing to two times during periods of high demand. Rock breaking is occasionally required (in situations where the blasted rock is too large to enter the crusher).

8.34 The entire quarry can be subdivided into three separate sections as evidenced on Figures 7.6 of the LSG Chapter and Figure 8.1 of the Water Chapter, and can be described as follows:

- **Area A:** This section of the quarry is the current void and is permitted to, and achieved, a floor elevation of -5m OD without any interception of groundwater. This is the main area of rock excavation. It is located from the centre in the direction of the eastern part of the site. The current permitted void area in the centre-east of the site is c. 8.4 ha.
- **Area B:** This section of the quarry is the strip of land along the eastern boundary and to the southwest of Area A and currently under consideration for permission to extract material to the same -5 mOD as the current floor of the quarry.

- **Area C:** This is the western half of the site and accommodates the processing areas, concrete manufacturing, block making, upper level Settlement Tank and the Section 4 Licensed Discharge to Groundwater Zone for waters arising, post treatment.
- **Note:** All Areas A, B and C form the application area. Hydro-G has labelled them and compartmentalised the total area for ease of Impact Assessment later.

8.35 Beyond the quarry's eastern boundary there is an old sand and gravel pit/infill site belonging to a separate owner (Galway County Council PL Ref 19325).

8.36 To the northeast of the quarry there is a permitted ESB Substation (Original Galway County Council PL Ref 052364) with associated overhead lines.

8.37 A large factory dedicated to Tooling Manufacturing, named C&F Tooling, exists to the north east of the ESB Substation.

Water Management Systems (Existing)

8.38 Refer to Figure 8.1 for Water Management System components.

8.39 Rainwater falls on the landscape surrounding the excavated void and enters the site by gravitational fall to, and across, the exiting quarry floor.

8.40 There are no major springs or groundwater ingress points within the site. Refer to the photographs of the Lands, Soils & Geology Chapter and the Apex (2024) Geophysical Report's photographs.

8.41 Observations of the walls of limestone around the perimeter of the void show a solid competent mass of dry limestone with the exception of the northeast corner of the void. There is shallow interflow water up high in the epikarst broken rock zone in the northeast corner wall of the void. Whilst some might refer to this water as 'groundwater' or to the mossy / brown staining it has left as Tufa, that is not how it should be described. Tufa is a precipitation of calcite *i.e.,* when water that has been in contact with carbonate rocks such as limestone emerges into the atmosphere the carbonate that it has assimilated from its long duration contact with the rock precipitates or escapes due to the action of oxygenation by the atmosphere on its escape to the free environment (e.g. the exposed rock face of a quarry void). The British Geological Survey (BGS) defines Tufa as follows: *"Tufa is a sedimentary rock composed of calcium carbonate or silica, formed by evaporation as a thin, surficial, soft, spongy, semifriable encrustation around the mouth of springs, seeps or along streams carrying calcium carbonate in solution*" (https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=TUFA). The wetness in the north eastern corner of the excavated void does not have hard white encrustation. It has created a brown mossy wall. The reason for no calcite precipitation is that it is not water that has been in contact with the limestone for a long time. Instead, it is recent rainfall that has fallen on the currently unquarried part of the north and eastern overall site, travelled vertically through the subsoil and when it reaches the top of the solid competent bedrock, it is forced to flow along the top surface of the rock until it escapes. This is what happens in the north eastern corner. There is no water ingress in any other location of any of the walls of the void. Therefore, the water management systems of the site are not extensive in size. The size of water management infrastructure at a site tells the story of how much water is experienced at a site. The excavation depth and current quarry floor level have not intercepted a groundwater flow system. While the 2020 permission (Plan File Ref. No. 20/499, ABP-308549-20) restricts extraction below the water table (Condition 6), in the context of a conduit-controlled limestone aquifer, the concept of a 'water table' is not applicable. Karst

hydrogeologists acknowledge that groundwater flow in such aquifers occurs primarily through conduits rather than a uniform water table. To date, no evidence of groundwater flow or significant karst conduits has been encountered in the workings completed to achieve the current floor level of -5m OD or in the 18 Site Investigation BHs reported in the 2020 EIAR for the proposed lateral expansion area.

8.42 Therefore, only rainfall runoff must be managed within the quarry area.

8.43 Rainwater runoff flows over the bedrock by gravity to a floor sump (labelled 1 on Figure 8.1) on the western wall of the existing quarry void.

8.44 From the floor sump, attenuated water is pumped to a Settlement Lagoon (labelled 2 on Figure 8.1) adjacent to the concrete batching plant.

8.45 From the Settlement Lagoon, water overflows by underground pipe to a Discharge Zone (labelled 3 on Figure 8.1) that is in the western portion of the site.

8.46 There is a Flow Meter on the discharge leaving the Settlement Lagoon.

8.47 The Discharge Zone is the licensed area for discharge to groundwater by infiltration lagoon. Although it predates the nomenclature, it is essentially a Nature Based Solution.

8.48 The Water Management Systems operate to ensure compliance with the Conditions of the Section 4 Licence and monitoring results will be presented and discussed later.

8.49 As previously stated, the eastern area under consideration for quarrying already sends its rainfall runoff and shallow interflow to the existing sump located on the excavated floor. Therefore, the existing Water Management Systems have proven capacity to accommodate the proposed development's waters arising.

8.50 Surface water runoff from the area of the batching plant and concrete block yard drains back to the floor for collection in its sump. The floor is a large area that can accommodate any depth duration of rainfall from other areas of the site.

8.51 For the purpose for dust suppression and other site uses, during dry periods the settlement tank topped up from an existing on site bored well, which is located on the north-eastern corner of the site. The well is also used to provide water to the concrete batching plant, supply the office supply and as a top-up for aggregate washing at the screening plant during dry periods and for production.

8.52 Class 1 hydrocarbon interceptors are in place where the potential exists for hydrocarbon pollution, *e.g.*, at refuelling points and at the site's garage. There is a final hydrocarbon interceptor beside the site's settlement tank on the pipeline to the licenced discharge infiltration area.

Site Services - Water and Wastewater

8.53 With respect to water supply to the site, a Water Supply Borehole serves the site's offices, concrete batching plant and provides supplementary water for dust when there is not enough rainfall sent from the floor to the site's settlement lagoon. The onsite water supply well is in the far north eastern corner of the site immediately adjacent to BH1 Groundwater Monitoring Well in which the groundwater strike in the conduits was reported to be between c.40 and c.100m bgl (Briody, 2007), which are calculated to be broadly equivalent to c.-15m to c.-70m OD. Water from the onsite water supply well is tested routinely for suitability for its use. Certificates of Analysis are presented with all site monitoring data (Appendix 8.11).

8.54 With respect to wastewater treatment, the site's staff are serviced by the wastewater treatment system and discharge zone that was granted permission in the parent permission for the site.

Planning History & Historic Assessments

8.55 It is important to note that the current permissions, under which the quarry is currently operating, sanction extraction of rock to an elevation of -5m OD across Area A.

8.56 Quarry Consulting, in earlier Chapters of this EIAR and the accompanying Planning Report, presented the historic detail of all Coshla Quarries Ltd.'s applications relating to the site from the initial 2006 applications through to the most recent applications in 2020 / 2021 (Plan File Ref. No. 20/499, ABP-308549-20).

8.57 Almost twenty years have passed since the commencement of extraction of the current permission.

8.58 Relevant to this evaluation, most recent applications (Galway County Council PL Refs 20499 & 21859, which was the extension of duration of the 09/1958 planning) were lodged and granted for the same Project Description as is currently proposed: continued operation of the quarry site and extension in depth in lands within the landholding to the north, east and south of the current void.

8.59 In the Board's Grant of permission in 2023 (Plan File Ref. No. 20/499, ABP-308549-20) there was a general theme that the proposal was defensible and sound. However, there were some misunderstandings relating to the material to be excavated, which has always been limestone bedrock, and as to whether there was a 'Water Table' in this Karst Conduit setting. Therefore, the applicant is lodging an application here that is the same as before. The focus of this assessment is to clarify, for the Planning Authority, the conceptual understanding of the water environment at and beneath a limestone bedrock site in a karst conduit aquifer. This application is intended to support planning conditions that align with the site's actual bedrock and aquifer characteristics. The important thing to note is that at the time of the 2020 / 2021 / 2023 Grant of planning (Plan File Ref. No. 20/499, ABP-308549-20) the information presented to the competent planning authorities included the Site Investigations for the depth of rock excavation to the elevation of -5m OD.

8.60 Historic applications have been accompanied by Environmental Impact Statements (EIS) in 2006 and 2009 and an Environmental Impact Assessment Report (EIAR) in 2020. Therefore, the historic body of works informing previous assessments and reporting the Site Investigations are relevant to this assessment also and shall be referenced accordingly.

8.61 This impact assessment builds on the findings of previous intrusive site investigations and incorporates updated data from additional drilling, geophysical surveys, and ongoing site monitoring.

The Proposed Development

8.62 The proposed development comprises the following:

- Continued use of the existing quarry to the permitted depth of minus 5 mOD, including drilling, blasting, crushing, processing, stockpiling of materials, associated roads and ancillary services (granted under Planning Ref. File No.: 09/1958 and ABP Ref.: PL07.235821),
- Continued use of open storage areas,

- Continued use of existing permitted concrete manufacturing facility (granted under Planning Ref. File No. 09230 and 19/517: ABP-304769-19),
- Continued use of the existing office (granted under Planning Ref. File No.: 09/1958 and ABP Ref.: PL07.235821),
- Continued use of the existing maintenance shed (granted under Planning Ref. File No. 09610),
- Continued use of the existing water management system (including settlement lagoons), weighbridge and wheelwash,
- Lateral extension of the existing permitted quarry area over a previously permitted extraction area (granted under Planning Ref. File No. 06/4125) of c.4.6 ha. area to a final floor level of minus 5 mOD. The total quarry extraction area will be c. 13 Ha,
- Restoration of the application area to natural habitat after uses following completion of extraction.

8.63 The proposed development is within an overall application area of c. 27.5 hectares and is for a total period of 22 years (comprising an operational period of 20 years followed by 2 years for restoration).

Assessment Objectives

8.64 Under the European Union's Environmental Impact Assessment (EIA) Directive (2011/92/EU as amended by 2014/52/EU), major building or development projects in the EU must first be assessed for their impact on the environment.

8.65 In Ireland, the EPA (2022) Guidance for Information to be Contained in Environmental Assessment is used to guide assessments and the preparation of an Environmental Impact Assessment Report (EIAR). EPA (2022) has been used in this assessment (refer to EIAR Chapter 2).

8.66 The objectives of this assessment are, as per the EIA Directive (2014/52/EU) and EPA Guidance (2022), to present an EIAR that contains all the relevant information for the Planning Authority's EIA, which includes, as follows:

- Baseline hydrogeological and hydrological conditions for the site & update previous assessments, which had a strong foundation in drilling and monitoring information.
- Potential impacts of the proposed development on the underlying groundwater body, associated surface water bodies and ecosystems.
- Potential for Cumulative Impacts and Transboundary Impacts.
- Appropriate mitigation measures for any identified potential impacts, as deemed necessary, with impacts and proposed mitigations reassessed and residual impacts defined for the convenience of the Planning Authority's EIA.

Guidance and Legislative Instruments

8.67 This report was prepared with consideration of Industry Guidance documents and ensuring compliance with European Legislation (Directives) and Irish Statutory Instruments and Regulations as listed in **Appendix 8.3**.

8.68 The author of this assessment hereby confirms that the assessment completed and reported adheres with EU EIA and EIAR Guidance and that the proposed project has been assessed in accordance with EPA (2022) Guidelines for EIA.

8.69 The author of this assessment hereby confirms that the assessment completed and reported has been completed with consideration of Irish Statutory legal instruments enacting the Water Framework Directive (WFD) and the Birds & Habitats Directive.

Data and Maps

8.70 This report was prepared using Desk Study available Data and Maps appropriate to the study site, and wider environment, and site-specific reports for the site as listed in **Appendix 8.4**. The data sources critical to the development of an understanding of the hydrology of the area are provided in full in Appendix 8.4.

Consultations

8.71 In relation to water, the site's agents have engaged with the Health Service Executive and the Geological Survey of Ireland.

8.72 Scoping Responses of relevance to this Water Assessment presented as **Appendix 8.5**, in which Hydro-G responses are also provided.

8.73 Hydro-G hereby confirms that all resources and consideration requests returned by the GSI has been included in the assessment. And the water related requests of the HSE have been addressed.

8.74 The Impact Tables at the end of this Chapter incorporate all information required by statutory stakeholders and the public.

Overall Assessment Methodology

8.75 The methodology adopted for this assessment is as follows:

- Review of current Legislation and Guidance relating to EIA and EIAR, Quarry Assessment Guidance and Water and Habitats related Legislation.
- Review of the 'Subject' development currently under consideration and assessment.
- Review of the 2020 Project Scoping document's Responses from Statutory Bodies because this 2025 application is for the exact same development description as that scoped in 2020.
- Characterisation of the Receiving Environment (hydrology and hydrogeology).
    - Determination of the Baseline.
    - Evaluation of WFD Reported characterisations for the environment.
    - Evaluation of the site's own receiving environment.

        (a) It is noted that HES (2020) reports completed and extensive site investigations relating to the entire site's geology, hydrogeology and associated external

hydrological systems. Information for the site was presented in a 2020 dated EIAR associated with previous Planning Determinations for the site.

(b) Hydro-G, Envirologic and Apex have completed Site Investigations in 2024. Those will be presented in detail later in this chapter.

- Review and analysis of Site Investigation Results and Long-Term site monitoring data.
- Application of EPA (2022) and IGI (2013) Guidelines on the Assessment of Potential Effects. Identification of Potential Effects, Mitigation Measures, Assessment of Residual Impacts & Other Impacts, as specified in Guidance. (Appendix 8.6).
- Application of the UK Environment Agency's Hydrogeological Impact Appraisal Methodology for Dewatering at Quarries (Appendix 8.7).
- Consideration of PWS Protection Measures & Consideration of SAC Protection Measures, including the conservation objectives of designated Natura 2000 sites.
- Completion of the Water Framework Directive Assessment.

Desk Study Receiving Environment

Historic Land Use

8.76 Historical land uses reviewed using maps and aerial photography are detailed in Table 8.1.

Table 8.1 Historical Land-use at the Site and its Surroundings

Ordinance Survey Map Reference (Dates)	On Site	Immediate Surroundings
OS 6" colour (1837-1842)	Nothing of note	The same cluster of farm buildings, to the east of the site, are the only buildings or homes nearby. There are some houses on the Regional Road R339 to the north of the site, but no homes in the immediate vicinity of the site.
OS 6" Cassini (1845)	The site is mapped as uncultivated land.	As above. Noted is that the road to C&F Tooling and the site does not yet exist.
OS 25" Historic (1888-1913)	No change from above	
Aerial Imagery 1995	The quarry is not yet developed. It is greenfield.	The evidence of the farmyard on the southern boundary of the site appears. The construction of the ESB Substation site has commenced. There are now some homes built on the access road from the R339 to the ESB Substation. C&F Tooling's site appears to have been used for a construction compound associated with the ESB Substation. A 'borrow pit' seems to have commenced at the site of the MPL Plant Hire Ltd (PL 19325) site to the east of the site and to the south of the ESB Substation.

Aerial Imagery 2001	The quarry is not yet developed. It is greenfield. There is some evidence of gravel or bedrock exposure central to the site.	The road from the R399 to the ESB Substation now has multiple sites developed for residential purposes.
Aerial Imagery 2006	Quarrying has commenced in the form of clearing lands, very shallow.	The M6 Motorway to the south has appeared as a construction site.
Aerial Imagery 2008	No change from above	
Aerial Imagery 2009 - present	The quarry progresses in depth in the permitted central-east area. Sometimes rainwater has accumulated on the floor or other trafficked parts of the southern boundary. Other times the quarry is dry and no water can be seen.	No change in the vicinity of the site.

Conservation Objective Sites

8.77 Conservation Objective Sites/ Designated Areas and the site are presented as Figure 8.2.

8.78 As previously introduced, the site is c.6km from Oranmore Bay, which is part of Galway Bay Inner SAC, SPA and proposed NHA. Given that the site is mapped as part of the Galway Bay South East Catchment (HA29), there is a hydrological link to the Conservation Objective sites associated with Galway Bay inner.

8.79 Galway Bay has designation as a European Site (Galway Bay Complex SAC 000268, Inner Galway Bay SPA 004031, Galway Bay Complex proposed NHA 000268) and also has two Statutory Instruments associated: European Union Habitats (Galway Bay Complex Special Area of Conservation 000268) Regulations 2021 [S.I. No. 548 of 2021] and European Union Conservation of Wild Birds (Inner Galway Bay Special Protection Area 004031) Regulations 2019 [S.I. No. 515 of 2019].

8.80 There is another SPA in the vicinity of Oranmore named the CREGGANNA MARSH SPA (004142), which is also a National Heritage Area (NHA) (https://www.npws.ie/protected-sites/spa). The Site Synopsis (NPWS, 2015) states that "*Cregganna Marsh is situated about 3 km south of Oranmore, to the west of the Galway - Ennis road. The predominant habitats on the site are lowland wet grassland and improved grassland, but areas of limestone pavement and other exposed rock, Hazel (Corylus avellana) scrub, freshwater marsh, drainage ditches and dry grassland are also represented. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for Greenland White-fronted Goose, which are part of the Rahasane flock. Cregganna Marsh SPA & NHA is of ornithological importance because it is regularly utilised by a nationally important flock of Greenland White-fronted Goose, a species listed on Annex I of the E.U. Birds Directive*".

8.81 The Clare (Galway) River, part of Lough Corrib SAC, SPA and pNHA, is 2.7km, approximately, north-west of the site. The river flows broadly west, before entering Lough Corrib. The quarry site is mapped as part of Hydrometric Area 29. Lough Corrib is mapped as part of the Corrib Catchment (HA30). The two HAs are considered separate and not connected in the context of potential for the quarry to affect Lough Corrib.

8.82 With respect to WFD and Groundwater Dependent Terrestrial Ecosystems, to the south of the site, the EPA maps a distinct GWB named 'GWDTE -Galway Bay Complex Fens (SAC000268)', whose closest northern mapped boundary is c. 350m to the south of the M6 in the vicinity of the quarry site. The M6 passes in and out of this GWDTE on its way to Galway, slightly west of the quarry. The Statutory Instrument associated with the Fens, as linked on the NPWS website (https://www.npws.ie/protected-sites/sac/000268), is S.I. No. 548 of 2021: European Union Habitats (Galway Bay Complex Special Area of Conservation 000268) Regulations 2021.

Public Water Supply (PWS)

8.83 EPA Envision mapping presents Drinking Water Protection Area (DWPA) information, as shown in Table 8.2.

Table 8.2 Drinking Water Protection Area (DWPA) information (Envision Mapping Source)

Name	Drinking Protection Type	EU Priority Area (PA) Type	EU PA Code	Hydro-G Notes
Clarinbridge	Groundwater	Article 7 Abstraction for Drinking Water	IEPA1_WE_G_0008	**NO Direct Hydro connection from the site to Clarinbridge's Groundwater Supply. There are no PWSs and no GWSs between the site and the coast. There is no risk to any Clarinbridge GWB Water Supply.**
Brockagh Lisduff	NFGWS Group Scheme Source Protection Areas	Article 7 Abstraction for Drinking Water	Not specified	This GWS is farther east and farther south of the site. Given the likely groundwater flow direction to the coast from the site, this scheme is not at risk.
Carheenlea GWS	NFGWS Group Scheme Source Protection Areas	Article 7 Abstraction for Drinking Water	Not specified	This GWS is farther north and therefore upgradient of the quarry. Groundwater cannot flow in the direction of that GWS.

8.84 On the basis of Desk Study data and evaluation, as presented in Table 8-2, no DWPAs are brought forward for specific PWS Protection Measure evaluation. The reason being that there is no connection between the site and any DWPAs mapped for the hydrometric area, groundwater body or wider environment associated with the site's situation in the landscape.

Rainfall & Recharge & Site Water Balance

8.85 Met Eireann Monthly Rainfall Values for the nearest Synoptic Station over the last number of years are shown in Table 8.3.

Table 8.3 Monthly rainfall values (mm) Athenry Met Eireann Synoptic Station.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2024	92.4	159.1	130.5	100.7	59	58.9	71.5	159	46.6	112.7	88	82.2	1,161
2023	113.9	42	185.9	93.4	63.5	93.8	224.1	129.1	148.2	179.9	113.5	202.9	1,590
2022	56.9	143.1	39	51.6	78.9	79.4	66	79.6	114.2	199.3	156.2	114.3	1,179
LTA	**116.7**	**87.8**	**94.7**	**72**	**75.3**	**79.6**	**86.5**	**107.8**	**100.3**	**128.9**	**120.3**	**123.2**	**1,193**

8.86 The Long-Term Average Annual Rainfall amount reported by Met Eireann, for Athenry Station for the 2022 - 2024 period, is c. 1.2m/yr.

8.87 The Geological Survey of Ireland provides Groundwater Recharge Data in which Annual Rainfall (RF) is reduced to ER [Effective Rainfall (ER) = RF - Evapotranspiration Et] as shown in Table 8.4.

Table 8.4 GSI reported Groundwater Recharge and Effective Rainfall Water Balance Components.

Effective Rainfall (mm/yr)	718.30
Recharge Coefficient (%)	60
Groundwater Recharge Pre Cap (mm/yr)	431
Recharge Cap Apply	N
Average Groundwater Recharge Range (mm/yr)	401 - 450
Hydrogeological Setting Description	Extreme Vulnerability: Till overlain by well-drained soil
Vulnerability Category	E
Vulnerability Description	Extreme
Subsoil Type (Quaternary Sediment Code)	TLs
Subsoil Description (Quaternary Sediment Description)	Till derived chiefly from limestone
Bedrock Aquifer Category & Description	Regionally Important Aquifer - Karstified (conduit)
Hydrostratigrahpic Rock Unit Group Name	Dinantian Pure Bedded Limestones

8.88 With reference to Table 8.4, the GSI data can be interpreted, as follows:

- Of the c.1.2m/yr Met Eireann average annual rainfall, 718.3mm/yr is reported as 'Effective'. This means that c.0.5m/yr is lost to the atmosphere by evapotranspiration or evaporation.
- The Groundwater Recharge co-efficient applied by the GSI is 60% because the TLs Subsoil type and the Dinantian Pure Bedded Limestone do not make it easy for rainfall infiltration to the underlying groundwater system. No 'Cap' is applied by the GSI and therefore the mapped amount of Groundwater Recharge is calculated to be 431mm/yr of the 1.2m /yr Met Eireann Rainfall.

- If the Effective Rainfall is 718.3mm/yr and the GSI mapped groundwater recharge is 431 mm/yr then the balance is what is lost to runoff and that value is (718.3 – 431) = 287mm/yr.

8.89 These values for rainfall, effective rainfall, groundwater recharge (and by balance, runoff) are important for the Site's Water Balance and conceptualisation of the way that water moves through the site. In particular, the values can be used to rationalise the flow meter readings for the licensed Section 4 discharge volumes.

8.90 For the site area of 27.5 ha and a value of 431 mm/yr from the GSI for groundwater recharge, it follows that (27.5 ha = 27,500 m2) x 431 mm/yr = 118,525 m3/yr = c.325 m3/d being the volume of rainwater that is recharged to the underlying rock, on average each day, across the entire site area.

8.91 For the site area of 27.5 ha and a value of 287 mm/yr for site runoff, it follows that (27.5 ha = 27,500 m2) x 287 mm/yr = 78,925 m3/yr = c.216 m3/d being the volume of rainwater that runs off the land's surface, on average each day, across the entire site area.

8.92 With reference to Desk Study available information available for the magnitude of the site's discharge, information presented in the Water Chapter of the 2020 EIAR (PL 20/499) suggests that an average value of 146 m3/d was discharged between January 2019 to January 2020.

8.93 Returning to Met Eireann and GSI data for the site, when added together the sum total of rainfall runoff requiring management plus groundwater recharge percolating downwards is (216 + 325) = 541 m3/d. Therefore, if the quarry were "operating below the water table", which was asserted previously in the 2020 EIAR, then the average amount of waters arising should be at least 545 m3/d arising from the Effective Rainfall components sending water to recharge the groundwater and to runoff at the site. However, if the quarry was actually 'below the Water Table' there would even be more groundwater volume brought in by the karst conduit system, if that karst conduit system did actually exist in the excavated depth of the quarry to -5m OD. However, on the basis of reported information (PL 20/499) the site does not discharge anything approaching the 550 m3/d. The site has previously been reported (EIAR 2020) to require management only of the c. 200 m3/d rainfall runoff component of the water balance.

Hydrology

8.94 The site lies within the Galway Bay South East Catchment (HA29), which is the land mass area drained by all streams entering tidal waters in Galway Bay between Renmore Point in Galway city and Black Head in County Clare.

8.95 EPA (2024) Hydrometric Area Reports for HA29, in which the site is mapped, and the Clare Corrib (HA30), which previous assessors have focussed on, are presented in Appendix 8.8.

8.96 Regional Hydrology is presented in Figure 8.3 and Local Hydrology is shown as Figure 8.4. There are no surface water systems within 4km of the site and no direct connection to either of the tributaries of that river named the CARROWMONEASH (Oranmore)_010, which drains from two locations: an Industrial Complex to the north of Oranmore and lands to the east of Oranmore.

8.97 EPA (2024) reports that the Galway Bay East catchment (HA29) drains a total area of land of 1,270km² into the sea. When the site is considered as having a total area of c.27ha, this is equivalent to c.0.27km2 and it is therefore 0.02% of the total catchment area. This has significance in terms of small scale and insignificant potential for impact.

8.98 The catchment profile of the Galway Bay South East Catchment (HA29) is described by the EPA (https://www.catchments.ie/), as follows:

- "The largest urban centre in the catchment is the eastern part of Galway City. The other main urban centres in this catchment are Athenry, Loughrea, Gort, and Oranmore.
- The total population of the catchment is approximately 74,365 with a population density of 59 people per km².
- This catchment is predominantly underlain by karstified limestone, including the northern part of the Burren in County Clare, and the groundwater and surface water systems in the area are closely interlinked.
- Only the southeastern part of the catchment, which is underlain by old red sandstones, does not contain karst and the associated assemblage of springs, swallow holes and numerous caves that dominate the majority of the catchment.
- There is essentially no natural connected surface drainage network in this catchment west of a line running from Athenry to Craughwell to Gort.
- Surface drainage is entirely absent in the north Clare part of the catchment.
- In this area virtually all rainfall in the area enters the bedrock aquifer and makes its way underground a number of groundwater flow routes towards the coast".

8.99 The nearest coastal water body is Oranmore Bay, which is c.6km south-west of the site.

8.100 EPA (2024) provides a useful image for the detail of HA29, and its constituent sub components of sub catchments and sub basins, and names of the other Hydrometric Areas (HAs) around the site. Refer to Plate 8.2.

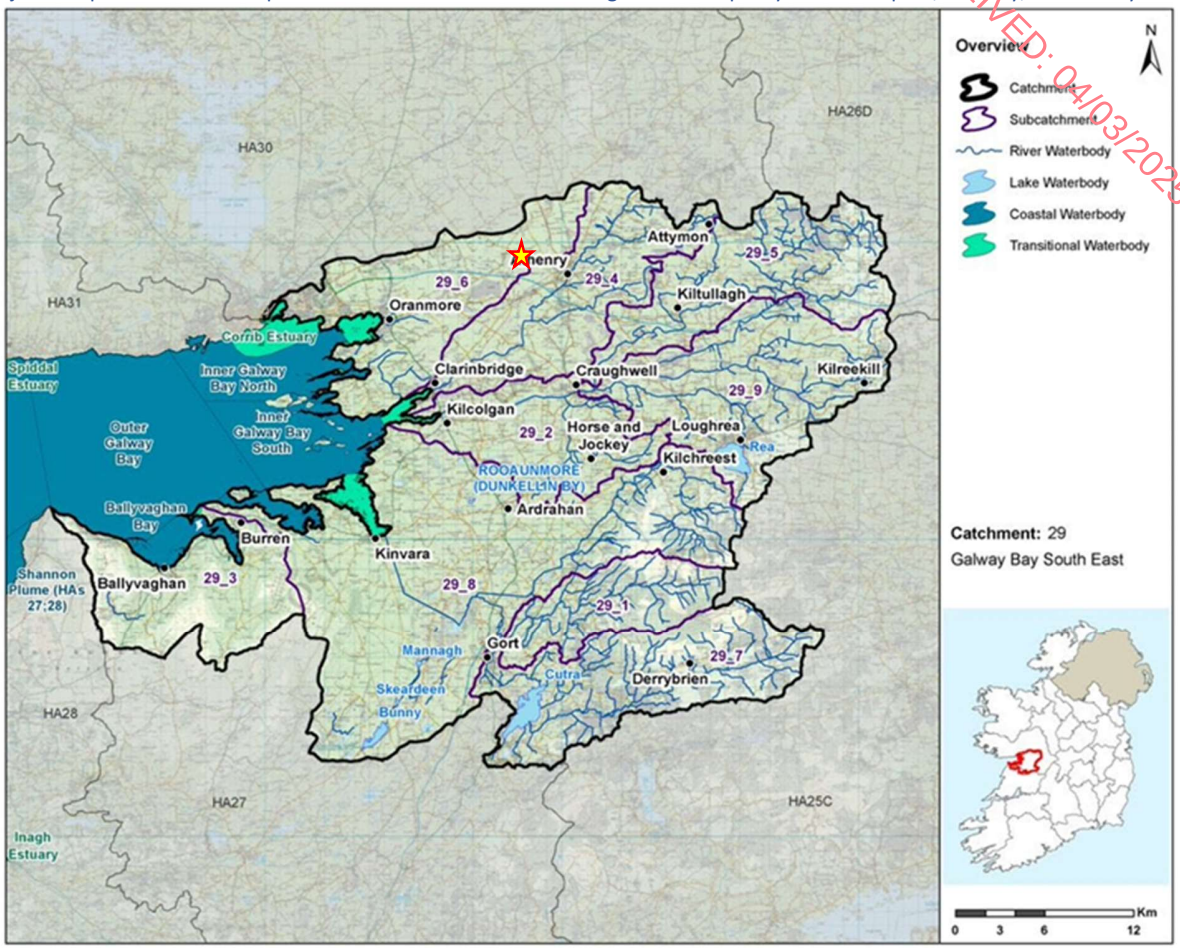

Plate 8-2 EPA (2024) presentation for the Galway Bay South East Catchment (HA29).

(Hydro-G Annotation for the approximate location of quarry ★ west of Athenry on the map).

8.101 Surface water features are wholly absent from the immediate area of the site: the Clare (Galway) River, which is c.4km north-west of the site. The Clare (Galway) River flows into Lough Corrib. However, the Clare (Galway) River and Lough Corrib are mapped by the EPA as part of HA30 and so at this Desk Study reporting of EPA and WFD Mapping there is no potential for a direct hydrological link between the site and the Clare River or Lough Corrib.

Hydrometrics

8.102 Because there are no flowing surface waters, there are neither EPA nor OPW Hydrometric Stations applicable to the study of the site.

Hydrogeology

8.103 The Lands, Soils and Geology Chapter presented detail for the Soils, Subsoils and Bedrock environment at the site and in the surroundings.

8.104 In this chapter, the water related aspects of the geological systems are presented.

8.105 **Groundwater Vulnerability** is mapped by the GSI as 'X' Rock at or near Surface or Karst and as 'E' Extreme. The 'E' Extreme Groundwater Vulnerability applies to large expanses of the region. Refer to Figure 8.5. All quarries are essentially E or X Groundwater Vulnerability because the concept relates to the depth of subsoil cover over bedrock and the whole aim of quarrying is to expose and extract bedrock for societal use.

8.106 **Aquifer Classification** is mapped by the GSI as Rkc - Regionally Important Karst Conduit. Refer to Figure 8.6. The area of this aquifer is reported by the GSI to be 7062.74 km2. Again, in terms of scale, the site represents 0.004% of the total mapped aquifer area. This has significance in terms of small scale and potentials for impact at the aquifer scale.

8.107 **Karstification** is the process whereby fissures, faults and joints in the purer units of limestone are enlarged by dissolution. Karstification can considerably enhance the permeability of limestone which has essentially no inter-granular permeability. The area is mapped to have numerous karst features such as turloughs (seasonal lakes), enclosed depressions and caves as shown in Figure 8.7. There is a GSI mapped cave to the immediate east of the ESB Substation and there is a cave to the northwest and to the southeast of the site. Review of the comprehensive directory of caves for the area, in a 340-page documentation and description book by the British Speleological society (Boycott *et al.,* 2019) does not provide any documentation or information for the mapped caves in the area.

8.108 No conduit Karst has been encountered in the operational excavation of bedrock to the -5mOD in the previously sanctioned permission.

8.109 A **Karst Conduit Aquifer** classification is of significance to how groundwater might move through conduits, or pipelines or corridors of void space, in the bedrock mass. Limestone is a sedimentary rock that was formed as sediment settled on the beds of prehistoric oceans and was compressed. There is no primary porosity in limestone bedrock, which means that it is not porous like a sponge, there is no contiguous water content in this Karst Conduit limestone bedrock. Groundwater flow in karst conduit bedrock is conceptualised as the plumbing system pipe network of a town's water distribution or storm network or as the pipes connecting radiators in a home and this is well documented by researchers at Trinity College Dublin in their Gort Flood Risk body of work (*e.g., Gill 2010, Gill et al. 2016, McCormack et al. 2014, 2018, 2020, Morrissey et al. 2020, 2020, 2021,, Naughton 2011, Naughton et al., 2012, 2017, 2018a,b,c).*

8.110 The most important hydrogeological concept is where the groundwater will move to after it passes through conduits or corridors under the site. Hydro-G offers that the likely groundwater flow direction from the site will be in the general direction of the coastline near Oranmore. Whilst there may be deflections and meanderings of conduits that influence groundwater flow direction along the way, ultimately all groundwater is trying to escape to the coast.

8.111 As previously stated, the coast is c.6km away and sea level is 0m OD. Therefore, the exposed walls of the void to the floor elevation of the site, to its exposed -5m OD, are below any possible conduits connecting lands to the north and east of the site to the sea.

8.112 The site is underlain by the Clarinbridge Groundwater Body (GWB) [IE_WE_G_0008]. The GSI reports that the area of this GWB is 375 km2. Again, in terms of scale, the site represents 0.07% of

the total mapped GWB area. Refer to Appendix 8.8 for a copy of the Clarinbridge GWB Descriptor Sheet (GSI, 2004). Some significant points presented in GSI (2004) are as follows:

- "The GWB occupies the area between Galway, Athenry, Kinvara and Loughrea, with Clarinbridge at a central location along the coastline.
- The land surface is low lying and relatively flat, with elevations ranging from sea level to 60 mAOD.
- The GWB is bounded to the west by the coastline, to the east by the poor aquifer lithologies of the Loughrea GWB, and to the north and south by surface water divides.
- **Groundwater velocity can be** 12-210 m/hr depending on location and groundwater levels.
- Groundwater velocities are in the order of 12-90 m/hr to Clarinbridge springs and 4-210 m/hr to Dunkellin springs. Groundwater velocities increase by 1.5 in high water conditions. The data suggest a zone of higher transmissivity stretching inland from the main discharge points at the head of the estuaries (Drew and Daly, 1993).
- Flow path lengths can be up to a several kilometres.
- Most groundwater flows in an epikarstic layer a couple of metres thick and in a zone of interconnected solutionally-enlarged fissures and conduits that extends approximately 35 m below this.
- Deeper inflows can occur in areas associated with faults or dolomitisation. Significant fracturing occurs at 8-14 m above sea level and at 15-35 m below sea level (Drew and Daly, 1993).
- Groundwater storage in karstified bedrock is low."

8.113 With respect to Desk Study resources for hydrology and hydrogeology, also included in Appendix 8.8 are the Groundwater Body Descriptor Sheets for the GWB to the north, which is the mapped Clare – Corrib GWB. In addition, the EPA (2024) Hydrometric Area Reports for HA29, in which the site is mapped, and the Clare Corrib (HA30), which previous assessors have focussed on, are presented in Appendix 8.8.

Water Framework Directive Mapping, Status, Risk & Assessments

8.114 EPA Envision mapping provides information on WFD names, codes, status, risk and report links for all cycles of the WFD, for which Ireland is currently in its 3rd Cycle of WFD assessment and reporting.

8.115 WFD data are available to all at https://gis.epa.ie/EPAMaps/Water and it is this mapping resource that has been used to populate the Desk Study baseline and WFD assessment, which is reported at the end of this Chapter.

8.116 All 3rd Cycle information for the Galway Bay South East catchment (HA29), and its associated waterbodies, is reported in a May 2024 3rd Cycle report available at https://www.catchments.ie/data/#/catchment/29.

8.117 With respect to groundwater (hydrogeology) underlying the application quarry, the Groundwater Body (GWB) underlying the site is reported by the EPA for WFD Compliance, as follows:

- Clarinbridge named GWB [IE_WE_G_0008]:
  - Good Status (2016-2021) & 3rd Cycle NOT AT RISK.

8.118 As previously stated, a separate GWB has been mapped to the south of the site and it is named the GWB as the GWDTE-Galway Bay Complex Fens (SAC000268) [IE_WE_G_0087]: it is mapped by the EPA for WFD Compliance, as follows:

  - Good Status (2016-2021)
  - 3rd Cycle NOT AT RISK.

8.119 What needs to be noted is that the mapping for GWDTE Fen SAC would have been completed post the initial WFD mapping of the Clarinbridge GWB (WFD Working Groups and GSI, 2004). The fen GWB is therefore a subset part of the Clarinbridge GWB, but the delineation of the Fen boundary is meant to convey that it is from within the mapped boundary outline that water flows to the fen. That is why it can be stated that the quarry site does not contribute to the Fens.

8.120 With respect to hydrology, mapping for Galway Bay South East Catchment (HA29), which has been described earlier in the Section Heading name HYDROLOGY, is the **macro** scale of WFD assessment and reporting. On a Galway Bay South East Catchment Scale (HA29), the 3rd Cycle Report (EPA, 2024) suggests that total of 52 (54%) waterbodies are currently meeting their environmental objective of Good or High Ecological Status.

8.121 With respect to the 54% of waterbodies currently meeting their environmental objectives, the 3rd Cycle Report (May, 2024) reports percentages by water body type as follows:

- Rivers: of the 33 mapped rivers, 14 are achieving objectives and that is 42%.
- Canals: reported as n/a.
- Lakes: of the 6 mapped lakes, 5 are achieving objectives and that is 83%.
- Transitional: of the 20 mapped Transitional water bodies, 1 (5%) is achieving WFD objectives.
- Coastal: of the 9 coastal water bodies, 7 (78%) are achieving Objectives and 100% (1) of the HSO coastal water body is achieving objectives.
- Groundwater: of the 28 mapped GWBs, 25 are achieving objectives and that is 89%.

8.122 With respect to the site under consideration and its associated water environment, the underlying GWB is one of the 89% achieving its Objectives.

8.123 The quarry has operated through all WFD Cycles and at no stage has it ever been reported by the EPA report as a Pressure.

8.124 On more local scales, *i.e.,* **micro** scales, the site is mapped by the EPA as being part of the sub catchments (SC) and sub basins named, as follows:

- Sub Catchment CARROWMONEASH[Oranmore]_SC_010 [SC ID 29-6]:
- Sub Basin CARROWMONEASH (Oranmore)_010 [EU_CD IE_WE_29C050400]. Area 99km2.

- 3rd Cycle Status (2016 – 2021) = Poor & 3rd Cycle Risk = Under Review

8.125 EPA (2019) provides a useful image for the subcatchment in which the site sits. Refer to Plate 8.3.

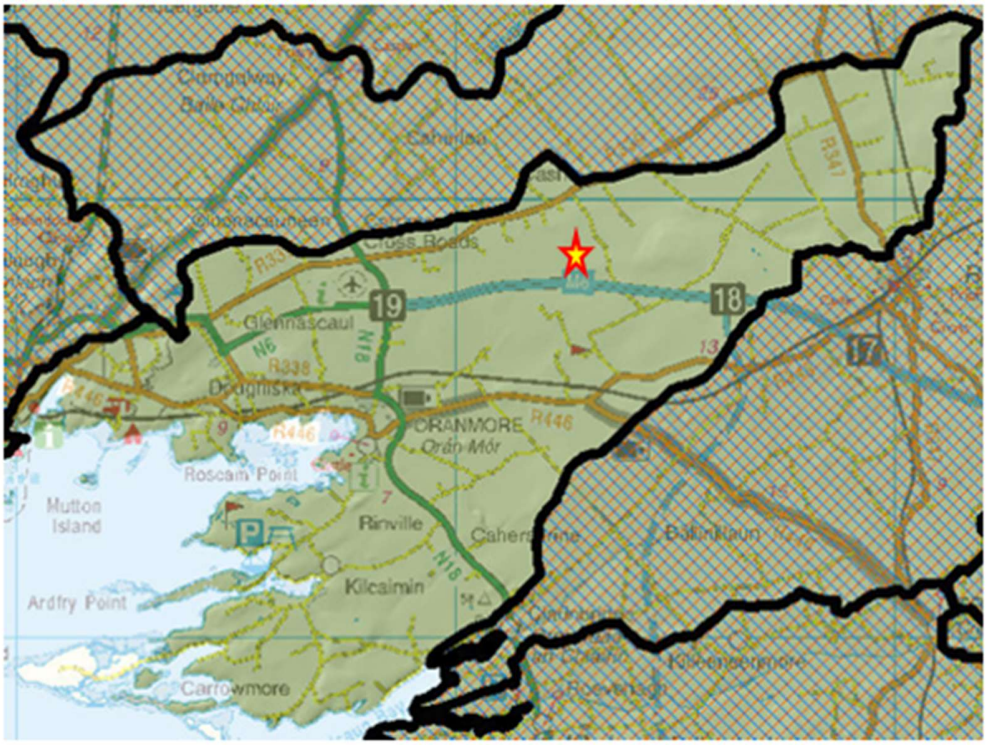

Plate 8-3 Coshla Quarries Ltd. INDICATIVE location, as annotated by Hydro-G, within the EPA presentation for the sub catchment named CARROWMONEASH[Oranmore]_SC_010 (EPA, 2019).

8.126 With respect to Transitional Water Bodies associated with HA29, the EPA maps as follows:

- Oranmore Bay [IE_WE_170_0500] is a Transitional Water Body, which is mapped as Unassigned Status (2016-2021) and 3rd Cycle NOT AT RISK. Oranmore Bay is c.6km from the site and a large catchment area drains to it. The quarry is insignificant in the scale of Oranmore Bay's hydrology.
- HA29 is connected to Renmore Lough [IE_WE_170_0600] and this overlaps with mapping for the Corrib Estuary [IE_WE_170_0700] Transitional Water Body. The Corrib Estuary is mapped as Moderate Status (2016-2021) and 3rd Cycle Under Review. Renmore Lough is Unassigned Status (2016-2021) and mapped as 3rd Cycle Under Review.
- The Ardfry Oyster Pool [IE_WE_170_0300], which is mapped as Moderate Status (2016-2021) and 3rd Cycle Under Review. This site is 10km to the south west of the quarry. A hydrological connection is physically impossible due to the landscape setting of the oyster pool on a sheltered inlet to the south of Renville Forest Park, south of Oranmore.
- Turreen Lough (Rinville West) [IE_WE_170_0400] is a Transitional Water Body that is mapped as Unassigned Status (2016-2021) and 3rd Cycle Under Review. Similar to the oyster beds,

there is no direct hydrological link between the quarry and the Lough because its landscape setting is to the south of Oranmore Bay.

8.127 With respect to Coastal Water Bodies associated with HA29, the EPA maps as follows:

- Inner Galway Bay North [IE_WE_170_0000], which is mapped as Good Status (2016-2021) and 3rd Cycle NOT AT RISK. Hydro-G notes that Oranmore Bay is a Transitional Water Body between the quarry and Inner Galway Bay North.
- Inner Galway Bay South [IE_WE_160_0000], which is mapped as HIGH Status (2016-2021) and 3rd Cycle NOT AT RISK.

8.128 There are no areas near the site mapped as a Priority Area for Action (PAA) and there are no LAWPRO reports for the downstream area between the site and Oranmore. Desk Studies for LAWPRO PAA's are available here: https://lawaters.ie/desktop-studies/.

8.129 The site's licensed discharge point is c. 6 km, as the crow flies, from the coast at Oranmore.

8.130 No part of Galway Bay, that could be in any way connected to the quarry site, is mapped as a Priority Area for Action (PAA). There is PAA mapping for the St. Clerans Stream Priority Area for Action (AFA0167), but this is for the bay at Kilcolgan / Clarinbridge and there is no hydrological connection between the site and this AFA. The entire report for St. Clerans Stream PAA is available on the https://lawaters.ie/desktop-studies/ site and it has been reviewed in full by Hydro-G. Clear surface water delineation and Pressures such as Forestry and Domestic Waste Water Treatment Systems mapping is reported by LAWPRO.

8.131 High Status Objective (HSO) waterbodies in HA29 are mapped by the EPA to be, as follows:

- BOLEYNEENDORRISH_010 & BOLEYNEENDORRISH_020 [IE_WE_29B040100] c.25km south east of the quarry.
- OWENDALULLEEGH_010,_020,_030,_040 [IE_WE_29O010800] c. 30km south of the quarry.
- Lough Bunny [IE_WE_27_114] c. 30km to the south of the quarry.
- Outer Galway Bay [IE_WE_100_0000] c.20km to the west of the site and Galway City is between the site and the Outer Galway Bay HSO site.

8.132 All but 2 of the High Status Objective (HSO) waterbodies in HA29 are meeting their High Status Objective: the exceptions being Lough Bunny and the OWENDALULLEEGH_030, which are both Good Status. Hydro-G offers that given the likely groundwater flow direction being from the site in the general direction of the coast in Oranmore, the site has ZERO potential to be hydrologically connected to any of the HSO surface water sites.

River Basin Plan & Programmes of Measures

8.133 In September 2024 the Department of Housing, Local Government and Heritage launched The Water Action Plan 2024 and its launch stated that the "*River Basin Management Plan for Ireland sets out the measures that are necessary to protect and restore water quality in Ireland. The overall aim of the plan is to ensure that our natural waters are sustainably managed and that freshwater resources are protected so as to maintain and improve Ireland's water environment. The principal causes of the decline in Ireland's water quality are the increasing loss into water of polluting*

phosphorus and nitrogen from farmland, inadequately treated waste water and physical impacts on water bodies, due to river barriers, and drainage of lands and rivers".

8.134 The Water Action Plan 2024 is available at https://www.gov.ie/en/policy-information/8da54-river-basin-management-plan-2022-2027/ and there is an Appendix series: Appendix 2 sets out the Programme of Measures. However, there are no actual sites or practical measures outlined. The WAP and the POMs are management documents describing how civil servant departments will meet and manage groups.

8.135 There are no surface waters directly connected to the site. Therefore, the site cannot affect surface water body status. The GWB associated with the site is Good Status and Not at Risk. The WAP 2024 and the RBMP 2022 – 2027 concerns the attempt that will be made over the next few years to maintain Good Status water bodies and improve those that are not good status. Given that the site is connected to a Good Status GWB and that agriculture and nutrients are catchment pressures, nationally, the site poses no risk to the attainment of the WAP, RBMP or WFD.

Groundwater Supply Wells

8.136 Consultation with Galway County Council's Water Section (Mr. Ronan Mannion, pers. comms 28/1/25) and Rural Water for County Galway (Mr. Alan Meenaghan, pers. comms 28/1/25) confirms that mains connection supplies water to all homes along the R339 and the local road connecting the R339 to the ESB Substation, C&F Tooling and the quarry.

8.137 With respect to this Desk Study element of the EIA and EIAR's compilation of information, the GSI website database for wells (https://dcenr.maps.arcgis.com/apps/MapSeries) presents information for wells: three to the north of the quarry and 1 to the south. Each of the wells is shown on Figure 8.9 along with Text Boxes presenting GSI mapped information for the wells. Hydro-G''s interpretation of their significance to the quarry is presented, as follows:

- Two of those wells are listed on the GSI database as being sources for the Cashla GWS. However, Galway County Council have confirmed that all those GWSs were TIC (Taken in Charge) by Galway County Council in 2013 (Rural Water for County Galway, Mr. Alan Meenaghan, pers. comms 28/1/25).
- The closest of the three GSI registered local wells is in the middle of a network of fields at a distance c. 1km to the north of the floor of the quarry. This is GSI registered as being part of Carnmore West GWS [Well Unique ID IE_GSI_GW_Well_8562, GSI Well Name 1421NWW038]. Communication between the quarry manager (Mr. Martin Collins) and the well owner for the purposes of this assessment confirmed that the well **is not in use**. Topographic information suggests that Ground Level elevation is c. 27m OD at the well, the GSI lists that it is 87.5m deep and that the yield is 218m3/d, the information source is cited as Daly (1985) County Galway Groundwater Report. Therefore, the well was drilled over 40 years ago. The reported yield is high and there would have been no need to progress 20m past the water strike, that is convention in drilling. Therefore, the water strike zone is likely to be c. 60 to 70 m bgl, which is an elevation of water strike range of 27mOD GL minus (60 to 70 m bgl) = c.-38m OD. It is noted that the permitted and proposed elevation of the floor of the quarry is -5mOD. Therefore, the water strike zone in that closest domestic well is significantly out of range of impact from the quarry.

- There is a well registered at a distance of 2km south of the quarry, on the other side of the M6, in a townland called Mountain West. Topographic information for this well's location suggests that it is near the 20m OD contour. GSI registration details (Well Unique ID IE_GSI_GW_Well_8695, GSI Well Name 1421NWW042) state that it is an 18.9m deep well with a water strike and big yield at 1.5m bgl. Therefore, the elevation of the water strike is c. 18.5m OD and the base elevation of the well is c. 0mOD. The quarry's floor operates at an elevation of -5mOD. Therefore, there is no potential to affect a well whose water strike is at 18.5.m OD and whose base is at c.0mOD because the well is significantly higher in elevation than the quarry.

8.138 Given that the GSI mapping is historic, and in the light of mains information obtained from Galway County Council, it can be concluded that there are no third party wells downgradient or within radius of the quarry.

8.139 However, the GSI well information is of critical importance to the development of the Conceptual Understanding of the groundwater system in proximity to the quarry.

8.140 Important information from the GSI database, which was populated by a robust scientific study into the Groundwater of County Galway (Daly, 1985), is that groundwater flow and water strike zones are at elevations significantly deeper than the existing and proposed quarry floor's -5m OD.

8.141 There is the quarry's own water supply well in the north eastern corner of the site but it cannot be impacted because its water strike zone is significantly deeper than the proposed -5m OD floor elevation under consideration in this work.

EPA Register of Abstractions

8.142 The EPA Register of Abstractions documents all Abstractions > 25m3/d and all PWS Abstractions will be of that magnitude, at least.

8.143 The EPA Register of Abstractions lists five groundwater abstractions for the GWB associated with the quarry. Table 8.5 presents EPA Registered Wells in the Area.

Table 8.5 EPA Registered Wells in the Clarinbridge GWB.

Organisation Name	Abstraction Type	Maximum Daily Volume Estimate for Abstraction (m3/d)	Cumulative Max. Daily Vol. Est. for Registration (m3/d)	Total Annual Volume (m3/yr)	County	Townland Name	Townland ID
Galway Race Committee	Groundwater	570	830	11,360	Galway	Galway City	51205
Coshla Quarries Limited	Groundwater	350	350	120,000	Galway	BARRETTSPARK	30926
Brockagh Lisduff GWS	Groundwater	35	35	12,775	Galway	CAHERBULLIGIN	30988
Bon Secours Hospital Galway	Groundwater	50	50	15,600	Galway	Galway City	51205
Esker Readymix Unlimited Company	Groundwater	100	100	10,000	Galway	KILLASCAUL	30951
			1,365	169,735			
			m3/d	m3/yr			

Group Water Scheme Supply Wells

8.144 The EPA December 2024 Register of Abstractions cites one GWS abstraction in the Clarinbridge GWB, and this is the Brocklagh Lisduff GWS, which is reported to be in a townland that is 0.8km to the south east of the quarry.

8.145 The Clarinbridge GWB (2004) descriptor sheet states that flow path lengths can be up to a several kilometres in length. Overall groundwater flow will be towards the coast. This is a North East to South West groundwater flow direction.

8.146 The likely regional NE to SW Groundwater flow direction suggests that the quarry and Brocklagh Lisduff GWS abstraction could not be linked because the GWS is to the SE of the quarry. In addition, the Registered Abstraction volume of 35m3/d is very small, and therefore suggests a very small Zone of Contribution to the Brocklagh Lisduff GWS that would not extend 8km from the site. An 8km flow path length or Zone of Contribution radius would be associated with abstractions of 1,000's of m3/d.

8.147 Whilst information supplied by Galway County Council's Water Section (Mr. Ronan Mannion, *pers. comms* 28/1/25) and Rural Water for County Galway (Mr. Alan Meenaghan, *pers. comms* 28/1/25) confirmed that mains connections supplies water to all homes along the R339 and the local road connecting the R339 to the ESB Substation, C&F Tooling and the quarry, it is also known locally that the Lisheenkyle GWS was a supplier of water in the area. The Lisheenkyle GWS supplied water from a southerly direction and as far as C&F Tooling, which is where the Galway County Council mains ceases. However, the Lisheenkyle GWS is not now the supplier and there is a booster pump near Palmerstown nearer Athenry Golf Club. No matter what the sources, there is therefore a distance of at least c. 2km south of the quarry as the crow flies. A search for EPA Registered Abstractions for all GWBs results in no matches for either a Lisheenkyle GWS or a Palmerstown GWS. This means that the schemes are < the 25m3/d statutory requirement for registration. As applied to the Brocklagh Lisduff GWS, an abstraction volume of <25m3/d is small, and therefore suggests a very small Zone of Contribution that would not extend 2km from the abstraction location.

8.148 There is a Zone of Contribution mapped by Conroy (2014) for the Carheenlea GWS but this is >6km upgradient in terms of groundwater flow and it is registered in the EPA December 2024 Register of Abstractions as being in the Clare Corrib GWB. There can be no connection between the quarry and the Carheenlea GWS.

8.149 Therefore, given the recharge and flow mechanisms, the quarry does not pose a threat to Group Water Scheme supply wells.

Geoheritage Sites

8.150 As requested in the GSI's Response to Scoping (**Appendix 8.5**), County Geoheritage Sites (CGS) associated with the site and wider environment should be considered in all assessments.

8.151 Neither the quarry, nor its general area, feature in the Geological Heritage of County Galway. An Audit of County Geological Sites in County Galway (Meehan et al., 2019).

8.152 The GSI Geoheritage Site map viewer presents mapping and information for Geoheritage sites along the M6 and the M17, with overview details as follows:

- GY024 Site Name Caherateemore M17 Road Cut: An 800 m long road cutting along the M17 motorway, with both high and low cliffs of rock. A well exposed representative section of Carboniferous limestone in central Galway. ITM Coordinates 546656.302, 733116.389.
- GC001 Site Name Doughiska N6 Road Cut Galway City. One kilometre long road cut section on the N6 dual carriageway. Road section cut into Carboniferous Burren Formation limestone. Clay wayboard layers interbedded with limestone. Calcite-flourite veins occur in the road cut walls. Coordinates (ITM) 535060.000, 726750.000.
- Site Code GY119 Roevehagh M18 Road Cuts. Road cuts excavated through limestone bedrock on the M18 motorway. The sections are good representative exposures for the Burren Formation and Tubber Formation strata. Coordinates (ITM) 544472.728, 719477.328

8.153 Each of these sites are >7km from the site and each of the Geoheritage sites are mapped for their contribution to geological understanding resulting from exposures during the construction of roads and their embankments. It is therefore concluded that there are no Geoheritage Sites associated with the proposed development and no potential for impact with any Geoheritage Sites.

Desk Study Flood mapping

8.154 Hydro-G reviewed desk resources relating to mapped flooding. Following on from review of information, consultations ensued with the GSI's groundwater flood expert and one of their karst experts, Ryan Hanley Consulting Engineers who completed assessments in the area (2010a&b), karst experts from Trinity College Dublin and retired from the EPA and GSI. Results of consultation were handed over to Dr. Colin O'Reilly of Envirologic with the remit to complete a site specific Flood Risk Assessment.

8.155 A site specific Flood Risk Assessment was completed for the site by Envirologic (2025). Desk study information and planning history is presented in the Envirologic (2025) report, which is presented as Appendix 8.9.

8.156 The site specific Flood Risk Assessment (Envirologic, 2025, Appendix 8.9) presents the record of Hydro-G's consultations, the site and local area's planning history in relation to Flood Risk, cataloguing of all flood mapping, review of Galway's County Development Plan 2022 – 2028 and its associated Strategic Flood Risk Assessment, LIDAR and flood mapping and all elements specified by 'The Planning System and Flood Risk Management (2009)' Guidelines.

County Development Plan & Quarrying

8.157 To complete the Desk Study, the quarrying and extractive industry policy of the Galway County Development Plan 2022 – 2028 was reviewed.

8.158 The Galway County Development Plan (CDP) 2022 – 2028 "sets out a range of proposed policy objectives with supporting narrative for development up to 2028". The plan recognises the importance of the extractive industry to employment and economic development within the county.

8.159 Chapter 15 of the CDP sets out development management standards for the extractive industry, including details on the information that should accompany a planning application for extractive

development. The detail specified in the CDP has been considered in the assessment of potential impacts in the EIA for the quarry.

8.160 As steered by Quarry Consulting, as outlined in the earlier chapters of this EIAR, assessors were alerted to the relevant policies of the Galway CDP 2022 – 2028, as follows:

- RD1-Rural Enterprise Potential: To facilitate the development of the rural economy through supporting a sustainable and economically efficient agriculture and food industry, together with forestry, fishing and aquaculture, energy and extractive industries, the bio-economy and diversification into alternative on-farm and off-farm activities, while at the same time noting the importance of maintaining and protecting the natural landscape and built heritage which are vital to rural tourism. Development of Cafes, Art Galleries, Hot Desk Facilities etc. which are important to the rural economy.
- MEQ1-Aggregate Resources: Ensure adequate supplies of aggregate resources to meet future growth needs within County Galway and the wider region and to facilitate the exploitation of such resources where there is a proven need and market opportunity for such minerals or aggregates and ensure that this exploitation of resources does not adversely affect the environment or adjoining existing land uses.
- MEQ2: Protection of the Environment: The Planning Authority shall require the following in relation to the management of authorised aggregate extraction.
- All quarries shall comply with the requirements of the EU Habitats Directive, the Planning and Development (Amendment) Act 2010 and by the guidance as contained within the DoEHLG Quarries and Ancillary Facilities Guidelines 2004, the EPA Guidelines 'Environmental Management in the Extractive Industry: Non-Scheduled Minerals 2006 (including any updated/superseding documents) and to DM Standard 19 of this Development Plan,
- Require development proposals on or in the proximity of quarry sites, to carry out appropriate investigations into the nature and extent of old quarries (where applicable). Such proposals shall also investigate the nature and extent of soil and groundwater contamination and the risks associated with site development works together with appropriate mitigation,
- Require Development Proposals to assess the potential impact of extraction in areas where geo-morphological interest, groundwater and important aquifers, important archaeological features and Natural Heritage Areas are located,
- Have regard to the Landscape Character Assessment of the County and its recommendations,
- Ensure that any quarry activity has minimal adverse impact on the road network and that the full cost of road improvements, including during operations and at time of closure, which are necessary to facilitate those industries are borne by the industry itself.
- Ensure that the extraction of minerals or aggregates does not adversely impact on residential or environmental amenity,
- Protect all known un-worked deposits from development that might limit their scope for extraction.
- MEQ4-Landscaping Plans: Ensure that all extractions shall be subjected to landscaping requirements and that worked out quarries should be rehabilitated to a use agreed with the Planning Authority which could include recreational, biodiversity, amenity or other end-of-

life uses. The use of these rehabilitated sites shall be limited to inert waste and sites shall be authorised under the appropriate waste regulations.

Field Work Completed

Rain Gauge

8.161 A site specific rain gauge (RG) was installed at the site in 2024. The purpose of the RG was to equip the site with long term collection of data to compare with the discharge volumes and data logger records for water level in each of the long term perimeter boreholes (3) and 2024 installation Monitoring Wells (3). Data from the RG are presented in Appendix 8.11 with all Site Monitoring Data.

Site Investigations

8.162 This is a Water Chapter. Site Investigations relating to the nature and characteristic of the bedrock were presented in the Land, Soils & Geology Chapter and the associated Appendices.

8.163 **Geotechnical:** A Geotechnical Assessment for the site is completed every 2 years by Advanced Mining Solutions and January 2025 is the latest report. Its findings are of significance to the Lands Soils and Geology Chapter, but it is noteworthy that its photograph series shows dry walls with no evidence of water ingress.

8.164 **Geophysical:** Also of note to this water assessment is the photograph series of the Apex (2024) report, which also shows dry walls with no evidence of water ingress. The Apex report is discussed more fully in the Lands Soils and Geology Chapter because it is a description of the competency of the bedrock: no water bearing zones were determined in the ground level to -5mOD elevation in Apex's work. The Apex (2024) report is presented as Appendix 7.3. In summary, Apex discussed their results as follows:

8.165 The data were examined for any suggestion of a water table to the west of the void i.e. in the direction of groundwater flow from the void, and below the quarry floor.

8.166 Aside from the potential for some water in the upper shallow layer of possible weathered/fractured limestone on ERT Profile R1, the resistivity values across R1 do not indicate any lateral reduction in resistivity values indicative of a water table within the bedrock.

8.167 The high resistivity values (>1500 Ohm-m) recorded from the quarry floor to -15 mOD (Profiles R2-R13) and observed on Profile R1 to the west are more typical of non-saturated pure limestones. This is supported by the low rate of water arising in the quarry void.

8.168 The layer or bed of lower resistivity values (500 – 1500 Ohm-m) observed below around -15 mOD on the quarry floor profiles likely indicate an increase in water filled fractures, fissures and joints at this level. This interpretation is supported by the water strikes recorded at similar depths on the 2007 boreholes BH1 - BH5.

8.169 The absence of a similar decrease in resistivity values below around -15 mOD on R1 as observed beneath the quarry floor on R2 to R13 may be explained by the better developed fracture, fissure and joint network immediately underneath the quarry floor associated with the effects of blasting overbreak and joint relaxation due to removal of the overlying rock.

8.170 The interpretation of the geophysical data is summarised on Drawing AGP24094_02, which is presented with the Apex (2024) report.

8.171 **Drilling:** Considering that this is a study of a site that is mapped by the GSI as a karst conduit aquifer, there is particular significance in the Dilling Site Investigation findings of competent solid limestone bedrocks in all 18 of the Site Investigation boreholes drilled in the limestone considered for further deepening to bring it to the same -5m OD elevation as the current permitted floor elevation (Reported by HES in the 2020 EIAR). Were there any evidence of conduits or water strikes in the bedrock boreholes drilled throughout the site to the -5m OD elevation in all historic phases of EIA at the quarry? The answer is no. Many boreholes have been drilled at the site and neither conduits nor cracks nor water strikes, nor any subterranean evidence of karst have ever been found in bedrock to the -5m OD elevation.

8.172 In summary, as discussed in full detail in the Land, Soils & Geology Chapter and in Figure 7.6, Site Investigation boreholes drilled across the entire site, include as follows:

- Eighteen BHs in the eastern part of the application area drilled to -5mOD (reported by HES in the 2020 EIAR). The purpose of the boreholes was to try to find evidence of groundwater flow and karst conduits. None were found in the total of eighteen boreholes drilled. HES (2020) reported dry dust drilling for the entire profile to -5mOD. Whilst they report water in the BHs at the end of the 18 day drilling programme, it was all at the top of the broken rock epikarst layer, which is entirely normal because the BHs act as mini sumps and drain the perimeter land's surface after drilling. The impermeability of the rock is such that water seeping in from the surrounding subsoil and broken rock has nowhere to go because, as demonstrated by the dry dust drilling, there is no groundwater flow system. Details are presented in Appendix 8.11 for the 18 Site Investigation BHs reported by HES in the 2020 EIAR.

- Five perimeter BHS drilled to depth by Briody Drilling in 2007. The driller's records were presented in Summary Tables and the Appendices of the Lands, Soils & Geology Chapter. The purpose of the boreholes was to try to find groundwater and the holes had to progress to depth ranges of -10m OD to -30m OD to find that groundwater. This is significantly deeper than the -5mOD proposed elevation. Of the five boreholes that were drilled at the site in July 2007, four (BH1-BH4) were located at the corners of the site perimeter and one (BH5) on the northern perimeter. The boreholes indicate that the limestone from the original ground level down to a depth of approximately -10 mOD comprises of very competent rock with the exception of occasional clay filled fractures/cavities e.g. in BH5. Below this (-10 mOD), weathered rock with clay filled fractures and cavities (with groundwater inflows) was encountered in the boreholes. The Coshla Quarry Extension EIAR (MKO, 2020) suggests that this bedrock weathering is likely a result of karstification and also possible dolomitisation in the deeper bedrock below the existing quarry. At the time of drilling, the shallowest groundwater inflows in the Briody (2007) boreholes, BH1 to BH5, occurred at elevations of -13.98, -10.98, -29.43, -8.89 and -21.85 mOD respectively (MKO, 2020). However, the magnitude of the shallowest inflows were not deemed to present groundwater in the sense that drilling of the boreholes could cease. The Briody boreholes had to continue to depths of -111, -68, -81, -78 and -74 m OD in BH1 to Bh5 respectively in order to encounter meaningful groundwater that would sustain borehole development.

- Three additional boreholes (MWA, MWB, MWC) were drilled in July/August 2024 from ground elevations of c. 21 to 25 mOD to depths of c. 50m bgl and base of hole elevations of c.-27m OD. No water strikes were encountered. Drilling returns were dry dust. No water was found in the profiles from ground level through to the base of hole elevations of c. -27m OD. MWA was drilled to the east of the operating and permitted excavation void, in proximity to the 18 boreholes of 2020, MWB and MWC were drilled northwest and southwest of the existing extraction area respectively. Logs for the MWs are presented in the Appendix series of the Land, Soils and Geology Chapter. The BHs were installed with 50mm diameter piezometers, with slotted screens in the bottom 3m, gravel packs around the slotted screens and bentonite seals to ground level. The purpose of the MWs were to evaluate conduit potential in the bedrock profile proposed for excavation to -5mOD, and deeper, and to create testing points for *insitu* bedrock permeability measurements.
- It is therefore concluded that a total of 26 bored holes were drilled at the quarry site and all progress to depths deeper than the -5m OD proposed elevation of this application.
- There is also information on water strike zones in boreholes at the C&F Tooling site across the road from the quarry access road, on the other side of the ESB Substation. At that location, no water was found until a conduit was encountered at a depth of 81m bgl, *i.e.,* c.-50m OD. The C&F Drilling Record is also presented in Appendix series of the Land, Soils and Geology Chapter.

8.173 **Bedrock Permeability:** Borehole details and the hydraulic response test results are presented in The Lands, Soils & Geology Chapter's Appendix series, which presents the hydraulic response test graphs and test details. The bedrock was tested for its ability to transmit water (saturated hydraulic conductivity, Ksat) using hydraulic response tests in each of the boreholes. The results for the bedrock are presented in detail in Appendix 7.3 for that field work element. In summary, the limestone bedrock is a solid mass of limestone with extremely low permeability ranging from 10^{-8} to 10^{-10} m/s.

8.174 With respect to hydraulic conductivity results, the Ksat results ranging from 10^{-8} to 10^{-10} m/s, which suggests that the limestone bedrock has a slower conductance of water than a heavy CLAY. This is the classic limestone **matrix** porosity of **no ability to transmit water**.

8.175 All site investigation results confirm the karst CONDUIT Aquifer classification. Site investigation results confirm that one has to find a conduit to find groundwater because there is no water in primary porosity of the bedrock.

8.176 No groundwater and no conduits exist in the rock profile at Coshla quarries until an elevation commencing at elevations of c.-10m OD at some locations and commencing at c.-22m OD at another location. An even deeper groundwater flow conduit system was found at the C&F Tooling site where drilling was dry until c.80m bgl and groundwater was not discovered until an elevation of c. -50m OD.

8.177 For the rock already extracted to -5m OD in the permitted main excavation, and the walls showing that exposure to -5mOD, and the proposed southwestern and eastern excavation strip to -5mOD not a single shred of actual evidence of groundwater or groundwater flow system or conduits have been found.

Long Term On-Site Monitoring Data

8.178 Results for all site monitoring are presented in Appendix 8.11.

8.179 In terms of existing data available, the assessment is fortunate in that there is a long-term dataset for the operational phase in relation to water management and monitoring within the site and the receiving waters. Hydrological and hydrogeological responses at Coshla Quarries are monitored at monthly intervals. The following is of significance. On a site local scale, the record for hydrological and hydrogeological monitoring includes as follows:

- Four perimeter groundwater monitoring boreholes for which there is a long-term record. [Borehole IDs BH1 – BH4]. Monitoring of groundwater levels and quality takes place Quarterly and is reported in the BHP Certificates of Analysis for the site, which are presented in the Site Data Appendix 8.11. Hydro-G offers that the perimeter borehole's water levels are representative of the hydrostatic or potentiometric (pressure head) level of the water in the deep conduits that they intercept. The water levels reported in the 2020 EIAR (PL20/499) should not be considered as the water levels relating to the quarry's elevation of -5mOD because the quarry is separate from the deep conduit system that flows deep beneath it. Hydro-G **does not** present water table graphs for the perimeter BHs numbered BH1 to Bh4, which were presented in the 2020 EIAR. The reason that the perimeter BH water levels are not presented is because they are entirely irrelevant to the proposal to excavate to -5m OD. The water levels in the perimeter BHs, as presented in the 2020 EIAR and as called out in the 2020 EIAR, relate to the potentiometric level of the water in the conduits that are far deeper underground than the proposed -5m OD of this application. The fact that the water levels in the perimeter boreholes do not represent the excavation existing or proposed is supported by both observations of perimeter walls and the site's relatively insubstantial water management infrastructure, which is both capable of maintaining a safe place of work for those on the floor and sufficient to ensure the ongoing and proven compliance with the site's Section 4 Licence ELVs.
- A flow meter on the discharge from the site provides a record of flow volume. Discharge Samples are analysed in an accredited laboratory for the physiochemical parameters of the Section 4 Licence: BOD, COD, Nitrate, pH, Temperature, Total Suspended Solids and Hydrocarbons.

8.180 Long Term Site Monitoring Results suggest, as follows:

- Four Groundwater Boreholes on the perimeter are monitored quarterly, as per the Conditions of the Section 4 Licence for the site. Groundwater Quality monitoring is completed Quarterly and Certificates of Analysis and Tabulated results are presented in Appendix 8.11.
- Groundwater Levels: There is no downward trend in water levels of the perimeter BHs used for monitoring. There are annual fluctuations due to the nature of karst conduit system responses, as reported by Bartley (2003), and the holes also have an unsealed subsoil bedrock interface. Those perimeter monitoring BHs primarily represent conduit flow groundwater that is far deeper than the -5m OD elevation. The 3 Hydro-G Monitoring Wells drilled in 2024 to -27m OD do not sustain water abstraction because they did not hit the conduit system. Therefore, they cannot be sampled because it is not possible to abstract a volume of water that is more than one well volume. This is normal. Results are presented in Appendix 8.11.
- Discharge Quality: Apart for one singe exceedance for SS, there is compliance for each of the parameters specified for Quarterly Monitoring for the Emission Limit Values of the Section 4

Discharge Licence W/469/13 (2013). Compliance in 100% of the sampling events was achieved for the parameters pH, BOD, COD, Nitrates, Petroleum Range Organics, Diesel Range Organics and Total Hydrocarbons. Results are Tabulated in Appendix 8.11. There are never detections in the discharge samples for Total Hydrocarbons, Petroleum Range Organics or Diesel Range Organics.

- Discharge Volumes:
    - Discharge varies throughout the year according to rainfall. Values of zero (0m3/d) are observed for some days in dry months.
    - The 2020 EIAR used data from January 2019 to January 2020 to determine the 146 m3/d average value.
    - As previously outlined in the Desk Study, for the size of the excavation the volume of 146m3/d is entirely relatable to rainfall runoff. The sump and pump and settlement infrastructure at the site confirms this.
    - In June 2024, the water meter reading relative to the reported 2019 reading suggested a long term average value of 87.9 m3/d. This is because there are days with no discharge.
    - Manual readings, as tabulated in Appendix 8.11, demonstrate that the site's discharge volumes range from 1 to 286 m3/d. The average discharge over the last five years is calculated to be 132 m3/d. Again, it is reiterated that for a 27.5 ha quarry, the volumes discharged are entirely relatable to rainfall runoff. The discharge volume values are compliant with the Section 4 Licence.

Flood Risk

8.181 A site specific Flood Risk Assessment was completed by Envirologic, and the associated report (2025) is presented as Appendix 8.9. The conclusion of the FRA was that there is no Flood Risk presented by the development proposal.

8.182 Neither the site nor the area are mapped by either OPW or GSI Flood Maps as having future flood risk potential on the basis of either groundwater pluvial, fluvial or groundwater.

8.183 The development proposal is deemed to concur with mapping for Galway's County Development Plan (2022 – 2028)'s Strategic Flood Risk Assessment.

8.184 Whilst there was a history of flooding in 2009, the OPW have installed a number of measures that have alleviated flood risk and there were no flood experiences in the 2015/2016 events. Details are presented in Envirologic 2025 (Appendix 8.9).

Conceptual Understanding of the Site, the Proposed Development and Interactions

8.185 The Conceptual Understanding of how the site interacts with the environment is a crucial element of all EIAs. The understanding of how this site works with the environment was developed by Hydro-G on the basis of site visits, observations of how the walls of rock behave in different seasons, site investigation information and assessments by others: detail for which is shared in the Appendix series of this EIAR. Key points are presented as follows:

8.186 The quarry is a large limestone bedrock quarry that has been in existence since 2007.

8.187 The M6 Motorway is to the south of the site.

8.188 The underlying Groundwater Body is mapped by the EPA as Good Status (2016 – 2021) and 3rd Cycle Not At Risk.

8.189 There are no mapped surface waters in the immediate vicinity of the site.

8.190 Regionally, groundwater generally flows from north east to south west in the direction of the coast at Oranmore.

8.191 With respect to hydrogeology, the site is mapped as part of a limestone body that is a Regionally Important Karst (conduit) Aquifer. The macro scale environment in which the quarry sits is conceptualised by hydrogeologists as a subterranean world of karst caves and conduits and very large underground flow rates. Perception would be that this is a high risk location with respect to encountering conduits. However, the existing excavation of rock to -5m OD has not intercepted a groundwater flow system. There is no evidence of a groundwater flow system in the excavated open area of rock walls of the void.

8.192 The fact that the quarry is able to operate in this hydrogeological environment is because the quarry has and would intend to continue excavating to an elevation of -5mOD, whereas the groundwater flow system in the conduits is well documented within and outside the site as operating at elevations ranging from c.-10m OD to c.-30m OD. The quarry is therefore operating above the groundwater flow system, and this is the correct terminology for groundwater in conduit karst aquifers: There is no 'Water Table' in this type of hydrogeological setting because karst limestone in the west of Ireland has no contiguous saturated pore space. There is no primary porosity in this type of limestone and the very low measured discharge rates are testament to this. The site has discharged an average of c.180m3/d in the last four years, which is a volume entirely relatable to rainfall runoff.

8.193 The reason that there is no hydro in the geology of the site is because the bedrock that is being quarried is significantly above the conduit system and the bedrock being quarried is as impermeable as a heavy CLAY. Field measurements for saturated hydraulic conductivity in site investigation boreholes suggests that the bedrock has no secondary porosity (karst or conduits) and that the matrix porosity of the limestone (sedimentary rock) is the same as a heavy CLAY. There is no evidence of water in the walls of the void.

8.194 On a site scale, no ground water was detected in 26 site investigation boreholes. The subsurface has been explored at 26 drilling locations within the application area to elevations significantly deeper than the proposed -5mOD floor level, which is the easterly portion of the overall quarry site.

8.195 The subsurface was also explored using geophysical survey technique, which enables a comprehensive understanding of the entire subsurface. The Apex (2024) assessment conclusion was that there was no evidence of groundwater flow in the depth from ground level to -5m OD.

8.196 The best karst expertise for the area and bedrock/aquifer information suggests that the major karst flows could be 30 to 40 m below sea level (Drew, D., *pers. comm.,* 2015). Therefore, impacts are not an issue with respect to the -5m OD excavation depth proposed.

8.197 The site does not present Flood Risk and neither is it located in a mapped Flood Risk zone. The historic 2009 flood event in lands to the north of the site did not repeat itself in the 2015/2016 national flood events because the OPW have installed a number of significant flood relief measures in the wider region, including the Claregalway Flood Eye Bridge and roadside drains on the R339 to the north of the quarry.

8.198 Hydrogeologists and hydrologists may present different hypotheses regarding which Hydrometric Area (HA) or which surface water catchment or basin the site sits in: the EPA & OPW map the site as part of HA29 but some hydrologists assign connectivity to the site with the Clare (Galway) River, which is in a different HA(30) to the north of HA29. It is true that the installation of the Flood Eye has at Claregalway provided flood relief and ease to lands immediately north of the quarry. However, whatever HA mapping is assigned to the site is entirely irrelevant to the quarry. Whether groundwater moves towards the sea at Oranmore or in another direction is irrelevant because the current and proposed -5mOD excavation elevation of the site is significantly above the groundwater conduit flow path system and therefore there is no interaction between the quarry and groundwater. Further, there is no direct hydrological links or surface water systems associated with the site.

8.199 For the current and proposed -5m OD floor elevation, the quarry is and will remain above the groundwater flow system: there is no 'Water Table' in a karst conduit system, there is only the conduit system. The groundwater flow conduit system is beneath the -5m OD floor elevation and whilst there is some evidence of minor flows at -10 m OD , more significant groundwater flow is conveyed in the conduits at elevations between -30m and 70m OD.

Envisaged Dewatering Volumes

8.200 No karst features and no water strikes have been encountered and none are expected as the quarry expands laterally in the southwestern and eastern portion of the site.

8.201 The Emission Limit Value of 360 m3/d will suffice as the amount of water that will require discharge in the future, considering rainfall, storms, and any subsurface interflow water that might be encountered.

8.202 The current discharge volume is a fraction of the permitted ELV. The proposed lateral extension area is already draining its surface water runoff to the void and therefore the capacity of the water Management Systems are already proven to be sufficiently sized.

Effects, Impact Assessment Methodology & Structure

8.203 This EIA and EIAR were completed in accordance with enacted EU and Irish legislation pertaining to Environmental Impact Assessment (Directive 2014/52/EU, meaning the EIA Directive and Irish EIA Regulations (2018, as amended 2020). As previously stated, the complete list of Guidance and Legislation employed in the completion of this work was presented in **Appendix 8.3**.

8.204 The Impact Assessment was completed with reference to Guidance relating to EIA and the preparation of EIA Reports, which includes the EU (2017), Department of Housing, Planning and Local Government (2018) and EPA (2022) on Guidelines on the information to be contained in Environmental Impact Assessment Reports.

8.205 Criteria for assessing importance of site attributes and their magnitude of importance were taken from the NRA Guidelines (NRA, 2008) and 'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements' (IGI, 2013).

8.206 The tools and structure of the assessment of Effects and Potential Impacts were detailed in **Appendix 8.6**, in which Industry Standard Tables for rating of the Importance of Environmental Criteria, Significance of Effects, Impacts, Mitigation Measures, Residual Impacts and more are presented.

8.207 In addition to the application of Irish Guidelines as outlined in EPA (2022) and NRA (2008), and in the absence of Irish Guidance specifically focussed on quarries and hydrogeology, the work presented in this EIAR Section has also applied UK practical guidance as published by the UK Environment Agency (the public body equivalent of the Irish EPA). The UK Guidance provides a 'Hydrogeological impact appraisal for dewatering abstractions' (Boak, R. et. al. (2007) and the approach is succinctly outlined in **Appendix 8.7**.

Development Phases Considered

8.208 The evaluation of Potential Effects and Impact Assessment completed usually considers phases as follows:

- Construction (enabling) Phase
- Operational Phase
- Landscaping, Restoration, Decommissioning & Aftercare.

Description of Likely Effects

8.209 The procedure for determination of potential impacts on the receiving hydrogeological environment was to identify potential receptors within the site boundary and surrounding environment and use the information gathered during the field work and desk study to assess the degree to which these receptors will be impacted upon.

8.210 The application site lies within and adjacent to the existing quarry void, and when considered as a cumulative site, will be of moderate to large size.

8.211 The site is therefore considered to be an attribute of high importance.

8.212 In line with best practice, the individual impacts will be considered with respect to the application site, plus the cumulative impacts with respect to the existing and application site.

8.213 Groundwater, Galway Bay SAC & SPA are potential receptors.

Potential Impacts

8.214 The main anticipated impact associated with the proposed quarry extension , in relation to hydrogeology, relates to the potential contamination of groundwater from quarrying activities and the subsequent risk posed to the underling groundwater, Galway Bay SAC & SPA are potential receptors.

8.215 As mentioned previously, water is discharged from the floor sump and pumped to a concrete settlement system before being discharged, under a Section 4 Licence, to groundwater *via* an infiltration area in the south western corner of the overall site.

8.216 A detailed assessment of all Potential Effects associated with all phases of the proposed development, on different environmental components are presented in Table 8.6, Duration, Frequency and Type of Effect are presented.

8.217 The direct impacts identified as likely to occur during the enabling (construction) stage are deemed to be none because the site is ready to continue from its current rock state to deeper.

8.218 The direct impacts identified as likely to occur during the operational stage are deemed to be slight to moderate and long-term in nature.

8.219 The restoration stage of the project describes the aftercare phase that follows the cessation of activities. The direct impacts identified as likely to occur during the restoration stage are deemed to be Significant to Moderate and permanent in duration.

8.220 Indirect impacts (or secondary impacts) are those which are not a direct result of the proposed activity, often produced away from the project site or because of a complex pathway. An example of a negative indirect impact is that silt deposition can impact surface water habitats. A positive indirect impact is that raw materials extracted and processed bring benefits to the progression of society housing and ensuring road safety by enabling the maintenance of roads.

8.221 Consideration has also been given to environmental impacts associated with unplanned events such as intense rainfall events, spillage, accidents, fire, trespassing, etc. The impacts identified as likely to occur due to unplanned events are deemed to be slight to significant and brief in duration.

8.222 The Importance of an Attribute was determined on basis of criteria from NRA (2008) and IGI (2013).

Table 8.6 Summary of Potential Effects

Phases	Activity	Attribute	Importance of attribute	Nature and description of the effect	Quality	Significance	Extent & Context	Probability of effects (pre-mitigation)	Frequency & Duration	Type of effect
Construction (Enabling) Phase	There will be no Construction Phase because the site has already been enabled. For the areas proposed for further excavation, the stripping of natural soils and subsoils has taken place, as per Details Submitted with the previous Application. The current proposal is to continue laterally into the bedrock within the existing site area.									
Operational Phase	Movement of aggregate stockpiles	Groundwater	Aquifer: Extremely High	Mobilisation and migration of suspended solids Sediment deposition in surface water features. Disruption of sensitive riverine habitats	Negative / Adverse	Significant	Clarinbridge GWB	Unlikely (the bedrock has been measured to be almost impermeable and the quarry is separate from the deep groundwater conduit flow system).	Rarely	Indirect
	Extraction of bedrock	Bedrock aquifer	Aquifer: Extremely High	Permanent removal of bedrock for society's use.	Negative / Adverse	Slight	Bedrock aquifer	Likely	Permanent	Direct
	Blasting of bedrock	Groundwater	Groundwater: Extremely High	Deterioration in groundwater quality	Negative / Adverse	Moderate	Clarinbridge GWB	Unlikely (Blast Technology is Advanced)	Temporary, Rarely	Direct
	Use of quarrying machinery and equipment – spillages during refuelling, use	Groundwater	Groundwater: Extremely High	Contamination of surface waters and groundwaters with hydrocarbons	Negative / Adverse	Moderate	Clarinbridge GWB	Likely	Temporary, Rarely	Direct

Phases	Activity	Attribute	Importance of attribute	Nature and description of the effect	Quality	Significance	Extent & Context	Probability of effects (pre-mitigation)	Frequency & Duration	Type of effect
	and storage of lubricants									
	Quarry dewatering – lowering of groundwater levels in surrounding area	Bedrock aquifer	Aquifer: Extremely High	Reduction in spring flows. Reduction in baseflow to surface waters.	Negative / Adverse	Moderate	Clarinbridge GWB	Unlikely	Temporary, Rarely	Direct
	Use of sump and Settlement Pond.	Groundwater	Groundwater: Extremely High	Removal and entrapment of particulate matter entrained in waters leaving site	Positive	Significant	Clarinbridge GWB	Likely	Long-term, Constant	Direct
	Cleaning of settlement ponds.	Groundwater	Groundwater: Extremely High	Improves efficiency of settlement ponds & attenuation Mobilisation and migration of suspended solids	Neutral	Not Significant	Clarinbridge GWB	Unlikely	Long-term, Annual	Direct
	Use of wheelwash	Groundwater	Groundwater: Extremely High	Removal and entrapment of particulate matter attached to haulage vehicles	Positive	Slight	Clarinbridge GWB	Unlikely	Long-term, Constant	Direct
	Wheelwash maintenance	Groundwater	Groundwater: Extremely High	Improves wheelwash and reduces Mobilisation and migration of suspended solids	Neutral	Not Significant	Clarinbridge GWB	Unlikely	Long-term, Annual	Direct

Phases	Activity	Attribute	Importance of attribute	Nature and description of the effect	Quality	Significance	Extent & Context	Probability of effects (pre-mitigation)	Frequency & Duration	Type of effect
	Use of hydrocarbon interceptors	Groundwater	Groundwater: Extremely High	Entrapment of hydrocarbons lost during refuelling/discharge	Positive	Slight	Clarinbridge GWB	Likely	Long-term, Constant	Direct
	Use of Office Toilet Facilities, On-Site WWT Plant & Discharge Zone	Groundwater	Groundwater: Extremely High	Discharge of treated wastewater to groundwater (nutrient and bacteriological)	Negative / Adverse	Imperceptible	Clarinbridge GWB	Unlikely	Long-term, Constant	Direct
	Pumped discharge of quarry waters	Groundwater	Groundwater: Extremely High	Deterioration in surface water quality	Negative / Adverse	Slight	Clarinbridge GWB	Unlikely	Long-term, Constant	Direct
	Use of concrete batching plant to work materials from the quarry extraction area	Groundwater	Groundwater: Extremely High	Contamination of Surface Waters and groundwaters with cementitious material	Negative / Adverse	Moderate	Clarinbridge GWB	Unlikely	Long-term, Constant	Direct
	Monitoring	Groundwater	Groundwater: Extremely High	Monitoring of discharge rates, suspended solids, discharge water quality, receiving surface water quality, groundwater quality	Positive	Not Significant to Imperceptible	On- and off-site	Unlikely	Long-term, hourly, quarterly, annually	Direct
Restoration	Removal of semi-mobile and mobile	Groundwater	Groundwater: Extremely High	Elimination of hydrocarbon sources	Positive	Slight	Within site boundary	Likely	Permanent	Direct

Phases	Activity	Attribute	Importance of attribute	Nature and description of the effect	Quality	Significance	Extent & Context	Probability of effects (pre-mitigation)	Frequency & Duration	Type of effect
	plant (pumps, generators, etc.)									
	Dismantling and removal of fixed plant & machinery (batching plant, wheelwash, etc.)	Groundwater	Groundwater: Extremely High	Elimination of hydrocarbon sources	Positive	Slight	Within site boundary	Likely	Permanent	Direct
	Landscaping, movement of infrastructure	Groundwater	Groundwater: Extremely High	Mobilisation and migration of suspended solids	Negative / Adverse	Moderate	Clarinbridge GWB	Likely	Temporary, Occasional	Direct & Indirect
	Cessation of pumping & discharge	Groundwater	Groundwater: Extremely High	Rainwater will accumulate in the excavated void.	Positive	Significant	Within site boundary	Likely	Permanent	Direct
Unplanned Events	Major Spillage	Groundwater	Groundwater: Extremely High	Hydrocarbon contamination	Negative / Adverse	Significant	Clarinbridge GWB	Likely	Temporary, Rarely	Direct
	Fire	Groundwater	Groundwater: Extremely High	Contamination of spent firefighting waters	Negative / Adverse	Significant	Within site boundary.	Likely	Brief, Rarely	Direct
	Intense Rainfall Events	Homes, Businesses, Village.	Groundwater: Extremely High	On-site & off-site flooding	Negative / Adverse	Moderate	Barrettspark, Cashla, Carnmore	Unlikely	Brief, Rarely	Direct

8.223 Mass balance calculations are presented to demonstrate potential for effects of blasting to present nitrogen residues in the discharge waters, which has potential to impact groundwater quality. The risk to groundwater and surface water is assessed by quantifying the resultant concentrations for the potential residual nitrogen compounds Nitrate (NO3), Ammonia (NH4) and Nitrite (NO2).

8.224 Peak activity rates of the extraction activities, blasting frequency and the type of explosives used were supplied to Hydro-G by the quarry manager.

8.225 The explosives contractor used by the quarry is Kemek and the explosives material used is Kemex 70, which is a site mixed bulk emulsion explosives produced from emulsion matrix. Emulsion matrix is essentially an aqueous solution of ammonium nitrate emulsified in oil. Kemex products may also contain ammonium nitrate prills, fuel oil, aluminium and/or gassing agents. The Technical Data Sheets (TDS's) and MATERIAL SAFETY DATA SHEET (MSDS's) for explosives, primers and detonators used at the site were used in this simulation.

8.226 Literature suggests that small percentages of N compounds can remain as residual coating on bedrock following blasting. This has the potential to be dissolved when it comes into contact with water, albeit potential concentrations are low. The study that is most referenced was completed by Environment Canada in 1988 (Ferguson & Leask, 1988). This study outlines a procedure for determining the residual N compounds for various mine site types. The stepwise procedure used in the 1988 study for predicting aqueous concentrations of N species, is as follows:

a) Calculate the annual leached nitrogen loading (kg/year) for the entire site based upon annual explosive mass usage and residual N fraction associated with explosive type.

b) Separate the leached nitrogen loading among quarry components (e.g. entering surface water, remaining on extracted rock etc.).

c) Separate into loadings of N compounds (Nitrate, Nitrite and Ammonia), and

d) Calculate the flow concentration.

8.227 The concentrations of N species in discharge water from the proposed extension at the application site quarry are calculated using this procedure. This is presented in Table 8.8, below.

8.228 The highest residual is for nitrate (99%), and upper limits of the ranges are used in all cases to determine the concentration of N species in pumped water. These are very conservative assumptions.

8.229 The calculation also assumes that 100% of residual N is dissolved in drainage waters and is subsequently pumped from the quarry by dewatering. The results of calculations presented in Table 8.7 clearly show that the residual N compounds would have low concentrations. Specifically, resultant concentrations in waters within the quarry, if impacted by explosives within the entire quarry site area, would be: 4.41 mg/l NO3, 0.069 mg/l NH4 and 0.115 mg/l NO2.

Table 8.7 N compound concentrations for explosives in dewatering discharge

EXPLOSIVE MASS BALANCE		
27.5	Total Quarry area	ha
6	BLAST EXPOSURE AREA	ha
60,000	BLAST EXPOSURE area	m2
30	Rock Depth to be blasted	m
1,800,000	Volume of rock to be exposed to BLASTING	m3
1,530,000	Rock Volume accounting for 15% losses	m3
0.4	Explosive Mass Required (Generally, at any quarry)	kg/m3
612,000	Explosives Mass Required	kg
30,600	Explosives Mass Required per year	kg/yr
NITROGEN MASS BALANCE		
94%	% Explosive mass as Ammonium Nitrate	%
35%	% Ammonium Nitrate as N	%
10,067	Mass of N	kg/yr
0.06	Residual Fraction	
604	Residual N	kg/yr
N COMPOUNDS**		
580	Residual NO_3 *(75-99% of Residual N value of 604 kg/yr)*	kg/yr
9	Residual NH_4 *(0.5 - 24% of Residual N value of 604 kg/yr)*	kg/yr
15	Residual NO_2 *(0-6% of Residual N value of 604 kg/yr)*	kg/yr
WATER BALANCE		
360	Section 4 Permitted Daily Quarry Discharge	m^3/day
131,400,000	Quarry Discharge	litres/yr
NITROGEN COMPOUND CONCENTRATIONS***		
Residual NO_3	***4.41***	*mg/L*
Residual NH_4	***0.069***	*mg/L*
Residual NO2	***0.115***	*mg/L*
*** Calculation of Residual Concentrations = (kg/yr*10^6 = mg/yr)/(litres/yr)		
MASS OF NITROGEN COMPOUNDS GENERATED AT THE SITE (kg/ha/yr)***		
Residual NO_3	***21.09***	*K/ha/yr*
Residual NH_4	***1.51***	*K/ha/yr*
Residual NO2	***0.00025***	*K/ha/yr*

8.230 Overall, the residual concentrations meet the requirements of the Threshold Values (TVs) of the Groundwater Regulations (2010), which prescribe TVs of 37.5 mg/l of NO3; 65 to 175 ug/l as Ammonium and 375 ug/l as Nitrite. Therefore, the residuals calculated for all N Species are a fraction of the TVs defined in the Groundwater Regulations. The calculated masses are lower than the concentrations in the site's quarterly discharge monitoring, which are currently 6 to 13 mg/l NO3. There is no expected exceedance for Regulatory Threshold Values specified in the Groundwater Regulations (2010, as amended). Neither are exceedances predicted for the ultimate receiving environment of the site's discharge to groundwater, which is Galway Bay. The calculated residual for Ammonia is compliant, in itself, with the Environmental Quality Objective specified in the Surface Water Regulations (2009, as amended).

8.231 The risk of impact to local and regional water quality arising from the use of explosives at the site is therefore negligible. These calculations are based on PEAK abstraction rates and no risk is determined

8.232 The Clarinbridge GWB is reported to have an approximate area of 375 km2 (GSI, 2004) and the GSI assigns a whole GWB area weighted average groundwater recharge value of c.431 mm/yr.

8.233 The volume of groundwater associated with this groundwater body is therefore 159,375,000 m3/yr, approximately.

8.234 Table 8.8 presents the quantitative water balance for the Groundwater Body.

Table 8.8 Groundwater Quantitative Balance

Coshla Quarries Ltd. WFD GWB Water Balance	
GSI assigned area for 'Clarinbridge Groundwater Body' (km2)	375
Groundwater Body Area (m2)	375,000,000
AVERAGE Across Region GSI Effective Rainfall (mm/yr)	718.3
AVERAGE Across Region GSI Groundwater Recharge Mapped as 401- 450 Range (mm/yr)	425
GSI Groundwater Recharge (m/yr)	0.425
Groundwater Recharge to GWB = [0.425m rainfall recharge x 375,000,000 m2 area] (m3/yr)	159,375,000
AVERAGE Groundwater Recharge PER DAY (m3/d)	436,644
Section 4 Discharge Licence (W/469/13) maximum daily discharge volume from the quarry (m3/d)	360
Annual Discharge based on MAX daily discharge from the quarry (m3/yr)	131,400
Hydro-G Calculation	
Proportion of Quarry's interception waters / discharge volume as a % of GWB's annual rechange amount to groundwater from rain falling on its catchment (%)	**0.08**
Other REGISTERED ABSTRACTIONS IN THIS GWB : EPA Register December 2024	
4 other Registered Abstractions cumulative (m3/d)	**1000.00**
Total Registered Abstractions + Quarry's Discharge volume as a % of GWB's annual rechange amount to groundwater from rain falling on its catchment (%)	**0.31**

8.235 The significance of the water balance information presented in Table 8.8 is that the water discharged from the quarry, when related to groundwater volume in the underlying GWB, would represent only 0.08 % of groundwater flowing through the GWB. This is a miniscule proportion of the groundwater resource. Therefore, the data in Table 8.8 provides further verification that the site essentially has no groundwater component, and the rainfall water balance is further verified.

8.236 WFD Working Group Guidance GW5 (2004b) assigns a rating of **'No Potential for Impact'** for a <1% result.

8.237 The Groundwater Balance presented as Table 8.8 relates to the Impact Potential of the site and the proposed development. With reference to the EPA (December 2024) Register of Abstractions there are four other groundwater abstractions in the GWB and the cumulative abstraction registered is an additional 1,000 m3/yr. When the Coshla Quarries Ltd. abstraction and other abstractions are added the total volume abstracted relative to the calculated available groundwater recharge flow through value the resultant Impact Potential remains <1%.

That value remains within the **'No Potential for Impact' classification rating of the** WFD Working Group Guidance GW5 (2004b).

Impact Assessment Discharge

8.238 The impact assessment relating to discharge was addressed during the consideration by Galway County Council in the issue of the Section 4 Discharge Licence in 2013. The Licence ELVs were determined by Galway County Council to present no impact potential and compliance with the Surface Water Regulations (2009) and Groundwater Regulations (2010).

8.239 The site's monitoring data suggest compliance with the Conditions of the Licence. A letter of Compliance from Galway County Council, dated the 29th of January 2025, is presented in Appendix 8.2 with a copy of the Discharge Licence.

8.240 A conclusion of no potential for impact resulting from the discharge is adopted.

Impact Assessment Flooding

8.241 A conclusion of no potential for impact with respect to flood potential arising from the proposal to continue operation of the quarry for reasons as follows:

- Quarrying creates a void that can accommodate flooding.
- Envirologic (2025) presented all details relating to Flood Risk in the area and concluded NO FLOOD RISK.

Mitigation Measures

8.242 The significant potential Effects identified in Table 8.6, above, are resolved under the mitigation measures set out under Table 8.9, below.

8.243 The key principles of avoidance, prevention, reduction and remedy/off-set have been adhered to in this regard.

8.244 The key mitigation measure for the site is that there is an existing groundwater infiltration zone in the south western corner, and this will control the MAXIMUM final site water level, which will be 19m OD. The void can be left as open as a habitat and rainfall attenuation system with ecological benefit. On the basis of the total 13ha proposed extraction area, its final shallowest depth of c.25m on its western boundary, rainfall runoff contribution data (Table 8.4 and text following), c. 80,000 m3/yr of rainfall runoff will accumulate in the final excavated void. It is therefore calculated that it will take at least 41 years for the void to fill with water after the cessation of works at the quarry. It is likely to take a little longer, given annual differences in rainfall, solar radiation, wind and evaporation rates, in combination with some differences in permeation through the floor and lateral movement through the walls of the void's shallow epikarst. It is therefore predicted that the void will be full of water by the year 2090. However, as stated, the 19m OD elevation of the groundwater infiltration zone will control the site's final water level elevation.

8.245 The FRA (Envirologic, 2025) proposed that no mitigation measures were necessary on the basis of the FRA concluding the same conclusion as the Galway County Council Planning Report on PL 20/499. However, the site could cease pumping its discharge to the licenced discharge area during flood events, if they were to occur in the wider area, which is unlikely.

Residual Impacts

8.246 Residual Impacts, following Mitigation Measures, are also presented in Table 8.9.

8.247 There are no anticipated residual impacts on the hydrological or hydrogeological environment as a result of the proposed quarry extension and the site's standard mitigation measures. The mass of solid bedrock, beneath the epikarst layer of more weathered rock at the subsoil bedrock interface, has little porosity and this has been proven by field measurement in the course of this work. No groundwater will be encountered at the site because the conduits are not there in the zone between ground level and the -5m OD permitted and proposed. The site has been dealing with its water allotment for years and it has easily been managed and no impacts have been detected in any surrounding Groundwater Body or the coastal environment at Oranmore Bay or Galway Bay.

8.248 Following the implementation of the mitigation measures proposed, residual impacts on the hydrological and hydrogeological environment during all phases are assessed to be unlikely and imperceptible.

Table 8.9 Summary of Mitigation Measures & Residual Effects

Phases	Potential Impact			Mitigation Measure	Residual Effect (following Mitigation)	
	Activity	Attribute/ Receiving Environment	Character of Potential Impact	Description of Mitigation	Significance or Quality of Effect	Probability
Construction (Enabling) Phase	Mitigation Measures for the Construction Phase are not required because the site has already been enabled, and therefore there is no Construction Phase. There will be no Construction Phase because the site has already been enabled. For the areas proposed for further excavation, the area is mostly stripped of subsoil but there are small areas in which overburden is stored in the east of the site. Perimeter Berms already exist. Minimal movement of natural soils, subsoils and stockpiling will take place, as per Details Submitted with the previous Application. Good Work Practices will continue and are the only mitigation necessary. The current proposal is to continue laterally working out from the current floor into the bedrock within the existing site area.					
Operational Phase	Extraction of bedrock	Bedrock aquifer	Removal of Bedrock for society's use.	No Mitigation Measures are possible, and neither are they necessary. The same Extreme Groundwater Vulnerability remains, as it was before the quarry operated: the Region is mapped as Extreme because of the naturally thin soil cover and exposed limestone. The Burren Formation limestone that is being abstracted is mapped by the GSI as covering an area of at least 56,000 ha and it is at least 177.25m thick in this area, based on geological logs from (Pracht & Somerville, 2015), with estimates from the Burren area itself suggesting the Formation is 390m thick (GSI, 2024). The proposed extraction of bedrock over the relatively small lateral extension area and a relatively small depth compared to the reported 56,000 ha of 177m thick limestone is inconsequential in terms of the regional resource of bedrock remaining *in situ*.	Imperceptible	Unlikely
	Blasting of bedrock	Groundwater	Deterioration in groundwater and surface water quality	Bedrock blasting at all sites is Gardai controlled and can only be completed by Industry specialists. In the EIAR, a sequence of calculations was presented to estimate the residuals of all nitrogen species (Nitrate, Ammonia, Nitrite) in all site waters after blasting. The results of the calculations show that the simulated resultant concentrations all N Species are very low and satisfy the relevant Threshold Values of the Groundwater Regulations and the Environmental Quality Standards (EQSs) of the Surface Water Regulations. It is surmised that the risk of impact to local water quality is imperceptible.	Imperceptible	Unlikely
	Use of quarrying machinery and equipment – spillages during refuelling, use and storage of lubricants	Groundwater	Contamination of surface waters and groundwaters with hydrocarbons	Excavations of rock will follow best management practices for maintenance of machinery. Fuelling, lubrication and storage areas and site offices are remote from surface water features, remote from the floor sump and settlement lagoons. ALL fuel tanks and other site activities (e.g. fuel storage, refuelling, adding hydraulic oils, etc) will be bunded and stored at elevations above any potential for interaction with water. ALL Refueling vehicles will carry Standard Operating Procedure Spill Kits. All bunded storage tanks will have Standard Operating Procedure Spill Kits in immediate proximity. Waste and fuel materials will be stored in designated areas that are isolated. Hazardous wastes such as waste oil, chemicals and preservatives, will be stored in sealed containers. All waste containers (including all ancillary equipment such as vent pipes and refuelling hoses) will be stored within a secondary containment system (e.g. a bund for static tanks or a drip tray for mobile stores and drums). The bunds will be capable of storing 110% of the tank capacity. Where more than one tank is stored, the bund must be capable of holding 110% of the largest tank of 25% of the aggregate capacity (whichever is greater). Drip trays used for drum storage must be capable of holding at least 25% of the drum capacity. Where more than one drum is stored the drip tray must be capable of holding 25% of the aggregate capacity of the drums stored. Regular monitoring of water levels within drip trays and bunds due to rainfall will be undertaken to ensure sufficient capacity is maintained at all times.	Imperceptible	Unlikely

Phases	Potential Impact			Mitigation Measure	Residual Effect (following Mitigation)	
	Activity	Attribute/ Receiving Environment	Character of Potential Impact	Description of Mitigation	Significance or Quality of Effect	Probability
				Oil which accumulates within the petrol interceptor shall be regularly removed by an appropriately licensed contractor. In addition, the petrol interceptor shall be appropriately maintained in accordance with the manufacturer's specification. Regular visual monitoring of the floor sump and settlement tank will be undertaken to ensure no visual oil or fuel contamination is present.		
	Quarry dewatering – lowering of groundwater levels in surrounding area	Bedrock aquifer	Reduction in third party well yields Reduction in spring flows Reduction in baseflow to surface waters	There are no domestic wells in use in proximity to the site because the application area under consideration is serviced by mains water supply. Even if there were local domestic wells, the groundwater strike zone is significantly deeper than the floor elevation of the quarry and the limestone mass between the quarry's floor and the groundwater conduit flow elevations. There will be no significant net loss or gain in the GWB system because volume intercepted and managed at the site represents, by calculated water balance, to be <0.1% of the regional groundwater volume. WFD Working Group Guidance GW5 (2004b) assigns a rating of 'No Potential for Impact' for a <1% result. There is no potential to impact surface waters because the volume of water managed at the quarry is infinitesimally small relative to the scale of the groundwater body contributing to any surface water systems. There are no flowing surface waters that could be affected by the quarry. All waters arising at the site are Discharged under Section 4 Licence (issued in 2013). Therefore, the potential for Impact is Mitigated by the valid licence.	Imperceptible	Unlikely
	Use of settlement ponds	Groundwater	Removal and entrapment of particulate matter entrained in waters leaving site	The site's Water management Systems are established, in use and have the benefit of prior planning. The Mitigation Measure is in place: waters arising on the quarry floor are attenuated in the floor sump, pumped to a settlement lagoon, pass through an oil interceptor and an infiltration area prior to discharge from the site. The Conditions of the site's Section 4 Licence specify monitoring of the discharge, and this is a Mitigation Measure already in place. The quarry sump and settlement lagoon have sufficient volumetric capacity to accommodate all waters for the required residence time. Discharge will be of a quality that will not have a detrimental impact on groundwater quality.	Imperceptible	Unlikely
	Cleaning of settlement ponds	Groundwater	Improves efficiency of settlement ponds, attenuation Mobilisation and migration of suspended solids	Particulate matter captured in settlement ponds to be transferred to bunds.	Imperceptible	Unlikely
	Use of wheelwash	Groundwater	Removal and entrapment of particulate matter attached to haulage vehicles	A wheel wash facility exists near the site offices and the roads have sprinkler systems. Regular monitoring and maintenance of the wheel wash's tank and silt traps will be undertaken in accordance with the manufacturer's specifications.	Imperceptible	Unlikely
	Wheelwash maintenance	Groundwater	Mobilisation and migration of suspended solids	The wheelwash is to be maintained in accordance with manufacturer's specifications.	Imperceptible	Unlikely
	Use & maintenance of hydrocarbon interceptors	Groundwater	Entrapment of hydrocarbons lost during refuelling/discharge	The site's infrastructure is already in place to manage solids and interception of oils in the baffled settlement lagoon system prior to discharge.	Imperceptible	Unlikely

Phases	Potential Impact			Mitigation Measure	Residual Effect (following Mitigation)	
	Activity	Attribute/ Receiving Environment	Character of Potential Impact	Description of Mitigation	Significance or Quality of Effect	Probability
	Pumped discharge of quarry waters	Groundwater	Increase flood risk to receptors	The void on the floor of the quarry is large enough to accommodate and holdback all extreme rainfall events. The OPW have installed road side drainage on the R339 and, in combination with the Flood Eye installed at Claregalway, local flood risk is now nil. Additional measures are not deemed because any failure at the OPW Flood Relief Mechanisms would be evident and the blockages could be cleared before any flood spread as far as the Cashla townland to the north of Barrettspark. However, if there were any expression of flood in the lands to the north of the site, which is highly unlikely and not predicted, the quarry could stop their licensed discharge to the licenced discharge area until flood regression.	Imperceptible	Unlikely
	Pumped discharge of quarry waters	Groundwater	Deterioration in groundwater quality	The Section 4 Licence issued in 2013 is designed to ensure protection of groundwater and, by default, downgradient surface and coastal waters.	Imperceptible	Unlikely
	Use of concrete batching plant to work materials from the quarry extraction area	Groundwater	Contamination of groundwaters with cementitious material	Concrete and other cement-based products are highly alkaline and can have a significant Negative / Adverse impact on water quality. The water system at the concrete batching plant is a closed loop system with all wash waters recirculated. Hence there will be no entry of cement based products into adjacent surface waters, mitigating the risk to the aquatic environment.	Imperceptible	Unlikely
	Monitoring	Groundwater	Monitoring of discharge rates, suspended solids, discharge water quality, receiving surface water quality, groundwater quality	The Conditions of the existing Section 4 Licence prescribe monitoring. There is no Mitigation needed. The action is Positive.	Imperceptible	Unlikely
Restoration Phase	Removal of semi-mobile and mobile plant (pumps, generators, etc.)	Groundwater	Elimination of hydrocarbon sources	Positive impact. No mitigation required.	None	None
	Dismantling and removal of fixed plant & machinery (batching plant, wheelwash, etc.)	Groundwater	Elimination of hydrocarbon sources	Positive impact. No mitigation required.	None	None
	Landscaping and movement of overburden stockpiles necessary to facilitate site restoration	Groundwater	Mobilisation and migration of suspended solids Sediment deposition in channels disrupting sensitive riverine habitats	Site restoration will take place on a phased basis as extraction is completed in defined areas of the site. In the final restoration of boundaries with adjoining lands levels will be graded to harmonise with the surrounding landscape. Perimeter silt fence to be installed at the toe of any overburden stockpiles. Restored areas to be vegetated to enhance stability.	Imperceptible	Unlikely
	Cessation of pumping & discharge	Groundwater	Filling of the void with rainfall.	On the basis of the total 13ha proposed extraction area, its final shallowest depth of c.25m on its western boundary, rainfall runoff contribution data, c. 80,000 m3/yr of rainfall runoff will accumulate in the final excavated void. It is therefore calculated that it will take at least 41 years for the void to fill with water after the cessation of works at the quarry. It is likely to take a little longer, given annual differences in rainfall, solar radiation, wind and evaporation rates, in combination with some differences in permeation through the floor and lateral movement through the walls of the void's shallow epikarst. It is therefore predicted that the void will be full of water by the year 2090. However, as stated, the 19m OD elevation of the groundwater infiltration zone will control the site's final water level elevation.	None	None

Phases	Potential Impact			Mitigation Measure	Residual Effect (following Mitigation)	
	Activity	Attribute/ Receiving Environment	Character of Potential Impact	Description of Mitigation	Significance or Quality of Effect	Probability
Unplanned events	Major Spillage	Groundwater	Hydrocarbon contamination	As specified above, Spill Kits are SOP and all Refueling vehicles will carry those Spill Kits, bunded tanks, drip trays, appropriate containers in appropriate locations will be ensured.	Imperceptible	Unlikely
	Fire	Groundwater	Contamination of spent firefighting waters	Used firefighting water which may be potentially contaminated may be contained via shutoff valves at the hydrocarbon interceptors. Contained firefighting water will be disposed of appropriately by a licensed contractor.	Imperceptible	Unlikely
	Intense Rainfall Events	Homes, Businesses	On-site & off-site flooding.	The floor of the quarry is large and this is the mitigation measure. The pumps in the sump can be shut off it there is a threat of flooding, caused by storm events, in the wider environment. A site specific Flood Risk Assessment (Envirologic, 2025) concluded no flood risk posed by the site and no flood risk in the environment outside the site. This is the same conclusion arrived at by the competent planning authorities in the conclusions of PL20/499 for the site.	Imperceptible	Unlikely

Cumulative Effects / Synergistic Effects

8.249 A search of Galway County Council's and An Bord Pleanála's online planning search facilities indicates that there are no other planned developments in the vicinity of the application site that have the potential to have any significant cumulative effects with the proposed development.

8.250 The cumulative impact assessment considered proposed and permitted activities within the Galway Bay South East Hydrometric Area. Discretion has been used to select those activities most likely to have an in-combination effect with the application site.

8.251 The application area forms part of an overall working quarry where processing, manufacturing plant and associated ancillary facilities are located along with extraction areas.

8.252 The application site is self-contained, and a groundwater monitoring programme is already in place to quantify the hydrogeological regime within the site and in the surrounding environs.

8.253 With reference to the EPA (December 2024) Register of Abstractions there are four other groundwater abstractions in the GWB and the cumulative abstraction registered is an additional 1,000 m3/yr. When the Coshla Quarries Ltd. abstraction and other abstractions are added the total volume abstracted relative to the calculated available groundwater recharge flow through value the resultant Impact Potential remains <1%. That value remains within the **'No Potential for Impact' classification rating of the** WFD Working Group Guidance GW5 (2004b).

Transboundary Impacts

8.254 EIA Directive 2014-52-EU invokes the Espoo Convention on Environmental Impact Assessment in a Transboundary Context (1991) and applies its definition of transboundary impacts.

8.255 Given the location of the site at c.120 km, approximately, at its closest position to the border with Northern Ireland, which is to the north east of the site, the nature, size and scale of the proposed development, and the fact that water from the catchment flows in a south westerly direction towards Galway Bay, it is expected that the development will not have any significant transboundary effects with respect to water bodies.

Do Nothing Scenario

8.256 This item requires consideration of the effect on the environment as it would be in the future should the proposed works not be carried out.

8.257 If the development did not proceed, the site of the proposed development would remain an exposed quarry floor and quarry void in the southern half of the site and scrubland in the elevated north-eastern half of the site, as per the current site status. Thus, it would be expected that the application site would not undergo any changes in a 'do-nothing' scenario.

8.258 In this work, the site has been assessed as having no evidence of groundwater conduits carrying groundwater. The site's volumes of waters arising are relatively small considering its size and relative to other limestone quarries in other locations. The waters arising at the site are primarily driven by rainfall and shallow interflow through the epikarst subsoil bedrock interface.

8.259 Interception of waters and discharge of same from the site will not significantly change the groundwater dynamics component of the site in its current condition because there is no significant net loss of water arising from the operation of the site but there would eventually be a lake if the Do Nothing Scenario were adopted.

8.260 Under the 'Do-Nothing' scenario the site will operate subject to the Conditions of PL 20/499.

8.261 When planning consents at the site expire, the restoration phase would involve the removal of all infrastructure and the restoration of the site to a secure wildlife refuge / amenity. The natural progression to lake or water feature would take place over the course of c.20 year period, on the basis of the size of the void and the measured rate of discharge currently. This would result in an attendant increase in the biodiversity interest and amenity of the site and environs.

8.262 If the proposed development did not proceed, the aggregate resource would remain unused *in situ*, and the local supply of quality aggregates and concrete products would be more restricted, the availability of materials for road maintenance would be constrained until another large company filled the need. There would be increased traffic and increased cost of materials at the alternative site, due to the nuances of the market and material's availability.

8.263 If the proposed development did not proceed, there would be an increase in heavy goods vehicles from a wider extent in the county and from a different hub.

8.264 It is expected that the site would not undergo any changes in terms of surface and groundwater under a 'do-nothing' scenario, and that the interception and discharge from the site will not significantly change the groundwater dynamics component of the site.

8.265 The nature of the void and on-site water management lagoon system provides significant attenuation capacity, which has a positive effect of reducing flood risk when compared with the pre-development regime. The proposed activities include restoration of the site following completion of targeted bedrock extraction.

8.266 Quarrying in the local area is established and has been integrated into the local environment. It is therefore considered more appropriate to continue activities at the current application site, as opposed to opening a new quarry on a greenfield site to meet the demands of the construction industry.

8.267 The demand for rock resources continues to be driven by the ongoing need for housing, roads, shopping centres, data centres, and industrial parks. The 'Do-Nothing' scenario would create a temporary supply shortfall in the construction market, which would eventually restore itself, but likely at a higher cost to the consumer. With respect to this water assessment, and water dependent habitats and species, given that the quarry has been in operation for many decades and there is no observable environmental or ecological effect there is no reason to enter the Do Nothing Scenario.

Monitoring Measures

8.268 Coshla Quarries Ltd. operates an Environmental Management System based on the Quarry Guidelines (2004), EPA Guidelines (2006) and specific requirements the site's 2009 permission. Quarry management have comprehensive Standard Operation Procedures in place for all components of its activities at the site.

8.269 With respect to groundwater monitoring, there is routine monitoring of Groundwater Quality and Levels and Quality on a Quarterly basis for the four Long Term Groundwater Monitoring Wells and that will continue. The three new MWs drilled in 2024 are not suitable locations for monitoring because there was no groundwater encountered to the -27m OD elevation at which the wells terminated The only reason it is possible to sample groundwater from the four perimeter BHs routinely monitored is because those wells terminated at depths of the reported 320 to 460ft (which is c.100 to 140m deep) and all groundwater strikes were in conduit elevation

ranges of -14 to -100 mOD. Therefore, the groundwater monitored represents the groundwater flow system beneath the proposed -5m OD floor elevation. There is no groundwater in the elevation from ground level to -5m OD. Therefore, no groundwater monitoring can be proposed additional to that which is already taking place for the deep system.

8.270 With respect to discharge monitoring, the Conditions of the Section 4 Licence for the site (W/469/13, 2013) specify monitoring and this is completed by a contracted accredited laboratory.

8.271 Monitoring measures will continue as usual and they verify whether the development is impacting on the hydrological and/or hydrogeological, and that the mitigation measures are effective.

8.272 The site's Standard Operation Management Plan addresses all potentially polluting activities and includes an emergency response procedure.

8.273 All personnel working on the site are trained in the implementation of the procedures. As a minimum, the manual is formulated in consideration of the standard best international practice including but not limited to:

- EPA (2006) Environmental Management Guidelines for the Extractive Industry (Non-Scheduled Minerals).
- CIRIA, 2011. Control of Water Pollution from Construction Sites, Guidance for Consultants
- CIRIA, 2005. Environmental Good Practice on Site (C650).
- EI, 2005. Oil Storage Guidelines (BPGCS005).
- Environment Agency, 2004. UK Pollution Prevention Guidelines (PPG).

8.274 Hydrocarbon and silt interceptors are serviced and maintained on a regular basis by an independent licensed contractor.

8.275 Regular inspections of the site infrastructure (settlement ponds, hardstanding, drainage infrastructure, on site WWTP and discharge zone, etc.) are undertaken by a designated person.

8.276 The quarry manager understands that it is part of his work and overall responsibility to ensure that all operations are carried out in such a way as to minimise potential impacts water receptors. The quarry manager is in constant communication, and works in the same office, as the operative monitoring the performances of pollution control measures adopted to ensure that the proposed development is not impacting on the environment.

Interaction with Other Measures

8.277 The EIAR guidelines (EPA, 2022) highlight that the interaction of impacts to the hydrological and hydrogeological environment arising from the proposed activities, with potential receptors identified in other EIAR chapters, must be given due consideration.

8.278 Ecology, Land, Soils and Geology and Water are the only components of the EIA that have any potential to be connected. Each of these EIA components and the mitigation measures that are proposed are addressed in detail in the relevant chapters of the EIAR. Considering the conclusions and residual impact assessment of the Water Chapter, there are no negative impacts to interact with each other.

8.279 In addition to the usual impact assessment, description of likely impacts and mitigation measures presented above, Hydro-G presented a UK Environment Agency (Boak, R. et. al., 2007) 'best practice' approach to a hydrogeologically focussed assessment (refer to Appendix 8.7). As previously outlined, the UK EA's approach suggests a stepwise thought-process. Following on from the completed desk and field studies, Hydro-G answers to each of the steps can be summarised as follows:

- ***Step 1:*** Establish the regional water resource status:

  Groundwater is mapped as a Regionally Important Karst Conduit Aquifer, named the Clarinbridge Groundwater Body, assigned EPA WFD Good Status (EPA 2016-2021) & 3rd Cycle Not At Risk.

  Surface Waters: there are no surface waters in proximity to the site. There is no direct hydrological link between the site and any surface waters.

- ***Step 2:*** Develop a conceptual model for the abstraction and the surrounding area:

  Answer = Recharge to the site is rainfall driven with most contributions from the subsoil/bedrock transition zone ingresses of recent rainfall. No conduits were determined during borehole drilling in the proposed extraction area. No conduits were encountered in any of the 18 Site Investigation boreholes drilled and reported in the 2020 EIAR, no conduits are visible in the large expanses of exposed bedrock of the walls of the void and no conduits and no water strikes were found in Hydro-G's drilling supervision for three new wells. No evidence of groundwater was found in the Apex (2024) geophysical survey's interpretive report for the proposed excavation depth to -5mOD. The site's current excavated floor will remain as It is and the proposed lateral extension with In the site boundary will be extracted down to the same final proposed floor level of -5m OD. The conceptual model, based on drilling and hydraulic response testing, is that no groundwater will be encountered. The field measured porosity of the bedrock is 10^{-8} to 10^{-10} m/s. This is **very** low. For a karst system, the volume is water arising is very low and entirely relatable to rainfall runoff only. Discharge measurements quantify a usual discharge volume range of c. 0 to c.200 m3/d. The site's water balance accounts for <0.5% of the WFD mapped Groundwater Body's water balance. This is a miniscule and NO POTENTIAL FOR IMPACT value. Therefore, the data provides further verification that the site will essentially continue to have no groundwater component and the rainfall water balance is further verified. The site is operating above the groundwater flow system, which is in deep conduits below the -5mOD elevation of the current quarry floor and the proposed lateral extension of the void within the current site area. There is no 'Water Table' in karst conduit groundwater environments. Whist the groundwater flow system will travel to the coast at Oranmore, the quarry is operating above the groundwater flow system. If there are any groundwater fed wells currently in use, the quarry has not potential to Interact with them because the quarry is set above their groundwater feed elevations and the mass of limestone is a massive, low permeability material, between the void of the quarry and any receptors.

- ***Step 3:*** Identify all potential water features that are susceptible to flow impacts:

- Clarinbridge GWB
- Galway Bay SAC and SPA.

- ***Step 4:*** Apportion the likely flow impacts to the water features.

  Answer = None,

  - No effects have been determined to date. Overriding value of significance is that the interception amount at the quarry represents 0.5% of the Clarinbridge Groundwater Body's water balance.
  - In addition, the excavation of bedrock at the quarry is completely independent of the groundwater flow system's elevation.

- ***Step 5:*** Allow for the mitigating effects of any discharges, to arrive at net flow impacts:

  Answer *= Discharge of waters that are surplus to dust suppression and product generation requirements is discharged from the site under Licence from Galway County Council (GCC). Monitoring data, submitted to GCC as part of the discharge license review, demonstrates that the quality of the quarry's discharge is compliant with the Conditions of the Licence. As stated, all waters arising at the site represent <0.5% of the Cong Robe groundwater body's water balance and so, even accounting for product use, the net flow potential for impact is negligible.*

- ***Step 6:*** Assess the significance of the net flow impacts.

  Answer = Negligible significance. There is no net loss.

- ***Step 7:*** Define the search area for drawdown impacts.

  Answer = The groundwater flow mechanism is Karst Conduit flow with extremely low measured hydraulic conductivity in the matrix of the bedrock boreholes. However, no conduits were determined during extensive site investigations. Drawdown, being a primary porosity bedrock media concept, **is not applicable to the site**. Routine monitoring of the existing groundwater monitoring boreholes suggests that excavations have not impacted groundwater levels. There are no local third party boreholes within potential impact radius to survey.

- ***Step 8:*** Identify all features in the search area that could be impacted by drawdown.

  Answer = Refer to comment at Step 7, above. An extending drawdown radius concept does not apply to the site.

- ***Step 9:*** For all these features, predict the likely drawdown impacts.

  Answer = None predicted.

- ***Step 10:*** Allow for the effects of measures taken to mitigate the drawdown impacts.

Answer = Not relevant.

- ***Step 11:*** Assess the significance of the net drawdown impacts.

  Answer = Not applicable

- ***Step 12:*** Assess the water quality impacts.

  Answer =

  - Calculations have been completed with respect to explosives residues and no water quality impact is predicted.
  - Galway County Council licensed discharge and issued ELVs that would ensure no water quality impacts.

- ***Step 13:*** If necessary, redesign the mitigation measures to minimise the impacts.
  - Not necessary.

- ***Step 14:*** Develop a monitoring strategy.
  - Quarterly sampling of discharge and groundwater monitoring is routine at the site. This will continue.

Conservation Objective Site Protection Measures (NATURA 2000)

8.280 As previously introduced, the site is c.6km from Oranmore Bay, which is part of Galway Bay. Given that the site is mapped as part of the Galway Bay South East Catchment (HA29), there is a hydrological link to the Conservation Objective sites associated with Galway Bay Inner SPA and the Galway Bay Complex SAC.

8.281 Galway Bay has designation as a European Site (Galway Bay Complex SAC 000268, Inner Galway Bay SPA 004031, Galway Bay Complex proposed NHA 000268) and also has two Statutory Instruments associated: European Union Habitats (Galway Bay Complex Special Area of Conservation 000268) Regulations 2021 [S.I. No. 548 of 2021] and European Union Conservation of Wild Birds (Inner Galway Bay Special Protection Area 004031) Regulations 2019 [S.I. No. 515 of 2019].

8.282 There is another SPA in the vicinity of Oranmore named the CREGGANNA MARSH SPA (004142), which is also a National Heritage Area (NHA) (https://www.npws.ie/protected-sites/spa). The Site Synopsis (NPWS, 2015) states that "*Cregganna Marsh is situated about 3 km south of Oranmore, to the west of the Galway - Ennis road. The predominant habitats on the site are lowland wet grassland and improved grassland, but areas of limestone pavement and other exposed rock, Hazel (Corylus avellana) scrub, freshwater marsh, drainage ditches and dry grassland are also represented. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for Greenland White-fronted Goose, which are part of the Rahasane flock. Cregganna Marsh SPA & NHA is of ornithological importance because it is regularly utilised by a nationally important flock of Greenland White-fronted Goose, a species listed on Annex I of the E.U. Birds Directive".* Hydro-G offers that there no potential for

hydrological link interaction between the quarry site and the SPA & NHA Marsh's Conservation Objectives because it is unlikely that the groundwater at the site would make its way to a distance of 3km south of Oranmore because the pull of the tides and coast at Oranmore would win over a pull from the area of the fen to the south of Oranmore.

8.283 The Clare (Galway) River, part of Lough Corrib SAC, SPA and NHA, is 2.7km, approximately, north-west of the site. The river flows broadly west, before entering Lough Corrib. Given that the quarry site is mapped as part of Hydrometric Area 29 and not part of the Corrib Catchment (HA30), there is no direct hydrological link between the site and Lough Corrib. There may be hydrostatic pressure links because the provision of a Flood Eye in Claregalway provided relief in 2015/2016 when there was no flooding in the area surrounding the quarry in the worst groundwater flooding event in Irish History. However, there is no potential for waters arising at the quarry to be in anyway linked to Lough Corrib or any other Conservation Objective site because the quarry operates above the groundwater conduit flow network and the quarry's discharge is controlled with Emission Limit Values designed to protect the downstream environment, no matter where that is.

8.284 With respect to WFD and Groundwater Dependent Terrestrial Ecosystems, to the south of the site, the EPA maps a distinct GWB named 'GWDTE -Galway Bay Complex Fens (SAC000268)', whose closest northern mapped boundary is c. 350m to the south of the M6 in the vicinity of the quarry site. The M6 passes in and out of this GWDTE on its way to Galway, slightly west of the quarry. With respect to potential for hydrological connectivity with the site, even though the GWDTE - Galway Bay Complex Fens (SAC000268)'s most northerly boundary is mapped relatively close to the site (*i.e., <500m)*, it is the potential for hydrological connectivity that is key. Hydro-G offers that there is **NO potential for hydrological or hydrogeological connectivity** between the site and the Fens because GWBs are mapped and conceptualised by the GSI and EPA as 'no flow' boundaries in that the surface water systems within or on the edge of a GWB, as in the coast at Oranmore, are the collectors and drainers of groundwater in each GWB. Given that the site is mapped as underlain by the Clarinbridge GWB and that there are no surface water features associated with that GWB in the vicinity of or between the site and the coast, it is then the Bay that drains the site's GWB and the groundwater connected to the quarry site is not moving south to the Fen GWDTE GWB. The Statutory Instrument associated with the Fens, as linked on the NPWS website (https://www.npws.ie/protected-sites/sac/000268), is S.I. No. 548 of 2021: European Union Habitats (Galway Bay Complex Special Area of Conservation 000268) Regulations 2021.

PWS Protection Measures

8.285 EPA Envision mapping, as tabulated earlier in this report, presented Drinking Water Protection Areas and potential for Impact has been assessed.

8.286 No Drinking Water protection Areas and no PWS Sources are deemed to be connected to the site.

Water Framework Directive Compliance Assessment

8.287 A WFD Compliance Assessment is reported in full in a separate report accompanying this application and associated EIAR. Summary points are presented here.

8.288 There is no direct hydrological link between the site and any surface water or terrestrial systems. Earlier in this EIAR, the Desk Study WFD information section dealt with each mapped element of the Hydrometric Area and the reasons for no interaction potential were presented then.

8.289 The only direct connection that the quarry has with any water body is the one that it has with the body mapped by the EPA as the Clarinbridge GWB (IE_WE_G_0008), which is mapped as Good Status (2016 – 2021) and 3rd Cycle Not At Risk. This is a mapping / administration connection because site investigations suggest that the quarry is separated from the underlying deep conduit groundwater flow system. Notwithstanding that, the quarry has operated through all 3 Cycles of the WFD and there has been no identified risk or deterioration in Status. Given that nothing new is presented for the site, continued compliance with the Objectives of the WFD are envisaged.

8.290 Further, with respect to Quantitative Groundwater Body Status and Risk, a numerical water balance has been completed for the underlying Clarinbridge GWB (IE_WE_G_0008) and reported in this work and the result is that the abstraction/licensed discharge of waters from the site accounts for <0.5% of the available groundwater resource volume. When the site's abstraction/discharge is considered in combination with all other EPA (2024) registered abstractions from the GWB the result is that <1% of the available groundwater resource volume is affected. Quantitative impact values of <1% are within the **'NO Potential for Impact'** category of the WFD (2004b) Working Group GW5 Guidance Document on Groundwater Abstractions.

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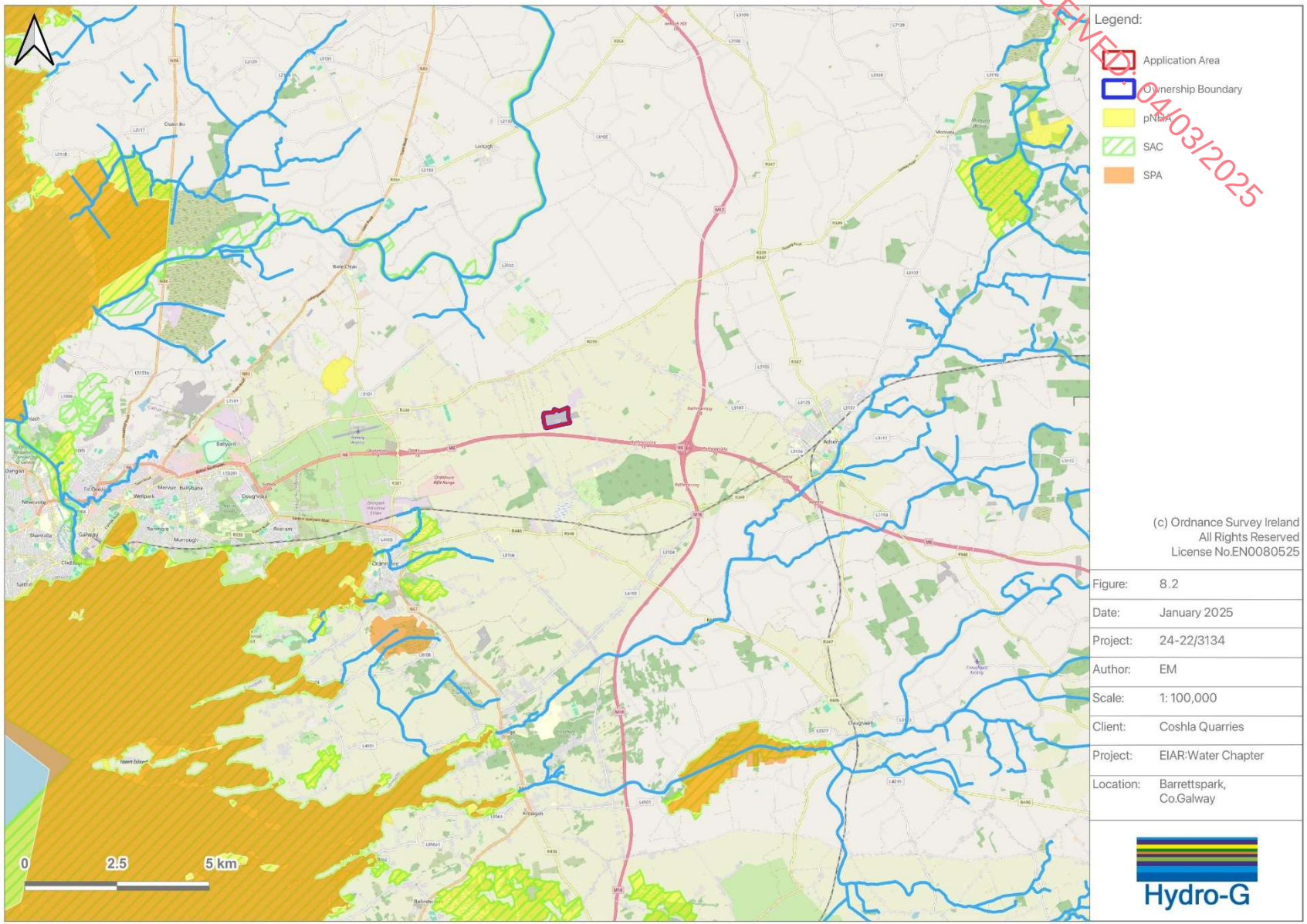

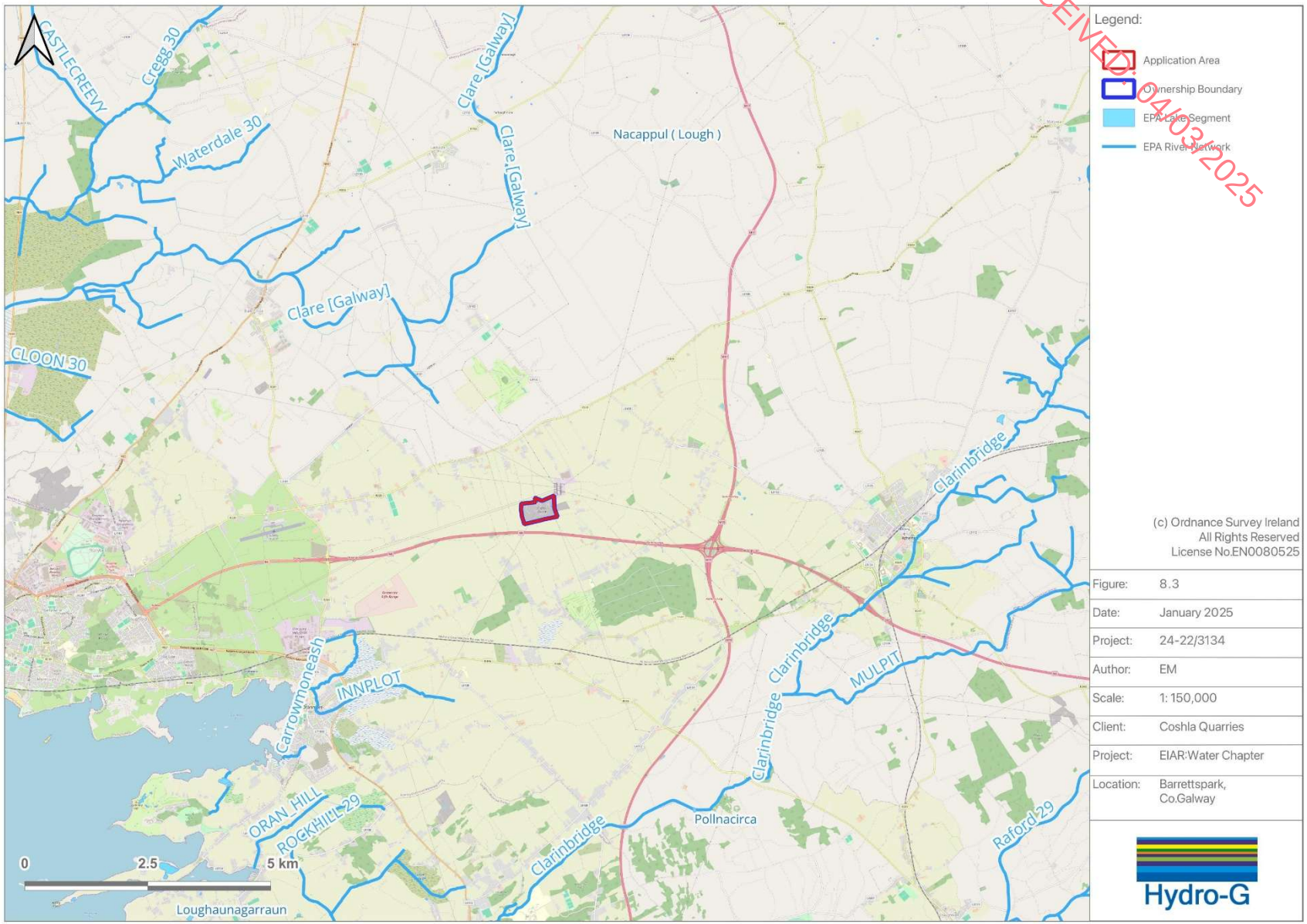

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Project:	24-22/3134
Author:	EM
Scale:	1: 50,000
Client:	Coshla Quarries
Project:	EIAR:Water Chapter
Location:	Barrettspark, Co. Galway

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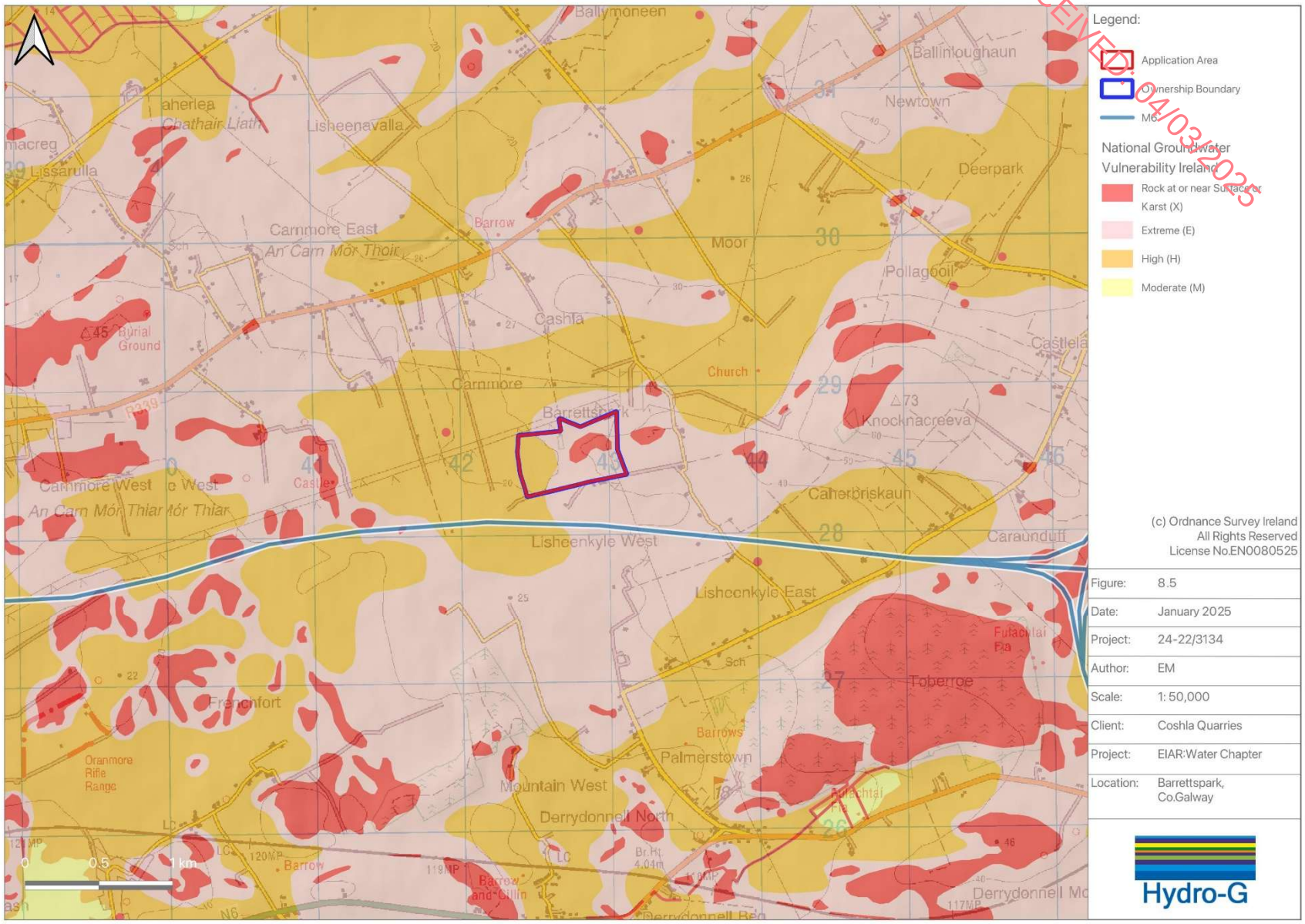

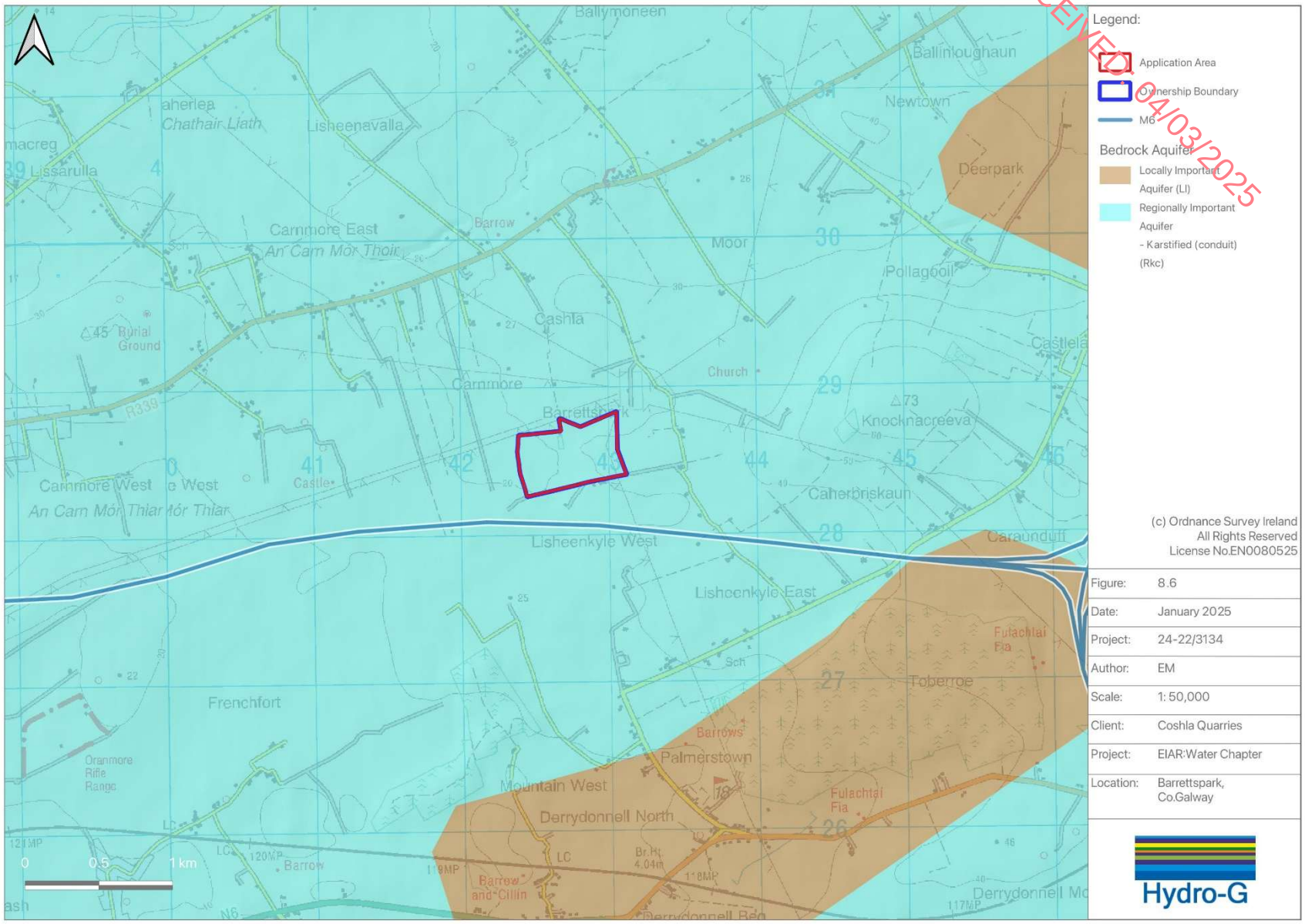

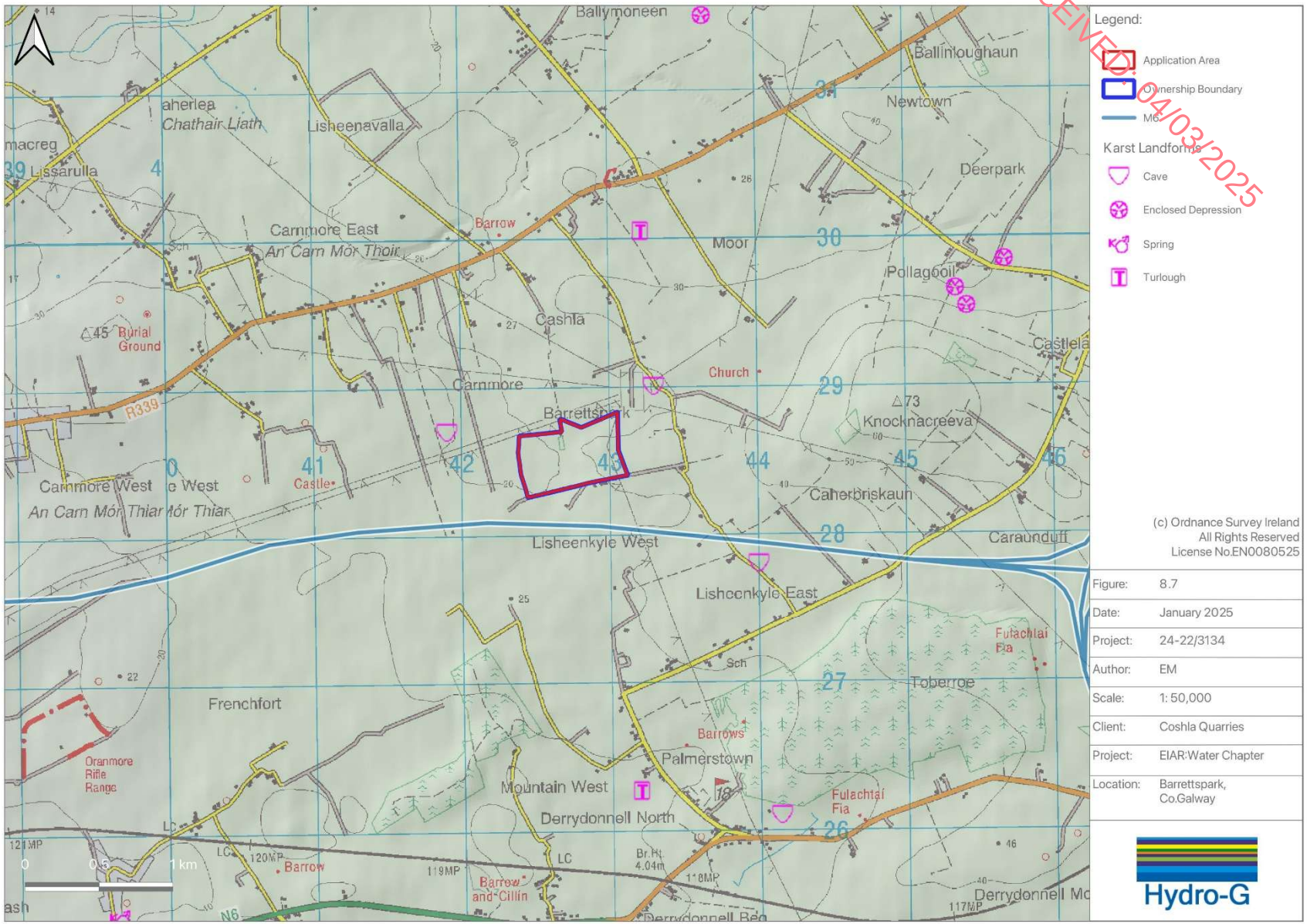

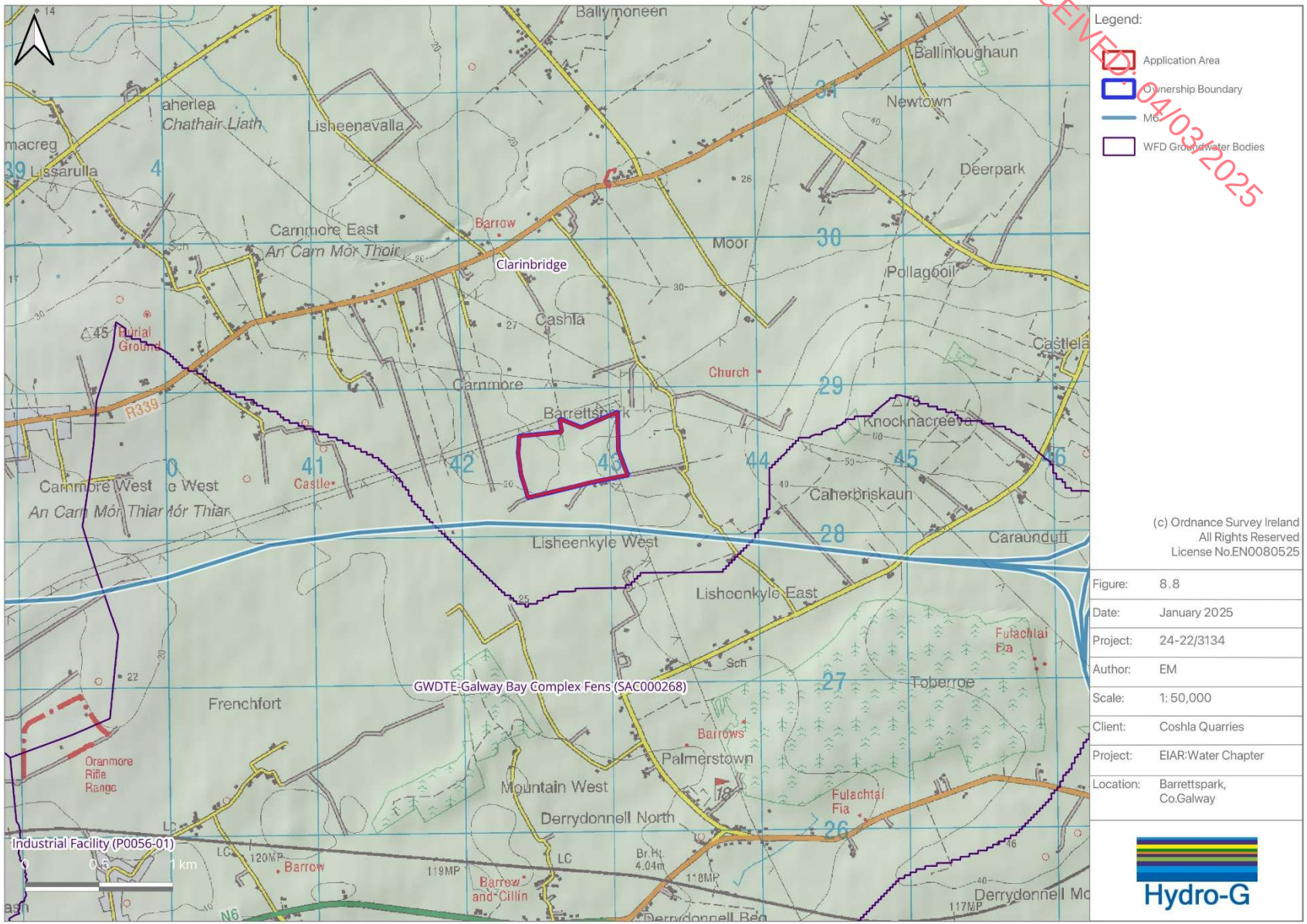

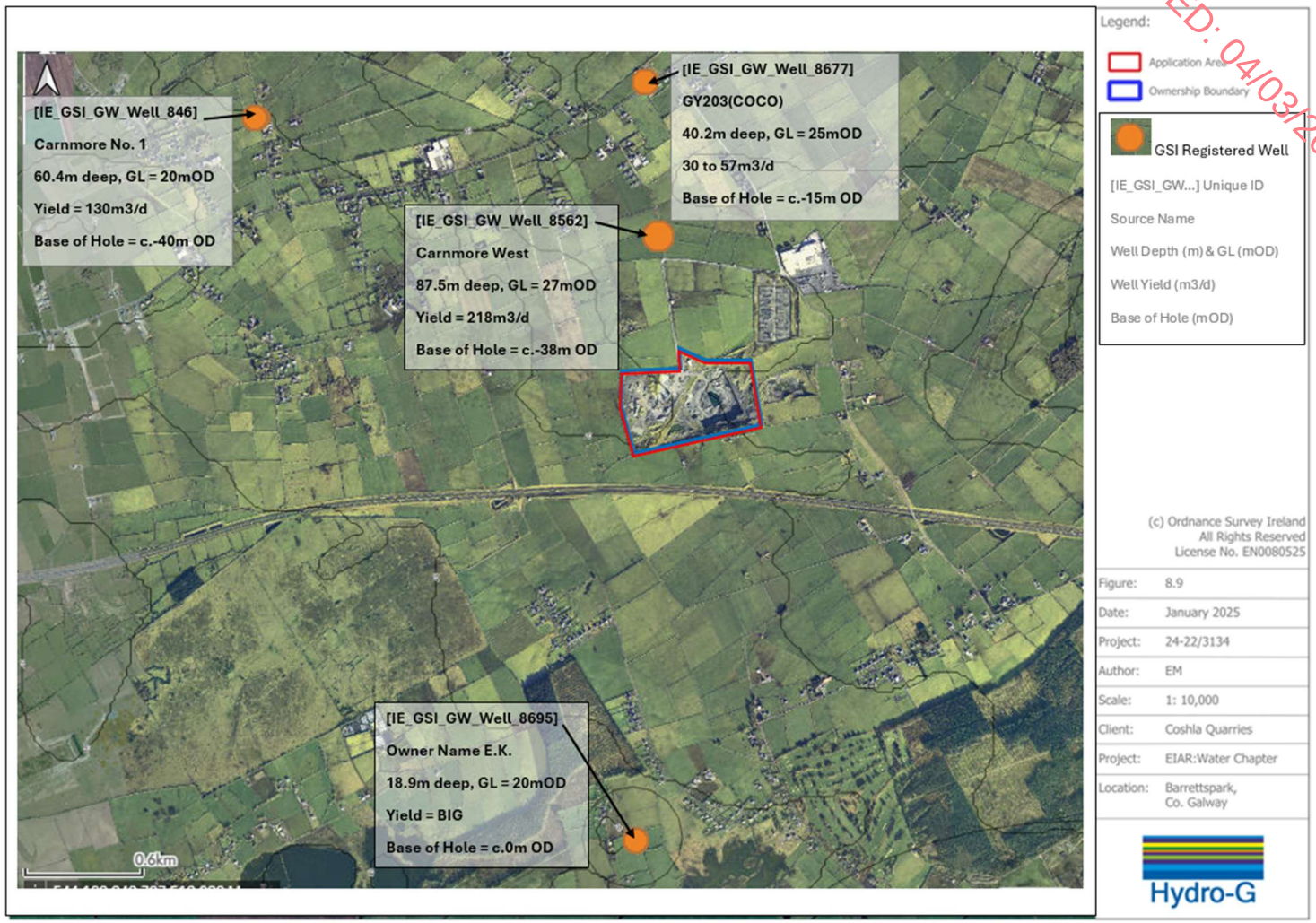

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