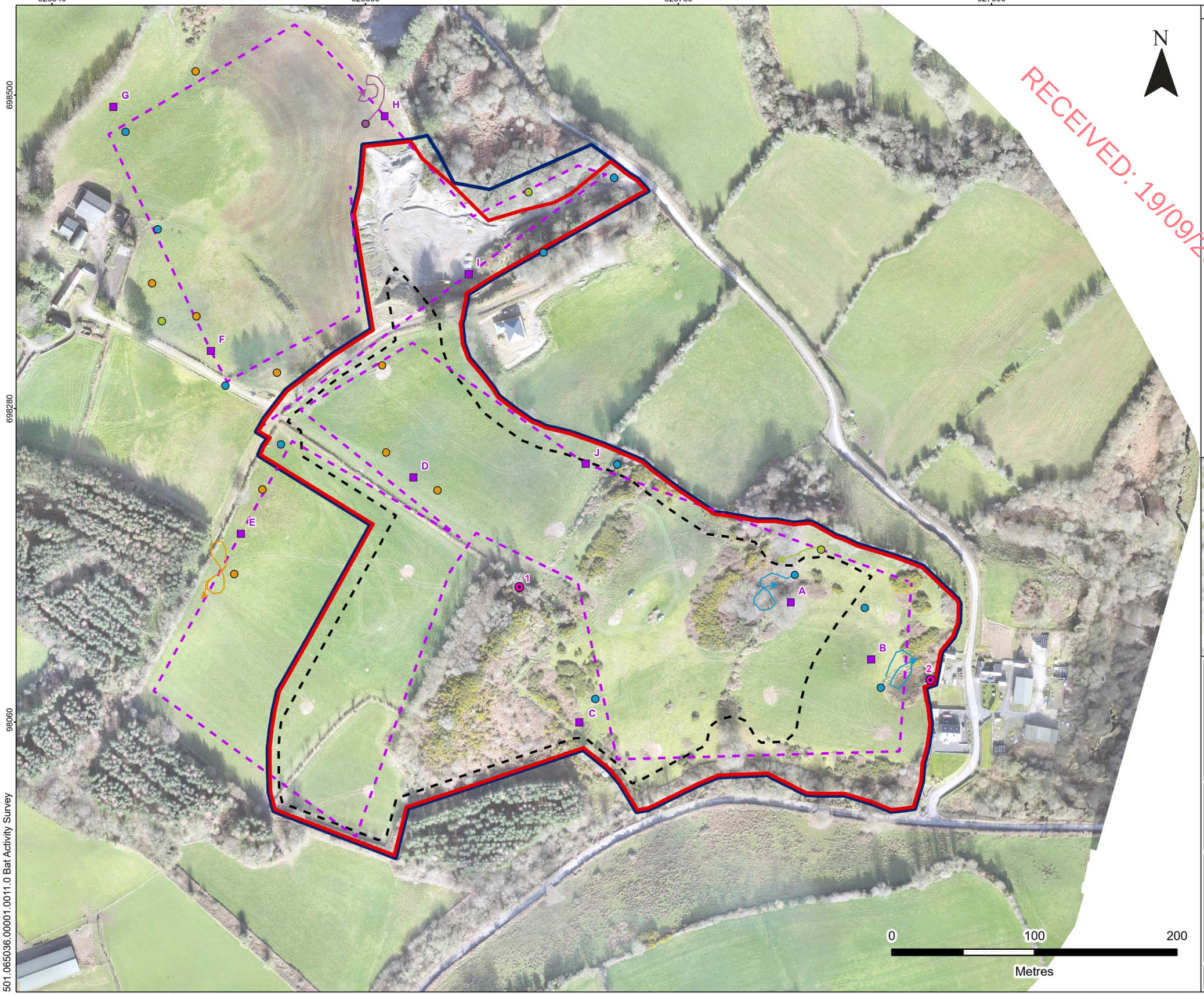
626340 626560 626780 627000

698500 698280 98060



LEGEND

- Planning Application Area
- Applicant's Land Interest Area
- Proposed S & G Extraction Area
- Bat Stopping Points
- Bat Transect
- Bat Static Location

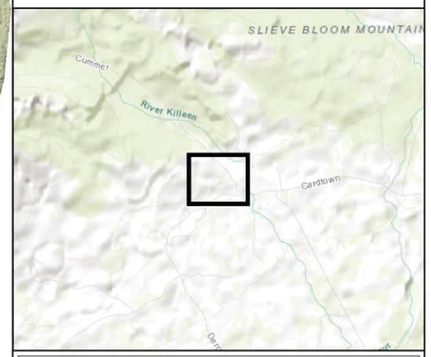
Species Record

- Common Pipistrelle
- Soprano Pipistrelle
- Pip Spp.
- Unidentified

Species Flight Line Record

- Common Pipistrelle
- Soprano Pipistrelle
- Pip Spp.
- Unidentified Species - Heard not Seen

Note:
Figure only showing extent of drone imagery flown by SLR. White space has no imagery available.



BREEDON IRELAND

SLR

CAMROSS S & G PIT DEVELOPMENT

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BAT ACTIVITY SURVEY RESULTS

FIGURE 5-8

Scale 1:2,500 @ A3

Date SEPTEMBER 2024

501.065036.00001.0011.0 Bat Activity Survey

626400 626600 626800 627000

698400

698200

501.065036.00001.0012.0 Bat Emergence Survey

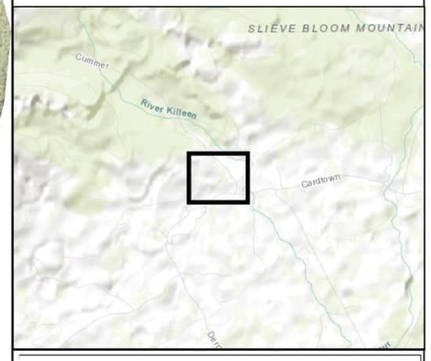
RECEIVED: 19/09/2024

N

LEGEND

- Planning Application Area
- Applicants Land Interest Area
- Proposed S & G Extraction Area
- Bat Trees
- Surveyor Location

Note:
Figure only showing extent of drone imagery flown by SLR. White space has no imagery available.



0 100 200

Metres

BREEDON IRELAND

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CAMROSS S & G PIT DEVELOPMENT

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BAT EMERGENCE SURVEY 1 RESULTS 03/07/2024

FIGURE 5-9

Scale 1:2,500 @ A3

Date SEPTEMBER 2024

626340 626560 626780 627000

698500

698280

98060

501.065036.00001.0013.0 Camera Trap Location

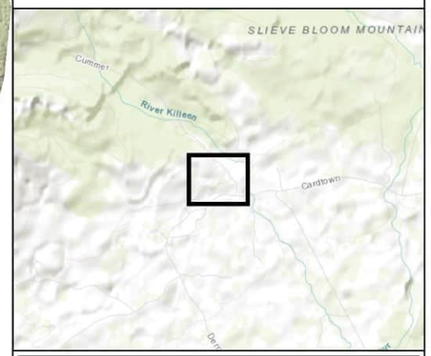
RECEIVED: 19/09/2024

N

LEGEND

- Planning Application Area
- Applicants Land Interest Area
- Proposed S & G Extraction Area
- Bat Camera Trap Location

Note:
Figure only showing extent of drone imagery flown by SLR. White space has no imagery available.



0 100 200

Metres

BREEDON IRELAND

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CAMROSS S & G PIT DEVELOPMENT

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

CAMERA TRAP LOCATION

FIGURE 5-10

Scale 1:2,500 @ A3

Date SEPTEMBER 2024

Appendix 5-A
Relevant Legislation and Planning Policy

5-A.1 EIA Directive 2014/52/EU

The EIA Directive, Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment as amended by Council Directive 97/11/EC of 3 March 1997, Directive 2003/35/EC of 26 May 2003 and Directive 2009/31/EC of 23 April 2009, now codified in Directive 2011/92/EU of 13 December 2011 and amended in Directive 2014/52/EU of 16 April 2014, is designed to ensure that projects likely to have significant effects on the environment are subject to a comprehensive assessment of environmental effects prior to project consent being given.

The EIA Directive was first transposed into Irish law by the European Communities (Environmental Impact Assessment) Regulations, 1989 (S.I. No. 349 of 1989) which amended the Local Government (Planning and Project) Act, 1963 (and other legislation) to provide for environmental impact assessment. The European Union (Planning and Project) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) transpose the requirements of Directive 2014/52/EU, Amending previous Directive 2011/52/EU, on the assessment of the effects of certain public and private projects on the environment (the EIA Directive) into Irish planning law.

5-A.2 Habitats and Birds Directive

The Habitats Directive ensures the conservation of a wide range of rare, threatened or endemic animal and plant species. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora was adopted in 1992 and aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. It forms the cornerstone of Europe's nature conservation policy with the Birds Directive and establishes the EU wide Natura 2000 ecological network of protected areas, safeguarded against potentially damaging projects. The Natura 2000 network of protected areas is known as Special Areas of Conservation (SAC) and Special Protection Areas (SPA). In general terms, they are considered to be of exceptional importance in terms of rare, endangered or vulnerable habitats and species within the European Community. The requirements of the Habitats Directive have been transposed into Irish law through the European Communities (Birds and Natural Habitats) Regulations 2011 [S.I. No. 477/2011]. This legislation affords protection to both Special Protection Areas and Special Areas of Conservation. Special Areas of Conservation (SAC) are designated under the Conservation of Natural Habitats and of Wild Fauna and Flora Directive 92/43/EEC (Habitats Directive) which is transposed into Irish law by the EC (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011). Special Protection Areas (SPA) are classified under the Birds Directive (2009/147/EC on the Conservation of Wild Birds). Article 6(3) of the Habitats Directive requires an ‘appropriate assessment’ to be undertaken for any plan or project that is likely to have a significant effect on the conservation objectives of a Natura 2000 site. An ‘appropriate assessment’ is an evaluation of the potential impacts of a plan or project on the integrity of a Natura 2000 site, and the incorporation, where necessary, of measures to mitigate or avoid negative effects.

5-A.3 National Legislation

Flora and fauna in Ireland are protected at a national level by the Wildlife Acts 1976 to 2018 and the Floral (Protection) Order 2022. Natural Heritage Areas (NHA) are areas that are considered to be important for the habitats present or for the species of plants and animals supported by those habitats. Under the Wildlife Amendment Act 2000, NHAs are legally protected from damage from the date they were formally proposed for designation. Section 19(1) of the Act states that ‘Where there is a subsisting natural heritage area order in respect of any land, no person shall carry out, or cause or permit to be carried out, on that land any works specified in the order or any works which are liable to destroy or to significantly alter, damage or interfere with the features by reason of which the designation order was made’. In addition, a list of proposed NHAs (pNHAs) was published in 1995 but to date these have not had their status confirmed. Prior to statutory designation, pNHAs are subject to limited protection under various agri-environment and forestry schemes and under local authority planning strategies such as County Project Plans.

5-A.4 Eastern and Midland Regional Assembly - Regional Spatial and Economic Strategy

The regional biodiversity and regional heritage policy objectives are set out in the following section and summarised in Table 5-A.4.

Table 5-A.4: Regional biodiversity and natural heritage policies for the eastern and midlands region.

Policy Reference	Policy
RPO 7.16	Support the implementation of the Habitats Directives in achieving an improvement in the conservation status of protected species and habitats in the Region and to ensure alignment between the core objectives of the EU Birds and Habitats Directives and local authority development plans.
RPO 7.17	Facilitate cross boundary co-ordination between local authorities and the relevant agencies in the Region to provide clear governance arrangements and coordination mechanisms to support the development of ecological networks and enhanced connectivity between protected sites whilst also addressing the need for management of alien invasive species and the conservation of native species.
RPO 7.18	Work with local authorities and state agencies to promote the development of all aspects of park management in the Wicklow National Park and the Slieve Bloom Mountains.
RPO 7.19	Support the consideration of designating a National Park for the peatlands area in the Midlands.
RPO 7.20	Promote the development of improved visitor experiences, nature conservation and sustainable development activities within the Dublin Bay Biosphere in cooperation with the Dublin Bay UNESCO Biosphere Partnership.

5-A.5 Relevant Planning Policy

5-A.5.1 Laois County Development Plan 2021-2027

The Co. Laois planning policy and legislation relating to biodiversity that is relevant to the proposed project is set out in the following section.

This plan contains a number of policies relevant to ecology and nature conservation that are summarised in Table A-2.

Table A-2: Biodiversity policies within the Laois County Development Plan 2021 - 2027

Policy Reference	Policy
CS 03	In the assessment of development proposals, to take account of transport corridors, environmental carrying capacity, availability and/or capacity to provide waste water and water supply services, potential to conflict with Water Framework Directive objectives, potential to impact on the integrity of European sites and Annexed Habitats and species, features of biodiversity value including ecological networks, impact on landscape and visual characteristics, education and other socioeconomic objectives.
CA ST 1	Protect and enhance the County's floodplains subject to flooding as "green infrastructure" where appropriate and subject to compliance with the Habitats Directive.
CM LU 2	Ensure that peatland areas which are designated (or proposed for designation) as NHAs, SACs or SPAs are conserved for their ecological, climate regulation, archaeological, cultural and educational significance;
CA LU 4	Support the creation and enhancement of ecological linkages and buffer zones from development;
CA LU 5	Support the creation and protection of ecological resilient and varied landscapes to help support a wide range of species;
RL 14	Support in principle the expansion of the aggregates and concrete products industry which offers opportunity for employment and economic development generally subject to environmental , traffic and planning considerations and ensure that any plan or project

Policy Reference	Policy
	associated with extractive industry is subject to Appropriate assessment screening in compliance with the Habitats Direction and subsequent assessment as required , applicants for planning permission shall have regard to the GSI-ICF Quarrying Guidelines.
DM RL 3	MINING AND AGGREGATES Applications for new development for aggregate extraction, processing and associated processes, shall 1. identify existing public rights of way and walking routes which may be impacted on or are adjacent to the development site. They shall be kept free from development as a Rights of Way/Walking Route 2. ensure the protection, conservation, preservation and safeguarding of recorded monuments and areas in their vicinity, World Heritage Sites (including Tentative Sites), NHA's, Euro Sites, Nature Reserves, scenic views and prospects archaeological sites and features, natural heritage, natural environment, features of natural beauty or interest and prescribed sites, geological sites and areas of geological/geomorphological or historic interest and areas of high scenic amenity from inappropriate development that might be detrimental to them. 3. minimise adverse effect on the environment and visual and natural amenities to the greatest possible extent must be carried out during all life cycle stages, whether in respect of new quarries or extensions to existing ones and development will be prohibited if the quality of the environment or landscape, particularly sensitive landscape, is adversely affected or there is a reduction of the visual amenity of areas of high amenity. 4. be landscaped either by the retention of existing vegetation or by screening to minimise the detraction from the visual quality of the landscape. 5. Require that development proposals on or in proximity to a quarry site should investigate the nature and extent of the risks associated with the development together with appropriate mitigation.
ES 50	Ensure that external lighting and lighting schemes are designed so that light spillage is minimised, thereby limiting light pollution into the surrounding environment and protecting the amenities of nearby properties and wildlife, including protected species.
BNH 1	Protect, conserve, and seek to enhance the county's biodiversity and ecological connectivity.
BNH 2	Conserve and protect habitats and species listed in the Annexes of the EU Habitats Directive (92/43/EEC) (as amended) and the Birds Directive (2009/147/EC), the Wildlife Acts 1976 and 2010 (as amended) and the Flora Protection Orders.
BNH 3	Support and co-operate with statutory authorities and others in support of measures taken to manage proposed or designated sites in order to achieve their conservation objectives and maintain the favourable conservation status and conservation value of Sites under National and European legislation and International Agreements and maintain and /develop linkages between them where feasible.
BNH 4	Protect and maintain the conservation value of all existing and future Natural Heritage Areas, Nature Reserves, Ramsar Sites, Wildfowl Sanctuaries and Biogenetic Reserves in the county.

Policy Reference	Policy
BNH 5	Projects giving rise to significant cumulative, direct, indirect or secondary impacts on Natura 2000 sites arising from their size or scale, land take, proximity, resource requirements, emissions (disposal to land, water or air), transportation requirements, duration of construction, operation, decommissioning or from any other effects shall not be permitted on the basis of this Plan (either individually or in combination with other plans or projects) [1]. Screening for AAs and AAs undertaken shall take into account invasive species as relevant.
BNH 6	Assess, in accordance with the relevant legislation, all proposed developments which are likely to have a significant effect (directly or through indirect or cumulative impact) on designated natural heritage sites, sites proposed for designation and protected species
BNH 7	Protect Natural Heritage Areas (NHA) from developments that would adversely affect their special interests.
BNH 10	Support the objectives of the All-Ireland Pollinator Plan 2015-2020 by encouraging the planting of pollinator friendly trees and plants within grass verges along public roads and existing and future greenways, new hedgerows, public parks and public open spaces in towns and villages, including part of mixed use and residential developments.
BNH 11	Support measures to protect Swift population such as the creation of Swift nest cavities in all new commercial and public buildings (schools/libraries, etc)
BNH 13	It is a policy objective of the Council to require new developments to identify, protect and enhance ecological features by making provision for local biodiversity (for example, through provision of swift boxes or bricks, bat roost boxes, green roofs, etc.) and improve the ecological coherence of wider green infrastructure.
BNH 14	It is an objective of the Council to protect existing swift roosts as identified in the County Swift Survey and ensure existing nest sites are not lost through inappropriate renovation or destruction.
BNH 15	In dealing with applications for new developments, the Planning Authority will have regard to the following: • Inclusion of swift nesting opportunities in new buildings through use of swift brick or swift nest boxes where appropriate
DM BNH 1	DEVELOPMENTS IN PROXIMITY TO pNHA Where a development is of a significant scale or in close proximity to a pNHA, the Council will require an Ecological Impact Assessment to determine the impact of the proposed development on the designated site or natural heritage.
DM BNH 2	APPROPRIATE ASSESSMENT Article 6(3) and 6(4) of the Habitats Directive requires an Appropriate Assessment of any plan or project whether within or outside a designated Natura 2000 site, which does not directly relate to the management of the site but may impact upon its conservation objectives. All planning applications shall be screened for Appropriate Assessment and a Phase II Appropriate Assessment carried out if necessary. Where full Appropriate Assessment is required, the assessment shall be based on best scientific knowledge, by a person with ecological expertise. It shall address the potential impacts of the plan or project on the conservation objectives of any Natura 2000 site. The impacts assessed must include the indirect and cumulative impacts of approving the plan or project, considered with any current or proposed activities, developments or policies impacting on the site. The potential impacts of policies outside Natura 2000 sites but potentially impacting upon them (known as 'ex situ' impacts) must also be included in the

Policy Reference	Policy
	assessment. (Refer to: Appropriate Assessment of Plans and projects in Ireland, Guidance for Planning Authorities, DEHLG (2009).
BNH 23	Encourage, pursuant to Article 10 of the Habitats Directive, the management of features of the landscape, such as traditional field boundaries and laneways important for the ecological coherence of the Natura 2000 network and essential for the migration, dispersal and genetic exchange of wild species.
BNH 26	Protect individual trees, groups of trees and woodland in the interests of landscape conservation (including townscapes) and nature conservation as part of the development management process.
BNH 27	Protect existing hedgerows, particularly of historical and archaeological importance of townland boundaries, from unnecessary removal in order to preserve the rural character of the countryside ad promote biodiversity.
BNH 28	Ensure that hedgerow removal to facilitate development is kept to an absolute minimum and, where unavoidable, a requirement for mitigation planting will be required comprising a hedge of similar length and species composition to the original, established as close as is practicable to the original and where possible linking into existing adjacent hedges. Native plants of a local provenance should be used for any such planting.
BNH 30	Ensure that hedgerow and mature tree removal to facilitate development is kept to an absolute minimum and, where unavoidable, a requirement for mitigation planting will be required comprising a hedge of similar length and species composition to the original, established as close as is practicable to the original and where possible linking into existing adjacent hedges. Native plants of a local provenance should be used for any such planting.
DM BNH 4	**MATURE TREES** Where there are trees within an application site, or on land adjacent to it that could influence or be affected by proposed development (including street trees), the planning application must include a detailed submission prepared by a suitably qualified Arboriculturist in accordance with British Standard 5837: 2012 'Trees in relation to design, demolition and construction – Recommendations'. A Tree Management Plan shall be provided to ensure that trees are adequately protected during development and incorporated into the design of new developments.
DM BNH 4	**MATURE TREES** Where there are trees within an application site, or on land adjacent to it that could influence or be affected by proposed development (including street trees), the planning application must include a detailed submission prepared by a suitably qualified Arboriculturist in accordance with British Standard 5837: 2012 'Trees in relation to design, demolition and construction – Recommendations'. A Tree Management Plan shall be provided to ensure that trees are adequately protected during development and incorporated into the design of new developments.
DM BNH 5	**HEDGEROWS** In dealing with applications for new developments, the Planning Authority will have regard to the following: a) Retention of a connected network of good quality hedgerows; b) The value of hedgerows as green infrastructure (landscape, biodiversity, shelter, supporting services to agriculture/horticulture; c) The avoidance of the unnecessary removal of hedgerows; d) If it is necessary to remove a hedgerow, developers should be reminded of their obligations under the Wildlife Acts not to remove or interfere with them during the bird nesting season, between March 1st and 31st August. Also, replacement or

Policy Reference	Policy
	compensatory planting of hedgerows using indigenous species such as whitethorn or blackthorn only will be required; e) Proposals to integrate hedgerows into the layout of a new linear feature such as a road/ pedestrian/cycle track; f) Depending on the potential risks of anti-social activity or requirements for a more garden look the margins of these new hedgerows/woodlands/new shrubberies could be planted with colourful non-natives (for amenity) or spiny shrubs to deter vandals. g) By occasionally mowing the grass margin of hedgerows (or part of it), they will look managed. As litter will accumulate in long grass along their margins arrangements will have to be made to carry out regular clean ups; h) Encouragement should be given to develop a new linear feature of biodiversity value such as a hedgerow or dry-stone wall, particularly if this type of habitat is found adjacent to the development site; i) The use of native tree and shrub species similar to those found in adjacent hedgerows in new or replacement hedgerows; j) The wholesale removal of hedgerows to facilitate the achievement of adequate sightline visibility for one-off houses in the countryside will not be encouraged.
BNH 31	Protect waterbodies and watercourses from inappropriate development, to ensure they are retained for their biodiversity and flood protection values and to conserve and enhance where possible, the wildlife habitats of the County's rivers and riparian zones, lakes, canals and streams which occur outside of designated areas to provide a network of habitats and biodiversity corridors throughout the county.
BNH 37	Protect the Nore Pearl Mussel through the measures set out in the Freshwater Pearl Mussel Nore Sub-Basin Management Plan (2009).
BNH 39	Protect, conserve, preserve, manage and enhance wetlands (including fens and turloughs) from infilling, fragmentation, degradation and protect and conserve their quality, character and features. Resist development (including land reclamation) which would destroy, fragment and degrade wetlands, coastal wetlands, estuarine marshland and control adjacent development by the use of buffer zones.
BNH 41	Protect the county's designated peatland areas and landscapes and to conserve and manage their ecological, archaeological, cultural, and educational heritage by promoting high environmental standards in conjunction with Bord na Mona, NPWS, IPPC, NGO's and local communities.
DM BNH 6	**PEATLANDS** In the consideration of development on or adjacent to peatland areas, the following guiding principles should apply: • Consideration of the potential contribution of peatlands to climate change mitigation and adaptation including renewable energy production; Offaly County Development Plan 2021-2027: Draft Stage Chapter 13 Development Management Standards 402; • Consideration of habitats and species of environmental significance; • Consideration of the potential contribution of peatlands to an existing or proposed greenway / blueway / peatway network; • Consideration of the ecosystem services and tourism potential provided by peatlands; • Development of peatlands shall ensure that there are no negative impacts on water quality and hydrology; • Consideration of peatland stability; • Achieving of a carbon emissions balance; and

Policy Reference	Policy
	• Incorporation of fire mitigation measures such as fire breaks or ensuring access points and routes are suitable for travel by emergency services.
LCA 19	Recognise the potential constraints on development created by river flood plains and the value of these flood plains as increasingly rare habitats.
LCA 23	Recognise the importance of peatlands for ecology, history, culture and for alternative energy production.
LCA 24	Conserve valuable habitats including any European and national designations.
LCA 25	Support the identification of projects that have the potential to achieve commercial value such as industrial developments, renewable energy, tourism developments etc. while at the same time promoting high environmental standards and supporting Biodiversity objectives.
LCA 27	Recognise that intact boglands are critical natural resources for ecological and environmental reasons and recognise that cutaway and cut-over boglands represent degraded landscapes and/or brownfield sites and thus are potentially robust to absorb a variety of appropriate developments.

5-A.5.1 Kilkenny City and County Development Plan 2021-2027

The Co. Kilkenny planning policy and legislation relating to biodiversity that is relevant to the proposed project is set out in the following section.

Development Management Requirements:

- To ensure that development proposals, where relevant, improve the ecological coherence of the Natura 2000 network and encourage the retention and management of landscape features that are of major importance for wild fauna and flora as per Article 10 of the Habitats Directive.
- To protect and where possible enhance wildlife habitats and landscape features which act as ecological corridors/networks and stepping stones, such as river corridors, hedgerows and road verges, and to minimise the loss of habitats and features of the wider countryside (such as ponds, wetlands, trees) which are not within designated sites.
- To ensure that appropriate mitigation and/or compensation measures to conserve biodiversity, landscape character and green infrastructure networks are required in developments where habitats are at risk or lost as part of a development.
- Require all developments in the early pre-planning stage of the planning process to identify, protect and enhance ecological features and habitats, and making provision for local biodiversity (e.g. through protection of existing breeding sites, and provision of appropriate new infrastructure such as swift, bat and barn owl boxes, bat roost sites, green roofs, etc.) and provide links to the wider Green Infrastructure network as an essential part of the design process.
- To protect existing woodlands, trees and hedgerows which are of amenity or biodiversity value and/or contribute to landscape character of the county, and to ensure that proper provision is made for their protection and management, when undertaking, approving or authorising development.
- To ensure that when undertaking, approving or authorising development that sufficient information is provided to enable an assessment of impacts on woodlands, trees, and hedgerows.

- To have regard to and seek the conservation of identified trees and woodlands from a) the National Survey of Ancient and Long-Established Woodlands, b) the Tree Register of Ireland (c) sites of significance identified in the Kilkenny Woodlands Survey 1997, (d) the National Survey of Native Woodlands, and (e) Survey of Mature Trees in Kilkenny City and Environs, in the assessment of planning applications.
- To retain hedgerows, and other distinctive boundary treatment such as stone walls, when undertaking, authorising or approving development; where the loss of the existing boundary is unavoidable as part of development, to ensure that a new hedgerow is planted using native species, and species of local provenance to replace the existing hedgerow and/or that the wall is re-built using local stone and local vernacular design.
- To discourage the felling of mature trees to facilitate development and, where appropriate make use of Tree Preservation Orders to protect important trees and groups of trees which may be at risk or have an amenity, biodiversity or historic value.
- To require the planting of native broadleaved species, and species of local provenance, in new developments as appropriate.
- To require relevant development proposals to address the presence or absence of invasive alien species on proposed development sites and (if necessary) require applicants to prepare and submit an Invasive Species Management Plan where such a species exists to comply with the provisions of the European Communities (Birds and Natural Habitats) Regulations 2011-2015.
- For proposals connected to surface water systems, risks associated with the spread of crayfish plague shall be considered and applicants should submit a crayfish plague management strategy where appropriate.
- The Council will promote the use of native plants and seeds from indigenous seed sources in all landscape projects.

Appendix 5-B
Bat Conservation Guidance

Table 5-29: BCT Guidelines for assessing the potential suitability of proposed development sites for bats

Potential Suitability	Description of Roosting Habitats in Structures	Description of Potential Flight-Paths and Foraging Habitats
None	No habitat features on site likely to be used by any roosting bats at any time of the year (i.e. a complete absence of crevices/suitable shelter at all ground/underground levels	No habitat features on site likely to be used by any commuting or foraging bats at any time of the year (i.e. no habitats that provide continuous lines of shade/protection for flight-lines or generate/shelter insect populations available to foraging bats).
Negligible[a]	No obvious habitat features on site likely to be used by roosting bats; however, a small element of uncertainty remains as bats can use small and apparently unsuitable features on occasion.	No obvious habitat features on site likely to be used as flight-paths or by foraging bats; however, a small element of uncertainty remains in order to account for non-standard bat behaviour.
Low	A structure with one or more potential roost features that could be used by individual bats opportunistically at any time of the year. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions[b] and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity and not a classic cool/stable hibernation site but could be used by individual hibernating bats[c]).	Habitat that could be used by small numbers of bats as flight-paths such as a gappy hedgerow or unvegetated stream, but isolated i.e. not very well connected to the surrounding landscape by other habitat. Suitable but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions[b] and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only, such as maternity and hibernation – the categorisation described in this table is made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for flight-paths such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure with one or more potential roost sites that are obviously suitable for use by large numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions[b] and surrounding habitat. These structures have the potential to support high conservation status roosts, e.g. maternity or classic cool/stable hibernation site.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by bats for flight-paths such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such a broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roost.

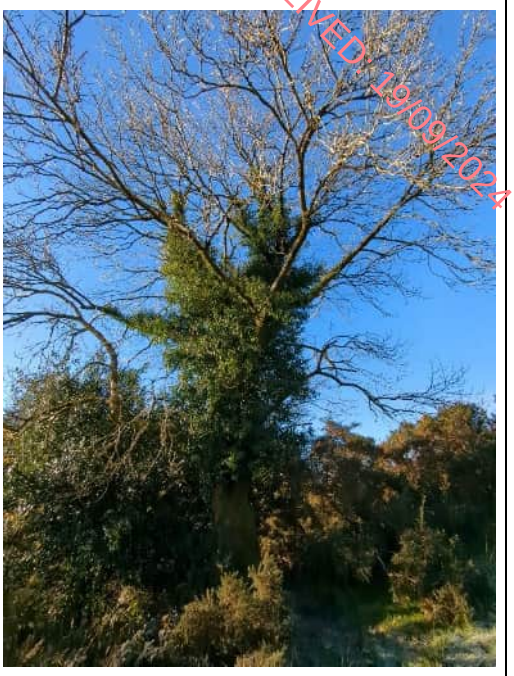
Potential Suitability	Description of Roosting Habitats in Structures	Description of Potential Flight-Paths and Foraging Habitats

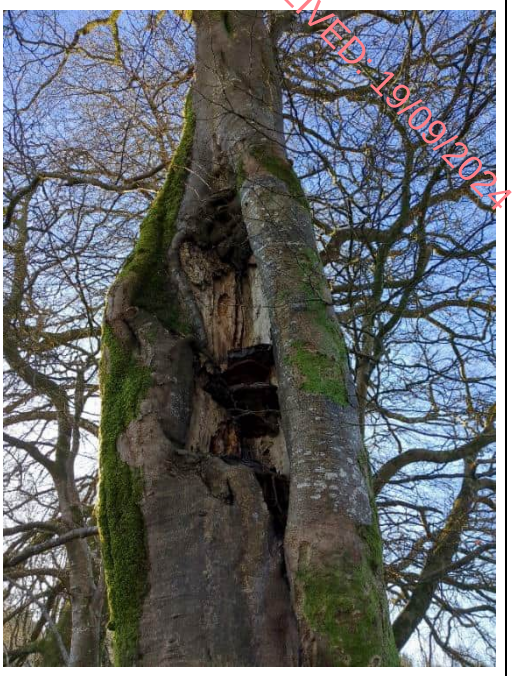
a Negligible is defined as 'so small or unimportant as to be not worth considering, insignificant'. This category may be used where there are places that a bat could roost or forage (due to one attribute) but it is unlikely that they actually would (due to another attribute).

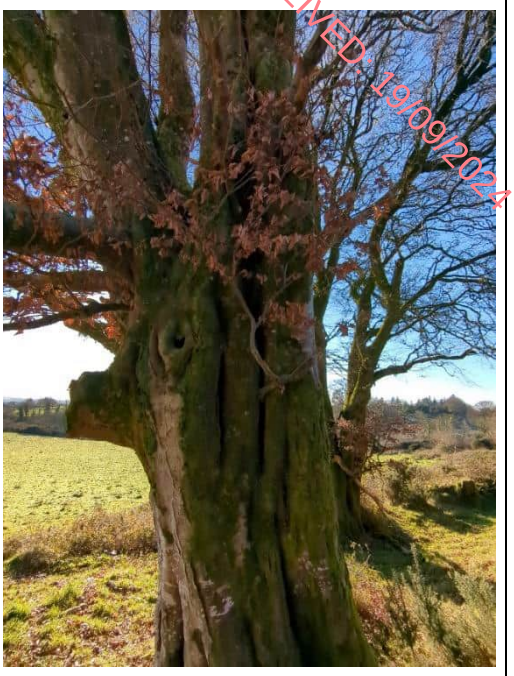
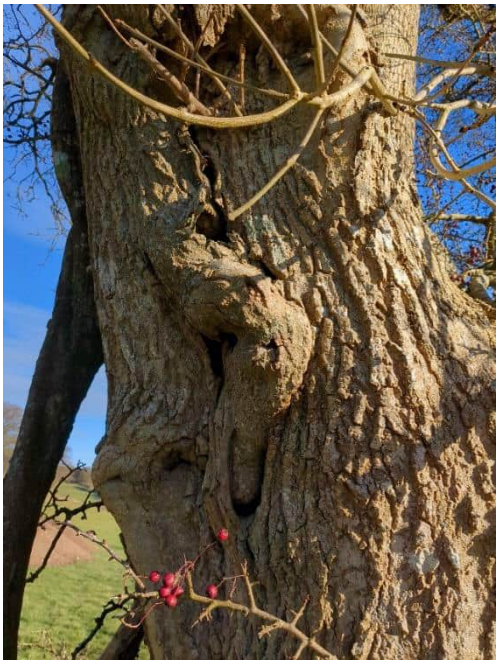
b For example, in terms of temperature, humidity, height above ground level, light levels or levels of disturbance.

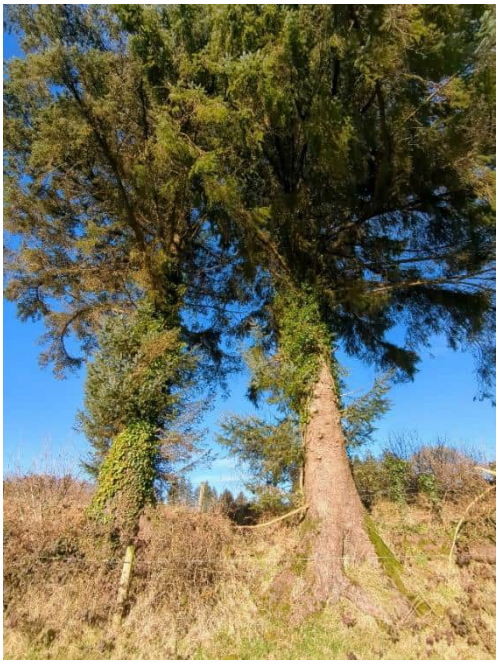
c Evidence from the Netherlands shows mass swarming events of common pipistrelle bats in the autumn followed by mass hibernation in a range of building types in urban environments. Common pipistrelle swarming has been observed in the UK and winter hibernation of numbers of this species has been detected at Seaton Delaval Hall in Northumberland. This phenomenon requires some research in the UK, but ecologists should be aware of the potential for larger numbers of this species to be present during the autumn and winter in prominent buildings in the landscape, urban or otherwise.

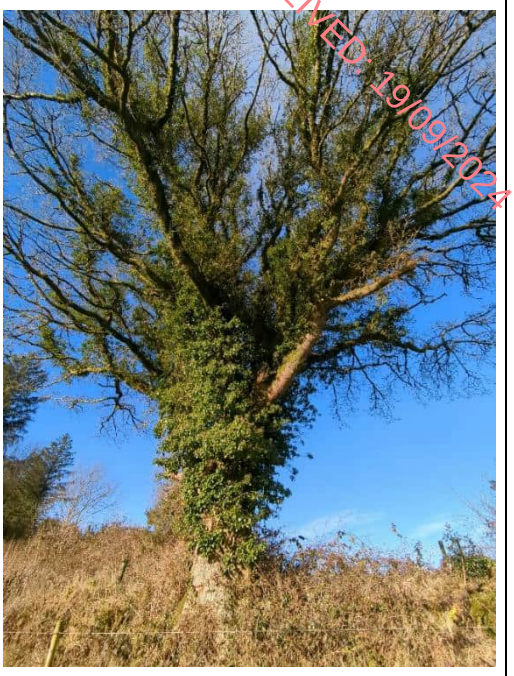
Appendix 5-C
Potential Roost Assessment

Ref.	Description	Evaluation	Overall assessment	Photograph
Tree 1	Tree 1 comprised a semi-mature ash located within the woodland/scrub mosaic to the south of the Site at approximate ITM co-ordinates 626722, 698044.	There were no PRFs identified on this tree. However, the main stem was covered in partially detached ivy with stem diameters in excess of 50 mm. It may be possible that PRFs exist within the obscured areas of the tree. It is anticipated that any potential PRFs within the stem would be suitable for crevice-dwelling and void-dwelling bats.	**Low bat roosting potential**	
Tree 2	Tree 2 (TN2) comprised a mature beech located on the edge of a treeline within the southern field at approximate ITM co-ordinates 626812, 698056.	The tree has vertically linear crevices located near the base and up to approximately 3 m along the main stem. Likely only suitable for single opportunistic crevice-dwelling bats. None of the crevices go significantly deep into the stem. There is a branch split on the NW aspect at a height of approximately 15 m. This split has a possible entry point leading further into the branch and further assessment is required.	**Moderate bat roosting potential**	

Ref.	Description	Evaluation	Overall assessment	Photograph
Tree 3	Tree 3 (TN3) comprised a mature beech located along a treeline at approximate ITM co-ordinates 626813, 698045.	There is a large trunk cavity with located approximately 3 m up the main stem. This has vertical linear crevices leading to potential roosting for numerous crevice-dwelling bats. There are also gaps leading behind deadwood into a potential trunk cavity.	**Moderate bat roosting potential**	
Tree 4	Tree 4 comprised a mature beech located along a treeline within the southern field at approximate ITM co-ordinates 626849, 698135.	There are minor crevices for single bats located throughout the main stem up to approximately 8 m in height. These are shallow and do not go deep enough to support numerous bats.	**Low bat roosting potential**	

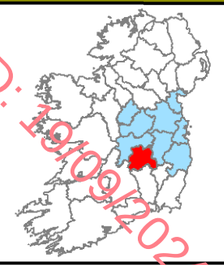
Ref.	Description	Evaluation	Overall assessment	Photograph
Tree 5	Tree 5 comprised a mature beech located within treeline at approximate ITM co-ordinates 626859, 698145.	There were many shallow crevices located along the main stem which were not deep enough to support numerous bats.	**Low bat roosting potential**	
Tree 6	Tree 6 comprised a mature ash located within a treeline along the northeastern site boundary at approximate ITM co-ordinates 626672, 698276.	There were several instances of loose bark leading into a potential trunk cavity along the main and secondary stems, between heights of 1.5 m and 5 m.	**Low bat roosting potential**	

Ref.	Description	Evaluation	Overall assessment	Photograph
Tree 7	Tree 7 comprised of a mature, multi-stemmed sycamore located within a treeline at approximate ITM co-ordinates 626649, 698294.	There is a trunk cavity located at a height of approximately 1 m, however it was uncertain whether this leads further upward into the stem.	**Low bat roosting potential**	
Tree 8	Tree 8 comprised of two mature spruces located within a treeline located to the north of the Site between the existing S&G pit and the northern field at approximate ITM co-ordinates 626608, 698339.	No PRFs were identified, and these trees were only given a low assessment rather than a negligible assessment due to the dense canopy obscuring parts of the stem However, based on the good health and semi-mature ages of the trees, it was considered unlikely to support features that would support larger numbers of bats.	**Low bat roosting potential**	

Ref.	Description	Evaluation	Overall assessment	Photograph
Tree 9	Tree 9 was located to the north of the Site, bordering the northern field at approximate ITM co-ordinates 626548, 698314.	There were no PRFs identified on this tree. However, the main stem was covered in partially detached ivy with stem diameters in excess of 50 mm. It may be possible that PRFs exist within the obscured areas of the tree. It is anticipated that any potential PRFs within the stem would be suitable for crevice-dwelling and void-dwelling bats.	**Low bat roosting potential**	

Appendix 5-D
NHA’s & Nature Reserves

ADOPTED 25/01/2022
LAOIS COUNTY COUNCIL
COUNTY DEVELOPMENT PLAN
2021-2027



N
W E
S

Legend:

- Natural Heritage Areas
- Town/Village
- Motorway
- National Secondary Roads
- Strategic Regional Roads
- Regional Roads
- Railway Routes
- County Boundary
- DED Boundaries

Offaly
Kildare
Tipperary
Kilkenny
Carlow

Clonaslee
Rosenallis
Mountmellick
Portarlington
Killenard
Emo
Ballyfin
Portlaoise
Vicarstown
Stradbally
Camross
Mountrath
Coolrain
Castletown
Timahoe
Ballyroan
Ballylynan
Shanahoe
Abbeyleix
Killeen
Arles
The Swan
Clough
Ballinakill
Newtown Doonane
Killeshin
Graiguecullen
Errill
Rathdowney
Durrow
Attanagh
Cullahill

000413 000859 000865 000416 002104 002357 000412 000881 000876 000878 000867 001494 001800 000864 000421 000860 000652 000868 001923 000857 000858 000418 000417 000862 002076 000869 000415 000419 000874

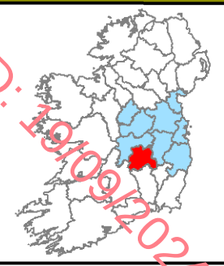
0 5
kilometres

MAP 11.3 - NATURAL HERITAGE AREAS

LAOIS COUNTY COUNCIL
FORWARD PLANNING SECTION

Drawn:	Checked:	Approved:
Bryan Scully	David O'Hara & Nathan Smith	Angela McEvoy

ADOPTED 25/01/2022
LAOIS COUNTY COUNCIL
COUNTY DEVELOPMENT PLAN
2021-2027



N
W E
S

Legend:

- Nature Reserves
- Town/Village
- Motorway
- National Secondary Roads
- Strategic Regional Roads
- Regional Roads
- Railway Routes
- County Boundary
- DED Boundaries

Offaly
Kildare
Tipperary
Kilkenny
Carlow

Clonaslee
Rosenallis
Portarlington
Killenard
Mountmellick
Ballybrittas
Emo
Slieve Bloom Mountains
Ballyfin
Vicarstown
Portlaoise
Stradbally
Camross
Mountrath
Timahoe Esker
Coolrain
Castletown
Timahoe
Ballyroar
Ballylynan
Shanahoe
Abbeyleix
Killeen
Arles
The Swan
Clough
Ballacolla
Ballinakill
Grantstown Wood and Lough
Newtown Doonane
Killeshin
Errill
Rathdowney
Durrow
Graiguecullen
Attanagh
Cullahill

0 5
kilometres

MAP 11.4 - NATURE RESERVES

LAOIS COUNTY COUNCIL
FORWARD PLANNING SECTION

Drawn:	Checked:	Approved:
Bryan Scully	David O'Hara & Nathan Smith	Angela McEvoy

Appendix 5-E
Hedgerow Appraisal

Table 5-30: Hedgerow significant assessment

Hedgerow reference	Central point location (ITM)	Criteria		Score	Justification
1	626577 698215	Historical significance	Period of establishment	Significant (3)	Hedgerow 1 forms an internal field boundary. Historical mapping[42] shows that this hedgerow/farm boundary was present in the first edition six-inch maps dating from surveys undertaken between 1829 and 1842.
		Species diversity significance	Tree/shrub/climber species count	Slightly significant (1)	Canopy dominated by hawthorn and hazel with some elder, holly, and blackthorn also present (i.e., five species)
		Ground flora significance	Species count	Low significance (0)	Ground flora included nettle, rush, creeping buttercup, wild strawberry, Yorkshire fog, creeping thistle, herb Robert, male fern, broad-leaved dock, common hogweed, foxglove, ivy, sorrel, germander speedwell *Veronica chamaedrys*, cleavers *Galium aparine*, willowherb, and ragwort. (i.e., 17 species in total). However, overall ruderals such as nettles and cleavers dominated the ground flora.
			Pteridophytes (Ferns)	N/A	Only one fern was present: male fern.
		Structure, construction & associated features	Wall/bank	Low significance (0)	No wall or bank present.
			Drain	Low significance (0)	No ditch present.
			Other	Low significance (0)	No badger sett or other notable features present.
		Habitat connectivity significance		Moderately significant (2)	Links with other hedgerows.
		Landscape significance		Low significance (0)	No notable landscape features present.
		Other factors of significance		N/A	N/A

[42] Using first edition OS mapping: https://osi.maps.arcgis.com/apps/dashboards/d5bdc7daef3e4537b67caa31dfcc42d5. Accessed May 2024.

Hedgerow reference	Central point location (ITM)	Criteria		Score	Justification
		Overall significance		**Cumulative score**	**Justification**
		Not considered 'Heritage hedgerows'		6	Cumulative score of 16 (or a cumulative score of 6 or greater in the Historical, Species Diversity or Structural Categories) needed.
2	626472 698222	Historical significance	Period of establishment	Significant (3)	Hedgerow 2 forms a farm boundary located adjacent to a farm road/track. Historical mapping[43] shows that this hedgerow/farm boundary was present in the first edition six-inch maps dating from surveys undertaken between 1829 and 1842.
		Species diversity significance	Tree/shrub/climber species count	Low significance (0)	Canopy species comprised gorse, bramble, hazel (i.e., three species)
		Ground flora significance	Species type	Slight significance (1)	Ground flora was limited due to the road/farm track and included herb Robert, buttercup, common hogweed, and meadowgrass. (i.e., four species in total).
			Species count		
			Pteridophytes (Ferns)	N/A	No ferns identified.
		Structure, construction & associated features	Wall/bank	Low significance (0)	No wall or bank present.
			Drain	Low significance (0)	No ditch present.
			Other	Low significance (0)	No badger sett or other notable features present.
		Habitat connectivity significance		Significant (3)	Links with other hedgerows as well as woodland located to the northeast and plantation woodland located to the southwest.
		Landscape significance		Moderately significant (2)	Links with other hedgerows.

[43] Using first edition OS mapping: https://osi.maps.arcgis.com/apps/dashboards/d5bdc7daef3e4537b67caa31dfcc42d5. Accessed May 2024.

Hedgerow reference	Central point location (ITM)	Criteria		Score	Justification
		Other factors of significance		Low significance (0)	No notable landscape features present.
		Overall significance		**Cumulative score**	**Justification**
		Not considered 'Heritage hedgerows'		9	Cumulative score of 16 (or a cumulative score of 6 or greater in the Historical, Species Diversity or Structural Categories) needed.
3	626535 698052	Historical significance	Period of establishment	Significant (3)	Hedgerow 4 forms an internal field boundary. Historical mapping[44] shows that this hedgerow/farm boundary was present in the first edition six-inch maps dating from surveys undertaken between 1829 and 1842.
		Species diversity significance	Tree/shrub/climber species count	Low significance (0)	Dominated by hazel and hawthorn (i.e., two species).
		Ground flora significance	Species count	Low significance (0)	Ground flora was very sparse and absent in many parts of the hedgerow. Where ground flora was present it included bramble, thistle, ivy, nettle, foxglove (i.e., five species in total).
			Pteridophytes (Ferns)	N/A	No ferns were recorded.
		Structure, construction & associated features	Wall/bank	Moderately significant (2)	Bank present between 0.5 – 1m in height difference.
			Drain	Low significance (0)	No ditch present.
			Other	Low significance (0)	No badger sett or other notable features present.
		Habitat connectivity significance		Significant (3)	Hedgerow 4 is connected to woodland and gorse scrub habitat to the northeast and plantation woodland to the southwest.

[44] Using first edition OS mapping: https://osi.maps.arcgis.com/apps/dashboards/d5bdc7daef3e4537b67caa31dfcc42d5. Accessed May 2024.

Hedgerow reference	Central point location (ITM)	Criteria		Score	Justification
		Landscape significance		Slightly significant (1)	Single link with semi-natural habitat including hedgerow
		Other factors of significance		Low significance (0)	No notable landscape features present.
		Overall significance		**Cumulative score**	**Justification**
		Not considered 'Heritage hedgerows'		9	Cumulative score of 16 (or a cumulative score of 6 or greater in the Historical, Species Diversity or Structural Categories) needed.
4	626812 698206	Historical significance	Period of establishment	Significant (3)	Hedgerow 4 forms a field boundary. Historical mapping[45] shows that this hedgerow/farm boundary was present in the first edition six-inch maps dating from surveys undertaken between 1829 and 1842.
		Species diversity significance	Tree/shrub/climber species count	Slightly significant (1)	Dominated by gorse, hawthorn, hazel, blackthorn, with occasional oak (i.e., five species).
		Ground flora significance	Species count	Moderately significant (2)	Ground flora was very sparse and absent in many parts of the hedgerow. Where ground flora was present it included bramble, ivy, sorrel, dandelion, wild strawberry, ragwort, and nettle (i.e., seven species in total).
			Pteridophytes (Ferns)	N/A	No ferns were recorded.
		Structure, construction & associated features	Wall/bank	Low significance (0)	No wall or bank present.
			Drain	Low significance (0)	No ditch present.
			Other	Low significance (0)	No badger sett or other notable features present.
		Habitat connectivity significance		Significant (3)	Hedgerow 4 is connected to gorse scrub and treelines.

[45] Using first edition OS mapping: https://osi.maps.arcgis.com/apps/dashboards/d5bdc7daef3e4537b67caa31dfcc42d5. Accessed May 2024.

Hedgerow reference	Central point location (ITM)	Criteria	Score	Justification
		Landscape significance	Slightly significant (1)	Single link with semi-natural habitat including hedgerow
		Other factors of significance	Low significance (0)	No notable landscape features present.
		Overall significance	**Cumulative score**	**Justification**
		Not considered ‘Heritage hedgerows’	10	Cumulative score of 16 (or a cumulative score of 6 or greater in the Historical, Species Diversity or Structural Categories) needed.

Table 5-31: Hedgerow condition assessment

Hedgerow reference	Central point location (ITM)	Criteria		Score	Justification
1	626577 698215	Structural variables	Height	Adequate (1)	The average height of the hedgerow is approximately 1 - 2m across its length.
			Width	Adequate (1)	The average width of the hedgerow is approximately 1.5 - 2m across its length.
			Profile	Highly favourable (3)	The profile of the hedgerow is overgrown with outgrowths at the base.
			Basal density	Highly favourable (3)	The hedgerow was densely vegetated and opaque.
		Continuity	% of gaps	Highly-favourable (3)	There were no gaps throughout Hedgerow 1 and the hedgerow was continuous.
			Specific gaps	Highly-favourable (3)	No gaps present.
		Negative indicators	Bank/wall	N/A	No bank or wall present.
			% of canopy dominated by ivy	N/A	Ivy was present but only in minor quantities (i.e., <25%).
			Unfavourable species composition	Unfavourable (0)	Unfavourable species including ragwort, creeping thistle, and broad-leaved dock made up >10% of ground flora.
			Ground flora/hedge base	Unfavourable (0)	Unfavourable species including ragwort, creeping thistle, and broad-leaved dock and nutrient rich species including nettle and cleavers made up >20% of ground flora.
			Degraded margin	Unfavourable (0)	Poaching occurs up to the base of the hedgerow.

Hedgerow reference		Central point location (ITM)	Criteria	Score	Justification
			Overall condition	**Cumulative score**	**Justification**
			Unfavourable	14	A score of 0 in any category represents a hedgerow in unfavourable condition.
2	626472 698222	Structural variables	Height	Adequate (1)	The average height of the hedgerow is approximately 1 - 2m across its length.
			Width	Adequate (1)	The average width of the hedgerow is approximately 1.5 - 2m across its length.
			Profile	Highly favourable (3)	The profile of the hedgerow is overgrown with outgrowths at the base.
			Basal density	Highly favourable (3)	The hedgerow was densely vegetated and opaque.
		Continuity	% of gaps	Favourable (2)	There were no gaps throughout the hedgerow other than an access point where a gate was located. Therefore gaps made up <5% of the hedgerow
			Specific gaps	Unfavourable (0)	One gap present, which was approximately 10m in length.
		Negative indicators	Bank/wall	N/A	No bank or wall present.
			% of canopy dominated by ivy	N/A	No ivy was present.
			Unfavourable species composition	N/A	No unfavourable species recorded.
			Ground flora/hedge base	N/A	No unfavourable species recorded.

Hedgerow reference		Central point location (ITM)	Criteria		Score	Justification
			Degraded margin		Unfavourable (0)	Poaching occurs up to the base of one side the hedgerow, with a farm track present to the base on the other side.
		Overall condition			**Cumulative score**	**Justification**
		Unfavourable			10	A score of 0 in any category represents a hedgerow in unfavourable condition.
3	626535 698052	Structural variables	Height		Favourable (2)	The average height of the hedgerow is approximately 3 - 4m across its length.
			Width		Adequate (1)	The average width of the hedgerow is approximately 2m across its length.
			Profile		Adequate (1)	The profile of the hedgerow was wind-shaped and losing base structure.
			Basal density		Adequate (1)	The basal density was semi-opaque in places and open in others.
		Continuity	% of gaps		Adequate (1)	There were several gaps throughout the where the base of the hedgerow was thinning and minor gaps between plants making up the hedgerow. This comprised 5 – 10% of the hedgerow
			Specific gaps		Adequate (1)	Gaps were generally 1m in length.
		Negative indicators	Bank/wall		Highly favourable (3)	No degradation noted.
			% of canopy dominated by ivy		N/A	No ivy was absent.
			Unfavourable species composition		N/A	Undesirable thistles were present but not in significant quantities.

Hedgerow reference	Central point location (ITM)	Criteria	Score	Justification
		Ground flora/hedge base	N/A	Nutrient rich species were present including nettle and thistles. However, ground flora was dominated by bramble.
		Degraded margin	Unfavourable (0)	Poaching occurs up to the base of both sides the hedgerow.
		Overall condition	**Cumulative score**	**Justification**
		Unfavourable	10	A score of 0 in any category represents a hedgerow in unfavourable condition.
4	626812 698206	Structural variables	Height	Favourable (2)	The average height of the hedgerow is approximately 2 - 3m across its length.
			Width	Favourable (2)	The average width of the hedgerow is approximately 2 - 3m across its length.
			Profile	Adequate (1)	The profile of the hedgerow was wind-shaped and losing base structure.
			Basal density	Adequate (1)	The basal density was semi-opaque in places and open in others.
		Continuity	% of gaps	Favourable (1)	There were several gaps between plants making up the hedgerow. This comprised <5% of the hedgerow
			Specific gaps	Unfavourable (0)	Gaps were present and reached >5m in length.
		Negative indicators	Bank/wall	N/A	No bank or wall present.
			% of canopy dominated by ivy	N/A	No ivy was present only in minor quantities.
			Unfavourable species composition	N/A	Undesirable thistles and ragwort were present but not in significant quantities.

Hedgerow reference		Central point location (ITM)	Criteria	Score	Justification
			Ground flora/hedge base	N/A	Nutrient rich species were present including nettle, dandelion and thistles.
			Degraded margin	Unfavourable (0)	Poaching occurs up to the base of both sides the hedgerow.
		Overall condition		**Cumulative score**	**Justification**
		Unfavourable		7	A score of 0 in any category represents a hedgerow in unfavourable condition.

Appendix 5-F
Survey Sheets

BAT ACTIVITY SURVEY RECORD SHEET

Date	17/04/2024	**Weather**	
Surveyors	Hugo Brooks & Alice Magee	**Temp:**	9°C
Start time	20:34	**Cloud cover:**	6/8 oktas
Finish time	23:12	**Wind force:**	3 Bft.
Bat detector model	Batlogger M (0230)	**Precipitation:**	None

Map ref.	**Stopping point ref.**	**Time**	**No. observed**	**Species ID (or frequency (kHz) recorded)**	**Notes & observations**
1	A	20:59	1	Common pipistrelle	6m high & foraging
2	A	21:01	1	Soprano pipistrelle	5m high
3	A to B	21:04	1	Common pipistrelle	Heard not seen
4	B	21:07	1	Common pipistrelle	Foraging over and around pond (many passes)
5	C	21:17	1	Common pipistrelle	Heard not seen (faint call)
6	D	21:26	1	Common pipistrelle	Heard not seen
7	D	21:28	1	Common pipistrelle	Heard not seen
8	E	21:35	2	Common pipistrelle	Feeding, many passes
9	E to F	21:42	1	Common pipistrelle	Heard not seen
10	E to F	21:44	1	Common pipistrelle	Heard not seen (many passes)
11	E to F	21:46	1	Common pipistrelle	Heard not seen (many passes)
12	F to G	21:49	2	Soprano pipistrelle	Heard not seen
13	F to G	21:51	2	Common pipistrelle and soprano pipistrelle	Heard not seen
14	F to G	21:54	1	Common pipistrelle	Heard not seen

HEN HARRIER SURVEY RECORD SHEET

Date	04/04/2024	**Weather**				
Surveyor	Hugo Brooks					
Start time	07:27		**Hour 1**	**Hour 2**	**Hour 3**	**Hour 4**
		Temp. (°C):	6	7	8	9
		Cloud cover (oktas):	8	8	8	8
End time	11:15	Wind speed (Bft.):	1	1	2	2
		Cloud height:	150 – 500m	150 – 500m	150 – 500m	150 – 500m
		Visibility:	Moderate (1-3 km)	Moderate (1-3 km)	Good (>3km)	Good (>3km)

Species	**No. seen**	**Time of observation**	**Flight ref.**	**Target species?**	**Notes**
Hen harrier	1	08:28	See Figure 5-4	Yes	Female in flight
Raven	1	09:35	N/A	No	N/A
Buzzard	1	09:43	N/A	No	N/A
Buzzard	1	09:57	N/A	No	N/A

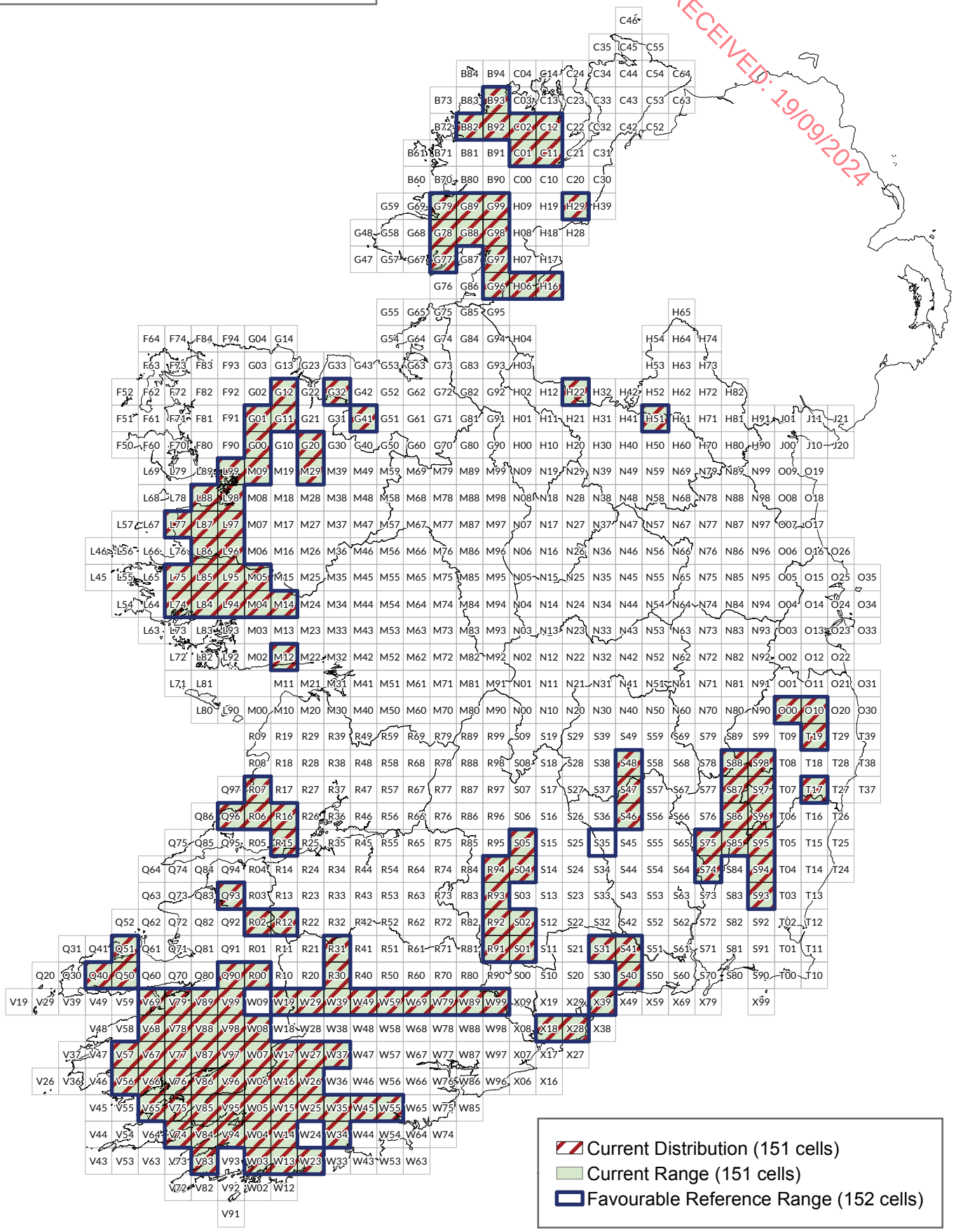
Date	16/05/2024	**Weather**				
Surveyor	Hugo Brooks					
Start time	07:05		**Hour 1**	**Hour 2**	**Hour 3**	**Hour 4**
		Temp. (°C):	10	12	14	15
		Cloud cover (oktas):	1	2	4	3
End time	11:35	Wind speed (Bft.):	2	2	2	2
		Cloud height:	>500m	>500m	>500m	>500m
		Visibility:	Good (>3km)	Good (>3km)	Good (>3km)	Good (>3km)

Species	**No. seen**	**Time of observation**	**Flight ref.**	**Target species?**	**Notes**
Kestrel	1	09:34	N/A	No	Male
Kestrel	1	11:10	N/A	No	Male
Buzzard	2	11:13	N/A	No	N/A

15	G	21:57	1	Common pipistrelle	6m high
16	G to H	22:03	1	Unknown	Heard not seen
17	H	22:08	2	Common pipistrelle and soprano pipistrelle	Heard not seen
18	H to I	22:27	1	Common pipistrelle	Heard not seen
19	H to I	22:30	1	39.48	Heard not seen
20	H to I	22:37	1	Common pipistrelle	Heard not seen
21	I	22:43	1	Common pipistrelle	Heard not seen
22	I to J	22:57	1	Common pipistrelle	Heard not seen
23	I to J	23:00	1	Common pipistrelle	Heard not seen
24	I to J	23:03	1	Soprano pipistrelle	Heard not seen

Appendix 5-G
Species and Habitat Distribution and Ranges

Freshwater Pearl Mussel
Margaritifera margaritifera (1029)
Article 17 (2013 - 2018) Assessment



An Roinn Cultúir, Oidhreachta agus Gaeltachta
Department of Culture, Heritage and the Gaeltacht

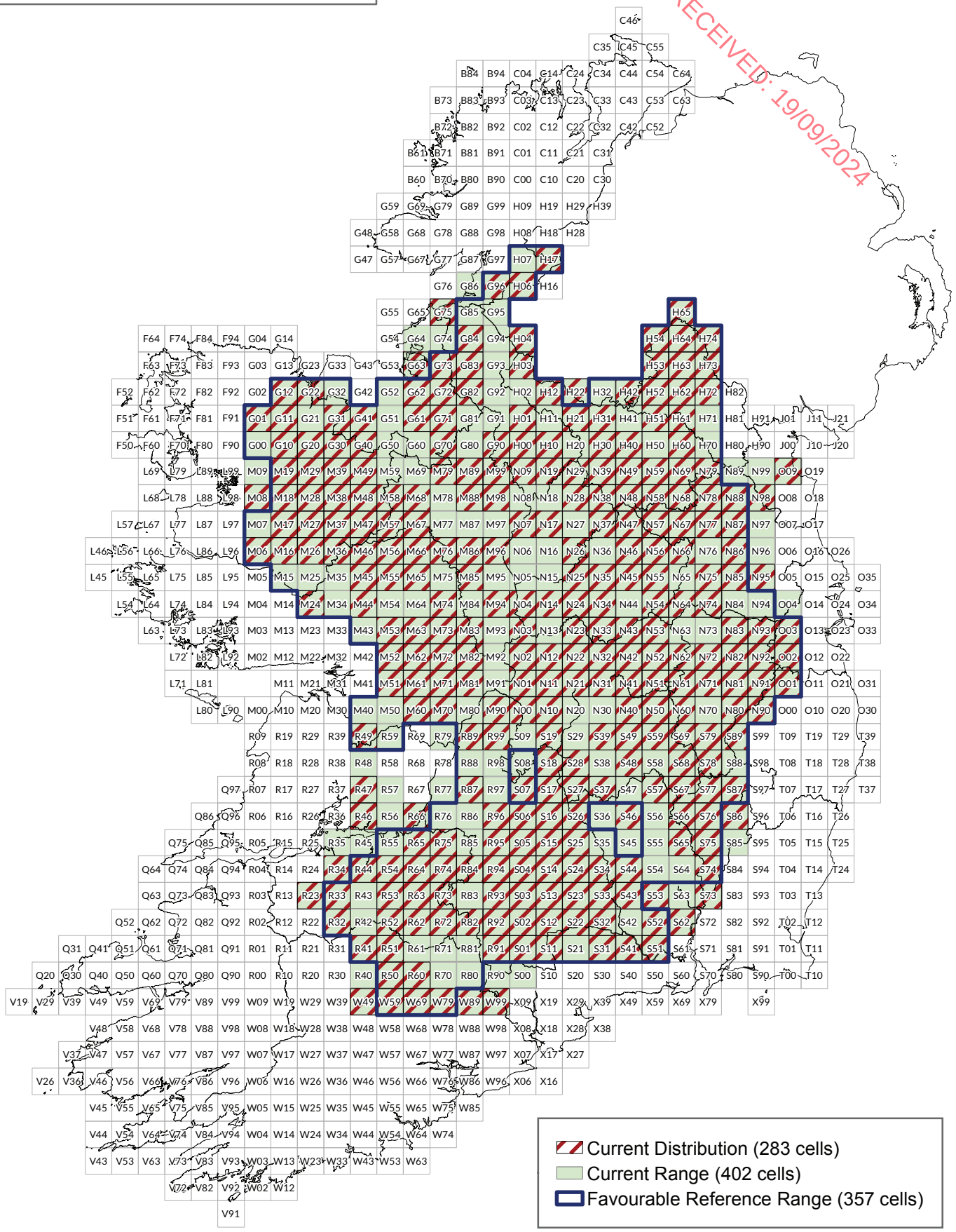
Produced by: Déanta in:
Biodiversity Monitoring Unit, Aonad Monatóireacht Bhithéagsúlachta,
National Parks and Wildlife Service, An tSeirbhís Páirceanna Náisiúnta agus Fiadhúlra

Scale - Scála
0 12.5 25 50 km

N

Map - rscáil V 2.0
Date áta June 2019

White -clawed Crayfish
Austropotamobius pallipes (1092)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
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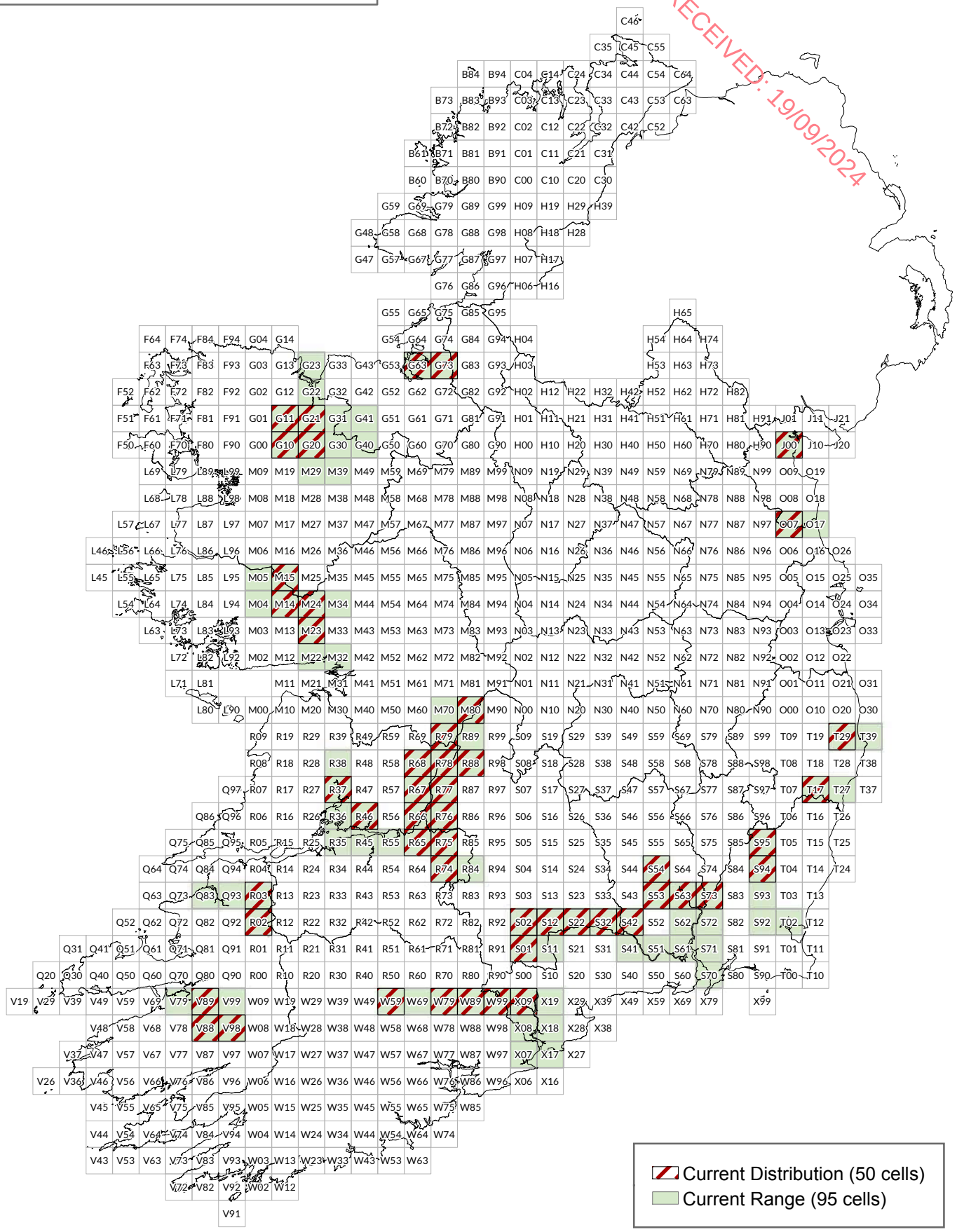
Map - rscáil V 2.0
Date áta June 2019

Sea lamprey
Petromyzon marinus (1095)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
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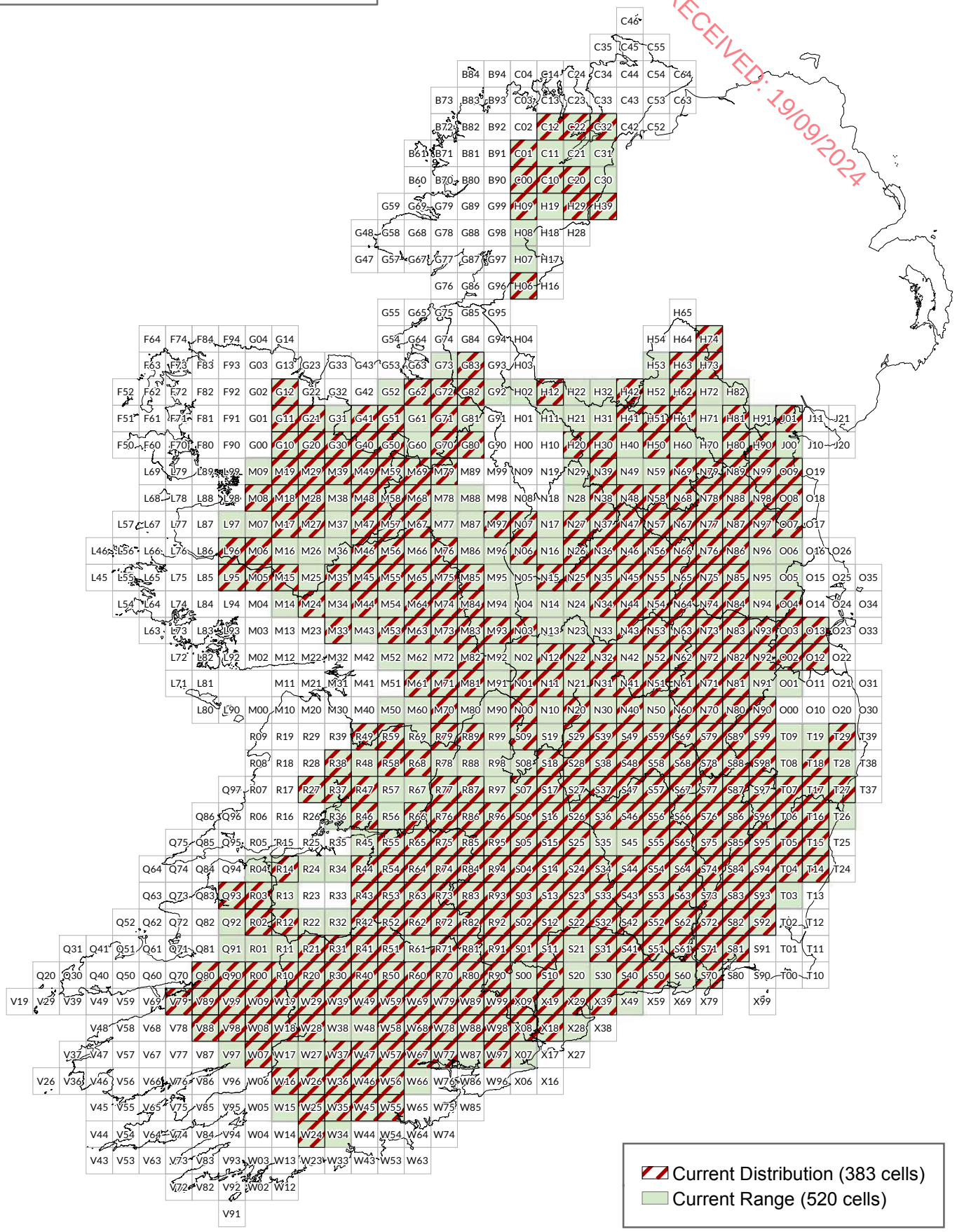
Map arscáil V 2.0
Dat Dát June 2019

Brook lamprey
Lampetra planeri (1096)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
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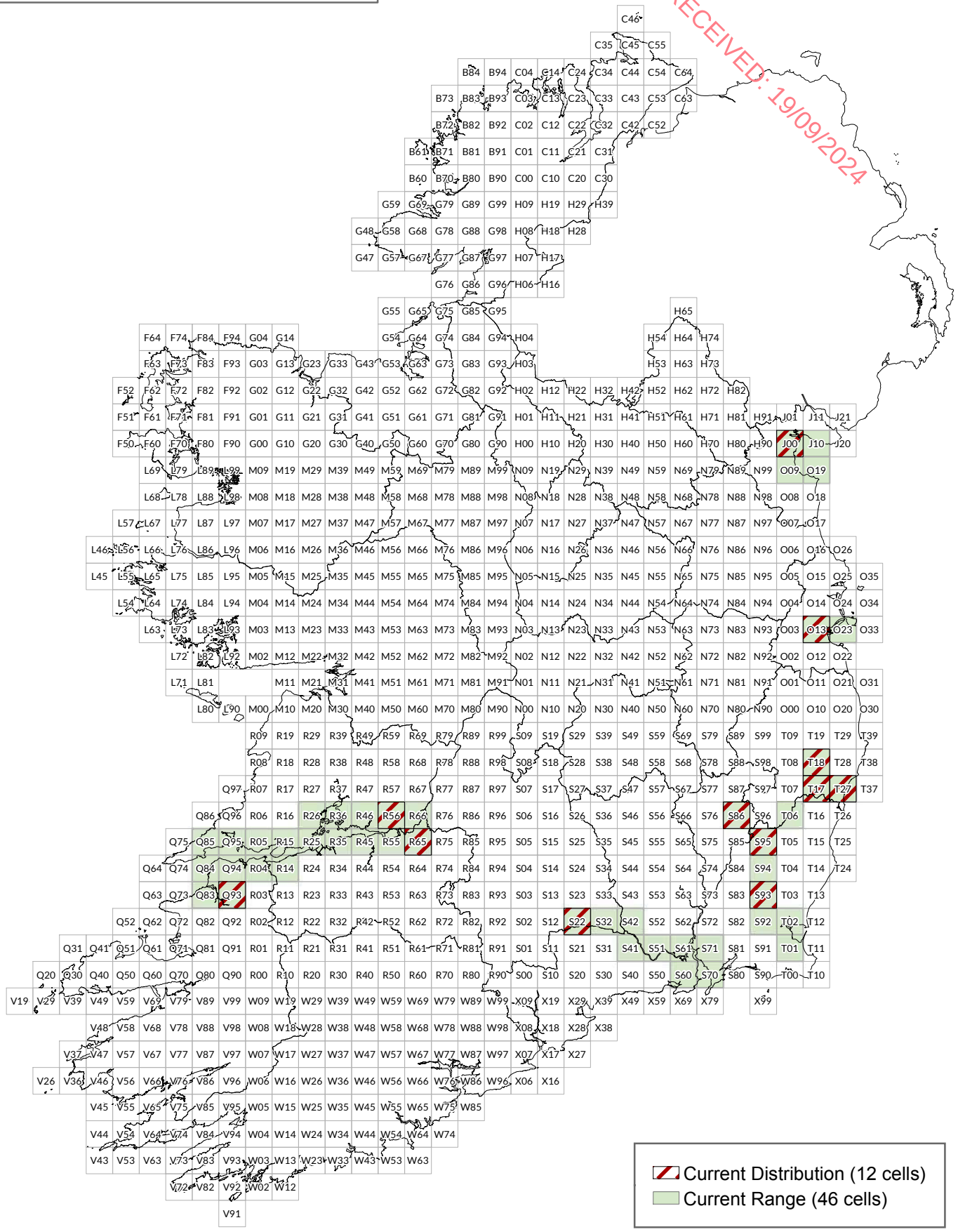
Map arscáil V 2.0
Dat Dát June 2019

River lamprey
Lampetra fluviatilis (1099)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
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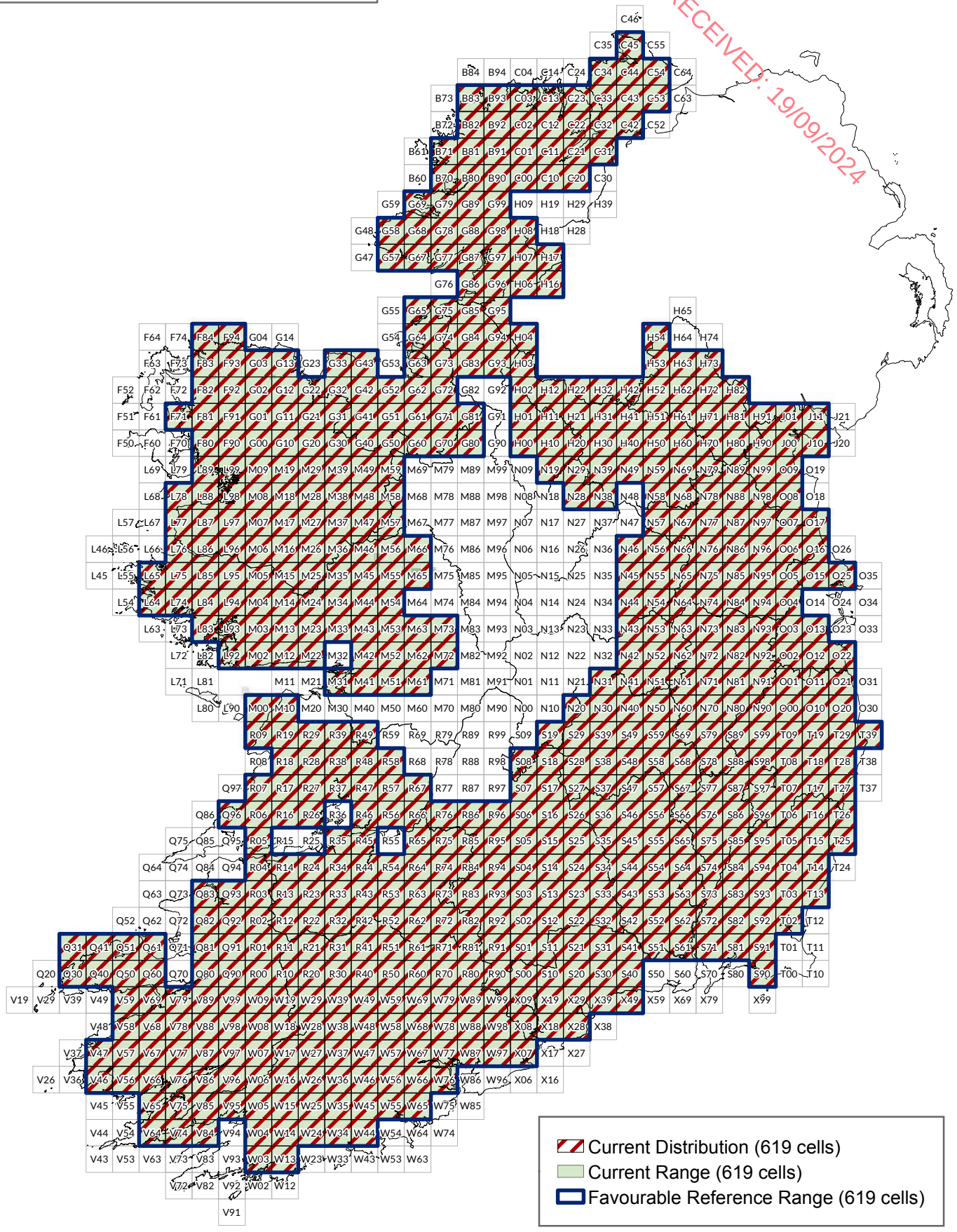
Map arscáil V 2.0
Dat Dát June 2019

Atlantic Salmon
Salmo salar (1106)
Article 17 (2013 - 2018) Assessment



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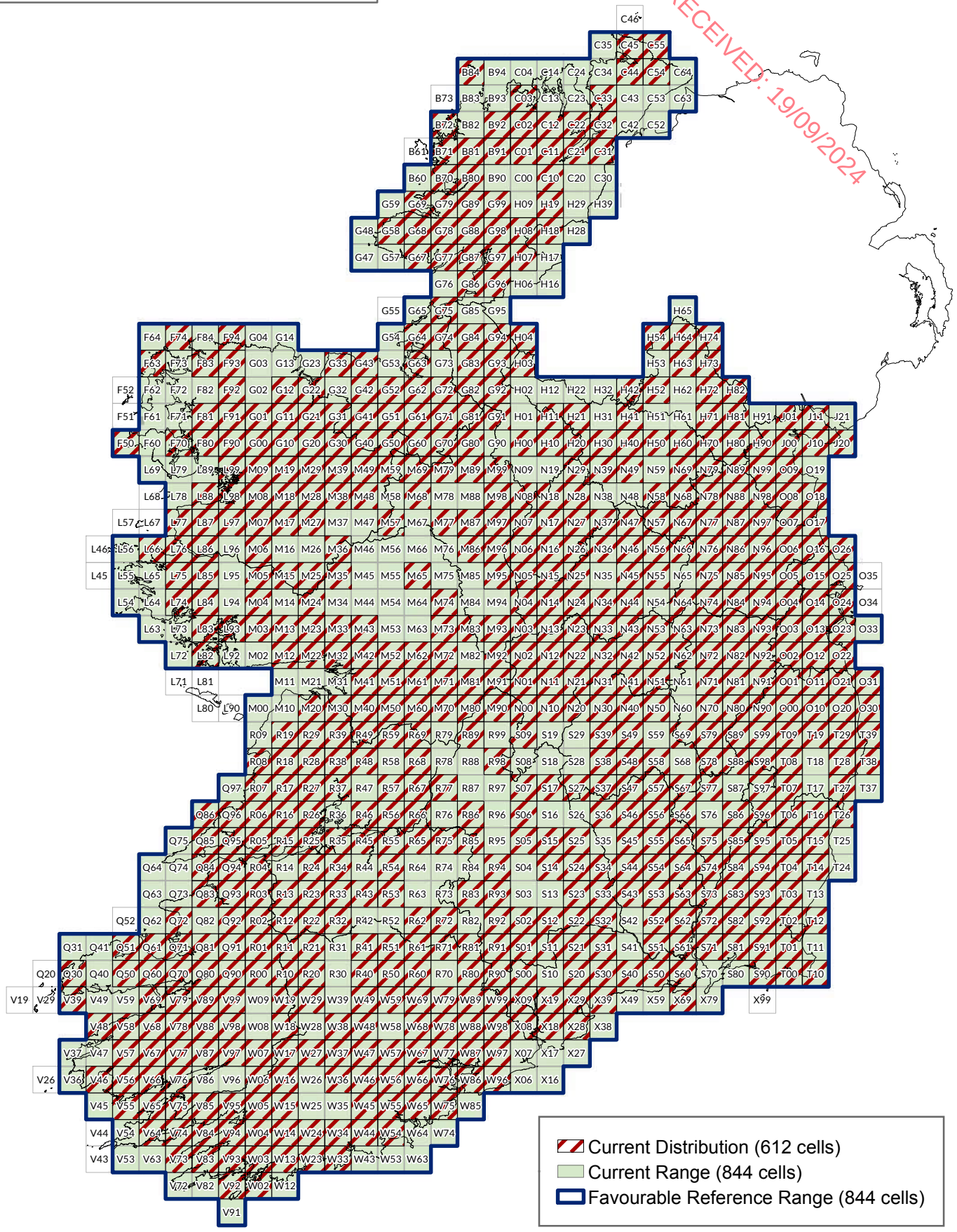
Map arscáil V 2.0
Dat Dát June 2019

Common frog
Rana temporaria (1213)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
0 12.5 25 50 km

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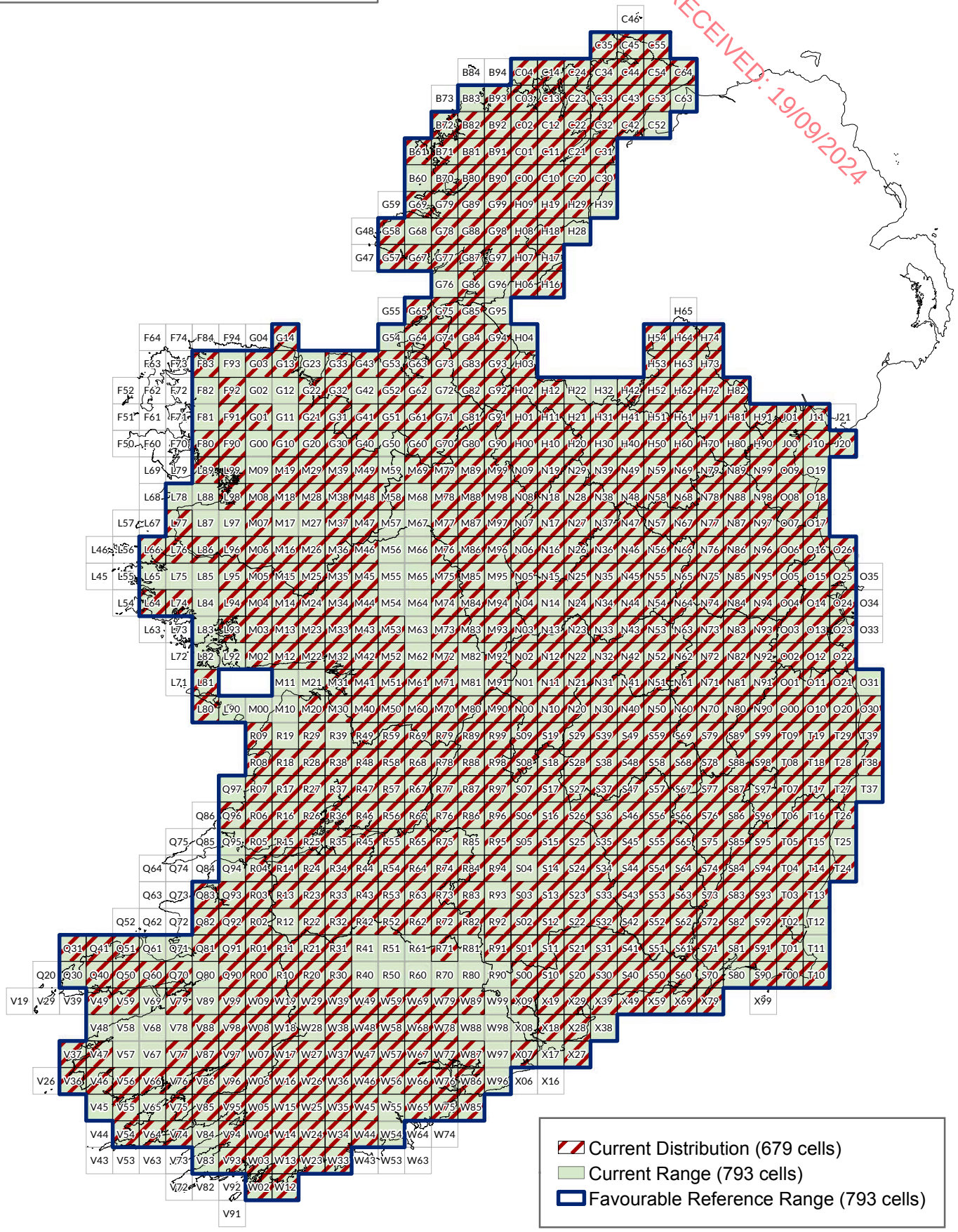
Map arscáil V 2.0
Dat Dát June 2019

Common Pipistrelle
Pipistrellus pipistrellus (1309)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
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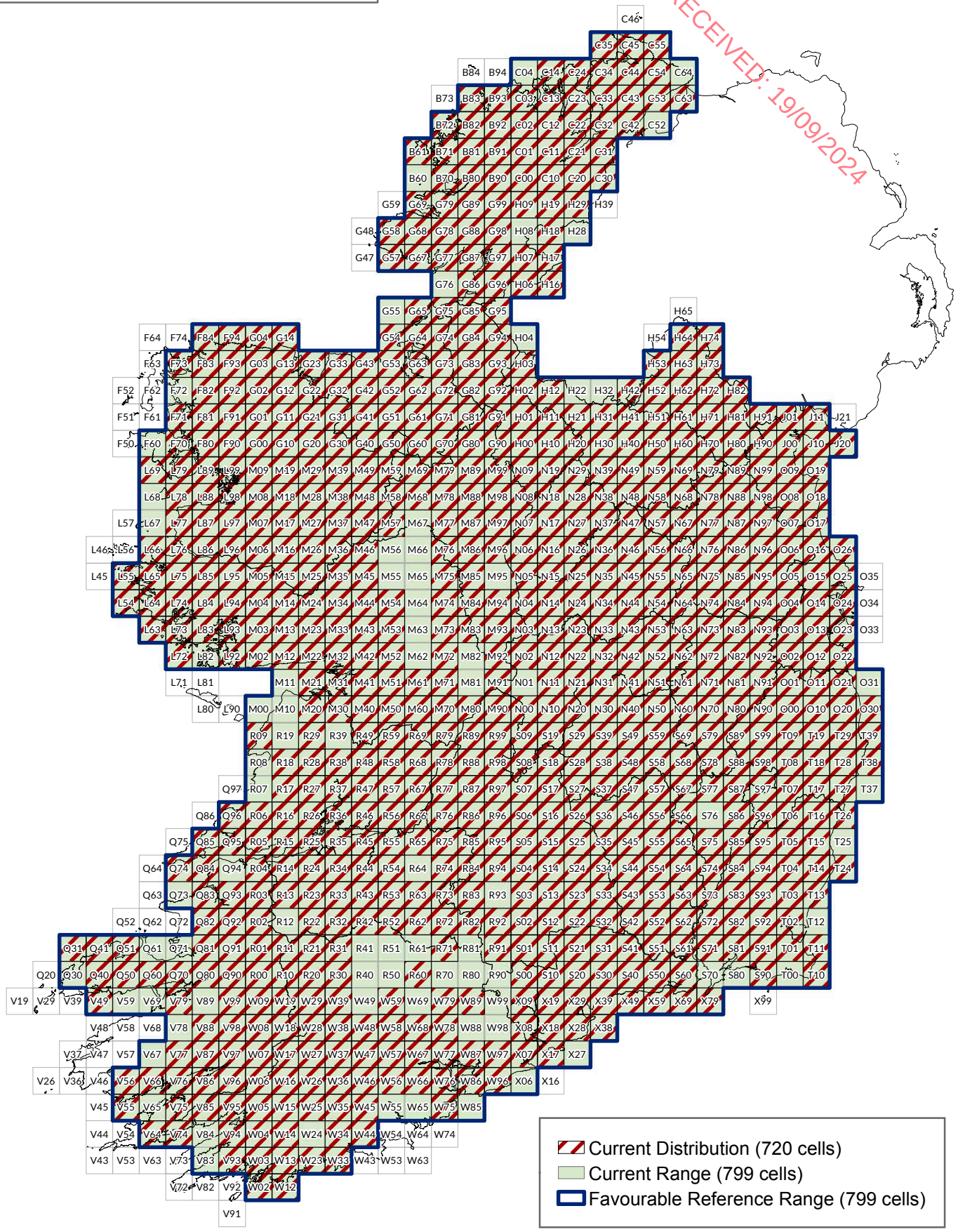
Map arscáil V 2.0
Dat Dát June 2019

Soprano Pipistrelle
Pipistrellus pygmaeus (5009)
Article 17 (2013 - 2018) Assessment



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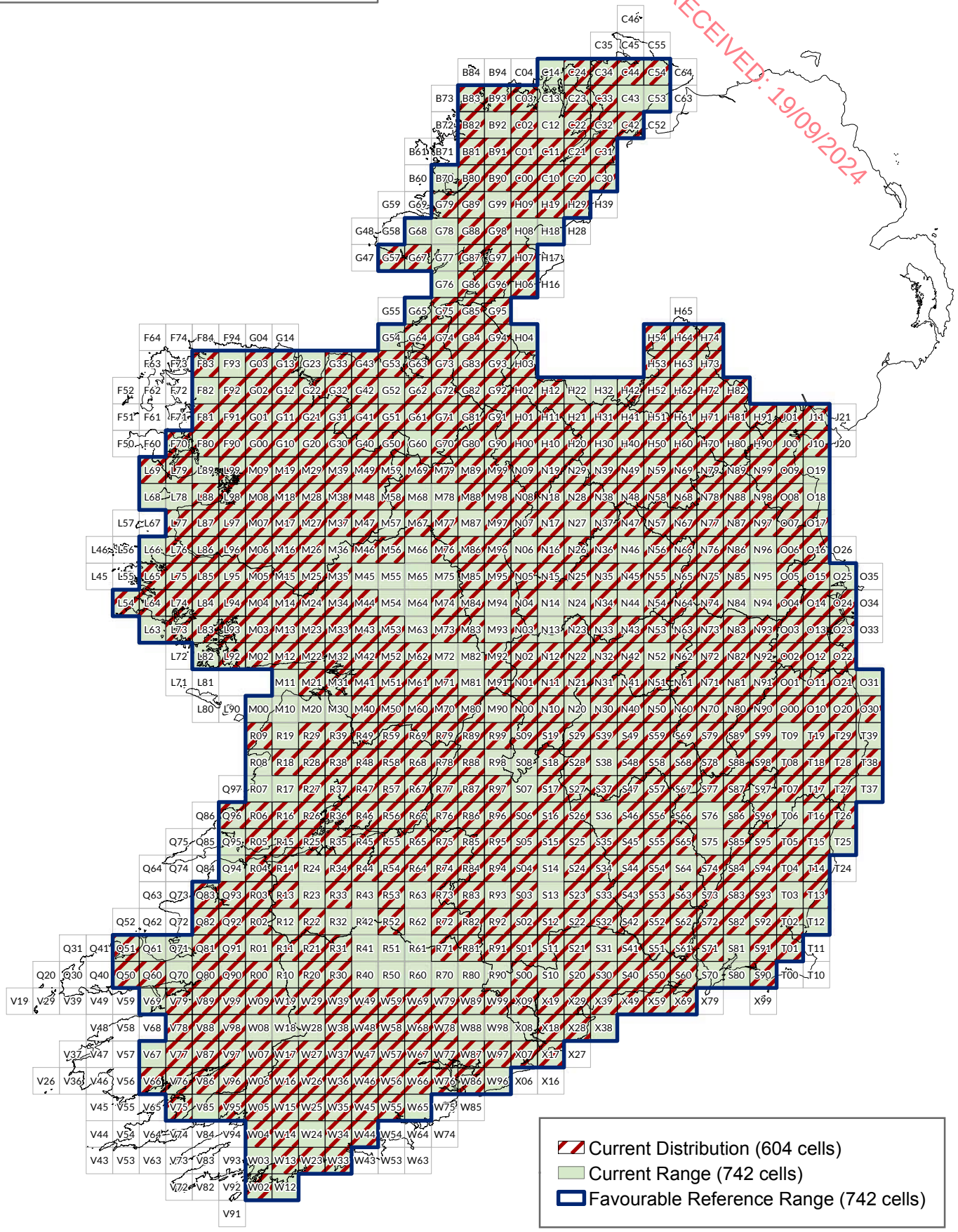
Map arscáil V 2.0
Dat Dát June 2019

Daubenton's Ba t
Myotis daubentonii (1314)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
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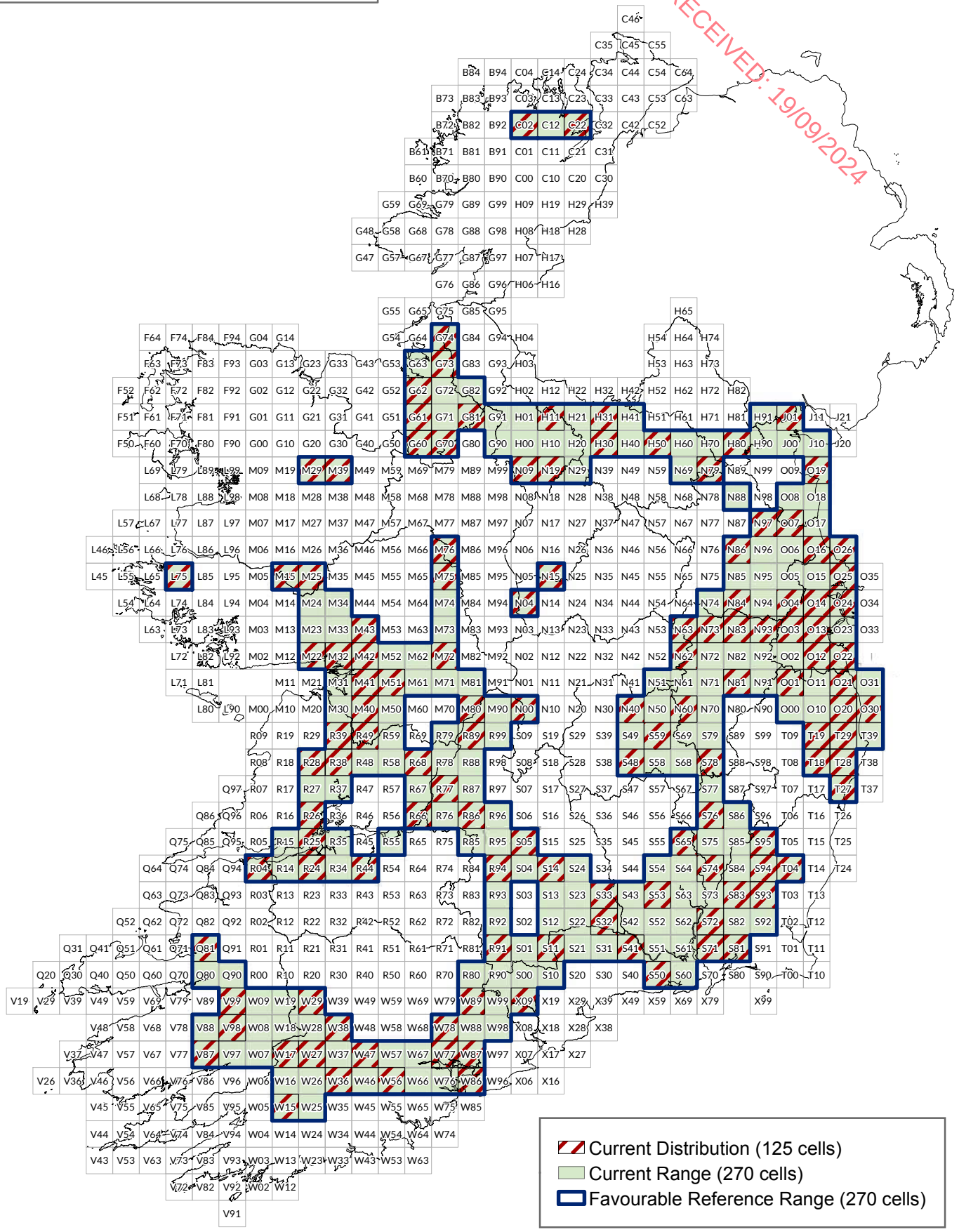
Dat Dát June 2019

Whiskered Bat
Myotis mystacinus (1330)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
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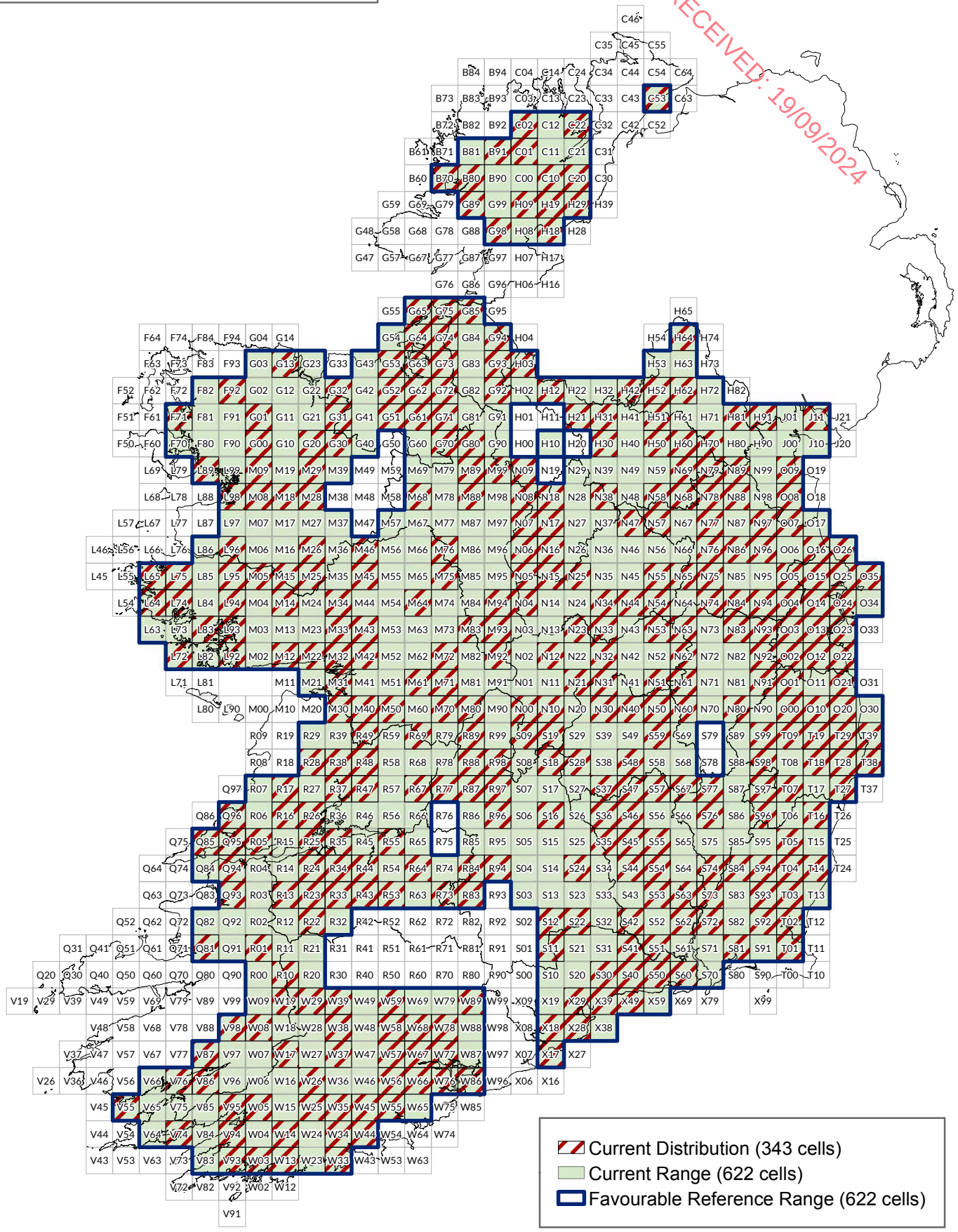
Map arscáil V 2.0
Dat Dát June 2019

Brown long-eared Bat
Plecotus auritus (1326)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
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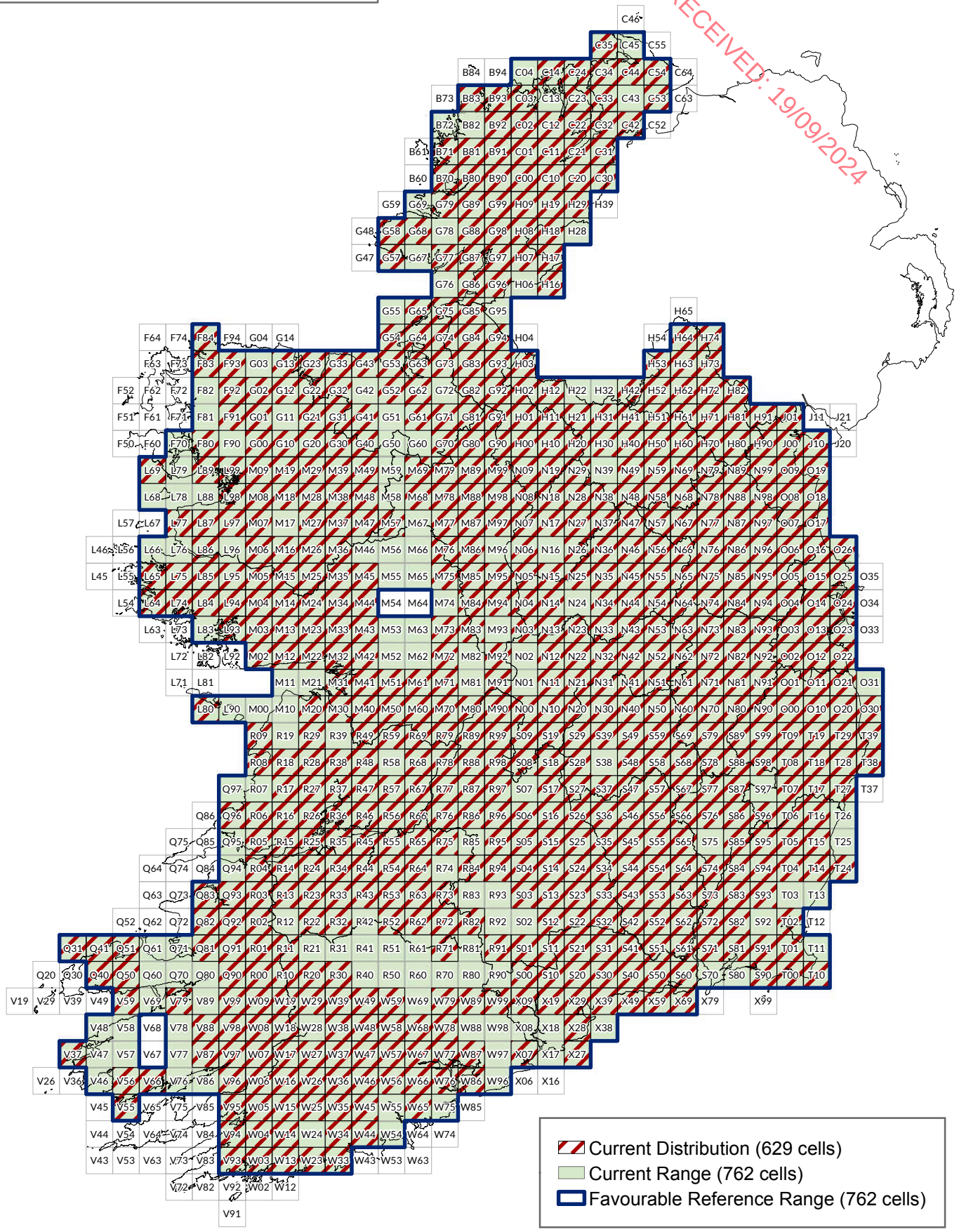
Map arscáil V 2.0
Dat Dát June 2019

Leisler's Bat
Nyctalus leisleri (1331)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
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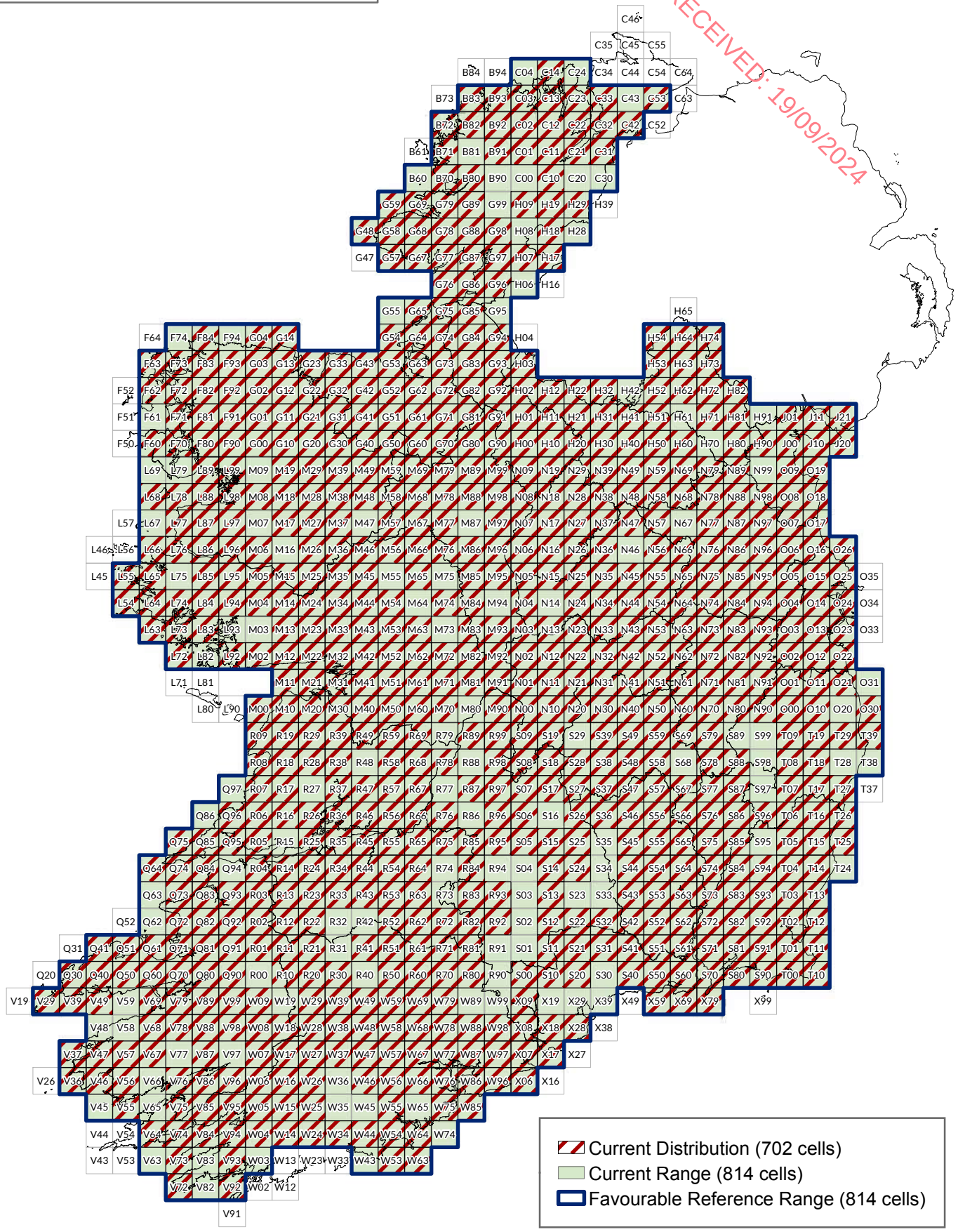
Map arscáil V 2.0
Dat Dát June 2019

Irish Hare
Lepus timidus (1334)
Article 17 (2013 - 2018) Assessment



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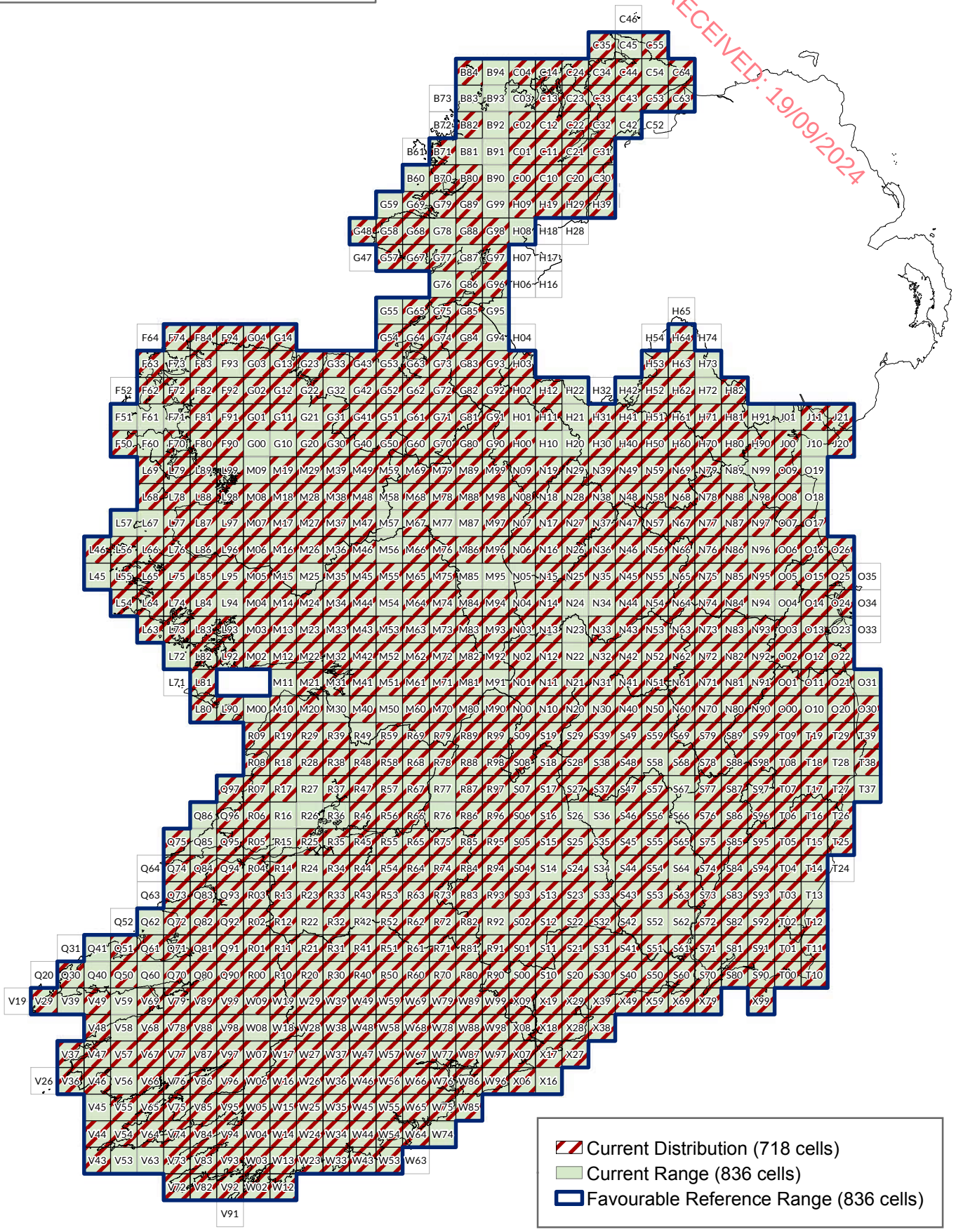
Dat Dát June 2019

Otter
Lutra lutra (1355)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
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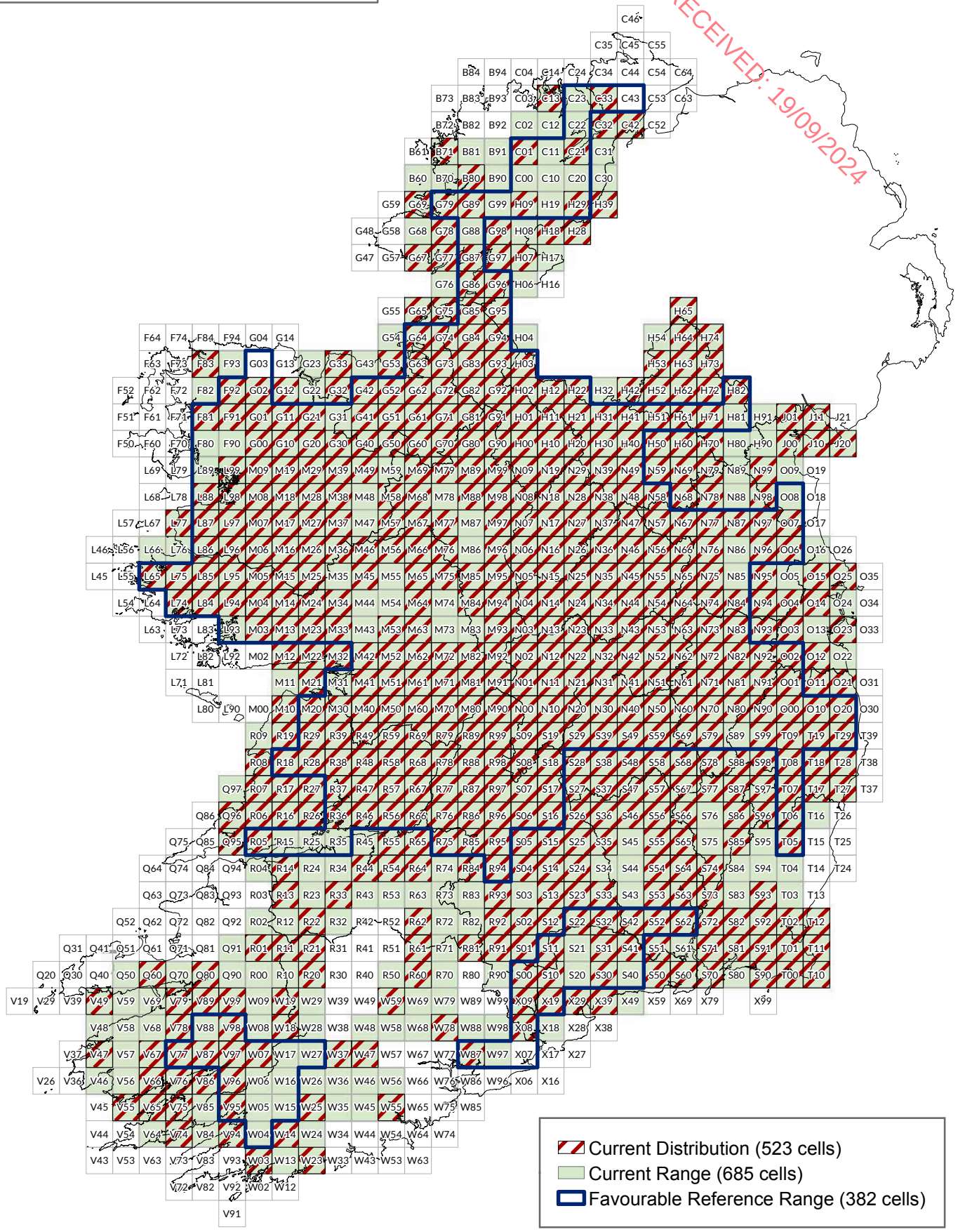
Map arscáil V 2.0
Dat Dát June 2019

Pine Marten
Martes martes (1357)
Article 17 (2013 - 2018) Assessment



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Scale - Scála
0 12.5 25 50 km

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Map arscáil V 2.0
Dat Dát June 2019

Appendix 5-H
Aquatic & Fisheries Baseline Report

Aquatic & fisheries baseline report for the continued operation and development of a quarry at Mounthall, Co. Laois

Triturus

Prepared by Triturus Environmental Ltd. for Breedon Ireland

August 2024

Please cite as:

Triturus (2024). Aquatic & fisheries baseline report for the continued operation and development of a quarry at Mounthall, Co. Laois. Report prepared by Triturus Environmental Ltd. for Breedon Ireland. August 2024.

Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by SLR Ireland Ltd. on behalf of Breedon Materials Ltd. trading as Breedon Ireland (hereafter Breedon Ireland) to conduct baseline aquatic and fisheries surveys to inform the EIAR and NIS preparation for the continued operation and extension of the existing quarry development at Mounthall and Cummer townlands, Co. Laois.

The existing quarry site is situated 3km north of Camross, south of the Slieve Bloom Mountains, and approximately 8km northwest of Mountrath (**Figure 2.1**). The Killeen River is situated to the east of the study area and is hydrologically connected to the River Barrow and River Nore SAC (002162) 3km downstream and southeast of the quarry (**Figure 2.1**).

The current aquatic and fisheries baseline survey would provide a detailed overview of the aquatic flora and fauna of high aquatic ecological value including the existing fisheries asset. The baseline surveys would also collate data on the contemporary biological water quality of watercourses in the catchment of the existing quarry study area.

1.2 Development description

The proposed development planning application consists of an extension to the existing permitted sand and gravel quarry including phased extraction and associated site facilities as described below. A full development description is provided in the Environmental Impact Assessment Report (EIAR) and Nature Impact Statement (NIS) report accompanying the planning submission.

- Extension to existing permitted sand and gravel pit registered under Section 261 of the Planning & Development Act 2000, as amended (site ref. QY05/10) within an overall application area of c. 12.2 hectares. The proposed development will consist of:
- Phased extraction of sand and gravel (dry working) over an area of c. 8 hectares with processing that includes crushing, washing (closed loop water recycling system with associated silt storage lagoons), screening and all ancillary works and structures;
- Site facilities consisting of mobile aggregate processing plant, weighbridge office (6.25m²), welfare facility including canteen and cloakroom (18.9m²), serviced portaloo toilet, bunded fuel storage and refuelling pad with hydrocarbon interceptor, weighbridge, wheelwash, water supply borehole, perimeter berms, vegetation planting and fencing;
- Access to the site will be via the existing Sand & Gravel Pit entrance;
- Restoration of the site to agricultural lands; and
- The proposed extraction operational period is for 10 years plus 1 year to complete restoration (total duration sought 11 years).

2. Methodology

2.1 Selection of watercourses for assessment

All of the downstream riverine sites which could be affected by the proposed development were considered as part of the current assessment. A total of *n*=6 sites in the vicinity of proposed works, inclusive of upstream controls, were selected for detailed aquatic assessment (see **Table 2.1, Figure 2.1** below). The nomenclature and alignments for the watercourses surveyed followed Environmental Protection Agency (EPA) mapping.

The survey sites were situated on an unmapped tributary of the Killeen River (EPA code: n/a) and the Killeen River (EPA code: 15K01)(**Table 2.1**). The aquatic survey sites were situated in the Killeen (Delour)_010 sub-basin within the Nore_SC_020 sub-catchment. The proposed quarry development was not located within a European site but did share downstream hydrological connectivity with the River Barrow and River Nore SAC (002162), situated 3km by water downstream via the Killeen River.

2.2 Aquatic site surveys

Aquatic surveys of the river sites downstream of Mounthall Quarry were conducted on the 8th July 2024. Survey effort focused on both instream and riparian habitats at each aquatic sampling location and included a fisheries assessment (electro-fishing & fisheries habitat appraisal), white-clawed crayfish survey, macrophyte survey, aquatic bryophyte survey and biological water quality sampling (Q-sampling) (**Figure 2.1**). This comprehensive approach informed the overall aquatic ecological evaluation of each site/watercourse in context of the proposed development and ensured that any habitats and species of high conservation value would be detected to best inform mitigation.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). This broad characterisation helped define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth, channel form) including associated evidence of historical drainage
- Substrate type and relative condition, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.)
- Substrate condition included surface deposition and infiltration levels via visual observation
- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition and bordering land use practices

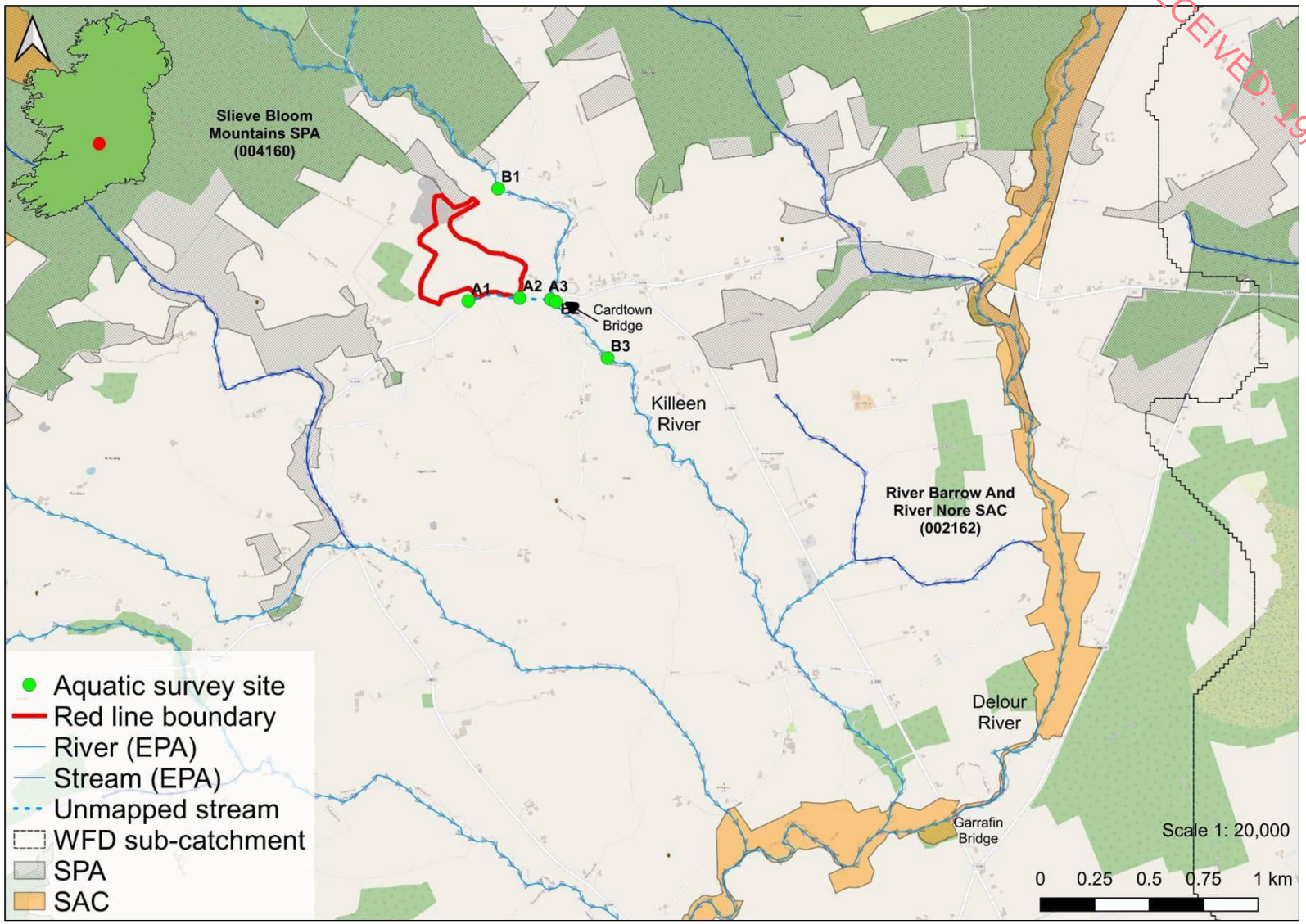

Figure 2.1 Location of the aquatic survey sites in the vicinity of the Mounthall Quarry, Co. Laois

Table 2.1 Location of the *n*=6 aquatic survey sites in the vicinity of Mounthall Quarry

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Unnamed Stream (not mapped by EPA)	n/a	Mounthall	626712	697982
A2	Unnamed Stream (not mapped by EPA)	n/a	Mounthall	626948	697996
A3	Unnamed Stream (not mapped by EPA)	n/a	Cummer	627091	697989
B1	Killeen River	15K01	Cummer	626849	698499
B2	Killeen River	15K01	Cardtown Bridge	627115	697978
B3	Killeen River	15K01	Killeen	627352	697720

2.3 Fisheries assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on riverine watercourses in the vicinity of Mounthall Quarry in July 2024 following notification to Inland Fisheries Ireland and under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The electro-fishing survey was undertaken across 6 no. riverine sites (see **Table 2.1, Figure 2.1**).

Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was also used to further reduce stress to any captured fish contained in the holding tank. Salmonids, European eel and other captured fish species were transferred to a holding container with oxygenated fresh river water following capture. To reduce fish stress levels, anaesthesia was not applied to captured fish. All fish were measured to the nearest millimetre and released in-situ following a suitable recovery period.

As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each sampling reach could be determined as a longer representative length of channel was surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., CFB, 2008).

2.3.1 Salmonids and European eel

For salmonid species and European eel, as well as all other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). A total of approx. 30-50m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages.

Relative conductivity of the water at each site was checked in-situ with a conductivity meter and the

electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the moderate conductivity waters of the sites a voltage of 250-300v, frequency of 35-40Hz and pulse duration of 3.5-4ms was utilised to draw fish to the anode without causing physical damage.

2.3.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered. As lamprey take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30Hz) burst DC pulse setting which also allowed detection of European eel in sediment, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water's surface, 10-15cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

2.4 Fisheries habitat appraisal

A fisheries habitat appraisal of all survey sites was undertaken to establish the importance of the supporting habitats as nursery, spawning and or holding habitats for salmonids and lamprey species but also considered European eel and other fish species. The appraisals of salmonids and lamprey were cognisant of species-specific habitat requirements and preferences as outlined in O'Grady (2006), Hendry et al. (2003), Armstrong et al. (2003), Harvey & Cowx (2003), Maitland (2003) and Hendry & Cragg-Hine (1997). River habitat surveys and fisheries assessments were also conducted utilising elements of the approaches in the River Habitat Survey Methodology (Environment Agency, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the riverine sites (i.e., channel profiles, substrata etc.).

2.5 Biological water quality (Q-sampling)

The 6 no. riverine survey sites were assessed for biological water quality through Q-sampling on the 8th July 2024 (**Table 2.1**). All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide using a 2-minute kick sample, as per Environmental Protection Authority (EPA) methodology (Feeley et al., 2020). Large cobble was also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley et al., 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification to species level. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD status classes (**Table 2.2**). Any rare invertebrate species were identified from the NPWS Red List publications

for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Table 2.2 Reference categories for EPA Q-ratings (Q1 to Q5) (Toner et al., 2005)

Q value	WFD status	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

2.6 Macrophytes and aquatic bryophytes

Surveys of the macrophyte and aquatic bryophyte community were conducted by instream wading at each of the survey sites, with specimens collected (by hand or via grapnel) for on-site identification. An assessment of the aquatic vegetation community helped to identify any rare macrophyte species listed under the Flora (Protection) Order, 2022 and or Irish Red list for vascular plants (Wyse-Jackson et al., 2016) or habitats corresponding to the Annex I habitats, e.g., 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]' (more commonly referred to as 'floating river vegetation').

2.7 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream invasive propagule mobilisation. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

3. Desktop review

3.1 Fisheries

The River Nore catchment drains an area of 2,597km² and is approximately 134km in length from source to sea flowing through counties Tipperary, Laois and Kilkenny (Gordon et al. 2021). The River Barrow and River Nore SAC (002162) is designated for five fish species (NPWS, 2021), namely; Sea lamprey (Petromyzon marinus) [1095], Brook lamprey (Lampetra planeri) [1096], River lamprey (Lampetra fluviatilis) [1099], Twaite shad (Alosa fallax) [1103] and Atlantic salmon (Salmo salar) [1106].

The Nore is ranked 4th in Ireland with regards to fluvial accessible habitat to salmon with 6% of the national total (McGinnity et al., 2003). However, the wider Nore catchment has a high number of instream barriers (AMBER Consortium, 2020; Gargan et al., 2011) that restrict the passage of migratory fish species.

Fisheries data for the Delour River (EPA code: 15D01) was lacking at the time of survey. However, the Delour River is known to support *Lampetra* sp. upstream of the Basin weir (Gallagher et al., 2020) in addition to Atlantic salmon and brown trout (Triturus, 2022).

3.2 Water Quality

The Killeen River had good status (**Q4**) biological water quality when most recently recorded at 2022 at Cardtown Bridge (Station RS15K010200), 0.5km southeast of the existing quarry. At EPA station RS15K010400, at a bridge upstream of the Delour River confluence on the Killeen River, biological water quality was recorded as (**Q4-5**) high status in 2005 but no more recent water quality data was available.

4. Results of aquatic surveys

The following section summarises each of the *n*=6 survey sites in terms of aquatic habitats, physical characteristics and overall value for fish and macrophyte/aquatic bryophyte communities. Biological water quality (Q-sample) results are also summarised for each riverine sampling site and in **Appendix A**. A summary of the fish species recorded at each survey site is provided in **Tables 4.1 and 4.2**. A summary of the aquatic species and habitats of high conservation concern recorded during the surveys is provided in **Table 4.3**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in July 2024.

4.1 Aquatic survey sites

4.1.1 Site A1 – Unnamed Stream

Site A1 was situated on a small upland eroding spate stream tributary of the Killeen River that flowed eastwards south of the quarry sites and formed a confluence with the Killeen River upstream of Cardtown Bridge. The stream ats site A1 was 1.5m wide and between 0.1-0.2m deep with 0.5-1.5m high banks being higher on the south bank. The channel had semi-natural meandering profile through grey willow (*Salix cinerea* sp. *oleifolia*), alder (*Alnus glutinosa*) and hazel (*Corylus avellana*) mixed broadleaved woodland pockets (WD1). The bed comprised of abundant small boulder, occasional cobble and mixed gravels between rocky outcrops with exposed coarse substrata throughout. The bed also had high siltation with evident infiltration and expanses of silt in depositing areas. The stream supported occasional fool's watercress (*Apium nodiflorum*), brooklime (*Veronica beccabunga*) and water mint (*Mentha aquatica*) amongst muddy areas of the stream margin. The exposed boulder tops instream supported frequent *Brachythecium rivulare* with submerged rocks supporting occasional *Rhynchostegium riparioides*. No filamentous green algae was observed, due to the high shading. However, floc (clumped masses of decaying algae and inorganic particles) cover was c. 30%. The stream was bordered by mixed broadleaved woodland pockets (WD1) and also wet pasture (GA1). Evident cattle poaching and soil erosion was evident at the downstream extent of the survey section that was contributing to high siltation and enrichment.

The stream was considered a moderate quality nursery given broken riffle and glide with abundant rocky refugia to support young of the year fish (0+). Spawning quality was moderate for brown trout given the presence of mixed gravels but was reduced given siltation and enrichment pressures. The presence of a low density (*n*=6) brown trout population supported the streams value as a nursery and spawning area. The stream was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the very shallow depth of the stream, small size and limited pool habitat are negative determinants of optimal eel habitat. Furthermore, known downstream significant barriers in the Nore catchment also contributed to poor upstream passage for eel (none recorded present).

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

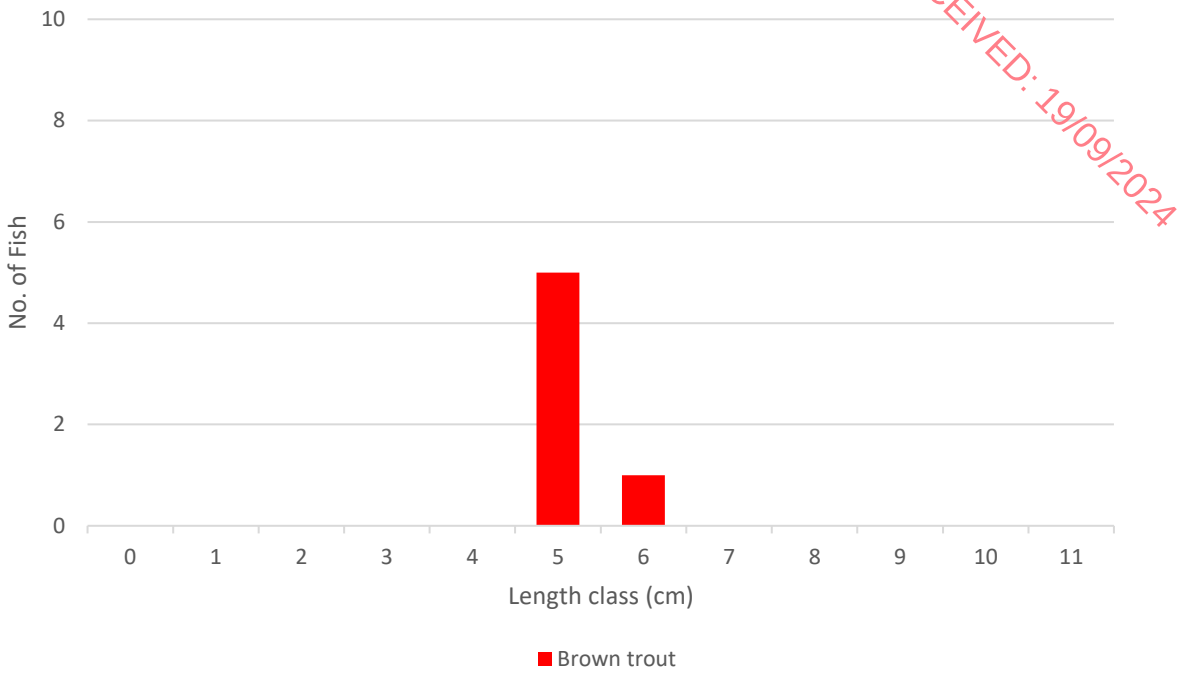

Figure 4.1 Length frequency distribution of brown trout recorded at site A1 the on unnamed tributary of the Killeen River

Plate 4.1 Representative image of the unnamed tributary of the Killeen River (Site A1)

Plate 4.2 Juvenile brown trout captured during electro-fishing from site A1 on the unnamed tributary of the Killeen River

4.1.2 Site A2 – Unnamed Stream

Site A2 was situated the unnamed stream tributary of the Killeen River downstream of site A1. As with upstream the watercourse was represented by a small upland eroding spate stream (FW1). The stream was 1m wide and between 0.1-0.15m deep with 2m high banks. The channel had semi-natural meandering profile through adjoining woodland. The stream was historically realigned along the local road. The bed comprised of frequent small boulder, occasional cobble and mixed gravels between rocky outcrops as with site A1 upstream. The bed also had high siltation with evident infiltration into the bed with localised pockets of shallow silt in pool habitat. The stream supported no macrophytes due to shading by mature trees. The exposed boulder tops instream supported occasional *Brachythecium rivulare* with submerged boulders supporting *occasional Rhynchostegium riparioides*. No filamentous green algae was observed, due to the high shading. The stream was bordered by mature hazel woodland (WN2) that overshaded the stream.

The stream was considered a moderate quality nursery given broken riffle and glide with abundant rocky refugia for young of the year fish (0+). Spawning quality was moderate given the presence of mixed gravels but was reduced given siltation and enrichment pressures. The presence of a low density (*n*=11) brown trout population supported the streams value as a nursery and spawning area. The stream was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the very shallow depth of the stream, small size and limited pool habitat may account for the species absence. Furthermore, known downstream significant barriers in the Nore catchment also contributed to poor upstream passage for eel.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

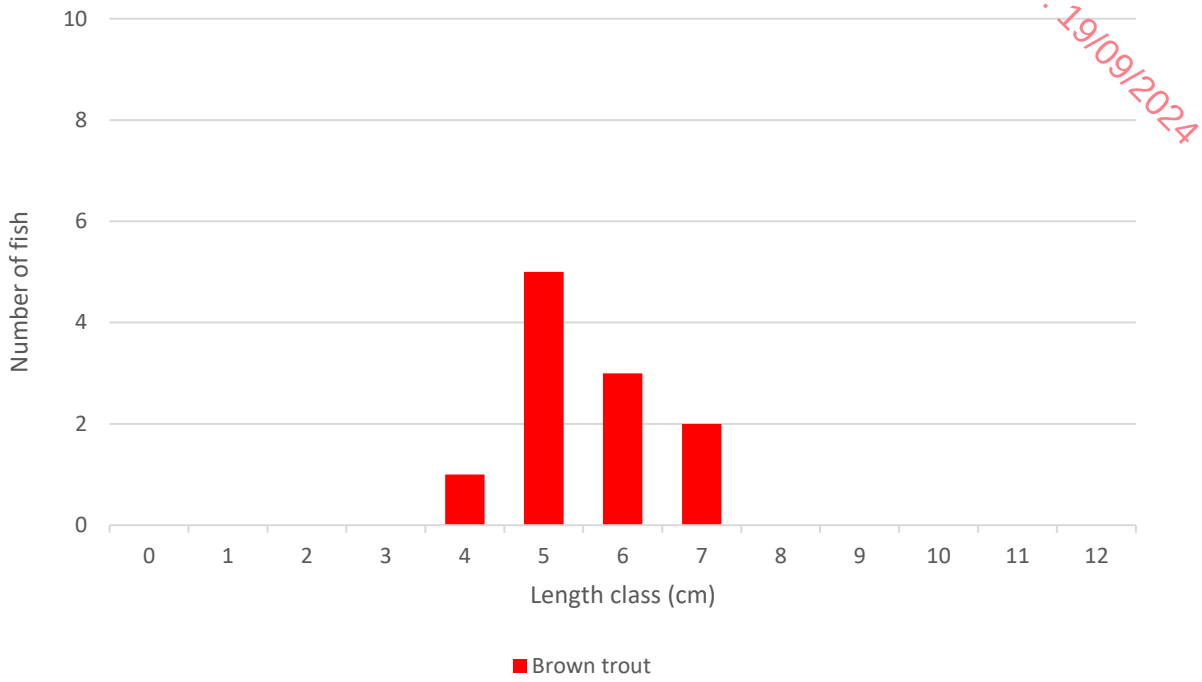

Figure 4.2 Length frequency distribution of fish recorded at site A2 on the unnamed stream tributary of the Killeen River, July 2024

Plate 4.3 Juvenile brown trout 0+ captured at site A2, July 2024

Plate 4.4 Representative image of site A2 on the unnamed tributary of the Killeen Stream

4.1.3 Site A3 – Unnamed Stream

Site A3 was situated on an unnamed small upland eroding spate stream tributary of the Killeen River downstream of site A2. The stream was 0.5-1m wide and between 0.1-0.15m deep with 2-2.5m high bank. The channel was historically modified (straightened) along the local road but retained a semi-natural profile with shallow riffle and glide sequences. The bed comprised of occasional small boulder, cobble and mixed gravels between rocky outcrops as with sites A2 and A3 upstream. The bed also had moderate siltation with evident infiltration and localised pockets of shallow silt. The stream supported no macrophytes due to shading by mature trees. The exposed boulder tops instream supported occasional *Pellia endiviifolia* with submerged boulders supporting occasional *Rhynchostegium riparioides*. No filamentous green algae was observed, due to the high shading. The stream was bordered by mature ash (*Fraxinus excelsior*), hazel and dense bramble (*Rubus fruticosus*) that overshaded the stream.

The stream was considered a moderate quality nursery given broken riffle and glide with abundant rocky refugia for young of the year fish (0+) trout. Spawning quality was moderate given the presence of mixed gravels but was reduced given siltation and enrichment pressures. The presence of a low density (*n*=9) brown trout population supported the streams value as a nursery and spawning area. The stream was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the very shallow depth of the stream, small size and limited pool habitat may support the species absence. Furthermore, known downstream significant barriers in the Nore catchment also contributes to poor upstream passage for eel.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

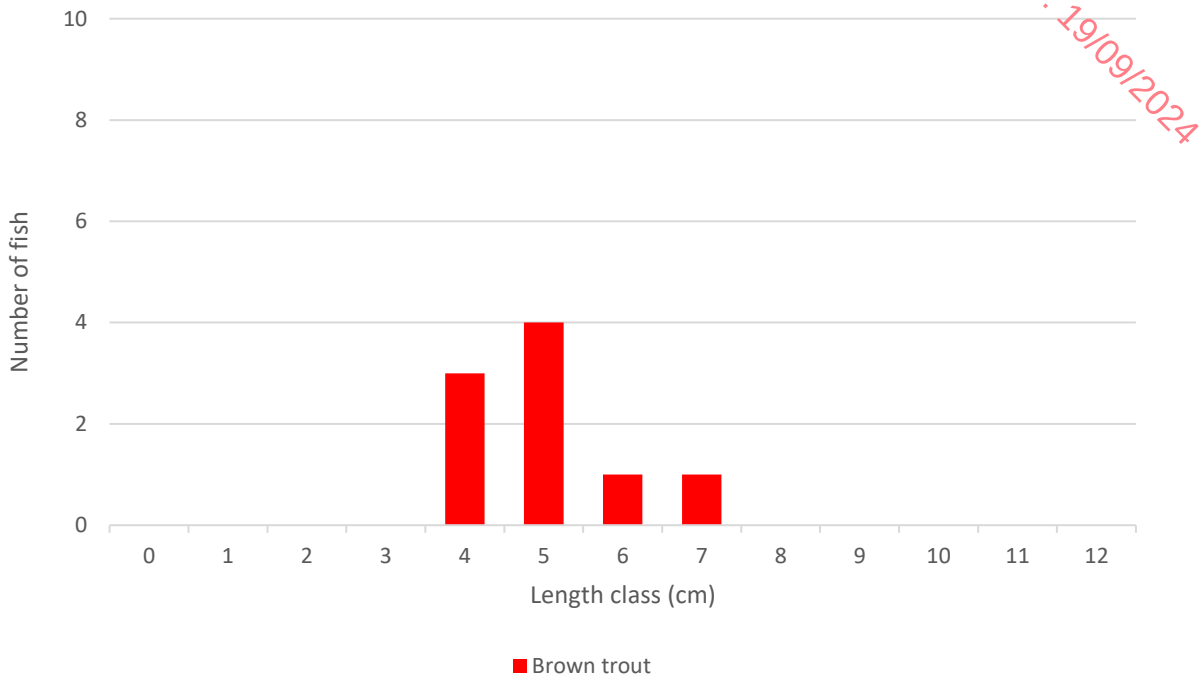

Figure 4.3 Length frequency distribution of brown trout recorded at site A3 on the unnamed stream tributary of the Killeen River, July 2024

Plate 4.6 Representative image of site A3 on the unnamed stream tributary of the Killeen River, July 2024

4.1.4 Site B1 – Killeen River

Site B1 was situated on the Killeen River an upland eroding spate stream (FW1), 4-5m wide and between 0.1-0.3m deep with 1-2m high banks. The channel had semi-natural meandering profile that was dominated by riffle and glide sequences with occasional pool. The bed comprised of frequent small boulder and cobble with mixed gravels between coarser substrata. Beds of exposed small boulder and cobble were present in the margins. The bed also had light siltation and compaction. The river was of too high energy to support macrophytes. However, the instream boulders supported occasional *Rhynchostegium riparioides*. A low surface cover of green filamentous green algae was observed (c. 5%) indicating some low enrichment pressures. The river was bordered by scattered mature alder, grey willow and holly (*Ilex aquifolium*). The understories supported dense bramble, bracken (*Pteridium aquilinum*) and gorse (*Ulex europaeus*).

The river was considered a very good quality salmonid nursery given broken riffle and glide with abundant rocky refugia for juvenile fish that was reflected by the good density of 0+ and 1+ salmonids captured during electro-fishing (*n*=20 fish). Spawning quality was locally good given the presence of mixed gravels with pockets of deeper glide and pool. The river was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the limited pool habitat accounted for the species absence inclusive of known downstream barriers in the Nore catchment.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

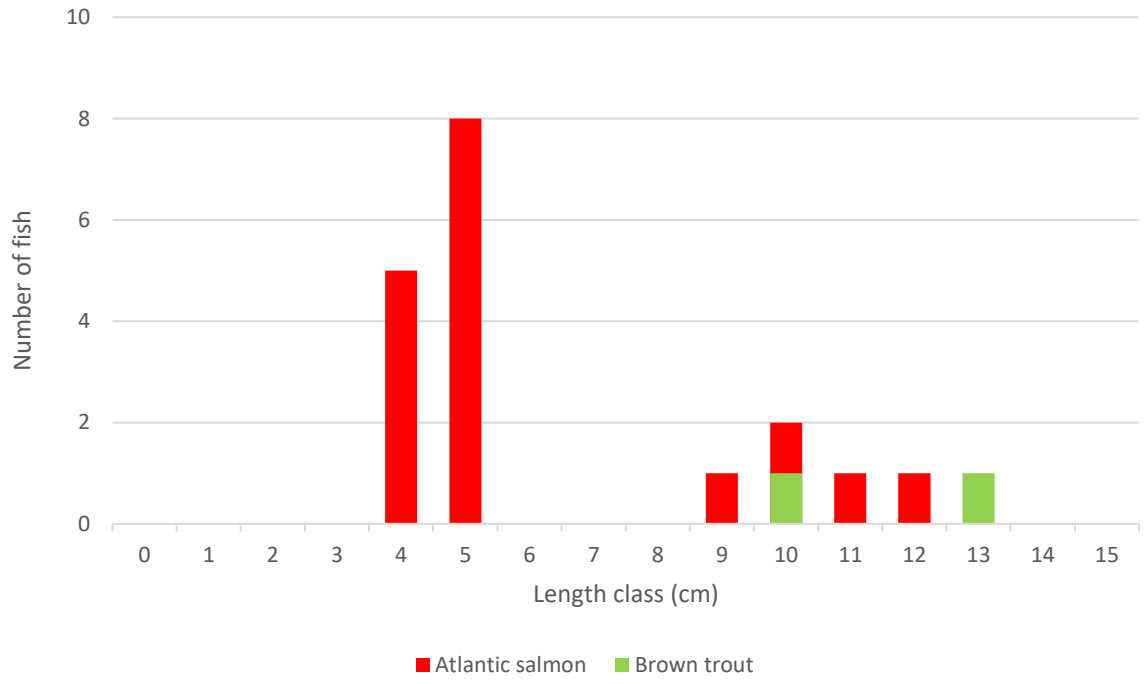

Figure 4.5 Length frequency distribution of brown trout recorded via electro-fishing at site B1 on the Killeen River, July 2024

Plate 4.8 Juvenile 1+ brown trout and salmon parr recorded at site B1 on the Killeen River, July 2024

Plate 4.9 Representative image of site B1 on the Killeen River, July 2024

4.1.5 Site B2 – Killeen River

Site B2 was situated on the Killeen River, an upland eroding spate stream (FW1), 4-5m wide and between 0.1-0.3m deep with 1m bank heights. The channel had a semi-natural profile dominated by riffle and glide sequences with occasional pool. The bed comprised of frequent small boulder and cobble with mixed gravels between coarser substrata. The bed also had moderate siltation and compaction with evident silt plumes underfoot. The river was of too high energy to support macrophytes. However, the instream boulders supported abundant *Rhynchostegium riparioides* and occasional *Leptodictyum riparium*. A low surface cover of green filamentous green algae was observed (c. 5%) indicating some low enrichment pressures. The river was bordered by scattered mature ash with dense bramble, bracken and gorse in the understories. Tree canopy cover was significantly higher upstream with heavy shading.

The river was considered a very good quality salmonid nursery given broken riffle and glide with abundant rocky refugia for juvenile fish that was reflected by the good density of 0+ and 1+ salmonid captured during electro-fishing (*n*=43 fish). Spawning quality was locally good given the presence of mixed gravels but was reduced given more limited deep glide and pool. The stream was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the limited pool habitat reduced habitat suitability for the species. Furthermore, known downstream significant barriers in the Nore catchment also contributed to poor upstream passage for eel.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

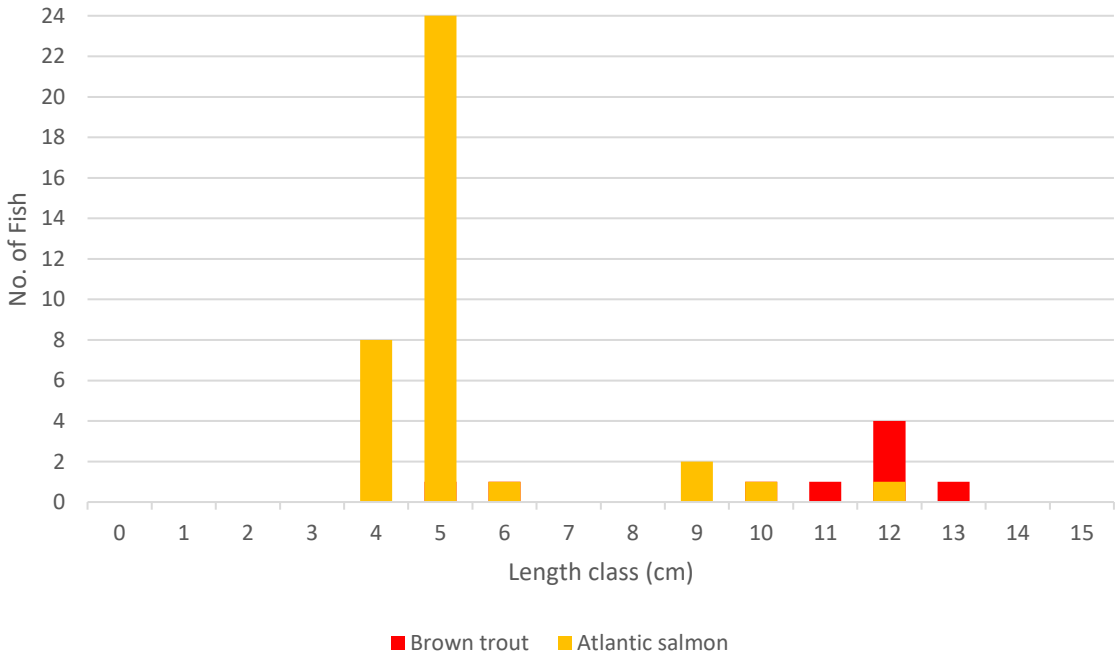

Figure 4.6 Length frequency distribution of fish recorded at site B2 on the Kileen River, July 2024

Plate 4.11 Representative image of site B2 on the Killeen River

4.1.6 Site B3 – Killeen River

Site B3 was situated on the Killeen River, an upland eroding spate stream, 4-5m wide and between 0.1-0.3m deep with 0.5-1m high banks. The channel had semi-natural meandering profile that was dominated by riffle and glide sequences with occasional pool. The bed comprised of frequent small boulder and cobble with mixed gravels between coarser substrata. The bed also had moderate siltation and compaction with evident silt plumes underfoot. The river was of too high energy to support macrophytes. However, the instream boulders supported occasional *Rhynchostegium riparioides* and *Chiloscyphos polanthos* with *Cinclodotus fontinaloides* recorded as rare. A low surface cover of green filamentous green algae was observed (c. 5%) indicating some low enrichment pressures. The river was bordered by scattered mature alder, grey willow and holly. The understories supported dense bramble, bracken and gorse.

The river was considered a very good quality salmonid nursery given broken riffle and glide with abundant rocky refugia for juvenile salmonid fish. This was reflected by the good density (*n*=47) salmonids captured during electro-fishing. Spawning quality was locally good given the presence of mixed gravels with pockets of deeper glide and pool. The river was of too high energy to support lamprey and the species was not recorded present. While the stream had moderate quality for European eel (i.e. abundant rocky refugia and shading), the limited pool habitat reduced habitat suitability for the species. Furthermore, known downstream significant barriers in the Nore catchment also contributed to poor upstream passage for eel.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern,' according to national red lists, were recorded via Q-sampling.

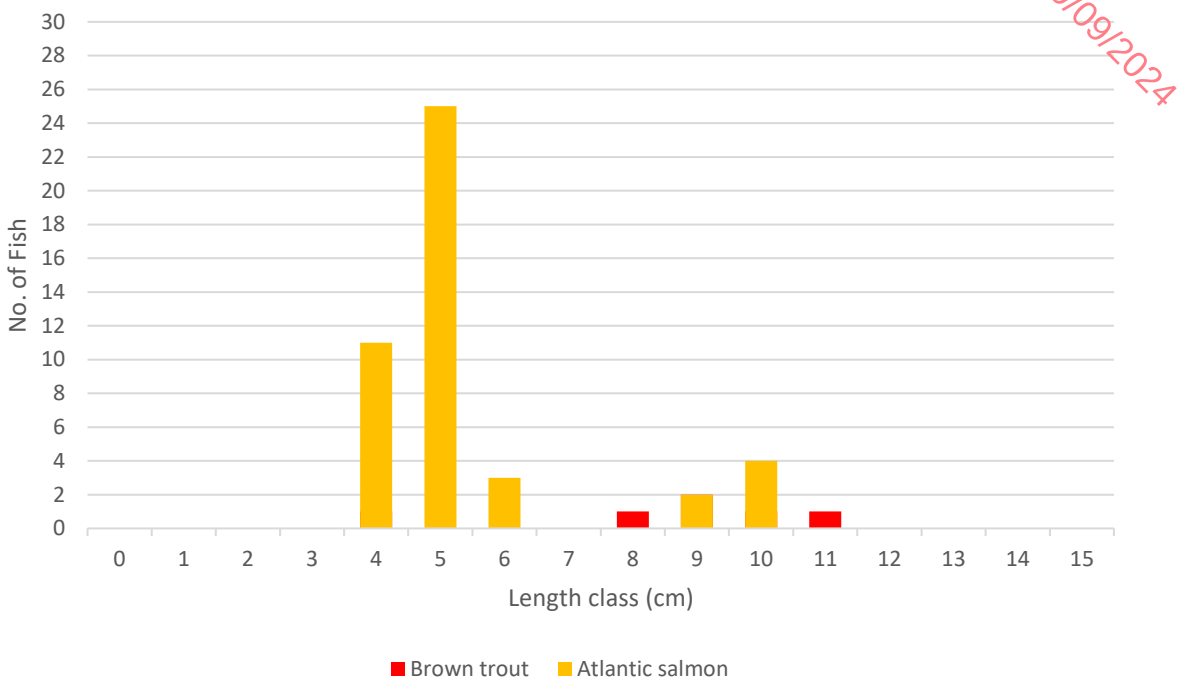

Figure 4.7 Length frequency distribution recorded via electro-fishing at site B3 on the Killeen River, July 2024

Plate 4.12 Juvenile 0+ and 1+ salmon captured at site B3 on the Kileen River, July 2024

Plate 4.13 Representative image of site B3 on the Kileen River, July 2024

4.2 Biological water quality (macro-invertebrates)

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from a total of 6 no. riverine sites in July 2024 (**Appendix A**).

Sites A1, A2 and A3 on the unnamed stream tributary of the Killeen River achieved **Q3-4 (moderate status)** water quality. There were no EPA group A (pristine water indicator species) in the samples collected. The survey sites were dominated by EPA group B and C (lower quality water quality indicators) and thus did not meet the qualifying criteria for good status (Q4) biological water quality as set out by Toner et al. (2005).

All three sites on the Killeen River (sites B1, B2 and B3) however, did achieve **Q4 (good status)** water quality. This status was based on the presence of EPA group A (most pollution sensitive) mayfly and stonefly species (i.e. *Rhithrogena semicolorata*, *Ecdyonurus dispar* & *Isoperla grammatica*) in combined numbers ≥5% of the total sample abundance (**Appendix A**). All sites on the Killeen River therefore met the target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Appendix A).**

Table 4.1 Fish species densities per m^2 recorded at sites in the vicinity of the proposed development, July 2024 (**bold** indicates highest density recorded per species)

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m^2)	Atlantic salmon	Brown trout
A1	Unnamed Stream	5	100	0.000	0.060
A2	Unnamed Stream	5	100	0.000	0.110
A3	Unnamed Stream	5	100	0.000	0.090
B1	Killeen River	10	200	0.095	0.010
B2	Killeen River	10	200	**0.185**	**0.045**
B3	Killeen River	10	200	0.170	0.030

Table 4.2 Relative abundance of fish species of higher conservation value recorded via **electro-fishing** in the study area, July 2024

Site	Watercourse	Atlantic salmon	Brown trout	Other species
A1	Unnamed Stream	Not recorded	Low	Not recorded
A2	Unnamed Stream	Not recorded	Low	Not recorded
A3	Unnamed Stream	Not recorded	Low	Not recorded
B1	Killeen River	Moderate	Low	Not recorded
B2	Killeen River	High	Low	Not recorded
B3	Killeen River	High	Low	Not recorded

Table 4.3 Summary of aquatic species and habitats of higher conservation value recorded in the study area, July 2024

Site	Watercourse	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
A1	Unnamed Stream	Not present	None recorded	None recorded	Brown trout
A2	Unnamed Stream	Not present	None recorded	None recorded	Brown trout
A3	Unnamed Stream	Not present	None recorded	None recorded	Brown trout
B1	Killeen River	Not present	None recorded	None recorded	Atlantic salmon & Brown trout
B2	Killeen River	Not present	None recorded	None recorded	Atlantic salmon & Brown trout
B3	Killeen River	Not present	None recorded	None recorded	Atlantic salmon & Brown trout

Conservation value: Atlantic salmon (*Salmo salar*) and lamprey (*Lampetra* spp.) are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive'). European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). Brown trout have no formal designation in southern Ireland but are a priority species in northern Ireland.

5. Discussion

5.1 Fisheries

Apart from Atlantic salmon parr and brown trout no fish or habitats of high conservation value were recorded during the current survey. Atlantic salmon are listed on Annex II and Annex V of the Habitats Directive (92/43/EEC). They are also a qualifying interest fish species of the hydrologically connected River Barrow and River Nore SAC (002162), situated 3km downstream of the study area (by water). Atlantic salmon were recorded at all sites on the Killeen River (i.e. sites B1, B2 & B3) but not on its unnamed stream tributary (i.e. sites B1, B2 and B3) (**Tables 4.2 & 4.3**). While not of significantly high conservation value, wild brown trout populations are of high local biodiversity value and were recorded at all sites in the study area at low densities.

All of the survey sites were of value as salmonid nurseries, although numbers of mixed-cohort trout were lower than anticipated for semi-natural spate type channels. The low trout densities may be as a result of enrichment and siltation pressures observed during the survey as trout recruitment is reliant on low order tributaries in the River Nore catchment (pers. obs.). The low density of trout in the Killeen River may reflect superior competition by salmon that in high energy higher order channels (where inter-specific competition exists) have better capacity to hold station in strong flows (i.e. sites A1, A2 & A3 on the Killeen River). Despite enrichment and siltation pressures the main channel of the Killeen River was achieving target 'good status' biological water quality (refer to biological water quality section 5.3 below).

Brook lamprey (*Lampetra planeri*) are listed as qualifying interests of the downstream-connecting River Barrow and River Nore SAC (002162) but were not recorded during the current survey. This was consequential of the high energy of the study area which discourages the settlement of deeper soft sediment deposits (most observed were superficial and or flocculent in nature). Lamprey species requires sufficient depth and particle composition for ammocoete settlement as per characteristics provided in Dawson et al., 2015; Aronsuu & Virkkala, 2014; Rooney et al., 2013; Lasne et al., 2010; Goodwin et al., 2008; Gardiner, 2003.

European eel are Red-listed in Ireland (King et al., 2011) and are classed as 'critically endangered' on a global scale (Pike et al., 2020). Habitat suitability was moderate and could support eel given the presence of flow refugia and food resources. However, downstream barriers in the Nore catchment (AMBER Consortium, 2020; Gargan et al., 2011) may restrict migration of eel into the upper reaches of the Killeen (Delour)_010 sub-basin.

5.2 Annex I aquatic habitats

The Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]' (also referred to as floating river vegetation) (EC, 2013) is characteristic of lowland depositing spate river channels in Ireland with *Ranunculus-Callitriche* dominated habitat often occurring with *Oenanthe aquatica* in addition to a low diversity of aquatic mosses. However, the habitat was not recorded during the current survey, likely because of the high energy of the study area that precludes the settlement of representative macrophyte plants.

5.3 Biological water quality & pressures

In terms of biological water quality, all three sites on the Killeen River (sites B1, B2 & B3) met the target good status (≥**Q4**) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Appendix A**). However, sites A1, A2 and A3 on the unnamed tributary of the Killeen River failed to achieve good status (i.e. moderate status **Q3-4**) biological water quality was recorded. Eutrophication (enrichment) and siltation pressures were particularly evident on the unnamed tributary of the Killeen River during the survey (sites A1, A2 & A3) that have contributed to biological water quality decline. Specifically this related to floc and silt settlement in addition to associated bed compaction (from silt infiltration). Likely sources included agriculture with evident cattle poaching observed during the survey. No rare or protected macro-invertebrate species (according to national red lists) were recorded in the samples taken from 8 no. riverine sites (**Appendix A**).

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7. Appendix A – Macro-invertebrates (biological water quality)

Table 9.1 Macro-invertebrate Q-sampling results, July 2024

Taxon	Family	Binomial name	A1	A2	A3	B1	B2	B3	EPA Groups
Ephemeroptera	Heptageniidae	*Rhithrogena semicolorata*	2	5	3	16	14	18	**A**
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*				3	2	4	**A**
Plecoptera	Perlodidae	*Isoperla grammatica*					1		**A**
Ephemeroptera	Baetidae	*Alainites muticus*	18	3			1		**B**
Plecoptera	Leuctridae	*Leuctra fusca*	3		1	10	7	13	**B**
Trichoptera	Glossosomatidae	*Glossosoma boltoni*				4	3	6	**B**
Trichoptera	Goeridae	Goeridae pupa		1					**B**
Trichoptera	Limnephilidae	*Halesus radiatus*				1			**B**
Trichoptera	Limnephilidae	*Potamophylax cingulatus*	1	1	1		1		**B**
Trichoptera	Limnephilidae	sp. indet.			1				**B**
Trichoptera	Odontoceridae	*Odontocerum albicorne*		5	3		2		**B**
Trichoptera	Sericostomatidae	*Sericostoma personatum*	2	2	1		1		**B**
Ephemeroptera	Baetidae	*Baetis rhodani*	10	5	4	13	8	13	**C**
Ephemeroptera	Ephemerellidae	*Serratella ignita*	7	7	4	12	45	14	**C**
Trichoptera	Hydropsychidae	*Hydropsyche siltalai*				1	1		**C**
Trichoptera	Philopotamidae	*Wormaldia occipitalis*	7		1				**C**
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*	2		1				**C**
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*			1	5	3	4	**C**
Amphipoda	Gammaridae	*Gammarus duebeni*	15	6	7		15	9	**C**
Arachnida	Hydrachnidiae	sp. indet.					2	1	**C**
Coleoptera	Elmidae	*Elmis aenea* (adult)	2			1			**C**
Coleoptera	Elmidae	*Elmis aenea* (larva)					1	1	**C**
Coleoptera	Elmidae	*Limnius volckmari* (adult)					2	2	**C**
Coleoptera	Elmidae	*Limnius volckmari* (larva)			2	1	3		**C**
Coleoptera	Hydraenidae	*Hydraena gracilis*				1	3		**C**
Coleoptera	Scirtidae	Scirtidae larva	1						**C**
Diptera	Simuliidae	sp. indet.	10	2	16	4	5	5	**C**
Diptera	Chironomidae	Non-chironomus spp.	1	1	1	2	14	5	**C**
Diptera	Dixidae	sp. indet.	2	1	3				**C**
Diptera	Limoniidae	Antocha sp.			1				**C**

Taxon	Family	Binomial name	A1	A2	A3	B1	B2	B3	EPA Groups
Diptera	Limoniidae/Pediciidae	sp. indet.		1					C
Diptera	Pediciidae	Dicranota sp.	4	5			4	2	C
Hirudinidae	Glossiphoniidae	sp. indet.			1	1			D
Diptera	Chironomidae	Chironomus spp.					1		E
Annelidae	Oligochaeta	sp. indet.	2	6	4				N/A
Total Abundance			**89**	**51**	**56**	**75**	**139**	**97**	
Taxon Richness			**17**	**15**	**19**	**15**	**23**	**14**	
Q Rating			**Q3-4**	**Q3-4**	**Q3-4**	**Q4**	**Q4**	**Q4**	
Water Quality Status			**Mod.**	**Mod.**	**Mod.**	**Good**	**Good**	**Good**	

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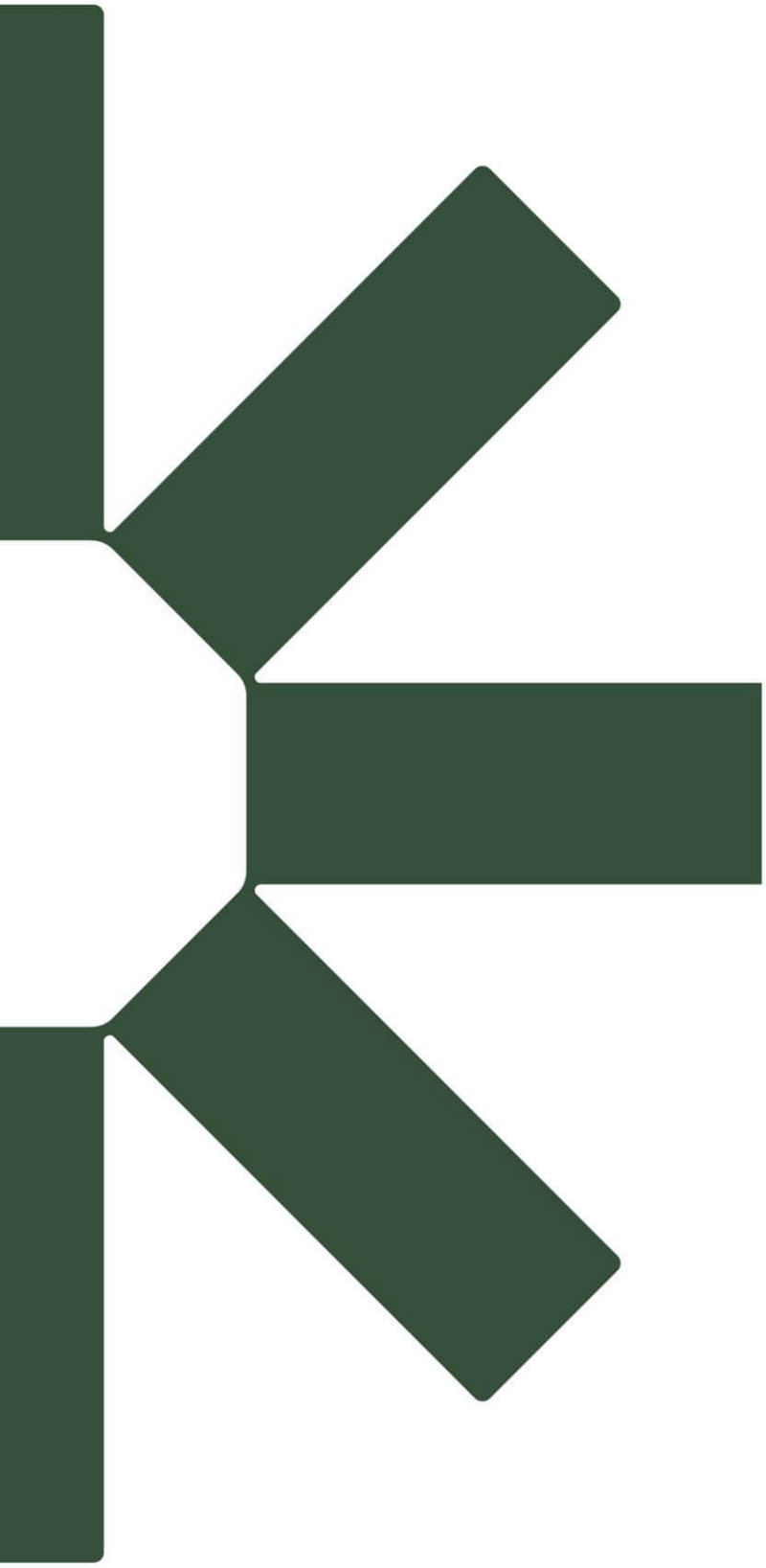


EIAR Extract

Chapter 7 Water

CONTENTS

TABLES

FIGURES

Introduction

Background

7.1 This chapter of the EIAR provides a description of the surface water (hydrology) and groundwater (hydrogeology) conditions in the application area within the context of the regional setting, and assesses the potential impacts the proposed development will have on surface water and groundwater. Mitigation measures, if required, are proposed.

7.2 Available information on the surface water and groundwater of the Mounthall area and its surrounds was collated and evaluated.

Proposed Development

7.3 The proposed development is described in detail in Chapter 2: Project Description of this EIAR and only those elements which relate to water and water management are presented here for the purpose of this chapter. The proposed site layout is shown on **Figure 2-3**.

7.4 Extraction within the existing pit was carried out as a dry extraction operation above the groundwater table. It is proposed that extraction within the extension area will also be carried out above the groundwater table, with the proposed pit floor sloping from northwest (c. 205m AOD) to southeast (c. 175m AOD). It is proposed to extract the sand and gravel in 3 phases as shown on **Figure 2-2** and outlined below with extraction progressing in an anti-clockwise direction from Phase 1 to Phase 3.

7.5 Sand and gravel extraction in the extension area will remain above the surficial groundwater level in the sand and gravel deposits (dry working). The sand and gravel deposits are not classified as an aquifer, and these deposits are underlain by low permeability silt and clay across the extension area, which provides protection to the underlying sandstone aquifer.

7.6 The proposed development consists of continued use and extraction of sand and gravel (dry working) over an area of c. 8 hectares with processing that includes crushing, washing (closed loop water recycling system with associated silt storage lagoons), screening and all ancillary works and structures.

7.7 The development includes site facilities consisting of mobile processing plant, portacabin site office, portacabin welfare facility, serviced portaloo toilet, bunded fuel storage and refuelling pad with hydrocarbon interceptor, weighbridge, wheelwash, water supply borehole, perimeter berms, vegetation planting and fencing.

7.8 Construction of silt storage lagoons (1,952.25m^2) associated with the washing plant closed loop water recycling system.

Water Management

7.9 The sand and gravel processing methods will consist primarily of washing and screening, using a mobile processing plant, to produce a range of aggregates for sale and distribution by the company. The mobile plant will operate within a closed loop water circuit with the silt storage lagoons to minimise the need for excessive take of groundwater and to eliminate the need to discharge process water from the site.

7.10 There is no surface water drainage infrastructure within the site. Rain falling across the existing site percolates down through the existing ground surface as recharge to shallow groundwater in superficial deposits.

7.11 The provision of a serviced portaloo on site will negate the requirement for installing a septic tank / propriety effluent treatment system.

7.12 Drinking water will be supplied by means of bottled water.

Water Supply Well

7.13 A water supply well will be required to provide water for the closed loop water recycling system for washing and dust suppression.

7.14 The water supply well will be located in the site facilities area and will extend into the underlying bedrock which is classified by the GSI as a locally important aquifer. Details on this aquifer are provided in Section 7.58.

7.15 Due to the closed loop water recycling system, the water requirement for top-up of the washing plant is considered to be minimal.

Scope of Work

7.16 The scope of this chapter includes:

- an assessment of the existing surface water and groundwater within approximately 2 km of the application area;
- an assessment of the potential impact of the proposed sand and gravel extraction on surface water and groundwater, and;
- where necessary, recommendation(s) for mitigation measures to reduce or eliminate any potential impacts.

Project Team

7.17 This chapter of the EIAR was prepared by SLR Consulting Ireland. The project team consists of:

- Technical Director (Hydrogeology) Dominica Baird BSc (Earth Science), MSc (Hydrogeology), CGeol, EurGeol, MIAH;
- Technical Director (Hydrology) Peter Glanville BA (Geography), PhD (Geomorphology), PGeo, EurGeol; and
- Project Hydrogeologist Mairéad Brown BSc (Earth Science).

Limitations / Difficulties Encountered

7.18 The evaluation of the hydrological and hydrogeological environment provided here relies on the detailed assessment, visual inspections conducted during site visits, a comprehensive dataset of monitoring records, publicly available information, and anecdotal evidence from local personnel.

7.19 No constraints or challenges were encountered during the compilation of this chapter in the Environmental Impact Assessment Report (EIAR).

Regulatory Background

Legislation

7.20 The key European Directives / European Union Legislation which apply to this Chapter of the EIAR and the hydrology and hydrogeology assessment presented herein are:

- Environmental Impact Assessment Directive (2011/92/EU); and
- Directive of the European Parliament and of the Council amending Directive 2011/92/EU on assessment of effects of certain public and private projects on the environment (2014/52/EU).

7.21 Other European Directives to which this EIAR makes reference, or has had regard, are listed in **Appendix 7-A**.

7.22 Irish Government Acts, National Legislation and Regulations which apply to this Chapter of the EIAR and the surface water and groundwater assessment presented herein are also listed in **Appendix 7-A.**

7.23 Most notably, under Regulation 4 of the Groundwater Regulations 2010, a duty is placed on public authorities to promote compliance with the requirements of the regulations and to take all reasonable steps including, where necessary, the implementation of programmes of measures, to:

7.24 *"(**a**) prevent or limit, as appropriate, the input of pollutants into groundwater and prevent the deterioration of the status of all bodies of groundwater;*

7.25 *`(**b**) protect, enhance and restore all bodies of groundwater and ensure a balance between abstraction and recharge of groundwater with the aim of achieving good groundwater quantitative status and good groundwater chemical status by 2015 or, at the latest, by 2027;*

7.26 *(**c**) reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order to progressively reduce pollution of groundwater;*

7.27 *(**d**) achieve compliance with any standards and objectives established for a groundwater dependent protected area included in the register of protected areas established under Regulation 8 of the 2003 Regulations [S.I. No. 722 of 2003] by not later than 2015, unless otherwise specified in the Community legislation under which the individual protected areas have been established."*

Planning Policy and Development Control

7.28 The Planning Policy and Development Control relating to water at the site in this EIAR is set out in the Laois County Development Plan 2021-2027.

Guidelines and Technical Standards

7.29 The following key guidelines apply to this hydrology and hydrogeology assessment:

- Institute of Geologists of Ireland. Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, April 2013;
- National Roads Authority, 2008. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;

- Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports: Environmental Protection Agency;
- Environmental Protection Agency, 2006. Environmental Management in the Extractive Industry: Non-Scheduled Minerals; and
- Geological Survey of Ireland - Irish Concrete Federation, 2008. Geological Heritage Guidelines for the Extractive Industry.

7.30 Additional guidelines and technical standards which apply to this Chapter of the EIAR and the hydrology and hydrogeology assessment presented herein are listed in **Appendix 7-A**.

Receiving Environment

Study Area

7.31 For the purposes of this assessment, the study area comprises the application site and the surrounding area up to 2km reflect the sensitivity of the surface water and groundwater; this is in line with the Institute of Geologists of Ireland's (IGI) guidelines (2013).

7.32 The IGI guidelines state that the minimum distance of 2 km should be reviewed in the context of the geological environment as well as the scale of development and increased to reflect the sensitivity of the subsurface, and this has been carried out.

Baseline Study Methodology

7.33 A detailed geological, hydrological and hydrogeological dataset has been collected as part of this EIAR study.

7.34 The investigation methodology adheres to the Environmental Protection Agency's (EPA) guidelines on environmental impact assessments and the IGI's recommendations on Geology in Environmental Impact Statements.

Desk Study

7.35 Existing information on the geology, hydrogeology and hydrological features of the Mounthall area and its surrounds was collated and evaluated. The desk study involved the examination of several datasets to determine the geological and hydrogeological setting of the area, as detailed in **Table 7-1**.

Table 7-1: Regional Data Consultation

Data	Dataset Source
Soils	Irish Soils Information System – Teagasc
Subsoil Geology	Teagasc/GSI/EPA Subsoil Mapping
Bedrock Geology	GSI Groundwater Data Viewer - Bedrock Geology
Surface Water	OSi Discovery Series mapping; Environmental Protection Agency online mapping; Water Framework Directive; OPW CFRAM; and Current Laois County Council Development Plan.

Groundwater	GSI Groundwater Data Viewer - bedrock and gravel aquifers, vulnerability, water supplies, groundwater recharge; GSI Groundwater body description documents; Environmental Protection Agency water maps; and National Federation of Group Water Schemes (NFGWS) Data Viewer.
Climate	Met Eireann
Protected Areas, Environmental Pressures	Environmental Protection Agency; and National Parks and Wildlife Service

Detailed Site Investigations

7.36 In addition to the above desk study of publicly available data, extensive data gathering has been undertaken at the site. The works carried out for assessing hydrology and hydrogeology in the Mounthall area is outlined as follows:

- Installation of 9 no. groundwater monitoring boreholes across the proposed development area, to monitor both the sand and gravel superficial deposits and underlying sandstone aquifer;
- Installation of groundwater level data loggers at 5 no. on-site groundwater monitoring boreholes to facilitate continuous groundwater level monitoring;
- Manual dipping of groundwater wells from 9 no. on-site groundwater monitoring boreholes on 13 no. occasions;
- 5 no. rising head tests;
- Installation of rain gauge;
- Measurement of surface water flow values at 3 no. locations over 3 no. rounds of monitoring,
- 3 no. rounds of surface water quality monitoring at 3 no. monitoring points in the vicinity of the proposed development area.
- 3 no. rounds of groundwater quality from 9 no. on-site groundwater monitoring boreholes; and analysis of the information gathered.
- Well survey of private wells within 500m of the proposed development area.

Site Setting

7.37 The proposed application area (c. 12.2 hectares) lies in County Laois in the townlands of Mounthall and Cummer, Camross. Within the application area, the northern portion of the site (c. 1.2 hectares) contains the existing sand and gravel pit and entrance onto the L10317. The existing pit consists of a single face typically 8m in height. Ground levels rise from the entrance at c. 194m AOD westwards to the toe of the existing face along the western boundary where ground levels are c. 200-203m AOD.

7.38 To the south of the existing pit, existing agricultural grazing lands are situated, over which the proposed extension extraction operations (c. 8 hectares) are intended to gradually advance through. The extension lands are undulating, and ground levels are variable from c. 205m AOD adjacent to the existing pit to the north, falling south-eastwards to c. 195m

AOD, before rising to 205m AOD and again falling away to c. 180m AOD in the southeast corner of the site.

7.39 The rural lands surrounding the application site mainly consist of agricultural fields and private residential properties.

7.40 Surface water features at the proposed development area include a small pond (c. 20m in diameter) located along the eastern site boundary, outside of the proposed extraction area which will be retained.

7.41 There is a small stream located along the southern boundary, which flows into the Killeen River from the southern boundary approx. 150m from the site.

7.42 Located north to the existing pit are the Slieve Bloom Mountains. These are both an SPA and a SAC. The Slieve Bloom SPA borders the north of the existing pit while the Slieve Bloom SAC is located c. 1.5km north of the pit.

Rainfall and Climate

7.43 There is no Met Éireann rainfall gauging station near to the application site and therefore a rain gauge station was installed on the site. The rain gauge was installed on 24th April 2024 at the entrance to the existing sand and gravel pit, see **Plate 7-1** below. The average monthly rainfall for the on-site rain gauge is presented in **Table 7-2**. The daily rainfall measurements are shown in **Appendix 7-B**.

Plate 7-1: Site Rain Gauge

Table 7-2: Average Monthly Rainfall (mm) for On Site Rain Gauge

April (from 25th)	May	June	July	August
17.4	63.4	63.6	82.2	36.2

7.44 The nearest Met Éireann rain gauging station is Slieve Bloom (Nealstown), located c. 8km to the south-west of the proposed extraction facility.

7.45 The Long-Term Average (LTA) annual rainfall is not available for the Slieve Bloom weather station but is available for Gurteen College, located c. 30km west of the site. The most recent period published is 1981-2010. The LTA annual rainfall for Gurteen is 948.2mm/yr for the period 1981-2010 (Met Eireann, 2021). The LTA monthly rainfall for the period 1981-2010 are shown in **Table 7-3** below.

Table 7-3: Long Term Average Annual Rainfall (1981-2010), Gurteen College

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
96.4	66.2	74.5	59.8	68.0	71.8	66.7	84.9	74.8	103.8	89.8	91.5

7.46 According to Met Éireann's Past Weather Statement for Spring 2024 (March – May), spring 2024 was one of the warmest and wettest springs on record. The highest daily rainfall total was 45.3 mm at Dublin Airport, Co Dublin on Friday 1st March (highest daily fall for spring since 2002). For the Winter 2023 / 2024 season, nearly all rainfall totals were above their Long-Term Average 1981-2010 (LTA).

Soils and Geology

7.47 Soils and Geology are discussed in detail in Chapter 6 of this EIAR. A summary is provided below. The soils are shown in **Figure 6-2**, subsoils are presented in **Figure 6-3** and Bedrock Geology is presented in **Figure 6-4**.

Soils and Subsoils

7.48 The Irish Soil Information System project has developed a national association soil map for Ireland, the project is co-funded by Teagasc and the Environmental Protection Agency (EPA). The soils are discussed in detail in Chapter 6 of this EIAR.

7.49 The soils at the site are coarse loamy drift with siliceous stones known as the Clonegall (0920a) Soil Association, see **Figure 6-2**.

7.50 The EPA website publishes subsoil maps created by the Spatial Analysis Unit and Teagasc in collaboration with the Geological Survey Ireland (GSI). The subsoils are discussed in detail in Chapter 6 of this EIAR.

7.51 The subsoils at the site are glacial tills chiefly derived from Devonian sandstone and glaciofluvial sands and gravels chiefly derived from Devonian sandstone, see EIAR **Figure 6-3**. These subsoils are moderate (glacial tills) to highly (glaciofluvial sands and gravels) permeable and are overlain by well-drained soil (GSI online map viewer).

7.52 The soils and subsoils at the site will be removed to facilitate extraction.

7.53 Surrounding subsoils are bedrock at or close to the surface and alluvium undifferentiated along the Killeen River, see **Figure 6-2**. All of these subsoils are moderate to highly permeable, according to the GSI online map viewer.

Local Bedrock Geology

7.54 The GSI online map viewer (1:100,000 geology map) shows the site is underlain by pale and red sandstone, grit and claystone of the Cadamstown Formation. The local bedrock geology is shown in **Figure 6-4**.

7.55 The formation consists predominantly of medium to coarse yellow-white, purple, grey and brown sandstones, with occasional intraformational conglomerates and quartz pebble conglomerates.

7.56 There is an unconformity present northwest of the site c. 2km between the Cadamstown Formation and the Capard Formation.

Karst

7.57 There is no carbonate geology within the vicinity of the proposed development and hence there is no record of any karst features within 5km of the site.

Groundwater – Hydrogeology

Aquifer Characteristics

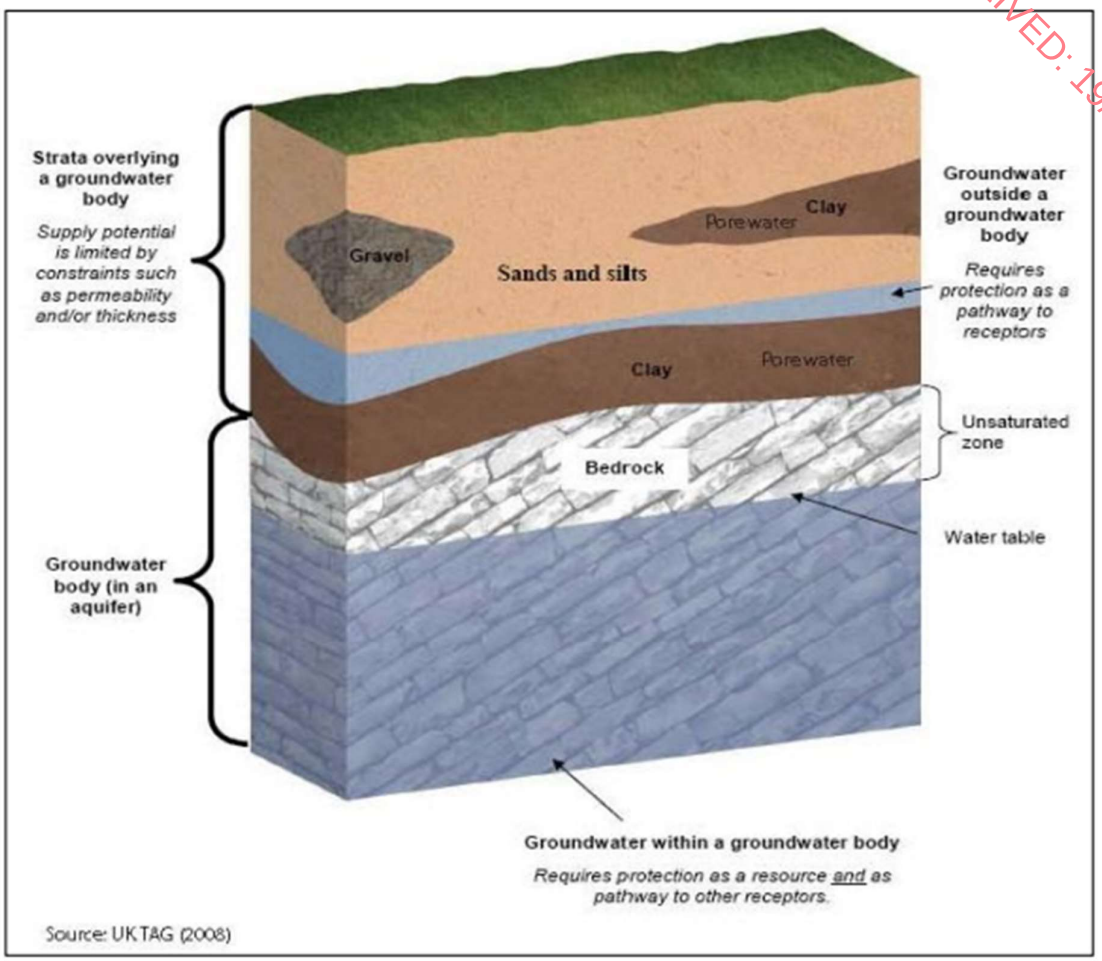
7.58 The GSI online map viewer shows the site is underlain by a locally important aquifer (Ll), Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones, see **Figure 7-1**. The aquifer has an area of 182 km^2.

7.59 The sand and gravel subsoils at the proposed development site are not defined by the GSI as an aquifer. A sand and gravel aquifer is defined by the GSI as being highly permeable, more than 10m thick or has a saturated thickness of at least 5m and having a continuous area of at least 1km^2. The superficial sand and gravel deposits at the site do not meet this criteria.

7.60 The EPA guidance on discharges to groundwater[1] defines the status of groundwater in strata overlying groundwater bodies, as shown in **Plate 7-2** below. Groundwater has a value as a lateral or vertical pathway to other receptors, and may be usable but only for local supplies <10m^3/d. **Plate 7-2** shows the scenario where groundwater is present outside a groundwater body, and separated from the underlying aquifer by a low permeability clay strata, as is the case for the proposed development site.

[1] EPA Guidance on the Authorisation of Discharges to Groundwater, V1 December 2011

Plate 7-2: Summary of Groundwater and Pore Water in Low Permeability Sediments



Groundwater Vulnerability

7.61 The GSI has developed a groundwater vulnerability classification for Ireland, refer to **Table 7-4** below. The groundwater vulnerability at a particular point is controlled by the natural geological and hydrogeological characteristics at that point. The vulnerability depends on the nature of the subsoils (i.e., their permeability characteristics), the type of recharge (point or diffuse) and the thickness of the unsaturated zone (depth to groundwater).

7.62 The groundwater vulnerability at the site is classed as High to Moderate, see **Figure 7-2,** indicating subsoil thickness of 3 - 10m.

Table 7-4: GSI Groundwater Vulnerability Rating

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			**Unsaturated Zone**	**Karst Features**
	High permeability (sand / gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/Gravel aquifers only)	(< 30 m radius)
Extreme (E)	0-3.0m	0-3.0m	0-3.0m	0-3.0m	-
High (H)	>3.0m	3.0-10.0m	3.0-5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0-10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (i) N/A= not applicable
(ii) Precise permeability value cannot be given at present.
(iii) Release point of contaminants is assumed to be 1-2m below ground surface.

7.63 According to the GSI online database, the hydrogeological setting of the proposed development is described as moderate permeability subsoil and overlain by well-drained soil. The effective rainfall (rainfall after evaporation) is 1,018 mm/yr. The groundwater recharge at the site is between 865 - 611 mm/yr, however a recharge cap applies to the site and the average recharge range is expected to be 151-200 mm/yr.

Groundwater Bodies

7.64 The proposed development is located within the Camross Groundwater Body (GWB). A description of the GWB is published by the GSI, and is summarised below and refers to the sandstone bedrock underlying the sand and gravel deposits at the site. Groundwater bodies are shown in **Figure 7-3.**

Camross GWB

7.65 This groundwater body is defined to the north by the boundary of the Nore River basin and to the south by the extent of the Cadamstown Sandstone. Most groundwater recharges in the north where subsoil thickness is lowest, then flows southeast. The rock units contained within this groundwater body area considered to be poor or locally important aquifers at best. Regional groundwater flow systems are not expected to develop. Discharge from the aquifer will be the nearest surface water feature in the area. Hydraulic gradients are likely to be high due to the elevated topography and therefore groundwater flow may be faster than anticipated from similar rock types located in low lying lands.

7.66 Groundwater will discharge locally to streams and rivers crossing the aquifer and also to small springs and seeps. Owing to the poor productivity of the aquifers in this body it is unlikely that any major groundwater - surface water interactions occur. Baseflow to rivers and streams is likely to be relatively low. This aquifer is considered to have low transmissivity and storativity.

7.67 In Slieve Bloom during the last glacial period, thick subsoils were deposited in the area occupied by the present day Delour Valley. The groundwaters in the bedrock are only moderately hard waters (220-240mg/l as CaCO3) but waters sampled from the recharging outcropping areas will be much softer. However, the bedrock waters have a high Mg/Ca

ratio, which reflects the lower levels of calcium and higher levels of magnesium in the strata. The groundwaters in this aquifer are mainly calcium/magnesium bicarbonate type waters. The average electrical conductivity is 374 (µs/cm). The bedrock strata in this aquifer is expected to be Siliceous, this is to be confirmed by the GSI.

Groundwater Monitoring Boreholes

7.68 An expansive network of groundwater monitoring boreholes, located in the shallow groundwater in the superficial deposits and the underlying sandstone bedrock aquifer, has been installed across the site. As the proposed extension lands are undulating, groundwater monitoring boreholes have been installed on the higher ground (BH08, see **Plate 7-3**), as well as on lower ground adjacent to the stream (BH06, see **Plate 7-4**).

Plate 7-3: BH08, located on higher ground

Plate 7-4: BH06, located on lower ground

7.69 There are nine groundwater monitoring wells at the site, see **Figure 7-4**. Borehole logs are presented in **Appendix 7-C**. BH01 – BH03 were installed in February 2023, BH04 and BH05 were installed in December 2023 and BH06 – BH9 were installed in February 2024. BH10 terminated at 7.80m bgl due to an obstruction when weathered bedrock was encountered. The borehole was dry and was backfilled. Boreholes BH01, BH02 and BH08 are located within the footprint of the proposed extraction area.

7.70 Drilling was carried out by Irish Drilling Ltd and Peterson Drilling Services Ltd and was supervised by SLR personnel.

7.71 All borehole installations included a gravel pack installed in the annular space between the slotted casing and the borehole; a bentonite seal was installed above the gravel pack to prevent the entry of surface water runoff from surrounding areas flowing directly into the boreholes. The boreholes were both fitted with a stand-up cover with a concrete surround. The borehole logs are included in **Appendix 7-C**.

7.72 Boreholes were drilled to a depth of between 4.0m bgl at BH06 (172.13 mOD), and 25.30m bgl at BH09 (175.82 mOD).

7.73 The boreholes encountered sands and gravels at all locations at the site, underlain by low permeability silt and clay. Sand and Gravel was underlain by low permeability silt and clay at BH1 - BH4 and BH7 - BH10. The ground conditions encountered during drilling are presented as an indicative Conceptual Site Model in **Plate 7-5** below.

7.74 Sand and Gravel was directly underlain by Sandstone at BH5 only, towards the west of the site and outside the extraction area. However, the Sand and Gravel strata overlying the Sandstone bedrock at BH5 was dry during drilling. The low lying BH6 to the south of the site encountered Cobbles underlain by Clay.

7.75 Details of groundwater monitoring boreholes installed on-site are presented in **Table 7-5**. Groundwater monitoring borehole locations are presented in **Figure 7-4**.

Plate 7-5: Conceptual Site Model

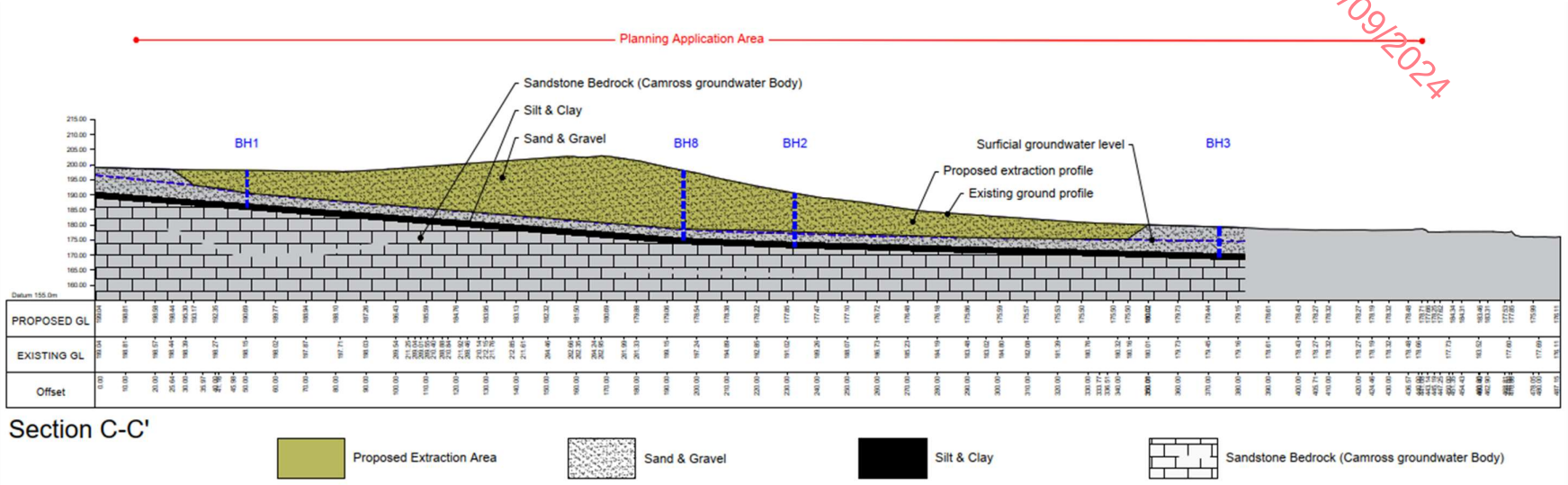


Table 7-5: Details of groundwater monitoring boreholes on-site

Borehole ID	Easting, Northing	Ground Level Elevation (m AOD)	Reference Level* Elevation (m AOD)	Depth (m bgl)	Elevation of base of borehole (m AOD)	Water strikes (m AOD)	Standpipe installation (m bgl)	Screened Strata
BH01	626571, 698126	197.52	197.8	11.5	186.02	No defined strikes	Plain 0 -2 Slotted 2 - 11.5	Sand and Gravel
BH02	626762, 698132	195.87	196.12	23.00	172.87	No defined strikes	Plain 0-2.9 Slotted 2.9 -23.0	Sand and Gravel
BH03	626900, 698105	181.38	181.67	12.00	169.38	No defined strikes	Plain 0-2.9 Slotted 2.9 -12.0	Sand and Gravel
BH04	626497, 698248	204.43	204.94	25.00	179.43	Water strike at 20m in fine grained sandstone - Medium inflow	Plain 0-14 Slotted 14 -25	Sandstone
BH05	626456, 698027	193.67	194.2	15.00	178.67	Water strike at 9.5m in fine grained sandstone - Slow inflow	Plain 0-9 Slotted 9 - 15.0	Sandstone
BH06	626763, 698015	176.30	176.79	4.00	172.30	Water strike at 2.2m in sandy cobbles - Medium inflow	Plain 0-2 Slotted 2 - 3.0	Clay and Cobbles
BH07	626497, 698248	208.52	208.77	6.20	202.32	Water strike at 3.0m in reddish brown sand - Medium inflow	Plain 0-2.2 Slotted 2.2 - 6.2	Sand

BH08	626721, 698126	199.31	199.60	24.20	175.71	No defined strikes	Plain 0-18 Slotted 18 – 24.2	Sand
BH09	626785, 698214	198.86	199.11	25.30	173.56	Water strike at 23.0m in brown silty sand - Slow inflow	Plain 0-19.3 Slotted 19.3– 25.3	Silty Sand
BH10	626537, 698138	198.09	-	7.80	190.29	No defined strikes	Dry - backfilled	No installation

Groundwater Levels

7.76 Manual groundwater levels were taken approximately every two weeks from February 2024 to August 2024 by Breedon Ireland and monthly by SLR personnel from April 2024 to July 2024. These were used to calibrate, verify and adjust the logger groundwater level data. Manual readings coupled with barometric data were used to correct the logger groundwater data for the site conditions.

7.77 Five water level loggers were placed in BH02, BH03, BH04, BH05 and BH06 on the 15th of April 2024 and set to record a groundwater level every hour. Groundwater level data from February 2024 to July 2024 is shown in **Figure 7-5** below.

7.78 A barometer was installed in borehole BH04 and set to take readings every hour. The barometer records variations in atmospheric pressure. One barometer is sufficing for a 25 km^2 area, therefore only one is needed for this site.

7.79 There is no rainfall gauging station nearby and therefore a rain gauge station was established on the site. The rain gauge was installed on 24th April 2024 at the entrance to the existing sand and gravel pit, see **Plate 7-1**.

7.80 Rainfall data is available from April 2024 to August 2024 and is graphed against groundwater levels in **Figure 7-5**. A summary of the groundwater levels recorded by the data loggers can be seen in **Table 7-6** below, the groundwater levels manually recorded are summarised in **Table 7-7** and a combination of the groundwater levels is summarised in **Table 7-8**. As previously noted, spring 2024 was one of the warmest and wettest springs on record. For the winter 2023 / 2024 season, nearly all rainfall totals were above their Long-Term Average 1981-2010.

7.81 There is minimal variation in groundwater levels in the Sand and Gravel deposits, for example in BH02 throughout the 2024 monitoring period minor variability was recorded, with a total variation of 1.13m, a maximum of 177.46m AOD and a minimum of 176.33m AOD.

7.82 The groundwater levels in the Sand and Gravel deposits at BH03 from the April 2024 to July 2024 monitoring period had a maximum of 174.69m AOD and a minimum of 174.36m AOD, showing a total variation of 0.33m. This is the smallest variation in all the monitoring wells.

7.83 The groundwater levels in the sandstone bedrock in BH04 have a total variation of 2.73m, with a maximum of 193.07m AOD and a minimum of 190.34m AOD. The sandstone bedrock at BH05 showed the maximum variation in all the wells with a total variation of 3.1m. The well reported a maximum of 189.92m AOD and a minimum of 186.82m AOD.

7.84 The groundwater levels in the Clay and Cobbles deposits near the stream at BH06 showed a minimal variation of 0.37m. This well reported a maximum groundwater level of 175.38m AOD and a minimum of 175.0m AOD.

7.85 It can be seen from the discussion above and **Figure 7-5** below, that there is very little variation in groundwater levels across the site. The gravel and sand strata across the site allow for intergranular groundwater flow and the storativity here is generally high. Water flow through this layer is generally quick leading to fast recharge rates.

7.86 Groundwater levels at each borehole do not vary greatly and do not seem to follow rainfall patterns due to high aquifer storativity. The manual groundwater levels trendlines have an average gradient of 0.01m. The highest trendline was recorded at BH05 (0.022m) and the lowest at BH03 (0.0018m).

7.87 Manual groundwater levels are graphed against rainfall in **Figure 7-5** below. The nearest Met Éireann rain gauging station is Slieve Bloom (Nealstown), located c. 8km to the south-west of the application site. Rainfall data is available at this station from February 2024 to April 2024 at the time of this report.

7.88 Rainfall from the Slieve Bloom rain gauging station and the onsite rain gauge was used in **Figure 7-6** below to create a time series of rainfall from February 2024 to August 2024.

7.89 Data from **Figure 7-6** shows that there has been little overall change to manual groundwater levels, but all wells have shown a decrease from February 2024 to August 2024. Groundwater levels have decreased no more than 3m since monitoring began.

7.90 **Figure 7-6** below shows that groundwater levels reached a peak in most wells between mid-March and early April. Groundwater levels had already begun to decrease before loggers were placed in some of the wells in April 2024. The lowest manual groundwater levels recorded were during the 9th July 2024 and 12th August 2024 monitoring rounds where both BH08 and BH09 were reported as dry.

7.91 Groundwater levels are highest in the north-west and lowest in the south-east of the site. These groundwater levels indicate that groundwater is flowing roughly in a south-easterly direction, towards the Killeen River as expected.

Table 7-6: Summary of groundwater level logger data (April 2024 – July 2024)

		BH02	BH03	BH04	BH05	BH06
Strata		Sand and Gravel	Sand and Gravel	Sandstone	Sandstone	Clay and Cobbles
mAOD	**Minimum**	176.33	174.37	190.34	186.82	175.00
	Average	176.87	174.56	191.31	188.05	175.18
	Maximum	177.26	174.70	192.64	189.66	175.38
m	**Range**	0.922	0.331	2.31	2.84	0.37

Table 7-7: Summary of manual groundwater levels (February 2024 – August 2024)

	Units	BH 01	BH 02	BH 03	BH 04	BH 05	BH 06	BH 07	BH 08	BH 09
Strata		Sand & Gravel	Sand & Gravel	Sand & Gravel	Sand-stone	Sand-stone	Clay & Cobbles	Sand	Sand	Silty Sand
Min	**m AOD**	188.41	176.39	174.23	190.43	186.84	174.53	205.16	176.93	176.59
Max	**m AOD**	190.50	177.46	174.84	193.07	189.92	175.66	207.60	178.37	177.35
Range	**m**	2.09	1.07	0.61	2.64	3.08	1.13	2.44	1.44	0.76

Table 7-8: Summary of combination of manual and logger groundwater levels

	Units	BH 01	BH 02	BH 03	BH 04	BH 05	BH 06	BH 07	BH 08	BH 09
Strata		Sand & Gravel	Sand & Gravel	Sand &Gravel	Sand-stone	Sand-stone	Clay & Cobbles	Sand	Sand	Silty Sand
Min	**m AOD**	188.41	176.33 (logger)	174.23	190.34 (logger)	186.82 (logger)	174.53	205.16	176.93	176.59
Max	**m AOD**	190.50	177.46	174.84	193.07	189.92	175.66	207.60	178.37	177.35
Range	**m**	2.09	1.13	0.61	2.73	3.1	1.13	2.44	1.44	0.76

Figure 7-5: Groundwater levels at on-site boreholes and on-site rainfall

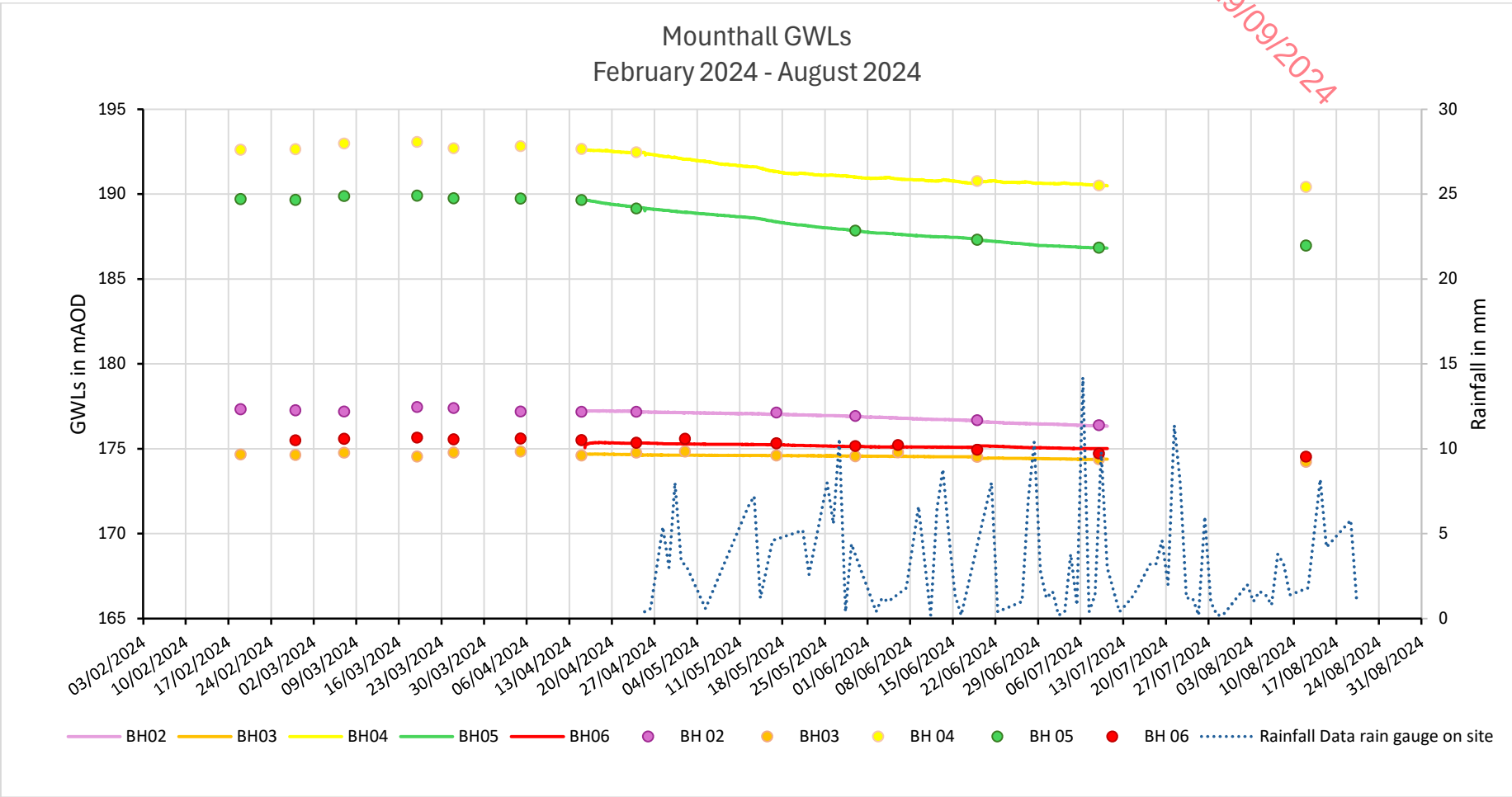
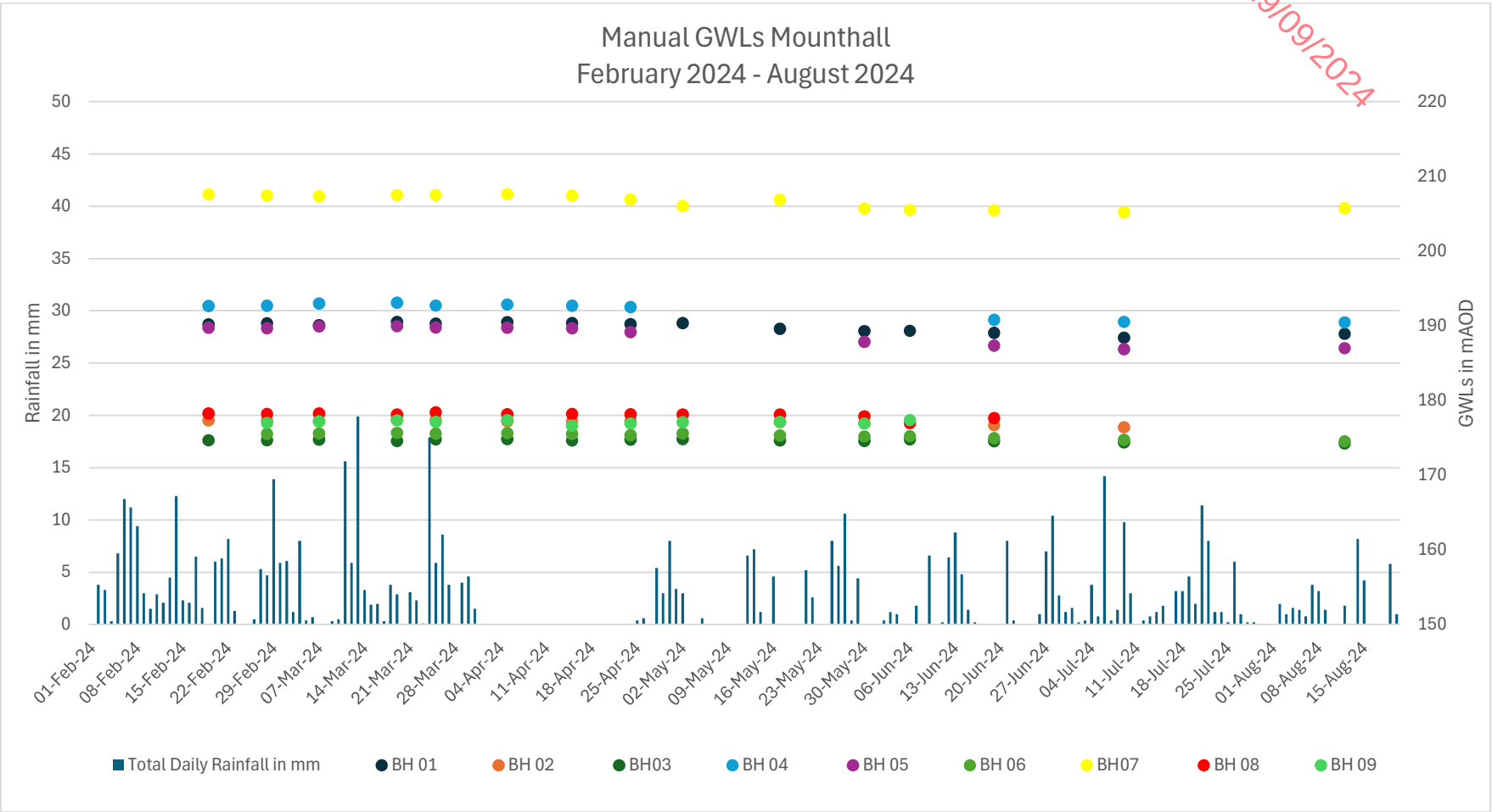


Figure 7-6: Manual groundwater levels at on-site boreholes and rainfall from Slieve Bloom and on-site rain gauge



Groundwater Quality

7.92 Groundwater quality monitoring was carried out on 24th April 2024, 18th June 2024 and 9th July 2024. The results were compared against Groundwater Regulations SI 366 of 2016, Drinking Water Regulations SI No 122 of 2014 and the EPA IGVs.

7.93 The results are presented in **Table 7-9** to **Table 7-11** and field record sheets are included in **Appendix 7-D**. A hydrocarbon sheen was noted at BH07 during all three monitoring rounds, and high silt content was noted at all monitoring locations.

7.94 The samples were collected by SLR personnel. A Waterra pump and tubing were used to pump water from depth in the borehole and ensure that recent surface water inflow was not collected. Each borehole was purged of three well volumes prior to taking the groundwater sample.

7.95 The samples were collected in the appropriate sample containers, which are supplied by the laboratory for the required analysis. Sample containers were filled so that there was minimum free air space. The containers were securely sealed so that there was no loss of volatile components such as moisture and no separation of components. All sample containers were clearly and uniquely labelled with details including ID and sampling date.

7.96 All samples were placed into a cooler box with ice packs to maintain a temperature at 5°C ± 3°C. The analysis required for each sample was listed on the Chain of Custody Record which accompanied samples. The samples were analysed at the ALS laboratories.

7.97 During the April round of monitoring, BH09 was dry and no sample could be obtained. In the other boreholes, there were several exceedances found. The pH level in BH01 was marginally lower than the Drinking Water Regulations, at 6.45 pH units compared to the assessment criteria of 6.5. In BH08, TPH exceeded the Groundwater Regulations concentration of 7.5µg/l, with a concentration of 2430 µg/l. At BH03, Naphthalene exceeded the EPA IGVs at a concentration of 1.39 µg/l and PAH exceeded the Groundwater Regulations SI 366 of 2016 with a concentration of 1.39 µg/l reported.

7.98 Similarly to the April monitoring round, BH09 was dry for the June monitoring round. The results of the June monitoring round featured no exceedances in the boreholes sampled.

7.99 During the July monitoring round, both BH08 and BH09 were dry. In contrast to the June monitoring round, several exceedances were noted. In BH06, aluminium exceeded the Groundwater Regulations with a concentration of 287 µg/l. Zinc exceeded the Groundwater Regulations with a concentration of 142 µg/l. In BH07, TPH exceeded the Groundwater Regs of 7.5 µg/l with a concentration of 2,230 µg/l. Acenaphthene exceeded the limit of detection at BH03 with 0.0159 µg/l reported and in BH07 with 0.0786 µg/l reported.

Table 7-9 Groundwater Quality (24th April 2024)

Parameter	Units	BH01	BH02	BH03	BH04	BH05	BH06	BH07	BH08
Inorganics									
Ammoniacal Nitrogen as N (low level)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH_3	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fluoride	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloride	mg/l	3.9	7.9	4.9	12.1	9.5	8.8	5.8	7
Conductivity	mS/cm	0.157	0.399	0.443	0.463	0.364	0.31	0.485	0.418
Nitrate as NO_3	mg/l	2.9	4.61	5.34	10.6	2.97	8.65	1.01	7.02
pH	pH Units	6.45	7.77	7.61	7.32	7.66	7.21	7.25	7.69
Phosphate (Ortho as PO4)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulphate	mg/l	<2	2.7	<2	4.2	3.8	2.1	5.1	3.5
Filtered (Dissolved) Metals									
Aluminium	µg/l	<10	<10	<10	<60	<10	<10	<10	<10
Arsenic	µg/l	<0.5	<0.5	<0.5	<3	<0.5	<0.5	<0.5	<0.5
Cadmium	µg/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium	µg/l	<1	<1	<1	<6	<1	<1	<1	<1
Copper	µg/l	<0.3	<0.3	<0.3	<1.8	<0.3	1.27	1.29	0.672
Lead	mg/l	<0.2	<0.2	<0.2	<1.2	0.394	<0.2	<0.2	<0.2
Magnesium	µg/l	1.29	2.4	2.12	3.12	2	2.62	6.59	3.68
Mercury	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	µg/l	0.494	<0.4	0.53	<2.4	0.777	0.88	1.38	<0.4
Iron	µg/l	<0.019	<0.019	<0.019	<0.114	0.0315	<0.019	<0.019	<0.019

Zinc	µg/l	2.75	1.64	1.64	<6	1.74	5.87	5.5	3.05
Organics Above Detection Limit									
Aliphatics >C21-C35	ug/l	<10	<50	<100	<100	<100	<10	<100	**424**
Aromatics >EC21-EC35	ug/l	<10	<50	<100	<100	<100	<10	<100	**2010**
Total Aliphatics & Aromatics >C5-35	ug/l	<10	<10	<10	<10	<10	<10	<10	2430
Total Aliphatics >C12-C35	ug/l	<10	<50	<100	<100	<100	<10	<100	**424**
Total Aromatics >EC12-EC35	ug/l	<10	<50	<100	<100	<100	<10	<100	**2010**
Naphthalene	ug/l	<0.01	<0.01	1.39	<0.1	<0.01	<0.1	0.0131	<0.1
PAH, Total Detected USEPA 16	ug/l	<0.082	<0.082	1.39	<0.82	<0.082	<0.82	<0.082	<0.82

Highlighted yellow: exceedances assessment criteria; SI No 366 of 2016 (GW Regs), SI No 122 of 2014 (EC Drinking Water Regs), EPA IGVs (in that order)

Bold: Exceeds laboratory limit of detection for organics where no assessment criteria exists

Table 7-10 Groundwater Quality (18th June 2024)

Parameter	Units	BH01	BH02	BH03	BH04	BH05	BH06	BH07	BH08
Inorganics									
Ammoniacal Nitrogen as N (low level)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH_3	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fluoride	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloride	mg/l	3.4	8.5	4.2	12.4	9.3	10.1	5.3	6.8
Conductivity	mS/cm	0.166	0.426	0.502	0.479	0.332	0.568	0.573	0.445
Nitrate as NO_3	mg/l	2.63	4.41	5.53	10.9	2.64	5.07	1.37	7.68
pH	pH Units	6.51	7.59	7.43	7.27	7.41	8	7.08	7.65
Phosphate (Ortho as PO4)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulphate	mg/l	<2	3.1	<2	4	3.4	6.7	5.3	3.7
Filtered (Dissolved) Metals									
Aluminium	µg/l	<10	<10	<10	<60	<10	<10	<10	<10
Arsenic	µg/l	<0.5	<0.5	<0.5	<3	<0.5	1.06	<0.5	<0.5
Cadmium	µg/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

Chromium	µg/l	<1	<1	<1	<6	<1	2.12	<1	<1
Copper	µg/l	3.23	0.55	0.566	2.25	3.15	3.2	1.95	0.378
Lead	mg/l	0.518	<0.2	<0.2	0.372	0.538	0.351	<0.2	<0.2
Magnesium	µg/l	1.27	2.96	2.48	3.41	1.94	2.9	8.99	2.86
Mercury	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	µg/l	0.494	<0.4	0.53	<2.4	0.777	0.88	1.38	<0.4
Iron	µg/l	<0.019	<0.019	<0.019	<0.114	0.0315	<0.019	<0.019	<0.019
Zinc	µg/l	2.75	1.64	1.64	<6	1.74	5.87	5.5	3.05

Exceedances assessment criteria; SI No 366 of 2016 (GW Regs), SI No 122 of 2014 (EC Drinking Water Regs), EPA IGVs (in that order)

No exceedances detected

Table 7-11 Groundwater Quality (9th July 2024)

Parameter	Units	BH01	BH02	BH03	BH04	BH05	BH06	BH07
Inorganics								
Ammoniacal Nitrogen as N (low level)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ammoniacal Nitrogen as NH_3	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fluoride	mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloride	mg/l	3.7	7.8	4.3	12.5	9.5	9.5	6
Conductivity	mS/cm	0.162	0.415	0.535	0.495	0.312	0.473	0.607
Nitrate as NO_3	mg/l	2.88	4.62	6.43	10.8	2.78	5.11	0.38
pH	pH Units	6.6	7.65	7.37	7.25	7.42	7.57	7.1
Phosphate (Ortho as PO4)	mg/l	<0.05	<0.05	<0.05	<0.05	0.051	<0.05	<0.05
Sulphate	mg/l	<2	<2	<2	3.1	2.2	3.7	6.4
Filtered (Dissolved) Metals								
Aluminium	µg/l	<10	18.3	<10	11.1	<10	287	<10
Arsenic	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	0.789	0.546
Cadmium	µg/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium	µg/l	<1	<1	<1	<1	<1	<1	<1

Copper	µg/l	2.77	0.455	2.18	1.28	4.25	16.5	13.4
Lead	mg/l	0.548	<0.2	0.452	<0.2	0.911	5.39	2.98
Magnesium	µg/l	1.32	2.62	2.44	3.14	1.83	4	8.7
Mercury	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	µg/l	0.952	<0.4	0.566	<0.4	0.768	3.33	3.79
Iron	µg/l	0.033	<0.019	<0.019	<0.019	<0.019	0.191	<0.019
Zinc	µg/l	20.4	10.1	7.93	25.1	17.3	142	32.5
Organics Above Detection Limit								
Aliphatics >C21-C35	ug/l	<100	<100	<50	<100	<10	<50	**2120**
Aromatics >EC21-EC35	ug/l	<10	<10	<10	<10	<10	<10	**109**
Total Aliphatics & Aromatics >C5-35	ug/l	<10	<10	<50	<100	<10	<50	2230
Total Aliphatics >C12-C35	ug/l	<100	<100	<50	<100	<10	<50	**2120**
Total Aromatics >EC12-EC35	ug/l	<100	<100	<50	<100	<10	<50	**109**
Acenaphthene	ug/l	<0.005	<0.005	**0.0159**	<0.01	<0.01	<0.005	**0.0786**
Naphthalene	ug/l	<0.01	<0.01	<0.01	<0.02	<0.02	<0.01	0.105

Highlighted yellow: exceedances assessment criteria; SI No 366 of 2016 (GW Regs), SI No 122 of 2014 (EC Drinking Water Regs), EPA IGVs (in that order)

Bold: Exceeds laboratory limit of detection for organics where no assessment criteria exists

Rising Head Tests

7.100 Rising head tests were carried out on 15th April 2024 at four locations, BH4, BH5, BH2 and BH3, and manual dips were taken. A longer test was taken at BH6, where recovery is slower, on 18th June 2024 using data loggers for measurement. The rising head test data is presented in **Appendix 7-E** and the calculation sheets are also presented.

7.101 The EPA defines high permeability subsoil as >1 x 10^{-4} m/s, moderate permeability subsoil as 1 x 10^{-4} to 1 x 10^{-8} m/s and low permeability subsoil as <1 x 10^{-8} m/s[2]. The results indicate that the Sand and Gravel, weathered Sandstone and Sandstone are moderate permeability, and the Clay and Cobbles strata are low permeability. The groundwater level at BH3 (Sand and Gravel) recovered almost immediately and so the permeability could not be estimated.

Table 7-12: Rising Head Test Results

Borehole	Strata	K (m/s)	K (m/d)	High / Moderate / Low Subsoil Permeability
BH4	Weathered Sandstone	2.47E-06	0.213	Moderate
BH5	Sandstone	7.72E-07	0.067	Moderate
BH2	Sand and Gravel	1.518E-06	0.131	Moderate
BH6	Clay and Cobbles	8.86E-09	0.00076	Low

Groundwater Supply Wells

7.102 Geological Survey Ireland (GSI) has an online database of wells and springs in Ireland. According to the GSI well database there are a number of wells within a 2 km radius of the site, these are shown on **Figure 7-7A**. The wells abstract from the locally important Lm bedrock aquifer. The distances below are taken from the centre of the locational accuracy radius.

7.103 The closest GSI recorded well are two domestic wells (GSI name 2019SEW014 and 2019SEW015), with the centre c. 300m east of the site, associated with the sand and gravel pit landowner's property. 2019SEW014 reports a depth of 21.3m with the depth to rock at 18.3m. The yield class is noted as poor (32.7 m³/day). 2019SEW015 reports a depth of 24.4m with the depth of rock at 18.3m. The yield class is also noted as poor (27.3 m³/day).

7.104 There are a number of other wells between 0.8km and 1km in the area that report similar depth and poor yields.

7.105 There is no Group Scheme Source Protection Areas near the site. The closest Group Water Scheme (GWS) is Clareen GWS c. 7 km west of the site. There is no public supply source protection area within the vicinity of the proposed sand and gravel extraction site, the closest is Knocks Public Water Supply (PWS) c. 10 km east of the site.

[2] EPA Water Framework Directive – Recharge and Groundwater Vulnerability Reference 2002-W-MS-16, dated 2008

Water Supply Well

7.106 As noted in Section 7.13, a water supply well will be required to provide water for the closed water recycling system for washing of sand and gravel aggregate and dust suppression. The water supply well will be located in the site facilities area and will abstract from the underlying sandstone bedrock locally important (Ll) aquifer.

7.107 Due to the closed loop water recycling system, the water requirement for top-up of the washing plant is considered to be minimal.

7.108 The Ll classification suggests that the bedrock aquifer is capable of supplying locally important abstraction of 100-400 m^3/d. Local shallow domestic boreholes suggest a yield of approximately 30m^3/d. The ongoing top-up requirement is expected to be easily accommodated by a water supply well abstracting from the sandstone aquifer.

7.109 The catchment area around a groundwater source, which contributes water to that source (ZoC), can be defined as a source protection zone (SPZ) when the Inner Protection Area (SI) and the Outer Protection Area (SO) are delineated. The SI is designed to protect the source against the effects of human activities that may have an immediate effect on the source, in particular in relation to microbiological pollution. It is defined by a 100-day time of travel (TOT) from any point below the water table to the source. The SO covers the remainder of the zone of contribution of the groundwater source. It is defined as the area needed to support an abstraction from long-term groundwater recharge.

7.110 The inner area of the water supply well can be estimated using the permeability estimates of the sandstone, which ranged from 0.213m/d to 0.067m/d. An inner area of between 21.3 – 6.7m is estimated for the water supply well.

Well Survey

7.111 A comprehensive domestic well survey was undertaken to supplement the available data and enhance the understanding of the regional hydrogeological regime in the context of the proposed water supply borehole. As detailed in Section 7.110, a 100-day time of travel around the proposed water supply borehole of 21.3m has been calculated. The location of the residential properties and 100-day time of travel radius is shown on **Figure 7-7B**.

7.112 The closest resident to the proposed water supply borehole is located 140m away, to the south at R1. The next closest residential location to the proposed water supply borehole is located 405m away, to the west at R10. As the residential location is located at distance from the estimated 100-day time of travel, minimal impact on any residential supply boreholes is anticipated.

7.113 A domestic well survey in the vicinity of the application site was carried out on 19th June 2024. The domestic well survey was carried out by SLR's project hydrogeologist, Mairéad Brown, and graduate hydrogeologist Michelle Sherry. The aerial photograph for the area surrounding the site indicates the presence of numerous one-off houses in the vicinity, particularly along the L1031 Killeen Road. Residence locations were numbered and properties within 500m of the proposed excavation area were surveyed.

7.114 A door-to-door survey was undertaken. Residential properties in the immediate vicinity of the site were surveyed, and the property locations are shown on **Figure 7-7B**. Where owners were not available for interview during the survey, a letter was left at the house.

7.115 The results of the survey are summarised in **Table 7-13** below. Interviews were carried out at residential properties 2/3, 8, 13, 11/12, 16 and 20. Monitoring boreholes were also identified and dipped.

7.116 Information from the residents indicates that most households have private wells, and in some instances a private well is shared between two household. The age of most of these wells is unknown.

7.117 A domestic supply borehole (Well 1) is present at R2/R3. The borehole is a pumped well and is used for both domestic and livestock use. The water level was measured at 12.20 m below ground level. The well was measured to be 17.87 m deep.

7.118 Well 2, a domestic supply borehole was dipped at residential property R8. The water level was 2.8 m below ground level. The well is used for domestic and livestock supply and is a pumped well.

7.119 A domestic supply borehole (Well 3) is present at R13. The borehole is a pumped well and is used for domestic use. The well was covered, and a water level measurement could not be obtained. The resident mentioned that the water had been tested a few years prior and the water quality was good.

7.120 Well 4, a domestic supply borehole was dipped at residential property R12. This is a pumped well and supplies R12, R11 and the farm. The water level was measured as 11.45 m below ground level and the well was measured to be 31 m deep.

7.121 Well 5, a domestic supply borehole was dipped at residential property R16. This is a pumped well and is used for domestic use. The water level was measured as 15.4 m below ground level and the well was measured to be 19.4 m deep.

7.122 A domestic supply borehole (Well 6) is present at R20. The borehole is a pumped well and is used for domestic use. The well was covered, and a water level measurement could not be obtained.

7.123 The closest identified domestic supply well to the proposed water supply well was Well 4 at R11, located 420m from the proposed water supply well location.

Table 7-13: Domestic Well Survey

Residence Ref	Well ID Number	Location	Property Type	Owner Interview / Letter	Outcome
R1		South of existing quarry, on minor access road	New	Letter	Assume private supply
R2 and R3	Well 1	Southeast of quarry on minor road	Established with farm	Interview	Both houses use same private well located in the garden of R2. Well is pumped and used for drinking water and livestock.
R4 and R14	Well 8	East – Southeast of quarry on minor road.	Established	Interview by phone	Both houses owned by same family. Private well located in a field between R4 and R14. Pumped well for domestic use. Resident noted that water pressure was low recently.
R5		South of quarry on L1031	Established	Letter	Assume private supply

Residence Ref	Well ID Number	Location	Property Type	Owner Interview / Letter	Outcome
R6		Southwest of quarry On minor access road off L1031	Appeared unoccupied	Letter	Pumphouse noted on site.
R7		Southwest of quarry on L1031	Established	Letter	Assume private supply
R8	Well 2	Southwest of quarry on L1031	Established with farm	Interview	Private well located in a field to the left of the property. Pumped well for domestic and livestock use.
R9		Southwest of quarry on L1031	Established	Letter	Assume private supply
R10		West of quarry on minor access road off L1031	Established	Letter	Assume private supply
R11 and R12	Well 4	Northeast of quarry on minor road	Established	Interview	Both houses use same private well located in the farmyard of R12. Well is pumped and used for drinking water and livestock.
R13	Well 3	East of quarry on minor road	Established	Interview	Private well located in the garden of R13 and to the left of the property. Pumped well for domestic use.
R15		Southeast of quarry on L1031 across the River Killeen	Appeared unoccupied	Letter	Assume private supply
R16	Well 5	Southeast of quarry on L1031 across the River Killeen	Established	Interview	Private well located in the garden of R16 and in front yard of the property. Pumped well for domestic use.
R17		Southeast of quarry on L1031 across the River Killeen	Established	Letter	Assume private supply
R19	Well 7	Southeast of quarry on L1031 across the River Killeen	Established	Interview by phone	Private well located in the garden of R19. Pumped well for domestic use.
R20	Well 6	Southeast of quarry on L1031 across the River Killeen	Established	Interview	Private well located in the garden of R20 and in the front garden of the property. Pumped well for domestic use.

Surface Water - Hydrology

Surface Water Bodies

7.124 Surface water bodies in the area are shown in **Figure 7-8**.

7.125 There is a small pond (c. 20m in diameter) located along the eastern site boundary, outside of the proposed extraction area which will be retained.

7.126 There is a small stream located along the southern boundary which is not shown on the EPA or GSI map viewer. This stream flows into the Killeen River from the southern boundary approx. 150m from the site.

7.127 There are two small streams located close to the proposed site, both of which flow into the Delour River.

- [DELOUR_10(IE_SE_15K010400) located northeast to the site; and
- DELOUR_30(IE_SE_15D010400) located southwest to the site.

7.128 The closest surface water body shown on the EPA online water maps is the Killeen River (IE_SE_15K010400), located 110 m (north east) from site entrance and 150 m (east).

Catchment

7.129 The site is located in the northern and upper part of the Nore Catchment (ID 15) which has an area of 2,585 km^2.

7.130 The catchment encompasses the region drained by the River Nore and all tributary streams eventually flow into tidal waters at Cheekpoint, County Waterford.

7.131 In terms of local catchments under the WFD, the site is situated in the Killeen (Delour) River Sub-Basin catchment, see **Figure 7-8**. The Killeen (Delour) River joins the River Nore c. 8km southeast of the site.

Flooding

7.132 The Office of Public Works (OPW) is the government agency with statutory responsibility for flooding in Ireland. The existing CFRAM and NIFM flood maps show that the site is at low risk of fluvial flooding (Flood Zone C). The available GSI data does not indicate that the site is vulnerable to groundwater flooding. Due to the location of the proposed sand and gravel pit, the risk of coastal flooding is also low (Flood Zone C). There are no records of historic flooding in the OPW database within 2 km of the site.

Surface Water Sampling

7.133 Surface water sampling was undertaken at three locations surrounding the site on a quarterly basis. The field record sheets are included in **Appendix 7-D**.

7.134 Two of these sampling locations are situated on the Killeen River. SW1 is located upstream of the site and SW2 is located downstream of the site. The third sampling location is located on the stream at the southern boundary which flows into the Killeen River c. 150m to the east of the site (SW3). SW2 is located near the EPA monitoring station on the Killeen River, Cardtown Br (NE of Cappanarrow). This station has been monitored since 1987.

7.135 These sample points are safe, with ease of access. These are grab sampling points only and a telescopic grab sampler was used to collect samples.

7.136 The samples were collected in the appropriate sample containers, which are supplied by the laboratory for the required analysis. Sample containers were filled so that there was minimum

free air space. The containers were securely sealed so that there was no loss of volatile components such as moisture and no separation of components. All sample containers were clearly and uniquely labelled with details including ID and sampling date.

7.137 All samples were placed into a cooler box with ice packs to maintain a temperature at 5°C ± 3°C. The analysis required for each sample was listed on the Chain of Custody Record which accompanied samples. The samples were analysed at ALS laboratories.

7.138 The following parameters are tested for:

- Metals: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc.
- Inorganics: Alkalinity, Ammoniacal Nitrogen as N, Biological Oxygen Demand (BOD), Chloride, Conductivity, Nitrates, Nitrites, Orthophosphate, pH, Sulphate, Total Suspended Solids.
- Speciated Total Petroleum Hydrocarbons (TPH).
- Volatile Organic Compounds (VOCs,

7.139 Tree felling is occurring at and upstream of SW1. It was also noted during the June monitoring round that livestock had access to the stream on the southern boundary where SW3 is taken from, see **Plate 7-6** below.

Surface Water Quality

7.140 Surface water quality monitoring was carried out on 24th April 2024, 19th June 2024 and 10th July 2024. The results were compared against EQS for Inland Surface Water SI No. 272 of 2009 and SI No. 77 of 2019. The laboratory results are presented in **Appendix 7-F** and the screened results are presented in **Table 7-14** below.

7.141 During surface water sampling in the June monitoring round, livestock were observed to be entering the stream at SW3 for drinking water and waste from the livestock was observed adjacent to the stream (see **Plate 7-6** below).

7.142 There were no exceedances of the EQS assessment criteria. All hydrocarbons and volatiles were reported at less than detection limit. However, there is a notable increase in Ammoniacal Nitrogen as N concentrations at SW2, with the concentration exceeding the limit for High Status for Ammonia as N.

7.143 During the June monitoring round, no exceedances were detected. However, the Limit of Detection (LOD) of Ammoniacal Nitrogen as N concentrations in all three surface waterbodies exceeded the EQS assessment criteria for High Status at a concentration of <0.2 mg/l.

7.144 During the July monitoring period, no exceedances were detected.

Plate 7-6: Livestock at SW3

Table 7-14: Surface Water Quality

Parameter	EQS Inland Surface Waters (MACs)	Units	SW1	SW2	SW3	SW1	SW2	SW3	SW1	SW2	SW3
			24th April 2024			**18th June 2024**			**10th July 2024**		
Inorganics											
Alkalinity, as $CaCO_3$	Soft water (<100mg/l CaCO3): 4.5-9.0. Hard water (>100mg/l CaCO3): 6.0-9.0	mg/l	48.5	57.9	170	59.8	67.3	172	12.4	14.3	172
Ammoniacal Nitrogen as N	High status ≤0.040 (mean) or ≤0.090(95%ile). Good status ≤0.065 (mean) or ≤0.140 (95%ile) *	mg/l	0.012	**0.052**	0.026	<0.2	<0.2	<0.2	0.02	0.017	0.013
BOD	High Status ≤0.04 (mean) or ≤ 0.09 (95%). Good status ≤0.065 (mean) or ≤0.140 (95%)	mg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride		mg/l	7.4	7.9	8.8	7.2	7.6	8.7	<10	<10	8.7
Conductivity @ 20 deg.C		mS/cm	0.123	0.141	0.342	0.136	0.151	0.336	0.0458	0.05	0.331
Nitrate as NO3		mg/l	1.95	2.51	6.33	1.64	1.44	6.81	<1.5	<1.5	6.46
Nitrite as NO2		mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.25	<0.25	<0.05
pH		pH Units	7.75	7.9	8.21	7.78	7.91	8.31	6.71	6.88	8.23
Phosphate (Ortho as PO4)		mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.1	<0.05
Sulphate		mg/l	<2	2	3.7	<2	2	4.6	<10	<10	3.7

Suspended solids		mg/l	<2	<2	<2	<2	<2	<2	8.2	10.6	<2
Filtered (Dissolved) Metals											
Arsenic		µg/l	<0.5	<5	<0.5	<0.5	<0.5	<0.5	0.527	<0.5	<0.5
Cadmium	≤0.45 -1.5, Class 3 (0.6)	µg/l	<0.08	<0.8	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium		µg/l	<1	<10	<1	<1	<1	<1	<1	<1	<1
Copper		µg/l	<0.3	<3	<0.3	<0.3	<0.3	<0.3	0.753	0.628	0.474
Lead		µg/l	<0.2	<2	<0.2	<0.2	<0.2	<0.2	0.428	0.36	<0.2
Mercury		µg/l	<0.01	<0.01	<0.01	0.0248	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel		µg/l	<0.4	<4	<0.4	<0.4	<0.4	<0.4	0.623	0.634	0.467
Selenium		µg/l	<1	<10	<1	<1	<1	<1	<1	<1	<1
Zinc		µg/l	1.37	<10	1.86	1.28	<1	1.6	5.04	3.42	2.27

*Ammonia as N

*Exceedances in **bold**

Surface Water Biological Quality in the Killeen (Delour)_010 River: Q Values

7.145 The surface water quality data of surface water bodies within the study area, was obtained from EPA web map. The EPA has a registered surface water monitoring stations through Ireland, which are continuously recording near real time river ecology monitoring results. The results are presented through "Q" values, that are reflecting average water quality at any location. These values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates (the young stages of insects primarily but also snails, worms, shrimps etc.) resident at a river site. Results scores are in range from 1 to 5, from the lowest (1) to the highest (5) water quality rating.

7.146 The closest monitoring station encountered is Cardtown Br (NE of Cappanarrow), located southeast of the application site on the Killeen River, and is located at the same point as the SW2 monitoring location. The monitoring station is located downstream of SW3, where livestock were observed to be entering the stream.

7.147 The latest water quality reports a 4 Q value, meaning that the river is good and in satisfactory condition. The Killeen River has declined in status from 4-5 to 4 since 2013.

7.148 **Table 7-15** summarises the monitoring station data.

Table 7-15: EPA Biological Water Quality Ratings

Station ID	Station Name	Water-course	Distance	1987	1991	1995	1998	2001	2005	2007	2011	2013	2016	2019	2022
RS15K010200	Cardtown Br NE of Cappanarrow	Killeen (Delour)_010	c. 200 m east	5	5	4-5	4-5	4-5	4-5	4	4-5	4-5	4	4	4

Surface Water Flow

7.149 Surface water flow measurements have been carried out at the three surface water monitoring locations, SW1 – SW3. The results are presented in **Table 7-16.** The flow measurements have been conducted with a flow meter on three separate events. The flow meter measures the flow velocity of a watercourse, from which the flow rate can be calculated.

7.150 The results show that the flow is increasing moving downstream of the catchment. This is because the bigger area of the catchment is contributing to the flow. The flow rates in the Killeen River ranges from 0.037 - 0.057 m^3/s at SW1 located upstream of the site to 0.136 - 0.223 m^3/s at SW2 located downstream.

7.151 Flow in the stream on the southern boundary of the site, which flows into the Killeen River, was measured at 0.024 – 0.139m^3/s.

Table 7-16: Surface Water Flow Measurements

Location	Date	Flow (m^3/s)
SW1	20-May	0.037
SW2		0.136
SW3		0.024
SW1	19-Jun	0.057
SW2		0.223
SW3		0.037
SW1	10-Jul	NA*
SW2		1.149
SW3		0.139

'* too deep to use flowmeter

Water Framework Directive

7.152 A Water Framework Directive (WFD) Assessment report has been to support the Planning Application and EIAR for the proposed development. In summary, the report includes three stages, a screening stage, a scoping stage and an assessment stage.

7.153 The WFD assessment includes information from the EIAR for the planning application, which includes a Geophysical survey, a borehole ground investigation and groundwater monitoring. In addition, a baseline aquatic survey has been undertaken. An Appropriate Assessment Screening and Natura Impact Assessment Report has also been prepared for the proposed development.

7.154 The groundwater investigation undertaken at the site indicates a shallow layer of groundwater in the sand and gravel material underlain by a lower permeability clay layer and which sits above the bedrock aquifer.

7.155 A zone of influence was taken to be a 15 km radius from the site boundary. The assessment identified seven potential receptors: the Killeen River, the Delour River, the unnamed stream which is a tributary of the Killeen River, the Camross Groundwater body, the Barrow & Nore Special Area of Conservation, the Nore Special protection area and the Nore Salmonid waters.

7.156 In terms of hydrological links between the proposed development and the identified WFD receptors it is considered that:

i. there is no direct hydrological pathway between the proposed development and the adjacent surface water courses as there will be no abstraction of surface water or discharge to surface watercourses;

ii. there is no direct hydrological pathway between the proposed extraction and the bedrock aquifer as the sand and gravel is underlain by a low permeability clay layer;

iii. There is an indirect hydrological pathway via the shallow groundwater in the sand and gravel which discharges as groundwater to adjoining surface water courses; and

iv. there is a direct hydrological pathway between the proposed development and the River Barrow & River Nore SAC, the Nore SPA and the Nore Salmonid waters via the shallow groundwater in the sands and gravels and the adjacent surface water courses.

7.157 Mitigation measures will be embedded within the proposed development to protect surface water and groundwater and the identified WFD receptors. The measures for the proposed development will be secured via any future planning permission and associated conditions relating to an approval.

7.158 It is considered here, that based on the nature of the proposed development and with the designed embedded mitigation measures on place there will be no deterioration in the status of the identified WFD receptors.

7.159 The proposed development will result in the removal of livestock from the lands at the site. This will eliminate cattle poaching of the stream banks of the unnamed stream along the southern boundary of the site. This measure will result in a reduction in eutrophication and siltation pressures on the stream and will be a positive contribution to the RBMP objectives.

7.160 Based on the findings from the WFD screening, scoping and assessment, it is considered that the proposed development, with the embedded mitigation measures in place, will not result in a deterioration of the existing status of the identified WFD receptors and it will not be a factor in the receptors failing to achieve their status objectives.

Protected Areas

7.161 There are three Natura 2000 sites (SAC or SPA) within 5km of the site.

- Slieve Bloom Mountains SPA (004160), located directly north of the site;
- Slieve Bloom Mountains SAC (000412), located 1.5 km north;
- River Barrow & River Nore SAC 000412 located 2.4 km east.

Water Environment Receptors

7.162 From the baseline study undertaken here, the following water environment sensitive receptors have been identified in the receiving environment:

- The Killeen River, located c. 110m[3] northeast of the site;
- Downstream Delour River, confluence with Killeen River located c. 3km southeast of the site;
- Locally important sandstone bedrock aquifer (within the Camross GWB), separated from overlying sand and gravel superficial deposits by low permeability silt and clay;
- Private groundwater supply wells; and
- River Barrow & River Nore SAC 000412 located 2.4 km east;

[3] Distance measured at its closest point

7.163 For each identified receptor, the significance and sensitivity of the receptor is assessed in **Table 7-17** below and a rating (High / Medium / Low / Negligible) applied, based on the methodology outlined in existing guidance and reproduced in **Appendix G**.

Table 7-17: Existing Environment - Significance and Sensitivity / Importance

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance / Sensitivity Rating (H/M/L/N)
1	Killeen River	Surface watercourse c. 110m northeast of the site. Site is within Killeen catchment.	A small stream located along the southern boundary flows into the Killeen River approx. 150m from the site. River is assumed to be in hydraulic continuity with the site through groundwater. Killeen River is classified as "At Risk" (WFD Third Cycle May 2024). Killeen River is classified as "Good" quality but has declined in status from 4-5 to 4 since 2013	**Medium** – Attribute has a medium quality or value on a local scale
2	Delour River	Downstream surface watercourse, confluence with Killeen River located c. 3km southeast. The Delour River flows into the Nore River.	Downstream river. Delour River 030 is classified as "At Risk" (WFD Third Cycle May 2024)	**Medium** – Attribute has a medium quality or value on a local scale
3	Locally important Sandstone bedrock aquifer	Sandstone bedrock aquifer is within the Camross GWB which has a good status (2016 - 2021). **Note** that the overall Camross GWB is classified as a poorly productive aquifer.	Bedrock aquifer underlying sand and gravel superficial deposits and separated by low permeability silt and clay. Sand and gravel deposits are not classified as an aquifer.	**Medium** – Attribute has a medium quality or value on a local scale (Locally Important Aquifer)
4	Private Groundwater Supplies	All local residents are assumed to have a private water supply and a well survey has been undertaken, with six residential locations within 250m of the site.	The private wells will supply <50 homes and may be sensitive to changes at the local scale.	**Low** - Attribute has a low quality or value on a local scale (potable water source supplying <50 homes)

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance / Sensitivity Rating (H/M/L/N)
5	River Barrow & River Nore SAC 000412	The River Barrow & River Nore is located 2.4 km east. The SAC is downstream of the Killeen River, and located just past the confluence with the Delour River c. 3km southeast.	Downstream SAC. The SAC is located within the Delour 030 subbasin and is classified as "At Risk" (see above).	**High -** Attribute has a high quality or value on an international scale (SAC status)

Receiving Environment - Baseline Summary

7.164 The site is underlain by sandstone bedrock of the Cadamstown Formation and by sand and gravel subsoils which are glacial tills chiefly derived from Devonian sandstone and glaciofluvial sands and gravels chiefly derived from Devonian sandstone.

7.165 The bedrock aquifer underlying sand and gravel superficial deposits is protected by low permeability silt and clay. The sand and gravel deposits proposed for extraction are not classified as an aquifer.

7.166 The site is within the Water Framework Directive (WFD) Nore Catchment and in the Killeen (Delour) River Sub-Basin catchment Boyne Sub-Catchment.

7.167 The closest surface water body to the site comprises a stream at the southern border of the site, this stream flows east into the Killeen River approx. 150m from the site.

7.168 Under the WFD classification, the Killeen River is 'At Risk' status due to sediment and oxygenation caused by a number of significant pressures such as nearby agricultural activity, forestry and domestic wastewater.

7.169 There are no recorded flood events at or near the site, nor is there any risk of potential flooding.

7.170 The site is located within the Camross Groundwater Body (GWB). This aquifer which underlies the site is protected by a low permeability layer of silt and clay. The rock units contained within this groundwater body area considered to be poor or locally important aquifers. This GWBs is classified as being good status under the WFD classification.

7.171 The groundwater vulnerability at the site is classed as high to moderate.

7.172 Nine groundwater monitoring boreholes (BH01 - BH09) have been installed on-site. To date, the maximum manual groundwater level monitored at the wells is 207.60m AOD (0.92m bgl) at BH07. The minimum level recorded is at 174.23m AOD (6.6m bgl) at BH03.

7.173 The sand and gravel extension area pit floor levels will be maintained above the high groundwater level.

7.174 A well survey has been carried out as there are a number of wells within the vicinity of the site, which are mostly private wells. The closest identified private residential well is 420m away from the proposed water supply borehole. The closest residential property to the proposed water supply borehole is located 140m away. As the residential location is located

at distance from the estimated 100-day time of travel, a minimal impact on any residential supply boreholes is anticipated.

Impact Assessment

Evaluation Methodology

7.175 The potential direct and indirect impacts to surface water and groundwater associated with the proposed sand and gravel pit continued use and extension at Mounthall are initially assessed in this chapter without any mitigation measures in place.

7.176 The methodology applied here is a qualitative risk assessment methodology in which the nature of the potential impacts are described in terms of the character, magnitude, duration, probability and consequence of the impact are considered. The terms used to describe the potential hydrological and hydrogeological impact or effects are explained in tables reproduced in . The cumulative impact of any potential impacts is also assessed.

7.177 The description of the potential impact is then screened against the significance and sensitivity of the receiving environment to establish the overall significance of the potential impact (without mitigation). The classification of the impact significance is determined using the matrix from the EPA Guidelines (2022) which is reproduced in **Appendix I**.

7.178 This approach provides a mechanism for identifying the key areas where mitigation measures are required, and for identifying mitigation measures appropriate to the risk presented by the proposed development. Following consideration of mitigation measures (existing and proposed) an assessment of the residual impacts arising from the proposed development is provided.

7.179 The following sections identify the potential impacts of the proposed development on the hydrogeological and hydrological environments. It also assesses the likelihood of occurrence of each identified impact. As previously noted, the impacts are initially assessed with no mitigation or design measures incorporated to reduce the risk.

7.180 The potential direct and indirect impacts to surface waters and groundwater during the Construction Stage (site preparation), the Operation Stage (extraction and processing) and Post Operational Stage (site restoration) are discussed below.

Construction Stage (No Mitigation)

7.181 The potential direct and indirect construction stage impacts to surface waters and groundwater are discussed below. In the context of the proposed sand and gravel pit continued use and extension, the construction stage is taken to comprise the stripping stage where in-situ soils and subsoils are removed and stockpiled before extraction activities can commence, as well as some limited activity setting up required site infrastructure.

Direct Impacts

Surface Water

7.182 There is no discharge from the proposed sand and gravel pit site to the stream on the southern boundary or the Killeen River and therefore there are no direct negative impacts on surface water quality or quantity during this stage.

7.183 The construction stage of the development of the sand and gravel pit will result in livestock being removed from the site. Currently, livestock are entering the stream on the southern boundary of the proposed development area and causing a direct contact with livestock waste. The stream flows directly into Killeen River which has declining status and has

recently been classified as “at risk” due to “significant pressures such as nearby agricultural activity”.

Groundwater

7.184 The stripping and storage of topsoil and subsoils, where present, could result in sediment run-off in recharge to the shallow groundwater in the sand and gravel superficial deposits, which could migrate into the underlying bedrock aquifer. Accidental leaking or spillage of fuel and/or other petroleum-based products could also impact on groundwater in the bedrock aquifer. However, the bedrock aquifer is separated from the shallow groundwater in the superficial deposits by low permeability silt and clay which protects the underlying bedrock aquifer.

7.185 Extraction will comprise dry working above the groundwater level in the superficial deposits, therefore there will be no dewatering associated with the proposed development and therefore there will be no impact on groundwater flows or quantities during this stage.

Indirect Impacts

Surface Water

7.186 The stripping and storage of topsoil and subsoils, where present, could result in sediment being carried in recharge impacting the underlying shallow groundwater and locally important bedrock aquifer which, in turn, could potentially impact the Killeen River which is in hydraulic connection with it. Accidental leaking or spillage of fuel and/or other petroleum-based products could also impact on the Killeen River. It is noted the bedrock aquifer is separated from the shallow groundwater in the superficial deposits by low permeability silt and clay.

7.187 Any impact on the Killeen River could impact the downstream surface water bodies, i.e. the Delour River, at distance from the site.

Groundwater

7.188 Any impact from the stripping and storage of topsoil and subsoils, where present, could result in sediment being carried in recharge to the shallow groundwater, which could migrate into the underlying bedrock aquifer and this in turn could indirectly impact the local water supplies in the area. Accidental leaking or spillage of fuel and/or other petroleum-based products could also indirectly impact on local water supplies. However, the bedrock aquifer is separated from the shallow groundwater in the superficial deposits by low permeability silt and clay.

Protected Areas

7.189 The River Barrow & River Nore SAC is located downstream of the Killeen River, and is located just past the confluence with the Delour River c. 3km downstream to the southeast. Any indirect impact on Killeen River could impact on the River Barrow & River Nore SAC, located at distance downstream.

Operational Stage Impacts

7.190 There is the potential for direct impacts on groundwater and indirect impacts on surface water and groundwater arising from the proposed sand and gravel pit extension during the operational stage. Potential impacts on surface water and groundwater have been identified and are outlined below.

Direct Impacts

Surface Water

7.191 There will be no discharge from the proposed sand and gravel pit extension to the Killeen River and there will therefore be no direct impacts on surface water quality or quantity during the construction stage.

7.192 The development of the sand and gravel pit will result in livestock being removed from the site. Currently, livestock are entering the stream on the southern boundary of the proposed development area and causing a direct contact with livestock waste. The stream flows directly into Killeen River which has declining status and has recently been classified as “at risk” due to “significant pressures such as nearby agricultural activity”.

Groundwater

7.193 There is a potential impact on groundwater quality from elevated levels of suspended solids generated during the excavation and transfer of sand and gravel materials. This could result in sediment being carried in recharge to shallow groundwater in superficial deposits, which could migrate into the underlying bedrock aquifer and this in turn could indirectly impact the local water supplies in the area. The bedrock aquifer is separated from the shallow groundwater in the superficial deposits by low permeability silt and clay. Accidental leaking or spillage of fuel and/or other petroleum-based products could also impact on groundwater in the bedrock aquifer.

7.194 The proposed sand and gravel pit will be worked at all times above the shallow groundwater in the sand and gravel deposits, meaning there will be no requirement for dewatering of shallow groundwater to facilitate aggregate extraction. As there is no dewatering associated with the proposed development, there will be no impact on shallow groundwater flow or quantity.

7.195 There will be a limited impact on groundwater in the bedrock beneath the site from the proposed water supply borehole. The required volumes are low, and so there will be a localised impact only on the groundwater flow and quantity in the bedrock aquifer. A 100-day time of travel around the proposed water supply borehole of 21m has been estimated.

Indirect Impacts

Surface Water

7.196 There is a potential impact from elevated suspended solids generated during the excavation during the sand and gravel pit extension. This could result in sediment carried in recharge impacting the underlying locally important bedrock aquifer which, in turn, could impact on Killeen River in hydraulic connection with it. The bedrock aquifer is separated from the shallow groundwater in the superficial deposits by low permeability silt and clay. Accidental leaking or spillage of fuel and/or other petroleum-based products could also impact on the Killeen River.

Groundwater

7.197 Any impact from elevated suspended solids generated during the removal of materials, resulting in sediment carried in recharge to shallow groundwater, which could migrate into the underlying bedrock aquifer and this in turn could indirectly impact the local water supplies in the area. The bedrock aquifer is separated from the shallow groundwater in the superficial deposits by low permeability silt and clay. Accidental leaking or spillage of fuel and/or other petroleum-based products could also impact on groundwater in the bedrock aquifer.

7.198 The localised impact on groundwater flow and quantity in the bedrock aquifer could indirectly impact the local well supplies in the area. A 100-day time of travel around the proposed water supply borehole of 21m has been calculated, and is at distance from residential locations.

Protected Areas

7.199 The River Barrow & River Nore SAC is located downstream of the Killeen River, and is located just past the confluence with the Delour River c. 3km downstream to the southeast. Any indirect impact on the Killeen River could impact on the River Barrow & River Nore SAC, located at distance downstream.

Post – Operational Stage Impacts

Direct Impacts

7.200 A restoration scheme has been prepared for the proposed site and will be implemented following permanent cessation of extraction activities, refer to Chapter 2 of the EIAR for details.

7.201 There are no anticipated direct impacts from the post – operational stage.

Indirect Impacts

7.202 There are no anticipated indirect impacts from the post – operational stage.

'Do-nothing Scenario'

7.203 If the proposed development is not permitted, the existing sand & gravel pit will remain and the proposed extension area will remain in agricultural use. The natural aggregate resource will remain in the ground and alternative pit development will be required at other locations.

7.204 The status of the Killeen River is in decline, and in May 2024 was classified as 'At Risk' due to sediment and oxygenation caused by a number of significant pressures such as nearby agricultural activity, forestry and domestic wastewater.

7.205 The proposed development will remove the direct impact of livestock on the stream over the duration of the project. If the development does not proceed, there will be no surface water monitoring programme implemented to assess the water quality of the stream which flows into the Killeen River and no groundwater monitoring programme to assess groundwater quality.

Rating of Identified Potential Impacts

7.206 The potential impacts outlined above during the construction and operational stages have been described in terms of the character, magnitude, duration, probability and consequence, and each impact is rated in terms of High (H), Medium (M), Low (L) and Negligible (N) based on the magnitude, extent, duration and consequence of the identified effects.

7.207 The description of the effects and rating for each identified impact is shown in **Table 7-18** below.

Significance of Impacts

7.208 The significance of impacts is based on the significance and sensitivity of the existing environment (**Table 7-17** above), and the description of identified potential impacts with likely significant effects outlined in **Table 7-18** below. The significance of Impact is determined from the Classification of the Significance of Impacts in **Appendix 7-I**.

Table 7-18: Classification of Significance of Impacts (**No Mitigation**)

No.	Potential Impacts	Impact Rating (No Mitigation)	Significance of Impact (No Mitigation)
Construction Stage – Direct – Surface Water			
1	Improvement in surface water quality due to removal of livestock from site.	**Low.** Potential to improve surface quality in stream by removing livestock entering stream and causing a direct contact with livestock waste. Stream flows directly into Killeen River which has declining status and has recently been classified as "at risk" due to "significant pressures such as nearby agricultural activity".	**Slight Positive**
Construction Stage – Direct - Groundwater			
2	Reduction in groundwater quality in bedrock aquifer from increase in suspended solids in shallow groundwater, which could migrate into the underlying bedrock aquifer	**Low** to **Negligible.** Potential to affect groundwater quality in bedrock underlying shallow groundwater through vertical migration. Migration limited by low permeability deposits between bedrock and sand and gravel deposits. Any impact to groundwater will be limited due to short term nature of works.	**Slight**
3	Reduction in groundwater quality in bedrock aquifer from accidental fuel leakage/ spillage, which could migrate into the underlying bedrock aquifer	**Low** to **Negligible.** Potential to affect groundwater quality in bedrock underlying shallow groundwater through vertical migration. Migration limited by low permeability deposits between bedrock and sand and gravel deposits. Any impact to groundwater will be limited due to short term nature of works. Any leakage / spillage would be accidental only and of limited volume.	**Slight**
Construction Stage – Indirect – Surface Water			
4	Impact on surface water quality in the Killeen River and downstream Delour River and SAC via groundwater baseflow to the watercourse	**Low** to **Negligible.** Potential to affect surface water quality (fuel / suspended solids) in the Killeen River, through groundwater baseflow to the watercourse. Impact is unlikely on the Killeen River due to short term nature of works. Any leakage / spillage would be accidental only and of limited volume. An impact on the Delour River and SAC located downstream is unlikely.	**Slight - Not Significant**

Construction Stage – Indirect – Groundwater			
5	Impact on groundwater quality in bedrock aquifer could indirectly impact the local water supplies in the area.	**Low** to **Negligible.** Potential to affect groundwater quality in bedrock aquifer (fuel / suspended solids) which could migrate to local water supplies. Migration limited by low permeability deposits between bedrock and sand and gravel deposits. Any impact on groundwater in the bedrock aquifer will be limited due to short term nature of works. Any leakage / spillage would be accidental only and of limited volume.	**Slight - Not Significant**
Operational Stage *– Direct – Surface Water*			
6	Improvement in surface water quality due to removal of livestock from site.	**Medium** to **Low.** Potential to improve surface quality in stream over medium term by removing livestock entering stream and causing a direct contact with livestock waste. Stream flows directly into Killeen River which has declining status and has recently been classified as “at risk” due to “significant pressures such as nearby agricultural activity”.	**Moderate Positive-Slight Positive**
Operational Stage *– Direct – Groundwater*			
7	Reduction in groundwater quality in bedrock aquifer from increase in suspended solids in shallow groundwater, which could migrate into the underlying bedrock aquifer	**Low** to **Negligible.** Potential to affect groundwater quality in bedrock underlying shallow groundwater through vertical migration. Migration limited by low permeability deposits between bedrock and sand and gravel deposits. Any impact to groundwater will be limited due to short term nature of works.	**Slight - Not Significant**
8	Reduction in groundwater quality in bedrock aquifer from accidental fuel leakage/ spillage, which could migrate into the underlying bedrock aquifer	**Low** to **Negligible.** Potential to affect groundwater quality in bedrock underlying shallow groundwater through vertical migration. Migration limited by low permeability deposits between bedrock and sand and gravel deposits. Any impact to groundwater will be limited due to short term nature of works. Any leakage / spillage would be accidental only and of limited volume.	**Slight - Not Significant**
9	Impact on groundwater flow and quantity in bedrock aquifer from proposed water supply borehole	**Low** to **Negligible.** Potential to impact on groundwater in the bedrock beneath the site from the proposed water supply borehole. The required volumes are low, and so there will be a localised impact on the groundwater flow and quantity in the bedrock aquifer only. The nearest residential location is at distance from the estimated 100-day travel time for the water supply borehole.	**Slight - Not Significant**

Operational Stage *– Indirect – Surface Water*			
10	Impact on surface water quality in the Killeen River and downstream Delour River and SAC via groundwater baseflow to the watercourse	**Low.** Potential to affect surface water quality (fuel / suspended solids) in the Killeen River, downstream Delour River and SAC through groundwater baseflow to the watercourse. Any leakage / spillage would be accidental only and of limited volume.	**Slight**
Operational Stage *– Indirect - Groundwater*			
11	Impact on groundwater quality in bedrock aquifer could indirectly impact the local water supplies in the area.	**Low** to **Negligible.** Potential to affect groundwater quality in bedrock aquifer (fuel / suspended solids) which could migrate to local water supplies. Migration limited by low permeability deposits between bedrock and sand and gravel deposits. Any impact on groundwater in the bedrock aquifer will be limited due to short term nature of works. Any leakage / spillage would be accidental only and of limited volume.	**Slight - Not Significant**
12	Impact on groundwater flow and quantity in bedrock aquifer from proposed water supply borehole could indirectly impact on the local water supplies in the area.	**Low - Negligible.** Potential to impact on groundwater in the bedrock beneath the site from the proposed water supply borehole. The required volumes are low, and so there will be a localised impact on the groundwater flow and quantity in the bedrock aquifer only.	**Slight - Not Significant**

Mitigation Measures

Construction & Operational Stages

7.209 The sand and gravel pit will establish an environmental management system (EMS).

7.210 Environmental water monitoring will be carried out on a regular basis to demonstrate that the sand and gravel pit is not having any significant adverse effects on the surrounding environment.

7.211 In order to mitigate against the risk of pollution to groundwater and surface water occurring at the site the following management measures will be implemented.

- Rain falling across hardstanding areas will percolate downwards and recharge to the underlying sand and gravel. There will be little or no surface water run-off or overground flow across the site;
- There will be no off-site discharge from the proposed development to any surface watercourse in the locality;
- Outside of impermeable surface areas at the site, all surface water percolates naturally to the ground;
- No re-fuelling (or servicing) of excavation plant will occur at extraction areas. Refuelling will take place adjacent to the bunded fuel storage area on a concrete pad with associated hydrocarbon interceptor attached;
- Fuel and oils will be stored in bunded fuel tanks, which will be covered and enclosed to prevent the build-up of potentially contaminated water within the bund arising from rainfall. A build-up of rainwater in the bund could also reduce the holding capacity of the bund. The bund capacity will be in excess of 110% of the combined volume of the tank(s);
- Final floor levels at the proposed pit excavations will be maintained above the underlying (seasonal maximum) groundwater level and any rain falling across the pit will percolate naturally through unsaturated ground to the underlying shallow groundwater in the superficial deposits;
- A number of spill kits will be available on-site to stop the migration of any minor accidental leakages or spillages should they arise;
- The incidence of fugitive dust outside of the operation will be reduced by the proposal to locate mobile crushing and screening plant within the pit void;
- In order to control dust emissions, water will be sprayed from a tractor drawn bowser on dry exposed surfaces and stockpiles (paved roads, unsealed haul roads and hardstand areas) as required;
- Areas of bare or exposed soils will, insofar as practicable, be kept to a minimum during the extraction operations;
- All HGVs exiting the site will be routed through the proposed wheelwash. This will minimise the transport of fines by HGVs over the access / egress road and the public road network;
- Periodic sweeping of the internal paved site access road and surrounding public roads will be carried out as required by a mechanical road sweeper, and;

- Breedon Ireland environmental team undertake quarterly environmental audits at the site to ensure that compliance with all planning consents, licences and site environmental management system, which is accredited to ISO 14 001 standard, is both maintained and enhanced.

7.212 The water requirement at the site is minimal, and will be reduced further through monitoring water use and by promoting recycling and water efficient practices.

7.213 Implementation of these measures at the application site will further reduce the potential impacts identified above to neutral.

Post – Operational Stage

7.214 As noted previously, the principal activity which will be undertaken at the application site is the extraction and processing of the in-situ sand and gravel with ultimate restoration of lands returned to an agricultural after-use and for the most part will merge back into the surrounding pastoral landscape.

7.215 The final phase of the restoration will start when all the accessible sand and gravel deposits have been exhausted. All plant associated solely with extraction and processing activities will be removed from site. The remaining pit slopes and material used in the construction of the silt lagoon and screening berms will also be regraded and the general area returned to a beneficial agricultural use over the pit floor.

7.216 A layer of overburden/silt material will be spread over the worked out pit floor as a sub-base in the progressive restoration area. On completion of the extraction works the sand and gravel pit will be restored to an agricultural use.

Assessment of Impacts with Mitigation Measures in Place

7.217 With the above mitigation measures in place at the application site, it is projected that the following reduction in the assessed significance of impacts will result:

- Reduction of the potential impact on groundwater quality in the bedrock aquifer from suspended solids during the construction stage from “slight” to “slight – not significant” (No. 2).
- Reduction of the potential impact on groundwater quality in the bedrock aquifer from accidental fuel leakage/ spillage during the construction stage from “slight” to “slight – not significant” (No. 3).
- Reduction of the potential impact on surface water quality in the Killeen River and downstream Delour River and SAC via groundwater baseflow to the Killeen River during the operational stage from “slight” to “slight – not significant” (No. 10).
- The significance of all other potential impacts during the construction and operational stage will be “slight - negligible” or lower to the water environment receptors.
- The potential positive impact of removing livestock from the stream will be “slight positive” to the Killeen River.

Residual Impact Assessment

7.218 Following the implementation of mitigation measures, a residual impact assessment has been undertaken. An assessment of the impacts with mitigation measures in place is presented in **Table 7-19** and **Table 7-20** above, and the residual impact for all potential impacts is assessed as “**neutral**”.

7.219 Examination of the identified potential impacts on the receiving environment show that with the mitigation measures in place, there are no significant residual impacts with respect to groundwater and surface water during the construction / operational / post operational stages of the proposed sand and gravel pit development.

7.220 Following mitigation, the significance of all potential negative impacts identified will be reduced to "**slight**" or lower.

7.221 The potential positive impact of removing livestock from the stream will be "**slight positive**" to the Killeen River.

Monitoring

7.222 Development of the sand and gravel pit presents an opportunity to improve surface water quality in a sub catchment where the surface water quality has been decreasing in recent years. The proposed monitoring program will allow for the following data collection in this sensitive sub catchment.

7.223 An expansive network of groundwater monitoring boreholes, located in the shallow groundwater in the superficial deposits, has been installed across the site.

7.224 The following monitoring activities will be carried out to demonstrate that the development is not having an adverse impact on the surrounding environment and will document any improvements in water quality.

- surface water quality monitoring to be undertaken on a quarterly basis for the duration of the proposed development. Improvements in surface water quality are expected at location SW2 in particular.
- groundwater levels in all boreholes will be monitored on a quarterly basis for the duration of the proposed development;
- groundwater loggers installed in the five selected boreholes will continue to provide for continuous groundwater level monitoring and logger downloads will be undertaken on a quarterly basis for the duration of the proposed development; and
- groundwater quality monitoring to be undertaken on an annual basis for the duration of the proposed development.

Table 7-19: Residual Impact with **Mitigation** Measures

Activity	Existing Environment	Character of Impact	Mitigation Measures	Residual Impact
Construction Stage				
Accidental fuel leakage / spillage	Groundwater quality in bedrock aquifer Killeen River and downstream Delour River and SAC via groundwater baseflow to the watercourse	Accidental fuel leakage/ spillage during construction works could affect groundwater quality in bedrock underlying shallow groundwater through vertical migration. Potential to affect surface water quality in the Killeen River, downstream Delour River and SAC through groundwater baseflow to the watercourse. Migration limited by low permeability deposits between bedrock and sand and gravel deposits. Any impact will be limited due to short term nature of works. Any leakage / spillage would be accidental only and of limited volume.	**Mitigation measures required.** No re-fuelling (or servicing) of excavation plant will occur at extraction areas. Refuelling will take place adjacent to the bunded fuel storage area on a concrete pad with associated hydrocarbon interceptor attached. Mobile plant and machinery will not be serviced / maintained within the sand and gravel pit to minimise the risk of uncontrolled release of polluting liquids to groundwater. A number of spill kits will be available on-site to stop the migration of any minor accidental leakages or spillages should they arise. Fuel and oils will be stored in bunded fuel tanks.	**Neutral**
Increase in suspended solids	Groundwater quality in bedrock aquifer Killeen River and downstream Delour River and SAC via groundwater baseflow to the watercourse	Reduction in groundwater quality in bedrock aquifer from increase in suspended solids in shallow groundwater, which could migrate into the underlying bedrock aquifer. Potential to affect surface water quality in the Killeen River, downstream Delour River and SAC through groundwater baseflow to the watercourse.	**Mitigation measures required.** The incidence of fugitive dust outside of the operation will be reduced by the proposal to locate mobile crushing and screening plant within the pit void. In order to control dust emissions, water will be sprayed from a tractor drawn bowser on dry exposed surfaces and stockpiles (paved roads, unsealed haul roads and hardstand areas) as required.	**Neutral**

		Migration limited by low permeability deposits between bedrock and sand and gravel deposits. Any impact will be limited due to short term nature of works.	Areas of bare or exposed soils will, insofar as practicable, be kept to a minimum through the phased extraction proposals. All HGVs exiting the site will be routed through the proposed wheelwash. This will minimise the transport of fines by HGVs over the access / egress road and the public road network. Periodic sweeping of the internal paved site access road and surrounding public roads will be carried out as required by a mechanical road sweeper.	
Operational Stage				
Accidental fuel leakage / spillage	Groundwater quality in bedrock aquifer Killeen River and downstream Delour River and SAC via groundwater baseflow to the watercourse	Accidental fuel leakage/ spillage during construction works could affect groundwater quality in bedrock underlying shallow groundwater through vertical migration. Migration limited by low permeability deposits between bedrock and sand and gravel deposits. Any leakage / spillage would be accidental only and of limited volume.	**Mitigation measures required.** No re-fuelling (or servicing) of excavation plant will occur at extraction areas. Refuelling will take place adjacent to the bunded fuel storage area on a concrete pad with associated hydrocarbon interceptor attached. Mobile plant and machinery will not be serviced / maintained within the sand and gravel pit to minimise the risk of uncontrolled release of polluting liquids to groundwater. A number of spill kits will be available on-site to stop the migration of any minor accidental leakages or spillages should they arise. Fuel and oils will be stored in bunded fuel tanks.	**Neutral**

Increase in suspended solids	Groundwater quality in bedrock aquifer Killeen River and downstream Delour River and SAC via groundwater baseflow to the watercourse	Reduction in groundwater quality in bedrock aquifer from increase in suspended solids in shallow groundwater, which could migrate into the underlying bedrock aquifer. Potential to affect surface water quality in the Killeen River, downstream Delour River and SAC through groundwater baseflow to the watercourse. Migration limited by low permeability deposits between bedrock and sand and gravel deposits.	**Mitigation measures required.** The incidence of fugitive dust outside of the operation will be reduced by the proposal to locate mobile crushing and screening plant within the pit void. In order to control dust emissions, water will be sprayed from a tractor drawn bowser on dry exposed surfaces and stockpiles (paved roads, unsealed haul roads and hardstand areas) as required. Areas of bare or exposed soils will, insofar as practicable, be kept to a minimum through the phased extraction proposals. All HGVs exiting the site will be routed through the proposed wheelwash. This will minimise the transport of fines by HGVs over the access / egress road and the public road network. Periodic sweeping of the internal paved site access road and surrounding public roads will be carried out as required by a mechanical road sweeper.	**Neutral**
Abstraction from proposed water supply borehole	Groundwater flow and quantity in bedrock aquifer	Potential to impact on groundwater in the bedrock beneath the site from the proposed water supply borehole.	The required volumes are low, and so there will be a localised impact on the groundwater flow and quantity in the bedrock aquifer only. Residential properties at distance from estimated 100-day time of travel around the proposed water supply borehole.	**Neutral**

Table 7-20: Summary of Residual Effects

No.	Potential Impacts	Impact Rating (No Mitigation)	Mitigation Required	Residual Effect
Construction Stage – Direct – Surface Water				
1	Improvement in surface water quality due to removal of livestock from site.	**Low.**	**No**	**Neutral**
Construction Stage – Direct - Groundwater				
2	Reduction in groundwater quality in bedrock aquifer from increase in suspended solids in shallow groundwater, which could migrate into the underlying bedrock aquifer	**Low** to **Negligible.**	**Yes**	**Neutral**
3	Reduction in groundwater quality in bedrock aquifer from accidental fuel leakage/ spillage, which could migrate into the underlying bedrock aquifer	**Low** to **Negligible.**	**Yes**	**Neutral**
Construction Stage – Indirect – Surface Water				
4	Impact on surface water quality in the Killeen River and downstream Delour River and SAC via groundwater baseflow to the watercourse	**Low** to **Negligible.**	**Yes**	**Neutral**
Construction Stage – Indirect – Groundwater				
5	Impact on groundwater quality in bedrock aquifer could indirectly impact the local water supplies in the area.	**Low** to **Negligible.**	**Yes**	**Neutral**
Operational Stage – Direct – Surface Water				
6	Improvement in surface water quality due to removal of livestock from site.	**Medium** to **Low.**	**No**	**Neutral**
Operational Stage – Direct – Groundwater				
7	Reduction in groundwater quality in bedrock aquifer from increase in suspended solids in shallow groundwater, which could migrate into the underlying bedrock aquifer	**Low** to **Negligible.**	**Yes**	**Neutral**

8	Reduction in groundwater quality in bedrock aquifer from accidental fuel leakage/ spillage, which could migrate into the underlying bedrock aquifer	**Low** to **Negligible.**	**Yes**	**Neutral**
9	Impact on groundwater flow and quantity in bedrock aquifer from proposed water supply borehole	**Low** to **Negligible.**	**Yes**	**No**
Operational Stage – Indirect – Surface Water				
10	Impact on surface water quality in the Killeen River and downstream Delour River and SAC via groundwater baseflow to the watercourse	**Low.**	**Yes**	**Neutral**
Operational Stage – Indirect - Groundwater				
11	Impact on groundwater quality in bedrock aquifer could indirectly impact the local water supplies in the area.	**Low** to **Negligible.**	**Yes**	**Neutral**
12	Impact on groundwater flow and quantity in bedrock aquifer from proposed water supply borehole could indirectly impact on the local water supplies in the area.	**Low** to **Negligible.**	**Yes**	**Neutral**

Figures