ATKINS

Member of the SNC-Lavalin Group

Desilting and Maintenance of Glendowns Pond, Portlaoise

Natura Impact Statement

Laois County Council

14-04-23

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Document history

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1. Introduction

1.1. Background

WS Atkins Ireland Ltd (“Atkins”) was appointed by Laois County Council to prepare, on its behalf, an Appropriate Assessment Screening Report in respect of the proposed removal of obstructions from a man-made shallow lake ‘Glendowns’, in Portlaoise, Co. Laois (“the proposed works”). The lake is showing signs of extensive siltation and requires intervention in order to address siltation and improve its biodiversity value. The proposed works entails the dredging and removal of silt and vegetation from the shallow lake using an excavator and pruning of light timber for access in a publicly accessible area, wood-chipping of brash, processing of timber and removal of all arisings. The work also entails the setting up and maintenance of pedestrian control measures.

This report comprises the Screening for Appropriate Assessment and the Natura Impact Statement in respect of the proposed works and is intended to assist the competent authority, by providing it with sufficient evidence to make a properly informed determination in respect of the proposed works.

2. Site Context

2.1. Site Location

Glendowns Pond is located along the western boundary of the Glendowns housing estate, southeast of Portlaoise town centre (Figure 2.1; 2.2; Plate 2.1). It is situated in a semi-urban setting with fields to the south and west and housing to the east. It is fed by the Little Borris stream, a tributary of the Triogue River. The urbanisation of the area is gradually expanding, as seen with the development of nearby housing and schools in recent years.

There are two other Lakes in the vicinity of Glendowns Pond, neither of which is hydrologically linked to Glendowns Pond. Páirc an Phobail (People's Park) Lake is located in a public park to the west of Glendowns and is fed by the Triogue River, a tributary of the River Barrow. To the east a road attenuation pond is located just off Stradbally Road / Southern Circular Road (see Plates 2.2; 2.3).

Glendowns Pond is distantly linked to the River Barrow and River Nore SAC (site code: 002162) via 13km along the Borris Great Stream and the River Triogue.

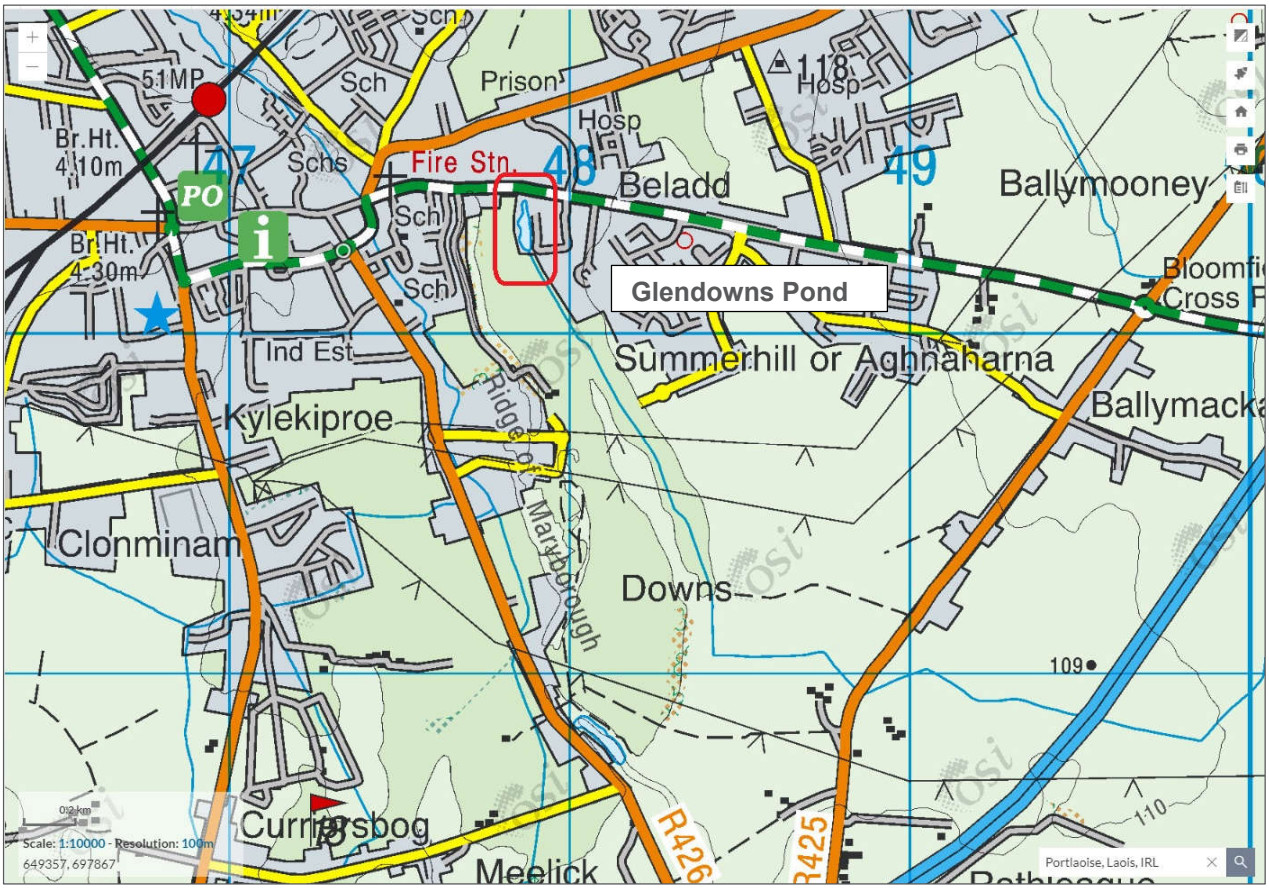

Figure 2.1 **Location of Glendowns Pond, OSi Discovery Series** (Source: Bing Maps).

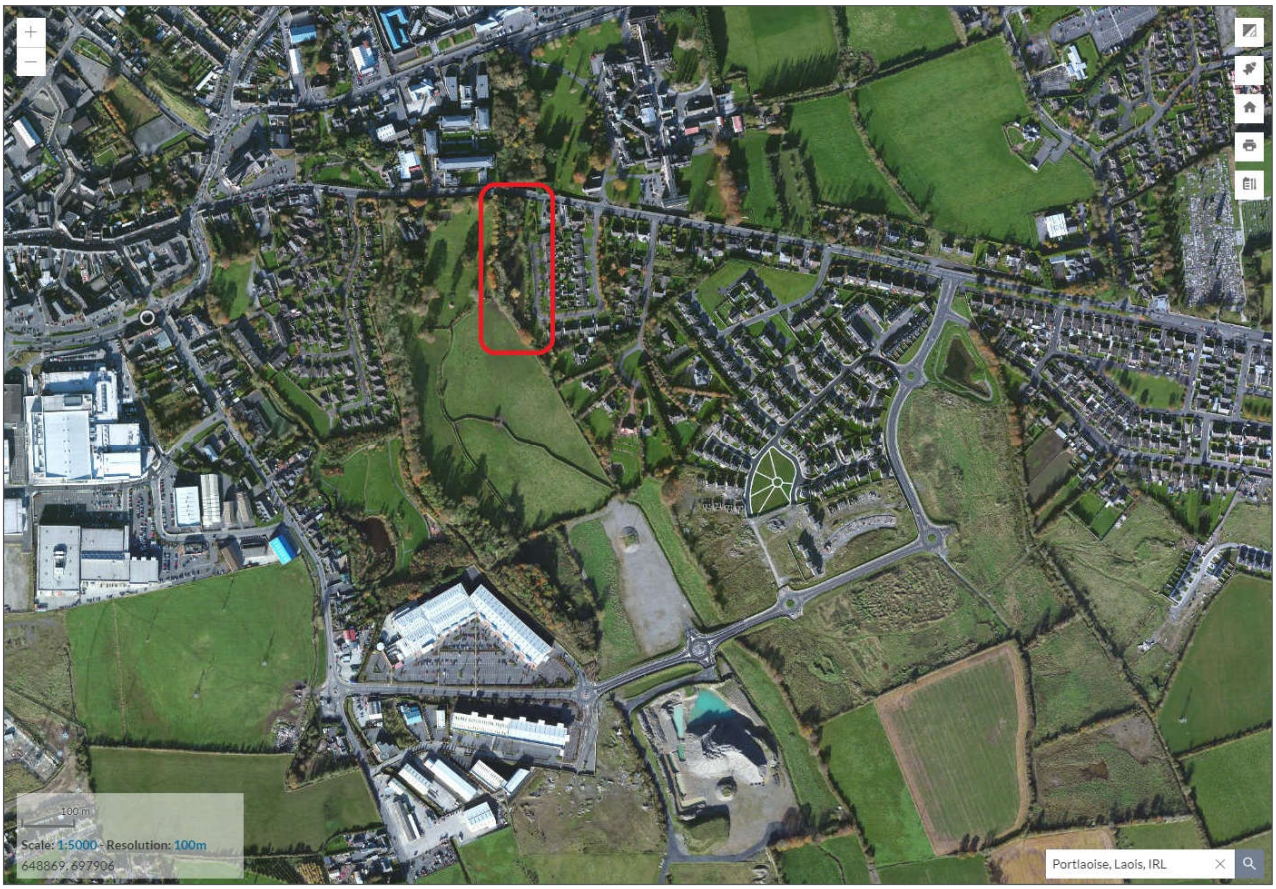

Figure 2.2 Location of Glendowns Pond, aerial image (Source: Bing Maps).

2.2. Site Context

2.2.1. Site Hydrology

The pond is fed by two small streams entering from the southwest (unnamed) and southeast (Little Borris Stream) (Figure 2.3). There is one outflow point from the north of the pond which is culverted to the north and re-emerges as the Borris Great Stream. As noted, there are two other ponds in the vicinity of Glendowns Pond, neither of which are hydrologically linked to Glendowns Pond.

Little Borris Stream rises in the townland of Derry to the southeast of the M7 It is culverted under the M7 and continues in a westerly direction, before turning to the north / northwest into the townland of Downs and Summerhill, where the Glendowns Pond is located. After exiting Glendowns Pond through a trash screen the stream passes under the Stradbally Road (N80). The stream appears to be largely culverted through / under St. Fintan's Psychiatric Hospital, the Dublin Road (R445) and the Prison, before remerging in Ballyroan (southeast of the railway line). Downstream of the pond it is known as the Borris Great Stream.

The distance from source to Glendowns Pond is ca. 3.2km. Its confluence with the Triogue River is ca. 5.8km from the pond outlet (near Two Mile Bridge). Before joining the Triogue River the Borris Great Stream joins with a number of other small watercourses which drain lands to the north and east of Portlaoise.

Initially consideration was being given to more extensive remedial works within the pond – in part to alter patterns of silt deposition within the pond. An assessment of baseline hydrology of the pond was therefore prepared by SLR on behalf of Laois County Council. However, based both on concerns that silt might mobilised into the downstream culvert system and the ecology of the pond, the proposals being advance or smaller and scale. However, the Baseline Hydrology Report is included in full in Appendix C for information.

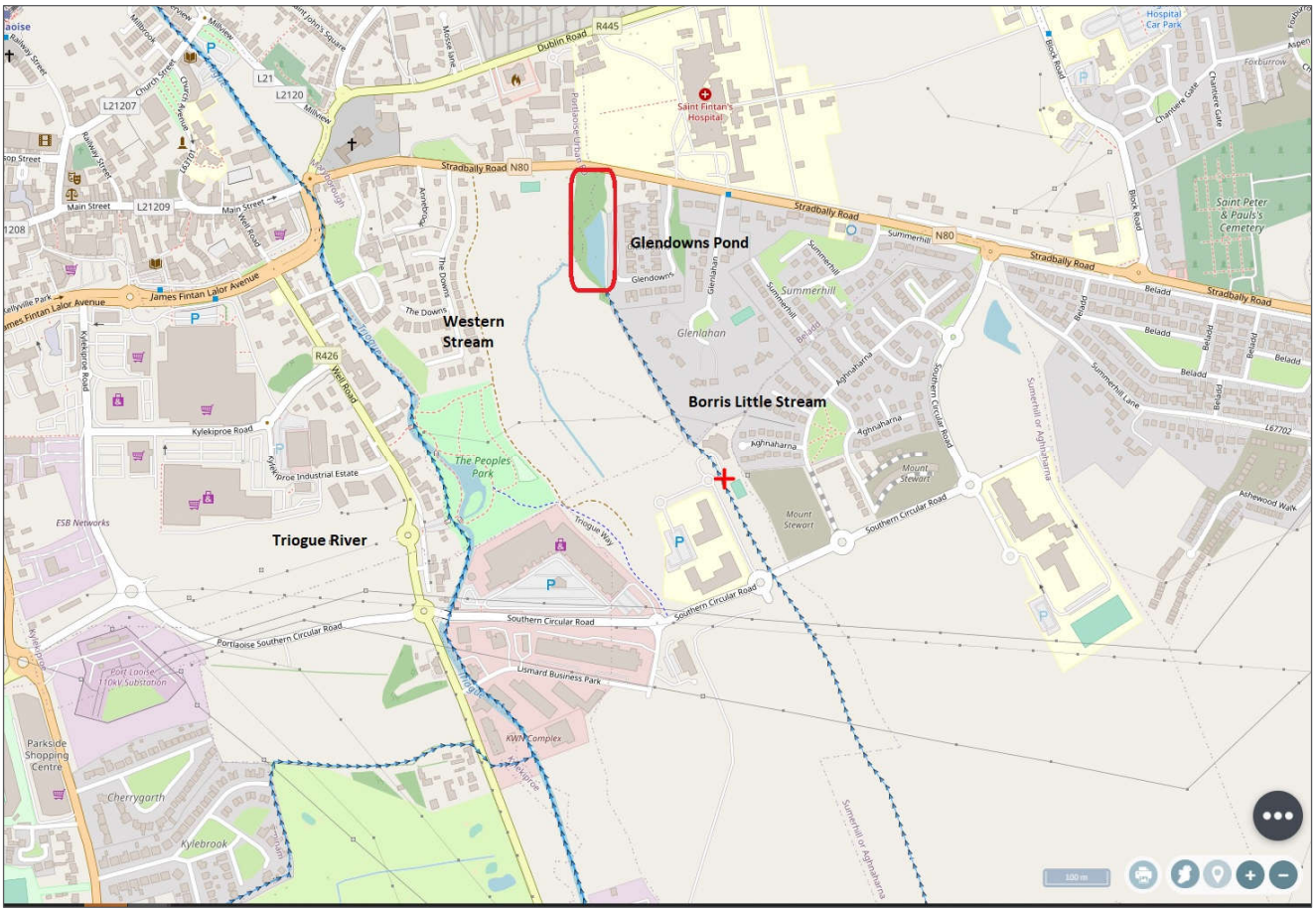

Figure 2.3 Watercourses in the environs of Glendowns Pond (Source: EPA Maps).

2.2.2. Site History

The arrangement of water features on site differs on historic mapping of the area from that currently visible on the ground. Historically, the main stream appears to have been the western (unnamed) stream; at Glendowns it appears to have followed a course not too dissimilar to the eastern side of the pond. However, Glendowns Pond is not mapped on 25" historic mapping of the site[1] (Figure 2.4).

Historic mapping shows the Little Borris Stream as a linear 19th Century Aqueduct which joined the unnamed stream at what approximates to the southern end of the current pond. Under the description LAIAR-013-035 in Hammond (2009[2]) the aqueduct is described as being captioned on OS maps dated 1839, 1889 and 1907. It carried a water supply to the former Maryborough Lunatic Asylum and County Infirmary. This description states that no visible traces of the aqueduct survives. However, the stream continues on what appears to be the original alignment of the aqueduct.

The description of bridge on the N80 (LAIAR-13-066) by Hammond (2009) confirms that the stream flowing out from Glendowns Pond is culverted under the grounds of the former Maryborough County Infirmary.

To the west of Glendowns Pond, Portan House[3], dating from 1790-1820, is listed on the National Inventory of Architectural Heritage (reg. no. 12507122). It once formed part of the historic ensemble of the former Maryborough Infirmary and St Fintan's hospital on Stradbally Road. Mature trees along the western side of the pond appear to be on the grounds of Portran House.

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[1] http://webgis.archaeology.ie/historicenvironment/

[2] Hammond (2009). *Bridges of County Laois. An Industrial Heritage Review. Part 2. Site Gazetteer Volume 1 – North Laois*. An Action of the Laois Heritage Plan 2007 – 2011 for Laois County Council.

[3] http://www.buildingsofireland.ie/niah/search.jsp?type=record&county=LA&regno=12507122

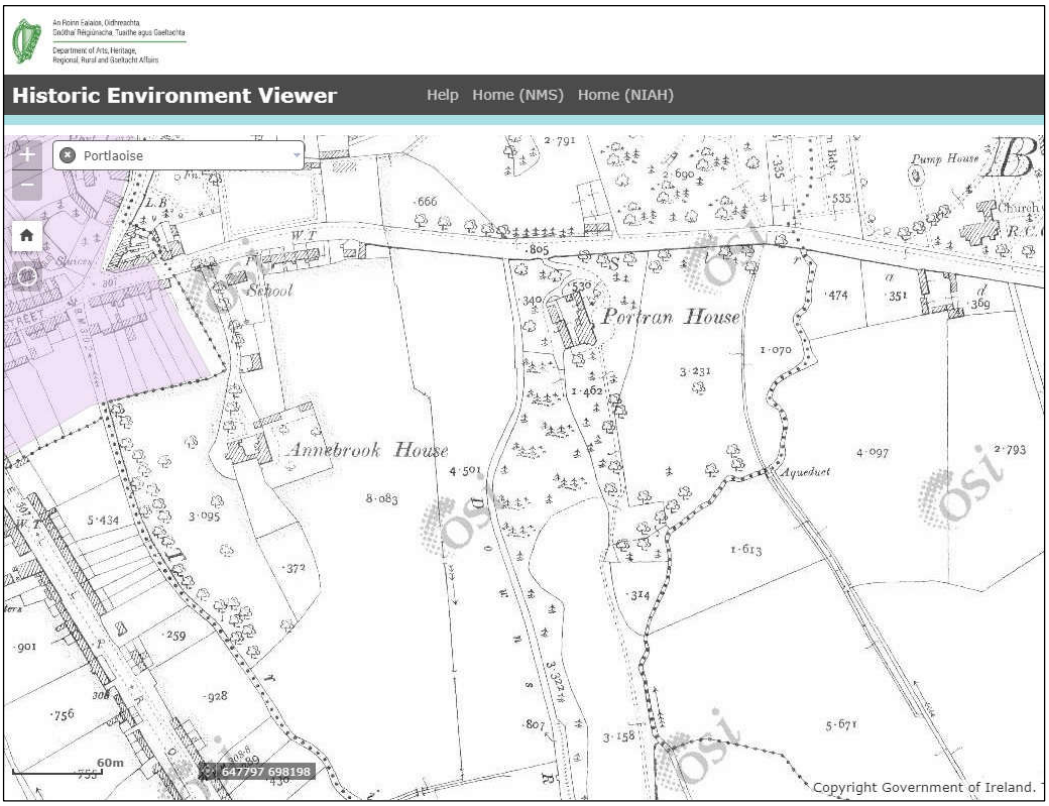

Figure 2.4 Historic map of site environs.

2.2.3. Landscape Character

From where it rises in Derry, Little Borris Stream runs though lands primarily managed as improved agricultural grassland (GA1[4]) and arable land (BC1). Upstream of the pond it crosses under, and potentially receives surface water runoff from a number of roads, including the M7, R425 and the Southern Circular Road in Portlaoise[5].

Just south of Southern Circular Road (southeast of Portlaoise Retail Park) the stream forms the eastern boundary of a disused aggregate quarry[6]. North of Southern Circular Road it borders a new school campus and agricultural grassland before entering residential lands at Glendowns Estate and the pond. It is presumed that it receives surface water runoff from housing estates to the east; namely Glendowns, Glenlahan, Aghnaharna Drive and Summerhill (all south of the Stradbally Road) as well as from the school grounds.

The unnamed western stream also passes through lands used for agriculture (grassland), as well as residential and commercial development. It also crosses local roads such as the Southern Circular Road.

Undeveloped agricultural lands to the west / southwest of Glendowns Pond are zoned G4 Active Open Space, with the objective To preserve, provide for and improve active and passive recreational public and private open space[7]. The formerly derelict site to the south (see Figure 2) was zoned S5 - Mixed/general community services/facilities uses; this site has since seen development of the Holy Family Schools, Aghnaharna, Summerhill, Portlaoise.

[4] Habitats classified as per *Fossitt, J. (2002). A Guide to Habitats in Ireland. Published by the Heritage Council.*

[5] Also known as the New Road.

[6] This is not listed as an active quarry on the Geological Survey of Ireland mapviewer – https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=ebaf90ff2d554522b438ff313b0c197a&scale=0

[7] www.myplan.ie

Plate 2.1 Glendowns Pond (looking upstream).

Plate 2.2 Large pond in Páirc an Phobail (August, 2018).

Plate 2.3 Settlement pond (junction of Stradbally Road & Southern Circular Road (east) (Source: GoogleMaps).

2.2.4. Site Designations

Glendowns Pond is located ca. 120m to the east of the Ridge of Portlaoise pNHA (site code 00876). The NPWS site synopsis describes the site as follows (NPWS, 2009[8]): -

> *"The ridge of Portlaoise is an elongated raised ridge or esker formed of sand and gravel which was deposited when a mass of ice covered this area during the last period of glaciation. The esker runs through the eastern part of Portlaoise town and extends in a south-south-east to north-north-west direction."*
>
> *"Eskers are under increasing threat in Ireland, due to the demand for sand and gravel for the construction industry. Of the few eskers which have survived, only a small percentage retain their semi-natural flora of woodland and this is one of the best examples of esker in Co. Laois, along with those at Timahoe (000421) to the south- east and Clonaslee (000859), to the north-west. The ridge of Portlaoise also has two rare plants, one of which is protected under the Flora Protection Order."*

Rare plants referenced are Nettle-leaved bellflower (*Campanula trachelium*) and Blue fleabane (*Erigeron acer*). There are no records of either species from the environs of Glendowns Pond.

The Ridge of Portlaoise pNHA is not hydrologically connected to the pond.

Glendowns Pond is distantly linked to the River Barrow and River Nore SAC (002162) via 13km along the Borris Great Stream and the River Triogue.

The Geological Survey of Ireland have identified the Ridge of Portlaoise as a site of geological heritage (LS029). It is identified as a long sinuous accumulation of sands and gravels deposited under the ice sheet and at its margin. It notes that "*what remains of the feature is still a high, striking example of a dry sand and gravel ridge*". It is classified as being of County Importance[9].

In the Local Biodiversity Action Plan for Portlaoise, Co., Laois MacGowan (2015[10]) classified areas of open water – FL8 Other artificial lakes & ponds – as being of Medium local biodiversity value. The Action Plan does not recommend specific measures for Glendowns Pond. Another large pond is located at Esker Hills, on the northern side of Portlaoise.

The second inflow enters the western side of Glendowns Pond. It appears to start in the environs of the new school on the Southern Circular Road; upstream of this point it appears to receive contributions from a network of drainage ditches. It is separated from the Triogue River by an esker (Ridge of Portlaoise pNHA).

There is no water quality data for either stream present on the EPA MapViewer[11].

[8] NPWS (2009). Ridge of Portlaoise pNHA Site Synopsis. Site code 000876.

[9] https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=ebaf90ff2d554522b438ff313b0c197a&scale=0 [Laois County Geological Site Report. Ridge of Portlaoise. LS029].

[10] MacGowan, F. (2015). *Local Biodiversity Action Plan for Portlaoise, Co. Laois*. Report for Laois County Council supported by the Heritage Council.

[11] https://gis.epa.ie/EPAMaps/

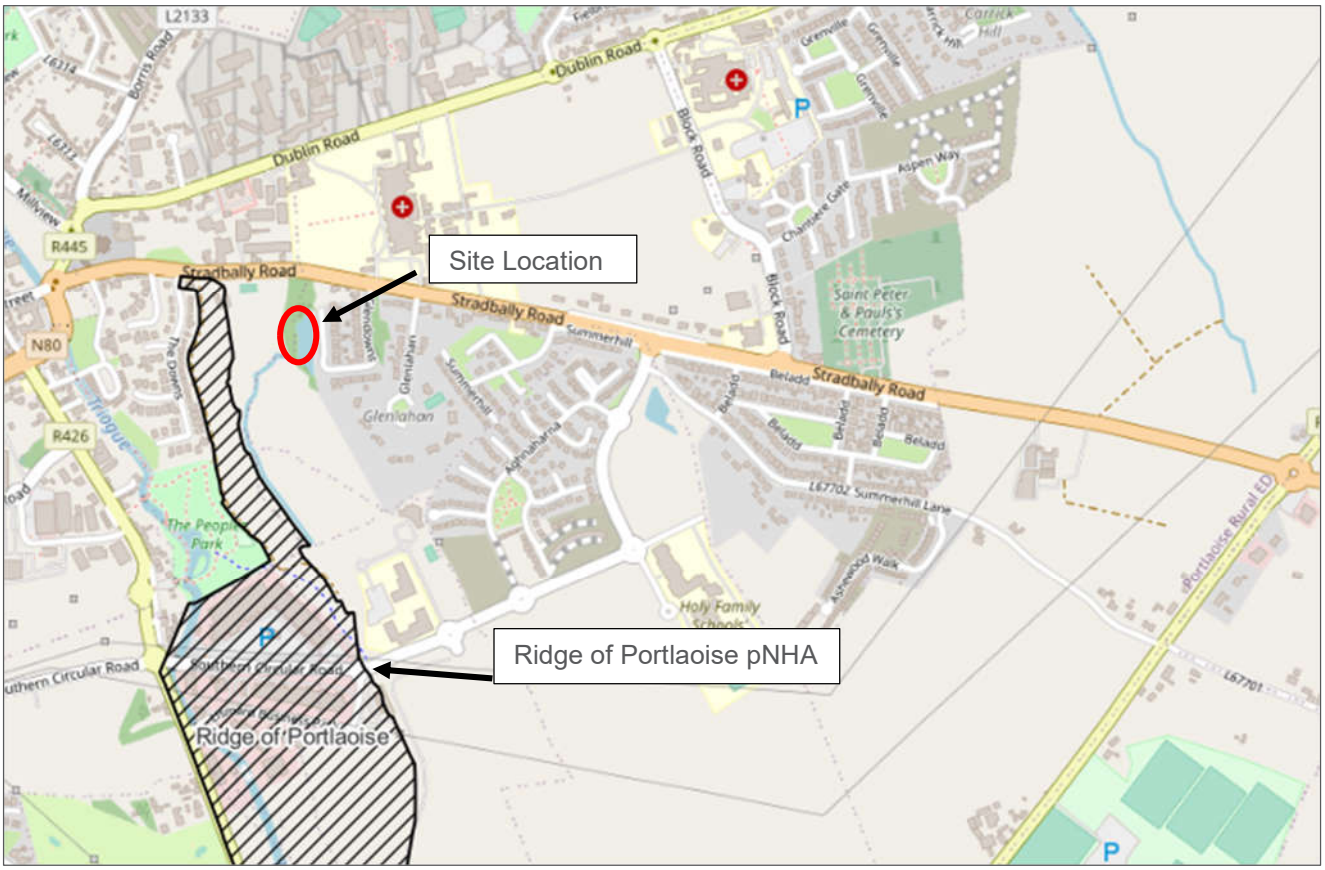

Figure 2.5 Glendowns Pond (red circle) in relation to the Ridge of Portlaoise pNHA (black area) (Source: NPWS).

2.2.5. Flood Risk

The Office of Public Works Flood Risk Mapping identifies Stradbally Road at the outflow from Glendowns Pond as an area subject to repeat flooding[12] (MCOS, 2000[13]). A trash gate is fitted on the outflow channel from the pond (just before it is culverted under Stradbally Road).

2.2.6. Photo Essay

The following series of photos present an overview of the lake and the key issues / constraints present.

[12] www.floodmaps.ie

[13] MCOS Consulting Engineers (2000). Portlaoise Main Drainage Preliminary Report. Technical Report no. 5. Storm Drainage Catchment Study. Report to Laois County Council.

Plate 2.4 Inflow stream – looking upstream to bridge crossings to fields.

Plate 2.5 Inflow stream – spawning lamprey on gravel substrate.

Plate 2.6 **Little Borris Stream inflow point. Marginal encroachment. No gradient.**

Plate 2.7 **Marginal vegetation in shallows; encroachment by willow.**

Plate 2.8 Extensive silt deposits; fallen tree limbs on far bank.

Plate 2.9 Little Borris Stream upstream of pond. Better quality. Low silt input to pond.

Plate 2.10 Looking north towards outflow. Heavy silt, dead algal accumulation & shading.

Plate 2.11 Outgoing stream. Heavy algal accumulation. Shallow, wide, slow flowing.

Plate 2.12 Outgoing stream. Heavy silt deposition. Shallow, wide, slow flowing.

Plate 2.13 Fallen trees in centre of pond.

Plate 2.14 View downstream to outflow / trash screen.

Plate 2.15 Discharge channel – showing fallen branches and algal accumulations.

Plate 2.16 Amenity grassland & landscaping on western side of pond.

Plate 2.17 Looking south to both inflow points. Heavy silt. Shallow water. Marginal encroachment.

3. Proposed Works

3.1. Description of Proposed Works

The proposed works involve the dredging and removal of silt and vegetation from Glendowns Pond in Portlaoise, Co. Laois, using an excavator. The proposed works also entails the pruning of light timber for access in a publicly accessible area, wood-chipping of brash, processing of timber and removal of all arisings. The works also entails setting up and maintenance of pedestrian control measures.

Parklawn Tree Services Ltd. who routinely undertake tree and landscaping maintenance works for Laois County Council, have been contracted to undertake the proposed works. The work is carried out by skilled, trained and competent individuals working in groups of not less than two and usually three or more at the work site as dictated by a task/job risk assessment.

All works procedures incorporate safe systems of working and form part of the internal quality control. These include the Forestry Industry Safety Accord (FISA) (formerly the Arboricultural & Forestry Advisory Group (AFAG)) guidelines published by the HSE (UK) and the Guide to Good Climbing Practice, where such is required.

3.1.1. Methods

[The full Method Statement from Parklawn Tree Services Ltd. is included in Appendix A].

1. Parklawn Tree Services Ltd. will ensure that the Safe Systems of Work Plan (risk assessment) is completed before any commencement of work each day. The Risk Assessment will detail all precautions to be taken to minimise the risks associated with the work and working close to water. All Parklawn staff on site will participate in the completion of the risk assessment. All staff must agree that it is safe to carry out the work. Particular consideration must be given to: -

    a) The presence or potential presence of members of the public, notably children.

    b) The presence of ground level, underground or overhead services close to the works area.

    c) Prevailing weather conditions, notably any forecasted severe weather.

    d) Vehicular and Pedestrian Traffic.

    e) Risks associated with working close to / in water.

    f) The condition and general health of any trees to be worked on. Pay particular attention to rotten timber, tree defects, crown die-back, dead wood, hangers, or broken/fractured limbs. Check that the root-plate is intact and check for the presence of or evidence of fungal fruiting bodies.

    g) Assess the presence of any hazards below trees. Remove all hazards where reasonably practicable.

2. The crew will be informed about the order in which the work will take place and their duties will be assigned to them. Work equipment will be visually inspected prior to the commencement of work.

3. When the method has been decided the site will be secured, and a Controlled Entry Zone (CEZ) will be established. The CEZ will be sufficient to prevent unauthorised access to the site at all foreseeable approaches and will be large enough to ensure no persons can come into contact with the working excavator. Where necessary, physical barriers and signage shall be put in place to prevent access. Where it is not possible to erect physical barriers on all approaches, sufficient staff shall be available to monitor the CEZ and prevent unauthorised access.

4. The site will be cleared of loose debris and trip hazards and ground conditions thoroughly inspected prior to work being carried out. Staff will pay particular attention to the presence of underground/ground level services or structures which might be damaged by falling timber or the working excavator.

3.1.1.1. Sequence of Works

Pruning

1. Tree branches may need to be pruned to clear a pathway for the excavator to enter the site.

2. Pruning will be carried out by fully trained NPTC Operatives that are certified in the use of Chainsaws / Polesaws.

3. All waste arisings from the pruning operations will be removed from site and appropriately disposed of off-site.

Wood-chipping

1. All brash <100mm in diameter shall be processed by a tracked woodchipper positioned within a reasonable distance of the landing zone.

2. All timber woodchip shall be directed away from the lake and chipped to the back of a woodchip lorry for removal and appropriate disposal of off-site.

Excavator Dredging

1. Glendowns Pond will be assessed by Parklawn Tree Services Ltd. prior to work commencing to gauge depths and safe travel distance for excavator at the time of proposed works.

2. Route for excavator will be walked before travelling with machine to ensure ground is suitable and free of hazards.

3. All hazards will be removed if practicable or marked and noted on SSRA.

4. Rubber mats will be used where necessary to prevent damage to the ground where machine will be working/travelling.

5. Machine will move to position beside bank of the pond and remain a minimum of 1.5m from the edge.

6. Silt traps will be put in place along the outflow channel to minimise the silt travelling downstream (see Figure 3.1).

7. Barriers and signage will be set up at least 10m outside the slew radius of the machine to the rear.

8. The excavator will clear silt and debris within its reach and stack/pile in neat stacks on the pond bank. This will allow for natural drainage of material and allow insects etc. to make their way back into the pond habitats.

9. Once an area is clear, barriers will be broken down in the direction of travel and machine will move under the supervision of an observer to the next works location.

10. When in place, barriers will be placed again around the machine and signs set up. This process will be repeated as many times as necessary until work is complete (working from south to north along the length of the pond) (see Figure 3.1).

11. An observer will remain in place to ensure no unauthorised access while machine is working.

12. Observer will be in communication with machine operator via 2-way radio for the duration of machine operation.

13. No persons will be permitted to approach the machine slew radius until the machine is powered down and the observer has received a clear positive signal that it is safe to approach. It will be the responsibility of the observer to ensure that no persons enter the CEZ when the machine is in operation.

14. It will be the responsibility of the observer to ensure that no persons enter the CEZ when the machine is in operation.

15. The observer will not approach closer than 1.5m to the edge of the bank.

16. Small light debris will be removed manually using a hook attached to fibreglass rods.

End of Shift Site Inspection

1. At the end of each work shift and before completion of each site, the site will be inspected for hazards and all hazards removed before crews leave site.

2. On completion of works, site will be inspected for remaining hazards, cleaned and cleared, and all making good completed before crews withdraw from site.

Figure 3.1 General Layout of the Proposed Works.

Figure 3.1 illustrates the location of proposed silt fences / sedimats within the outflow stream. These will be placed upstream from the brash screen at the point where the stream passed under the Stradbally Road and will be in place through excavation works.

No excavation works will take place on the inflow stream (Little Borris Stream). Works will take place on the outflow stream as this is heavily silted. However, works will only remove silt down to the original gravel bed of the stream. There will be no alterations to the invert level of the outflow stream. Works will also be limited at the confluence of the inflow stream and lake (under the guidance of an Ecological Clerk of Works).

At the southern end of the pond there is a short access lane which provides access to a small bridge and farmland on the western side of the Little Borris Stream / Glendowns Pond. This access lane is currently not used and will be used as a site compound in which to safely park the excavator and store material overnight.

Works will take approximately 3-4 weeks to complete.

Figure 3.2 illustrates how works will be undertaken. Each cell shows the approximate works envelope of the excavator from each works station. The excavator will enter the pond (along the fine red line) and then excavate silts within the reach of the bucket, moving forward into the pond where it has been deemed safe to do so. As noted rubber mats will be used where necessary to prevent damage to the ground where machine will be working/travelling. Also, some pruning of trees may be needed to facilitate access.

Following completion of works any damaged areas of amenity grassland will be reinstated and any damage trees will if need be replaced (these trees are non-native landscape planting withing amenity grassland between the estate road and the pond).

Some fallen trees will also be taken down / pruned back on the western side of the lake. Access to this area will be on foot from the above noted lane and then from the western side of the lake.

3.1.1.2. Machinery

Plant and machinery operating instructions are included in the operations procedures. These procedures include inspections prior to use and operational testing. All plant and machinery is regularly inspected by a competent person as required by legislation and the team leader and during quality and supervisory visits. Faulty equipment is withdrawn from service and repairs undertaken prior to return to field operational use.

All tools and personal equipment in use by field operatives are regularly inspected by the PICW (person in charge of works) and during site and supervisory visits. Daily visual and weekly checklists are carried out on all tools and equipment. All field operatives are under instructions to replace faulty equipment immediately.

Plant

- Hitachi EX130 Excavator 13t
- Lorry and lowloader
- Woodchipper

Hand tools

- Stihl MS241 x 3,
- Stihl MS201T x 2
- Leaf Blowers, Rakes, Shovels, Brushes, Spanners, Screwdrivers
- Ladders
- Pulling Ropes

3.1.1.3. Waste

Parklawn Tree Services Ltd. only use companies who carry a permit under the Waste Management Act 1996 to dispose of waste. Wherever possible, arisings are stored at the depot in purpose built holding bays and utilised as a renewable energy source. Alternatively, wood chip may be put back onto the land as mulch, where it will benefit the local Eco-system. Mature timber may be stacked for use by the owner or occupier of the land as a source of fuel or as a habitat.

Silts to be removed from the pond are equivalent to "*17 05 06 dredging spoil other than those mentioned in 17 05 05*" as per *Waste Classification List of Waste & Determining if Waste is Hazardous or Non-hazardous* (EPA,

2018). As noted, once removed from the pond wastes will initially be placed on the bank to allow both water and aquatic organisms to return to the pond. Initially, this will be supervised by the ECoW to ensure it is being done correctly. Waste silt will then be transferred to a truck for removal offsite under licence and disposal at an appropriately licence facility.

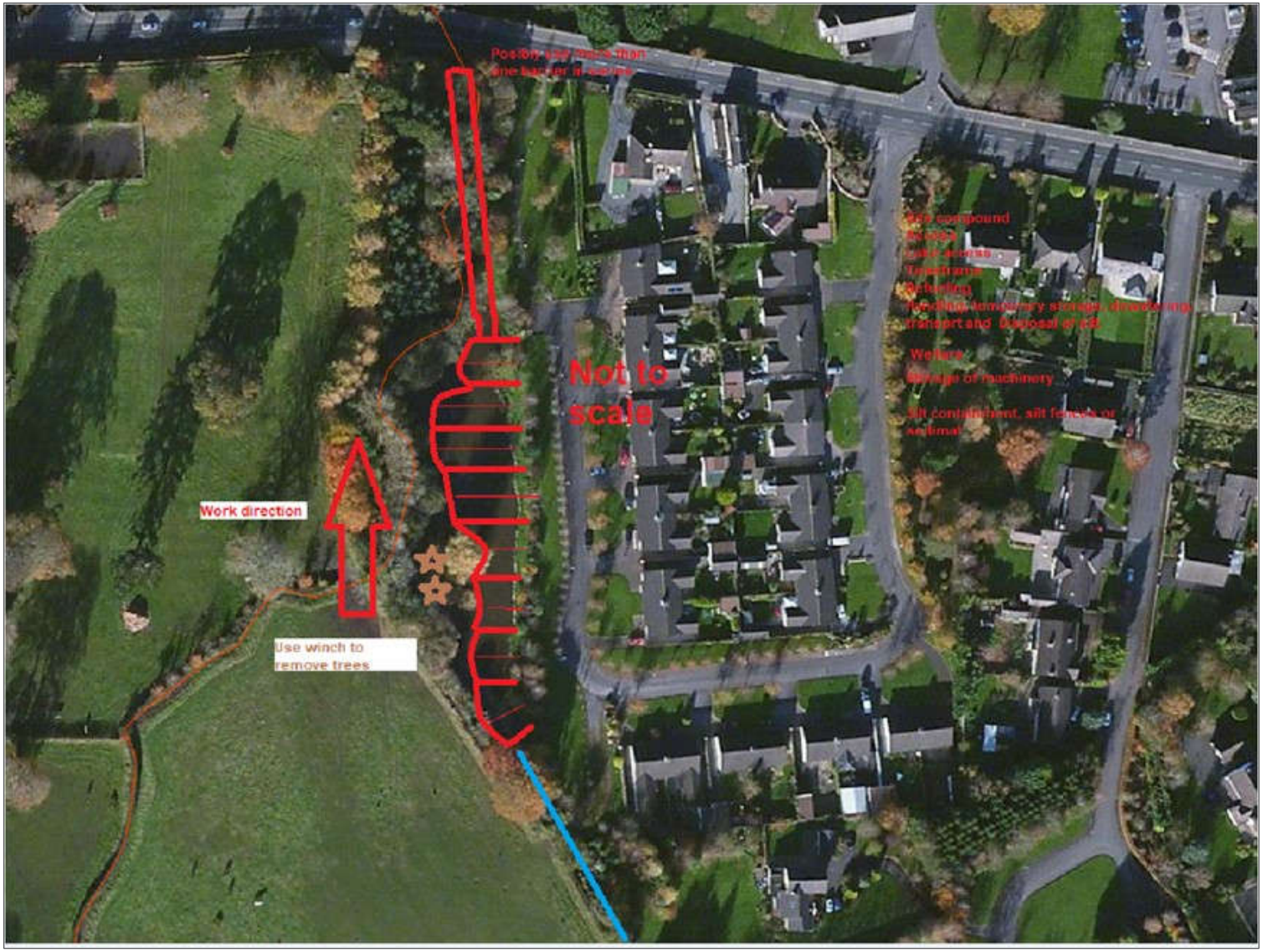

Figure 3.2 General layout of proposed works shown on aerial image.

4. Scope of Study

4.1. Legislative Context

4.1.1. Natura 2000

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora ("the Habitats Directive") is a legislative instrument of the European Union (EU) which provides legal protection for habitats and species of Community interest. Article 2 of the Directive requires the maintenance or restoration of such habitats and species at a favourable conservation status, while Articles 3 to 9, inclusive, provide for the establishment and conservation of an EU-wide network of special areas of conservation (SACs), known as Natura 2000, which also includes special protection areas (SPAs) designated under Article 4 of Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds ("the Birds Directive"). Both SACs and SPAs are commonly referred to as "European sites" or "Natura 2000 sites".

SACs are selected for natural habitat types listed on Annex I to the Habitats Directive and the habitats of species listed on Annex II to the Habitats Directive. SPAs are selected for species listed on Annex I to the Birds Directive and other regularly occurring migratory species. The habitats and species for which a Natura 2000 site is selected are referred to as the "qualifying interests" of that site and each is assigned a "conservation objective" aimed at maintaining or restoring its "favourable conservation condition" at the site, which contributes to the maintenance or restoration of its "favourable conservation status" at national and European levels.

4.1.2. Appropriate Assessment

Article 6 of the Habitats Directive deals with the management and protection of Natura 2000 sites. Articles 6(3) and (4) set out the decision-making process, known as "Appropriate Assessment" (AA), for plans or projects in relation to Natura 2000 sites. Article 6(3) states:

> *"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."*

The first sentence of Article 6(3) provides a basis for determining which plans and projects require AA, i.e. those "*not directly connected with or necessary to the management of [one or more Natura 2000 sites] but likely to have a significant effect thereon, either individually or in combination with other plans or projects*". In *Waddenzee* (C-127/02), the Court of Justice of the European Union (CJEU) ruled that significant effects must be considered "likely" if "*it cannot be excluded, on the basis of objective information*", that they would occur. This clearly sets a low threshold, such that AA is required wherever there is a reasonable possibility of significant effects on a Natura 2000 site. In the same judgment, the CJEU established that the test of significance relates specifically to the conservation objectives of the site concerned, i.e. "significant effects" are those which, "*in the light, inter alia, of the characteristics and specific environmental conditions of the site*", could undermine the site's conservation objectives. In addition to the effects of the plan or project on its own, the combined effects arising from the plan or project under consideration and other plans and projects must also be assessed (see Section 9.1 below for more details).

The last part of the first sentence of Article 6(3) defines AA as an assessment of the "*implications [of the plan or project] for the site in view of the site's conservation objectives*". In the second sentence, Article 6(3) requires that, prior to agreeing to a plan or project, the competent authority must "ascertain" that "*it will not adversely affect the integrity of the site concerned*". In *Sweetman v. An Bord Pleanála* (C-258/11), the CJEU ruled that a plan or project "*will adversely affect the integrity of that site if it is liable to prevent the lasting preservation of the constitutive characteristics of the site that are connected to the presence of a priority natural habitat whose conservation was the objective justifying the designation of the site in the list of sites*". On that basis, EC (2018) described the "integrity of the site" as "*the coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations*

of species for which the site is designated". As such, the "integrity" of a specific site is defined by its conservation objectives and is "adversely affected" when those objectives are undermined. In *Waddenzee*, the CJEU ruled that the absence of adverse effects can only be ascertained "*where no reasonable scientific doubt remains*".

The "precautionary principle" applies to all of the legal tests in AA, i.e. in the absence of objective information to demonstrate otherwise, the worst-case scenario is assumed. Where the tests established by Article 6(3) cannot be satisfied, Article 6(4) applies (see explanation in Section 4.2 below).

4.1.3. Competent authority

The requirements of Articles 6(3) and (4) are transposed into Irish law by, inter alia, Part 5 of the European Communities (Birds and Natura Habitats) Regulations, 2011 (as amended) ("the Habitats Regulations") and Part XAB of the Planning and Development Act, 2000 (as amended) ("the Planning and Development Acts"). As per the second sentence of Article 6(3), it is the "competent national authorities" who are responsible for carrying out AA and, by extension, for determining which plans and projects require AA. The competent authority in each case is the authority responsible for consenting to or licensing a plan or project, e.g. local authorities, An Bord Pleanála, the Environmental Protection Agency (EPA) or a Government Minister. In all cases, it is the competent authority who is ultimately responsible for determining whether or not a plan or project requires AA and for carrying out the AA, where required.

4.2. Appropriate Assessment Process

The AA process can be described as being made up of three distinct stages, as described below, the need to progress to each stage being determined by the outcome of the preceding stage.

Stage 1: Screening – This stage involves a determination by the competent authority as to whether or not a given plan or project required AA. As explained in Section 4.1 above, AA is required in respect of any plan or project not directly connected with or necessary to the management of a Natura 2000 site, but for which the possibility of likely significant effects on one or more Natura 2000 sites cannot be excluded. In *People Over Wind* (C-323/17), the CJEU ruled that measures intended to avoid or minimise harmful effects on a Natura 2000 site cannot be considered in making this determination. Consideration of the potential for in-combination effects is also required at this stage.

Stage 2: Appropriate Assessment – This stage involves a detailed assessment of the implications of the plan or project, individually and in combination with other plans and projects, for the integrity of the Natura 2000 site(s) concerned. This stage also involves the development of appropriate mitigation to address any adverse effects and an assessment of the significance of any residual impacts following the inclusion of mitigation. In *Kelly v. An Bord Pleanála* (IEHC 400), the High Court ruled that a lawful AA must contain complete, precise and definitive findings based on examination and analysis, and conclusions and a final determination based on an evaluation of the findings. In the same judgment, the High Court stressed that, in order for the findings to be complete, precise and definitive, the AA must be carried out in light of best scientific knowledge in the field and cannot have gaps or lacunae. In *Holohan v. An Bord Pleanála* (C-461/17), the CJEU clarified that AA must "*catalogue the entirety of habitat types and species for which a site is protected*" (i.e. the qualifying interests of the site) and assess the implications of the plan or project for the qualifying interests, both within and outside the site boundaries, and other, non-qualifying interest habitats and species, whether inside or outside the site boundaries, "*provided that those implications are liable to affect the conservation objectives of the site*". The proposer of a plan or project requiring AA is furnishes the competent authority with the scientific evidence upon which to base its AA by way of a Natura Impact Statement (NIS) or Natura Impact Report (NIR). If it is not possible to ascertain that the plan or project will not adversely affect one or more Natura 2000 sites, authorisation can only be granted subject to Article 6(4).

Stage 3: Article 6(4) – If a plan or project does not pass the legal test at Stage 2, alternative solutions to achieve its aims must be considered and themselves subject to Article 6(3). If no feasible alternatives exist, authorisation can only be granted where it can be demonstrated that there are imperative reasons of overriding public interest (IROPI) justifying its implementation. Where this is the case, all compensatory measures must be taken to protect the overall coherence of Natura 2000.

The three stages described above are illustrated in Figure 1.1 below.

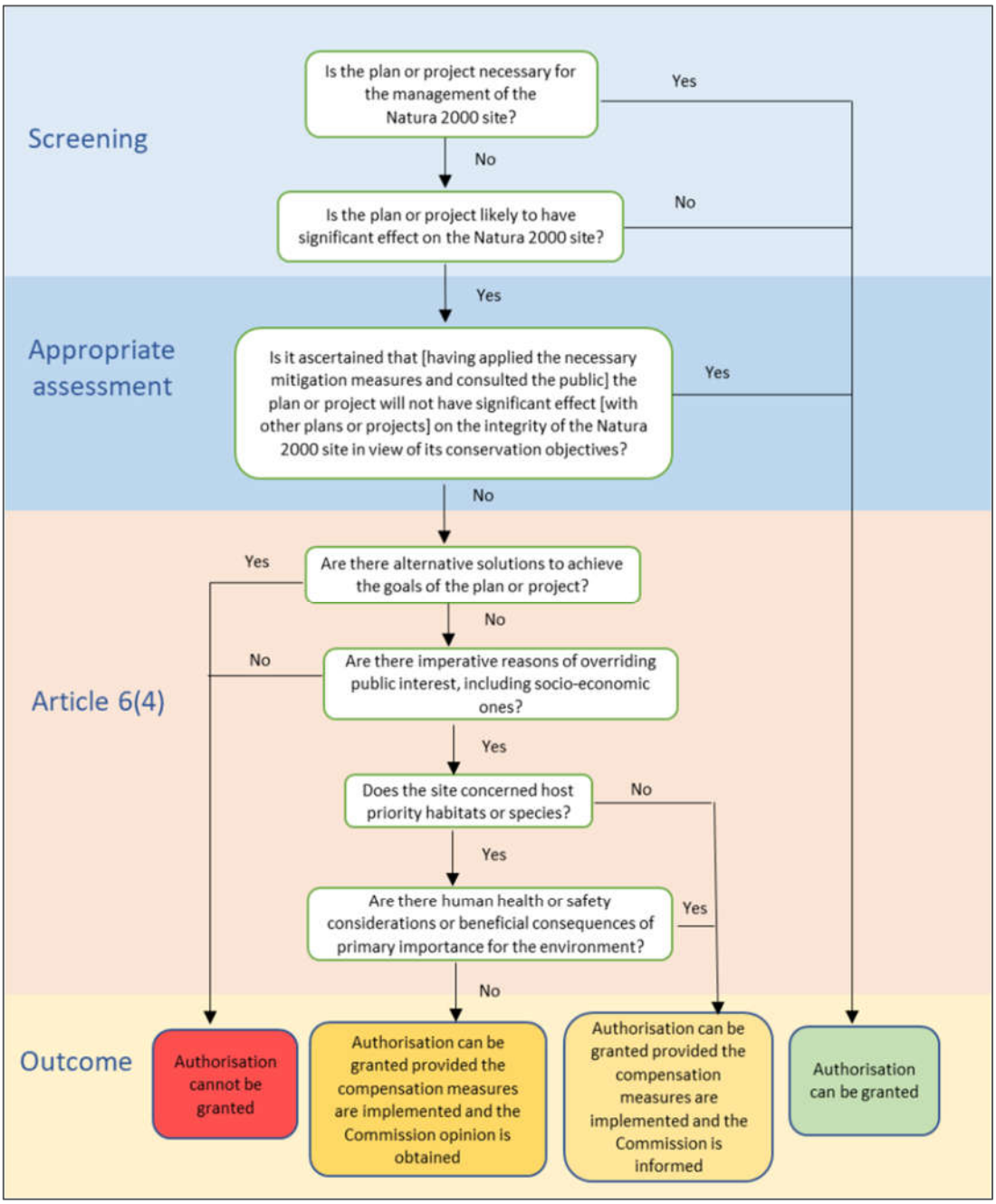

Figure 4.1 Stages of the Appropriate Assessment process (EC, 2021).

5. Methodology

5.1. Sources of Guidance

This report was prepared with due regard to the relevant European and Irish legislation, case law and guidance, including but not limited to: -

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild flora and fauna. *Official Journal of the European Communities* L 206/7-50.
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. *Official Journal of the European Union* L 20/7-25.
- European Communities (Birds and Natural Habitats) Regulations, 2011. *S.I. No. 77/2011* (as amended) ("the Habitats Regulations").
- Planning and Development Act, 2000. *No. 30 of 2000* (as amended) ("the Planning and Development Acts").
- Planning and Development Regulations, 2001. S.I. No. 600/2001 (as amended) ("the Planning Regulations").
- EC (2018) *Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.* European Commission, Brussels.
- EC (2021a) *Assessment of plans and projects in relation to Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC. C(2021) 6913.* European Commission, Brussels.
- EC (2021b) *Guidance document on the strict protection of animal species of Community interest under the Habitats Directive. C(2021) 7301.* European Commission, Brussels.
- DEHLG (2010a) *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. Revised 11/02/2010.* Department of the Environment, Heritage and Local Government, Dublin.
- DEHLG (2010b) *Circular NPW 1/10 & PSSP 2/10. Dated 11/03/2010.* Department of the Environment, Heritage and Local Government, Dublin.
- NPWS (2012a) *Marine Natura Impact Statements in Irish Special Areas of Conservation. A Working Document. April 2012.* National Parks & Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin.
- NPWS (2021) Guidance on the Strict Protection of Certain Animal and Plant Species under the Habitats Directive in Ireland. *National Parks & Wildlife Service Guidance Series* 1, Department of Housing, Local Government and Heritage, Dublin.
- Mullen, E., Marnell, F. and Nelson, B. (2021) Strict Protection of Animal Species – Guidance for Public authorities on the Application of Articles 12 and 16 of the EU Habitats Directive to development/works undertaken by or on behalf of a Public authority. *National Parks & Wildlife Service Guidance Series* 2, Department of Housing, Local Government and Heritage, Dublin.
- OPR (2021) *Appropriate Assessment Screening for Development Management. OPR Practice Note PN01.* Office of the Planning Regulator, Dublin.
- *Applications for Approval for Local Authority Developments made to An Bord Pleanála under 177AE of the Planning and Development Act, 2000, as amended (Appropriate Assessment) – Guidelines for Local*

Authorities <https://www.pleanala.ie/getmedia/0f385f48-7e84-43e3-b405-1201e490740a/Applications-for-approval-for-LA-Developments-S177AE-EN.pdf>. An Bord Pleanála, Dublin.

- Case law, including *Waddenzee* (C-127/02), *Sweetman v. An Bord Pleanála* (C-258/11), *Kelly v. An Bord Pleanála* (IEHC 400), *Commission v. Germany* (C-142/16), *People Over Wind* (C-323/17), *Holohan v. An Bord Pleanála* (C-461/17), *Eoin Kelly v. An Bord Pleanála* (IEHC 84) and *Heather Hill* (IEHC 450).

- Sundseth, K. and Roth, P. (2014) *Article 6 of the Habitats Directive – Rulings of the European Court of Justice.* Ecosystems LTD (N2K Group), Brussels.

5.2. Desk Study and Consultation

A desk study was carried out to collate information available on Natura 2000 sites in the vicinity of the proposed works. These areas were viewed using Google Earth, Google Maps[14] and Bing Maps[15] (last accessed 31/01/2022).

The National Parks and Wildlife Service (NPWS) and National Biodiversity Data Centre (NBDC) online databases were reviewed concerning European sites and their features of interest in the vicinity of the proposed project.

The locations and boundaries of Natura 2000 sites in relation to the proposed works were reviewed on the *NPWS Designations Viewer* (NPWS, 2022d). Information on the qualifying interests and the structures and functions of the relevant Natura 2000 sites was found in the Site Synopsis, Natura 2000 Standard Data Form, Conservation Objectives and supporting documents for each site. Reporting under Article 17 of the Habitats Directive (NPWS, 2019a-c; ETC/DB, 2022a) and Article 12 of the Birds Directive (NPWS, 2022e; ETC/BD, 2022b) provided further information on the habitats and species concerned at the national level.

Spatial and other data regarding rivers and other waterbodies were obtained from the Environmental Protection Agency (EPA) using its online facility *EPA Maps: Water* (EPA, 2022).

Locations and boundaries of all European sites within 15km of the proposed project were identified and reviewed using the NPWS online map viewer. Boundary shapefiles were also downloaded from this site to facilitate the preparation of project graphics.

Desktop information on relevant European sites were reviewed on the NPWS website, including the site synopsis for each SAC/SPA, the conservation objectives, the site boundaries as shown on the NPWS online map viewer, the standard Natura 2000 Data Form for the SAC/SPA which details conditions and threats of the sites, and published information and unpublished reports on the relevant European sites.

Relevant planning information for the surrounding area was reviewed using the planning enquiry systems of Kerry County Council. Search criteria were implemented to determine whether such projects or plans would not be relevant to this study. Information on other plans and projects proposed or consented to in the vicinity of the proposed works was also reviewed. This information was used to identify potential in-combination effects from other plans and projects with the proposed works.

Baseline data regarding the receiving environment, including Natura 2000 sites, was gathered through desk study and consultation with relevant bodies, most importantly the National Parks & Wildlife Service (NPWS).

5.3. Site Visits

An initial site visit to Glendowns Pond was carried out by Atkins Ecologists on the 20th August 2018. A number of short visits were also undertaken in November 2017 and April 2018. A second site visit was undertaken on the 9th of July 2022 by Triturus Environment Ltd, who were contracted by Atkins to conduct an aquatic baseline and fisheries survey of Glendowns Pond. The full survey is included in Appendix B. Glendowns Pond and the Little Borris Stream were broadly characterised in terms of their physical habitats, fish, macro-invertebrate and macrophyte (aquatic plant) communities. Environmental DNA (eDNA) was also collected to help validate the present of cryptic fish and invertebrate species including European eel (*Anguilla anguilla*), lamprey (*Lampetra*

[14] https://www.google.ie/maps
[15] http://www.bing.com/maps/

sp.) and white-clawed crayfish (*Austropotamobious pallipes*). The adjoining habitats were noted according to Fossitt (2000) to provide a baseline. These approaches are detailed below.

Site visits were undertaken following the Heritage Council's *Best Practice Guidance for Habitat Survey and Mapping* (Smith et al., 2011) and habitats were classified according to the Heritage *Council's A Guide to Habitats in Ireland* (Fossitt,2000). In addition, any habitats potentially corresponding to types listed on Annex I to the Habitats Directive were classified following the European Commission's *Interpretation Manual of European Union Habitats* (DG Env, 2013).

5.4. Impact Assessment

The assessment detailed in this report was undertaken in the following steps, following the best practice guidance highlighted above: -

1. Description of the proposed works, including their locations, nature, scale, duration, and potential impacts on the natural environment.

2. Description of the baseline conditions in the receiving environment, focussing on habitats, species, ecological corridors, and any known threats, pressures and activities.

3. Establishment of a Zone of Influence, and identification and description of Natura 2000 sites therein.

4. Identification of source-pathway-receptor chains between the proposed works and the qualifying interests of Natura 2000 sites, and evaluation of effects in view of the relevant conservation objectives.

5. Consideration of the potential for significant effects in combination with other plans and projects.

6. Conclusion and recommendation.

Further details of the methodology and the rationale behind it are provided in the relevant sections.

5.5. Statement of Authority

This report has been prepared by Sinéad Kinsella and reviewed by Paul O'Donoghue.

Sinéad Kinsella has a BSc in Applied Freshwater and Marine Biology. She has experience in preparing Appropriate Assessment Screening Reports, Natura Impact Statements and prepares Ecological Impact Assessment Reports and undertakes a range of ecological surveys (e.g. mammal and bat surveys) for a range of proposed developments.

Paul O'Donoghue is an Associate Director at Atkins. Paul holds a BSc (Hons) in Zoology, an MSc in Behavioural Ecology and a PhD in Avian Ecology and Genetics. Paul is a Chartered member of the Society for the Environment (CEnv) and a Full Member of the Chartered Institute of Ecology and Environmental Management (MCIEEM). Paul has over 18 years' experience in ecology; including extensive experience in the preparation of Habitat Directive Assessments/Natura Impact Statements, i.e. Appropriate Assessment under Article 6(3) of the Habitats Directive.

6. Receiving Natural Environment

This section provides an overall description of the natural environment in the vicinity of the proposed works and is not limited to Natura 2000 sites.

6.1. Habitats and Species

6.1.1. Site Surveys

6.1.1.1. 20th August 2018

A site visit to the Glendowns Pond was conducted by Atkins ecologists on the 20th August 2018. A number of short visits were also undertaken in November 2017 and April 2018.

Under habitat classification criteria set out in *A Guide to Habitats in* Ireland, (Fossitt, 2000) the Lake can be characterised a FL8 *other artificial lakes and Lakes.*

Around the Lake, all margins are heavily encroached by watercress (*Rorippa nasturtiumaquatica*) and fool's watercress (*Apium nodiflorum*). There are some areas of branched bur-reed (*Sparganium erectum*) present also. In the centre of the Lake is an island supporting several large trees, some of which have toppled and are lying in the Lake. This is likely to be causing hydrological issues, resulting in slower flow and circulation within the Lake and higher silt accumulation

The substrate appears to be anoxic with several centimetres of silt deposition, accumulation of dead plant matter and algal growth. The water appeared to be stationary within the Lake; it was observed that disturbed silt did not flow in any direction and duckweed (*Lemna minor*) was abundant at the margins.

The Lake is bordered to the east by amenity grassland (GA2) and ornamental trees, including cherry (*Prunus* sp.); Leylandii, cherry laurel (*Prunus laurocerasus*), etc. Along the outlet channel there are extensive areas of nettle (*Urtica dioica*), lesser celandine (*Ficaria verna*), sycamore (*Acer pseudoplatanus*) and ash seedlings (*Fraxinus excelsior*); indicating localised enrichment of soils alongside the Lake. The far shore of the Lake (western side) is lined by a mix of mature trees, including ash, sycamore, willows (Salix sp.), hawthorn (*Crataegus mongyna*) and non-native species. In a number of places trees and / or tree limbs have fallen into the Lake.

The Little Borris Stream flowing into the Lake from the southeast is highly calcareous and was not experiencing the same problems of siltation and marginal encroachment as the Lake downstream. Silt deposition may therefore either be an artefact of historical events, be episodic in nature or be entering via the unnamed stream from the west. Further study is required to confirm the over-riding influences on the Lake.

The Little Borris Stream was sampled for macroinvertebrates by kick sample. The results of this sampling exercise are displayed in Table 4-1. Species recorded are indicate of moderate water quality. Of note, two juvenile white-clawed crayfish (*Austropotamobius pallipes*) were recorded in the sample. White-clawed crayfish is listed on Annex II of the EU Habitats Directive. Crayfish have been recorded by the EPA in 1997 from the Triogue River (S478971), but not from the Little Borris Stream (Source; NBDC). Thus, this stream is of ecological importance and its value should be maintained. Therefore, any proposed works to the Lake should not extend back up the inflow stream.

Lamprey were also recorded in the stream during a site visit in April 2018. Observations suggest that they may have been spawning in the river (Plate 4-1). Lamprey are also listed on Annex II of the EU Habitats Directive. These are likely to be either Brook lamprey (*Lampetra planeri*) or River Lamprey (*L. fluviatilis*); though this would need to be confirmed by survey to determine. It would be important to determine which species in present as the River lamprey is anadromous (i.e. a species which migrates up rivers from the sea to spawn), while the Brook lamprey is not. The culvert downstream of the lake may represent a significant barrier to movement downstream from the Lake; suggesting that these are most likely Brook lamprey. Thus, this stream is of ecological importance and its value should be maintained.

There are no records of Lamprey species from the Triogue system (Source: NBDC). Both species are, however, qualifying interests of the River Barrow and River Nore SAC16, as is the white-clawed crayfish. Minnow (*Phoxinus*

phoxinus) were also noted in the stream. They are categorised as of Least concern with regard to their conservation status in Ireland. There are no records of Otter (*Lutra lutra*) from the Lake (Source: NBDC). Common frog (*Rana temporaria*) or smooth newt (*Lissotriton vulgaris*) have not been recorded; though frog tadpoles have been recorded from a nearby garden Lake (S4798).

Mallard (*Anas playtrhynchos*) and moorhen (*Gallinula chloropus*) were recorded using the Lake. A large number of droppings on trees along the western side of the Lake suggests that these trees are being used by bird species, such as crows, as either a pre-roost gatherings site or as a night-time roost. There was no evidence of nesting.

The stream flowing into the Lake from the southwest could not be surveyed due to access issues. However, during a site visit in April 2018, which encountered this stream approximately 500m upstream of its confluence with the Lake, it was noted that this stream had been heavily modified resulting in loss of riparian margins and heavily siltation. This silt input should be considered in the context of the condition of Glendowns Pond.

The outgoing stream is shallow and subject to heavy encroachment by marginal vegetation, slow flow and heavy accumulation of leaf litter and silt. There is no marginal heterogeneity which could conduct a higher flow rate and improve the condition of the substrate.

Table 6.1 Macroinvertebrate community identified at inflow to Glendowns Pond.

Little Borris Stream, Glendowns	
Species	Note
2 no. juvenile crayfish	<20mm length
Minnow	Rare
Species	DAFOR abundance
Potamopyrgus sp. Elmidae *Gammarus sp.* Hydropsychidae Tipulidae Limnephilidae *Ecdyonurus sp.* Oligochaetae Baetidae	Abundant Abundant Frequent Occurring Occurring Occurring Rare Rare Rare

Plate 6.1 Juvenile crayfish recorded upstream of Glendowns Pond.

6.1.1.2. 9th July 2022 - Aquatic Assessment Results

The following data is taken from Triturus Environmental, 2022 (included in full in Appendix B).

Site 1 – Little Borris Stream (lake inflow)

Survey site 1 was situated on the inflowing stream to Glendowns Pond, known as the Little Borris Stream (14L26). The stream was a small 4m wide lowland depositing (FW2) channel. The historically straightened channel had 0.5m bankfull heights but retained semi-natural flow characteristics with shallow riffle and glide present (typically 0.1m deep). Pool habitat (c. 0.3-0.5m deep) was very localised and largely restricted to the small bridge crossing area and offered refugia for fish during the low summer flows. The stream bed was dominated by small cobble with frequent mixed medium and fine gravels bedded between cobble and scattered isolated small boulder. The bed was heavily compacted with moderate to heavy siltation. The channel supported the frequent branched bur-reed (*Sparganium erectum*), occasional blue water-speedwell (*Veronica anagallis-aquatica*) and occasional narrow-fruited watercress (*Nasturtium microphyllum*) upstream of its confluence with Glendowns Pond. Macrophyte vegetation became sparse moving upstream towards the bridge crossing. No submerged macrophyte species were present in the channel. Instream cobble and scattered boulder supported occasional clumps of the moss *Rhynchostegium riparoides* with the liverwort *Pellia endiviifolia* being locally frequent. These are common bryophytes in midlands rivers. No rare macrophytes or bryophytes were recorded in the survey area and no examples of Annex I Habitat, 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260)' were recorded.

The riparian zone of the west bank supported mature beech (*Fagus sylvatica*) with a dense ivy (*Hedera helix*) carpet in the understory. The west bank supported scattered mature beech and sycamore with a recently cut dry grassy margin (GS2: Fossitt, 2000).

The Little Borris Stream had capacity to support a small brown trout population given its semi-natural character. However, the shallow depth, high siltation and enrichment evidently reduced the quality of the salmonid habitat overall. The nursery value was thus moderate at best given that the low summer flow reduced the available oxygenation in the riffle-glide area downstream of the bridge. Spawning habitat quality was considered moderate due to embedded substrata and moderate siltation pressures. Holding habitat was poor overall with it being limited to pool under the small bridge crossing. Despite evident hydromorphological pressures in the Little Borris Stream, brown trout were detected.

The Little Borris Stream also had good habitat quality for brook lamprey (*Lampetra planeri*). Spawning habitat was considered good locally given the presence mixed fine gravels in the interstitial spaces of cobble in the shallow riffle-glide habitat present. Ammocoete nursery habitat was also good with organic rich silt downstream of the spawning areas, particularly at the confluence with Glendowns Pond. The stream also had suitability to support an eel population and the presence of stoney refugia and pool habitat in addition to abundant silt for burial indicated good eel nursery habitat. Both European eel and brook lamprey were detected by eDNA sampling thus supporting the onsite observations (section 3.3 of Appendix B).

White-clawed crayfish were recorded at low density in the Little Borris Stream with n=4 adults captured during a search of 30 refugia. This equates to 1 crayfish per 7.5 refuges which is considered a low-density population. One of the four crayfish captured exhibited porcelain disease, a pathogen of crayfish caused by the microsporidian parasite *Thelohania contejeani* (see Plate 3.4 of Appendix B). In summary the Little Borris Stream has high local biodiversity value with a semi-natural character supporting brown trout, lamprey and crayfish populations.

Site 2 – Glendowns Pond, South Basin

The southern basin of Glendowns Pond included the confluence of the Little Borris Stream and the adjoining open water of the basin, inclusive of the small, wooded island. The lake basin was broadly oval in shape with a simple lake margin (i.e. no regular breaks with points and secluded bays etc.). The lake's summer depths averaged 0.1m and the basin supported clear water. The lakebed was heavily silted and had a green filamentous algae carpet covering 90% of the lakebed (as with the north basin), indicating gross eutrophication (refer to site 3 below). The south basin was even shallower than the north, with a very heavy build-up of exposed silt from the inflowing Little Borris Stream. The south side of the basin featured low gradient margins and supported a heavily vegetated littoral, particularly along the east bank and at the confluence of the inflowing stream. The margins supported macrophytes that graded into a herb and damp weed community characteristic of wet and paludal areas of lakes. Branched bur-reed was frequent with more localised common water starwort (*Callitriche*

stagnalis). Water mint (*Mentha aquatica*) was occasional on the littorals of the island along with frequent blue water-speedwell. The confluence of the inflowing Little Borris Stream supported small patches of narrow fruited watercress. The lake margins also supported frequent great willowherb (*Epilobium hirsutum*), hedge bindweed (*Calystegia sepium*), clustered dock (*Rumex conglomeratus*) and purple loosestrife (*Lythrum salicaria*). The southern basin was lined by mature trees, particularly along the west bank where mature sycamore (*Acer pseudoplatanus*), ash (*Fraxinus excelsior*) and ivy were present. The central island supported mainly grey willow (*Salix cinerea* sp. *oleifolia*) and sycamore with a very mature white willow (*Salix alba*) also present. The adjoining eastern bank of the lake graded into the parkland of the Glendowns Estate and supported scattered weeping willow (*Salix babylonica*), large-leaved lime (*Tilia playphyllus*), birch (*Betula* sp.), sergeant's cherry (*Prunus sargentii*), copper beech (*Fagus sylvatica purpurea*) and sycamore.

A number of small fish species were recorded via sweep samples. These included three-spined stickleback (*Gasterosteus aculeatus*), ten-spined stickleback (*Pungitius pungitius*) and stone loach (*Barbatula barbatula*). Glendowns Pond was considered to have suitability to support lamprey at the confluence with the Little Borris Stream. The lake also supports a small brown trout population that may migrate between the lake and the Little Borris Stream, dependent on water levels. The lake also had high suitability for European eel. Brown trout, lamprey and European eel were all detected in the composite eDNA sample from the lake.

No white-clawed crayfish were recorded during sweep sampling of the lake basin and the habitat was considered sub-optimal due to heavy siltation and enrichment. Crayfish were however detected in the eDNA samples collected from the lake and are likely present at low densities. The species may move between the Little Borris Stream and Glendowns Pond when foraging at night.

Plate 6.2 Representative image of the south basin facing towards the Little Borris Stream confluence illustrating dense growth of branched bur-reed on the east bank.

Plate 6.3 Profuse growth of branched bur-reed and blue water speedwell on the muddy paludal areas of Glendowns Pond (south basin) at the Little Borris Stream confluence point.

Site 3- Glendowns Pond, North Basin

The northern basin of Glendowns Pond had a heavily vegetated littoral particularly along the east bank and at the outflow of the Little Borris Stream. This included a dense reed swamp littoral comprising branched bur-reed with great willowherb and bittersweet (*Solanum dulcamara*) on the immediate lake littoral. Small patches of common water starwort and the narrow leaved pondweed species *Stuckenia pectinata* were present in the margins of the open water of the basin. Water mint was present in the small bay in the north-west corner of the lake. Given the very shallow nature of the lake basin (average 0.15m deep) and clear water conditions, the soft silt bed had a high coverage (90%) of green filamentous algae (Plate 3.7). The west bank was lined by overhanging mature trees, where mature 30m-high black poplar (*Populus nigra*), crack willow and sycamore were present.

Scattered ornamental trees were present on the east bank including weeping willow, goat willow (*Salix caprea*), copper beech, large-leaved lime, and downy birch (*Betula pubescens*). As with the south basin, the north basin also supported populations of three-spined stickleback, ten spined stickleback and stone loach. The north basin was also considered to have suitability for lamprey particularly at the outflowing Little Borris Stream. The north basin likely also supports a small brown trout population that may migrate between the lake and Little Borris Stream, dependent on water levels. There was high suitability for European eel. Brown trout, lamprey and European eel were all detected in the composite eDNA sample from the lake.

No white-clawed crayfish were recorded during sweep sampling of the lake basin and the habitat was considered sub-optimal due to heavy siltation and enrichment. Crayfish were however detected in the eDNA sample collected from the lake and are likely present at low densities.

Plate 6.4 Heavily silted shallow nature of Glendowns Pond showing very high cover of blanket filamentous green algae.

Plate 6.5 Heavily silted margins of the north basin of Glendowns Pond near the outflow.

Plate 6.6 Heavily vegetated littoral of the east bank in the northern basin of Glendowns Pond showing branched bur-reed, great willow herd, bittersweet and hedge bindweed bordering recently cut dry grassy meadow (GS2 vegetation).

Plate 6.7 Disused otter holt (background) in poorly accessible west bank of Glendowns Pond adjacent to old fishing net and waders.

Site 4 – Little Borris Stream (lake outflow)

The Little Borris Stream (14L26) exited Glendowns Pond in the north-eastern corner and continued in a historically widened and straightened channel before it entered a culvert under the Stradbally Road (N80). The outflowing stream was predominantly 4-5m wide in narrow sections of the channel but widened to 15m in a small muddy bay adjoining mixed broad-leaved woodland (WD1) on the west bank. The stream was very shallow at 0.1m to 0.2m deep and the substrata comprised deep silt to 0.5m depth. The stream had been historically widened and realigned as part of historical drainage works and thus flow rates were very low and the profile comprised exclusively of very slow-flowing glide and or stagnating water. The slow flows resulted in high growth of common duckweed (*Lemna minor)* that covered 15% by surface area of the channel, forming large floating rafts in the margins along with biofilms. The stream was evidently enriched (exhibiting eutrophic conditions) and suffered from heavy siltation but the water was clear and no hydrocarbon slicks or foul smell was observed during the survey. Instream, the channel supported brooklime (*Veronica beccabunga*) and fool's watercress (*Apium nodiflorum*) locally. Branched bur-reed was frequent at the lake outflow in addition to occasional blue-water speedwell and bittersweet in muddy paludal areas. No rare macrophytes or bryophytes were recorded in the survey area and no examples of Annex I Habitat 'Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation (3260)' were recorded.

The riparian zone of the west bank was open with dry grassy verges (GS2) that were recently cut back and scattered mature trees including weeping willow, silver birch (*Betula pendula*), sergeants cherry, downy birch, grey willow, sycamore and ash. The east bank comprised mixed broadleaved woodland with sitka spruce (*Picea sitchensis*), ash and sycamore with a shaded understory supporting mainly nettle (*Urtica dioica*). The shallow nature of the outflowing stream (with deep silt accumulations) offered poor suitability for brown trout due to the absence of spawning, nursery and or holding habitat. The Little Borris Stream also provided good habitat quality

for brook lamprey ammocoetes (i.e. nursery habitat) given abundant organic-rich silt downstream of the lake. The outflowing stream also had suitability to support an eel population given eels often bury in silt (like lamprey) and can use silty streams as nursery areas (pers. obs.). Indeed, both European eel and brook lamprey were detected by eDNA sampling downstream of the lake, thus supporting the onsite observations. No white-clawed crayfish were captured during sweep netting of marginal macrophytes. There was no suitable boulder and cobble habitat for the species given gross siltation.

Plate 6.8 The Little Borris Stream downstream of Glendowns Pond showing gross siltation.

Plate 6.9 The Little Borris Stream at the culvert crossing of the Stradbally Road (N80) showing low summer flows and heavy siltation.

Otter

An otter survey was undertaken around the full circumference of the lake and in the adjoining Little Borris Stream. No otter signs were recorded apart from a disused otter holt (ITM 647801, 698379) in the northwest corner of Glendowns Pond in dense tree cover and scrub (Plate 3.10). A local resident stated that an otter was killed on the road during 2020. It is unknown whether the same otter used the otter holt recorded during the July 2022 survey.

Environmental DNA (eDNA)

Site 1, the Little Borris Stream, upstream of Glendowns Pond, tested positive for European eel, lamprey, brown trout and smooth newt. Very strong eDNA signatures were recorded for eel, lamprey and brown trout which is considered evidence of these species' presence. Only a single qPCR replicate was positive for smooth newt indicating low concentrations of the species eDNA. The result indicates a small local population present in the Little Borris Stream at or upstream of the survey area with no eDNA detected downstream in Glendowns Pond or in the outflowing Little Borris Stream (Appendix B). As white-clawed crayfish were recorded present during the site surveys no eDNA sample was collected as the species presence was already confirmed.

Site 4, on the Little Borris Stream, downstream of Glendowns Pond, also had strong eDNA signatures for European eel, lamprey and white-clawed crayfish (Appendix B). While upstream populations of these species could spike the samples, the strong signatures recorded (i.e. high number of positive replicates) likely support these species' presence. Brown trout eDNA was not collected given the very poor habitat and water quality that was not considered suitable to support the species in the outflowing Little Borris Stream. No smooth newt eDNA was recorded present which is considered evidence of the species' absence at site 4 (i.e. present in the pond or upstream habitats).

The composite eDNA samples collected from Glendowns Pond tested positive for white-clawed crayfish, lamprey, brown trout and European eel (Appendix B). The strong eDNA signatures (i.e. 12 positive qPCR replicates out of 12) supports the presence of these species within the lake. The oxygenation from the Little Borris Stream likely helps support these high conservation value species within the pond basin, which suffers from eutrophication pressures and heavy siltation. Northern pike (*Esox lucius*) eDNA was detected; however, the shallow nature of the lake and poor water quality would likely be incapable of supporting the species. No smooth newt eDNA was recorded which is consider evidence of the species' absence at Glendowns Pond.

Macro-invertebrate (Q-sampling)

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from *n*=2 sites in July 2022 from the Little Borris Stream.

Macro-invertebrate (pond samples)

In July 2022, a composite macro-invertebrate sweep sample was collected from Glendowns Pond. A total of *n*=21 species were recorded between the two samples. The BMWP average score per taxon (ASPT) scores of 4.4 and 4.2 would indicate the pond is 'moderately impacted'. This was supported by the observed anoxic sediment, exuberant filamentous algae growth and the presence of abundant common duckweed in the pond the poorer water quality is also reflected in the more pollution tolerant invertebrate community composition as described below.

No rare or protected macro-invertebrate species were recorded in the Glendowns Pond sample when compared to national red lists for aquatic beetles (Foster et al., 2009), stoneflies (Feeley et al., 2020), mayflies (Kelly-Quinn & Regan, 2012) and other relevant taxa (e.g., molluscs; Byrne et al., 2009). The invertebrate community at Glendowns Pond was dominated by pollution-tolerant species such as corixids (water boatmen), chironomids (bloodworm), freshwater hog-louse (*Asellus aquaticus*), gastropod snails and tubificid worms. A single specimen of the ubiquitous blue-tailed damselfly (*Ischnura elegans*) was recorded with an absence of any notable rare damselfly or dragonfly species. Blue-tailed damselfly are considered tolerant to pollution (enrichment) and are a very widespread species across Ireland in vegetated shallow, and enriched ponds. The beetle species *Haliplus lineatocollis*, *Helophorus brevipalpis* and a member of the *Haliplus ruficollis* group were recorded during the survey. These species are widespread species of shallow enriched ponds with weedy margins. A single mayfly species, the pond olive (*Cloeon simile*), was recorded in fair numbers during the survey. This species is common in ponds where oxygen levels are good but the species is notably tolerant of enrichment and siltation.

6.1.2. Invasive Species

Section 49 and 50 of Part 6 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011) outlines the legal context for the prohibition of the introduction and dispersal of certain plant and animal species. Specifically, Section 49, paragraph 2 states that any person without the required licence "*who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow*" any plant species listed in Part 1 of the Third Schedule within the State shall be guilty of an offence.

There are no records of Japanese knotweed (*Fallopia japonica*) from Glendowns Pond (Source: NDBC). It has, however, been recorded from Páirc an Phobail to the west. There are also no records of Himalayan (Indian) balsam (*Impatiens glandulifera*); Giant Hogweed (*Heracleum mantegazzianum*), Giant-rhubarb (*Gunner* sp.). Himalayan knotweed (*Persicaria wallichii*) or Giant knotweed (*Fallopia sachalinensis*) from Glendowns Pond.

Again, whilst not an exhaustive survey, no aquatic invasive species were noted.

6.2. Ecological Corridors

Two small streams feed Glendowns Pond, entering from the southwest (unnamed watercourse) and southeast (Little Borris Stream) (Figure 2.3). There is one outflow point from the north of the Lake which is culverted to the north and re-emerges as the Borris Great Stream. As noted, there are two other Lakes in the vicinity of Glendowns Pond, neither of which are hydrologically linked to Glendowns Pond.

Little Borris Stream rises in the townland of Derry to the southeast of the M7. It is culverted under the M7 and continues in a westerly direction, before turning to the north / northwest into the townland of Downs and Summerhill, where the Glendowns Pond is located. After exiting Glendowns Pond through a trash screen the stream passes under the Stradbally Road (N80). The stream appears to be largely culverted through / under St. Fintan's Psychiatric Hospital, the Dublin Road (R445) and the Prison, before remerging in Ballyroan (southeast of the railway line). Downstream of the Lake it is known as the Borris Great Stream.

The distance from source to Glendowns Pond is ca. 3.2km. Its confluence with the Triogue River is ca. 5.8km from the Lake outlet (near Two Mile Bridge). Before joining the Triogue River the Borris Great Stream joins with a number of other small watercourses which drain lands to the north and east of Portlaoise.

The second inflow enters the western side of Glendowns Pond. It appears to start in the environs of the new school on the Southern Circular Road; upstream of this point it appears to receive contributions from a network of drainage ditches. It is separated from the Triogue River by an esker (Ridge of Portlaoise pNHA).

There is no water quality data for either stream present on the EPA MapViewer[16].

As mentioned, Glendowns Pond is distantly linked to the River Barrow and River Nore SAC (site code: 002162) via 13km along the Borris Great Stream and the River Triogue (Figure 4-2). The Ridge of Portlaoise proposed Natural Heritage Area (pNHA) (site code:000876) is located c. 120m to the west of Glendowns Pond but has no hydrological connection to the proposed works area.

The Borris Great Stream, which is the outflow stream of Glendowns Pond, and the Little Borris Stream, which is an inflow stream of the lake, are both located within Hydrometric Area no. 14 – the Barrow Catchment and the Barrow_SC_020 subcatchment.

Q-values, a biological water quality metric based on the composition of a river's macroinvertebrates community, detail the Triogue River, which the Borris Great Stream joins, as being of 'Poor' (Q3) ecological condition at a sampling station 'Eyne Bridge' ca. 6.4km downstream of Glendowns Pond.

[16] https://gis.epa.ie/EPAMaps/

7. Connectivity to Natura 2000 sites

7.1. Zone of Influence

The "*Zone of Influence*" of a plan or project is the area which may experience ecological effects as a result of its implementation, including any ancillary activities. The various impacts of a plan or project will each have their own characteristics, e.g. nature, extent, magnitude, duration etc. Accordingly, the area subject to each impact ("zone of impact") will vary depending on characteristics of the impact and the presence of pathways for its propagation. Ecological features within or connected to one or more zones of impact could, depending on their sensitivities, be affected by the plan or project under consideration. The area containing such features may be regarded as the Zone of Influence. As such, in establishing the Zone of Influence for a plan or project, regard must be had to the characteristics of its potential impacts, potential pathways for impacts and the sensitivities of ecological features in the receiving environment.

In its guidance on selecting which Natura 2000 sites to include in the AA Screening, *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities* (DEHLG, 2010a) recommends inclusion of sites in the following three categories: -

- Any Natura 2000 sites within or adjacent to the plan or project area,
- Any Natura 2000 sites within the Zone of Influence of the plan or project (generally within 15 km for plans, to be established on a case-by-case basis for projects, having regard to the nature, scale and location of the project, the sensitivities of the ecological receptors and the potential for in-combination effects), and
- Following the precautionary principle, any other Natura 2000 sites for which the possibility of significant effects cannot be excluded, e.g. for a project with hydrological impacts, it may be necessary to check the full extent of the catchment for Natura 2000 sites with water-dependent qualifying interests.

In addition, *Assessment of plans and projects in relation to Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC, 2021) recommends consideration of Natura 2000 sites hosting fauna which could move to the plan or project area or its zone(s) of impact, and the potential for the plan or project to sever ecological connectivity within or between Natura 2000 sites. *Appropriate Assessment Screening for Development Management* (OPR, 2021) emphasises the importance of employing the source-pathway-receptor model (rather than arbitrary distances such as 15 km) when selecting Natura 2000 sites for inclusion in the AA Screening.

Based on the descriptions of the proposed works (Section 3) and the receiving natural environment (Section 6), the zones of impact of the proposed works were defined as: -

- For temporary disturbance to fauna, all areas within a precautionary buffer of 500m of each of the proposed works locations, and
- For hydrological impacts, waterbodies and riparian zones/floodplains within 500m of all works locations and downstream waterbodies as far as any accidental pollution could conceivably be carried.

The Zone of Influence was defined as the above zones of impact as well as other areas with potential ecological connectivity to them, i.e. the freshwater stretches of the Borris Great Stream and the River Triogue and its tributaries downstream of the proposed works on Glendowns Pond, including the riparian zone.

Publicly available spatial data for river, transitional and coastal waterbodies (EPA, 2022) were used in conjunction with aerial imagery to identify pathways and zones of impact for disturbance and water quality impacts from the proposed works. These were then mapped in relation to Natura 2000 sites (see Figure 7.1). In addition, the wider Zone of Influence described above was examined to identify any other Natura 2000 sites with potential ecological connections to these zones of impact.

7.2. Identification of Sites

7.2.1. Disturbance to habitats

The River Barrow and River Nore is designated for a number of aquatic or riparian habitats. The habitats present within the zone of impact for disturbance could for example include 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' (3260).This habitat is a qualifying interests of the River Barrow and River Nore SAC (site code: 002162) and must be considered.

*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)' (91E0) is also a qualifying interests of the River Barrow and River Nore SAC (site code: 002162) and is frequently found alongside wetland habitats such as lakes. While not recorded within the 10km grid square[17] (S40) which the proposed works is located within its potential occurrence on site should be considered.

7.2.2. Hydrological impacts

Water quality

'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' (3260), Freshwater Pearl Mussel (*Margaritifera durrovensis*), Atlantic Salmon (*Salmo salar*), Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*) and White-clawed Crayfish (*Austropotamobius pallipes*) are all known to occur or considered likely to occur within the zone of impact for water quality impacts from the proposed works. These habitats and species are directly sensitive to water quality impacts and are qualifying interests of the River Barrow and River Nore SAC.

Based on the presence or likely presence of these qualifying interests of the River Barrow and River Nore SAC within the zone of impact for water quality impacts, there are clear pathways for impacts from the proposed works.

7.2.3. Disturbance to fauna

Otter (*Lutra lutra*), which is a qualifying interest of the River Barrow and River Nore SAC, was not recorded during the site survey within the area of the proposed works. A disused otter holt was recorded in the northwest corner of Glendowns Pond. There is also no record of otter present within the zone of impact for water quality impacts recorded by the NBDC. Therefore,

7.2.4. Invasive alien species

The introduction or spread of any aquatic or riparian invasive alien species could negatively affect the river itself, i.e. 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' (3260) and the communities of fish and other native aquatic species. The introduction or spread of any terrestrial invasive alien species could negatively affect '*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)' (91E0). In addition, the introduction or spread of diseases such as crayfish plague pose a risk to species such as White-clawed Crayfish (*Austropotamobius pallipes*). As these habitats and species are qualifying interests of the River Barrow and River Nore SAC, there are clear pathways for impacts from invasive alien species.

7.2.5. Indirect effects

In the wider Zone of Influence, the following Natura 2000 sites occur: -

- Blackstairs Mountain SAC (site code: 000770)
- Ballyprior Grassland SAC (site code: 002256)
- Mountmellick SAC (site code: 002141)

[17] https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2019_Vol2_Habitats_Article17.pdf

- Slieve Bloom Mountains SAC (site code: 000412)
- Slieve Bloom Mountains SPA (site code: 004160)
- River Nore SPA (site code:004233)

The Blackstairs Mountain SAC is located downstream of the proposed via the Triogue River and the River Barrow ca. 53km from the proposed works site, via straight line distance. There is a remote hydrological connection, from the proposed works to this SAC. The qualifying interests of this site are Northern Atlantic wet heaths with Erica tetralix [4010] and European dry heaths [4030]. Ballyprior Grassland SAC is located ca. 11.6km from the proposed works site and the sole qualifying interest is semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210]. Mountmellick SAC is located ca. 10.4km from the proposed works site and the sole qualifying interest is Desmoulin's Whorl Snail (*Vertigo moulinsiana*) [1016]. Slieve Bloom Mountains SAC is located ca. 13.3km from the proposed works site and the qualifying interests of this site are Northern Atlantic wet heaths with *Erica tetralix* [4010], Blanket bogs (* if active bog) [7130] and Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae*) [91E0]. Slieve Bloom Mountains SPA is also located ca. 9.5km from the proposed works site, via straight line distance, and the qualifying interest is Hen Harrier (*Circus cyaneus*) [A082]. The River Nore SPA is located ca. 15km from the proposed works and there is no hydrological connection between the two. The sole qualifying interest of this SPA is the Kingfisher (*Alcedo atthis*) [A229] and there was no suitable habitat for kingfisher recorded in the vicinity of the proposed works. Given these distances and the lack of ecological connectivity between the zones of impact of the proposed works and the qualifying interests of these sites, the possibility of likely significant effects on these sites can be ruled out at this stage.

Summary

Based on the above examination of the Zone of Influence, the following Natura 2000 sites have been selected for inclusion in the screening assessment: -

- **River Barrow and River Nore SAC (site code: 002162).**

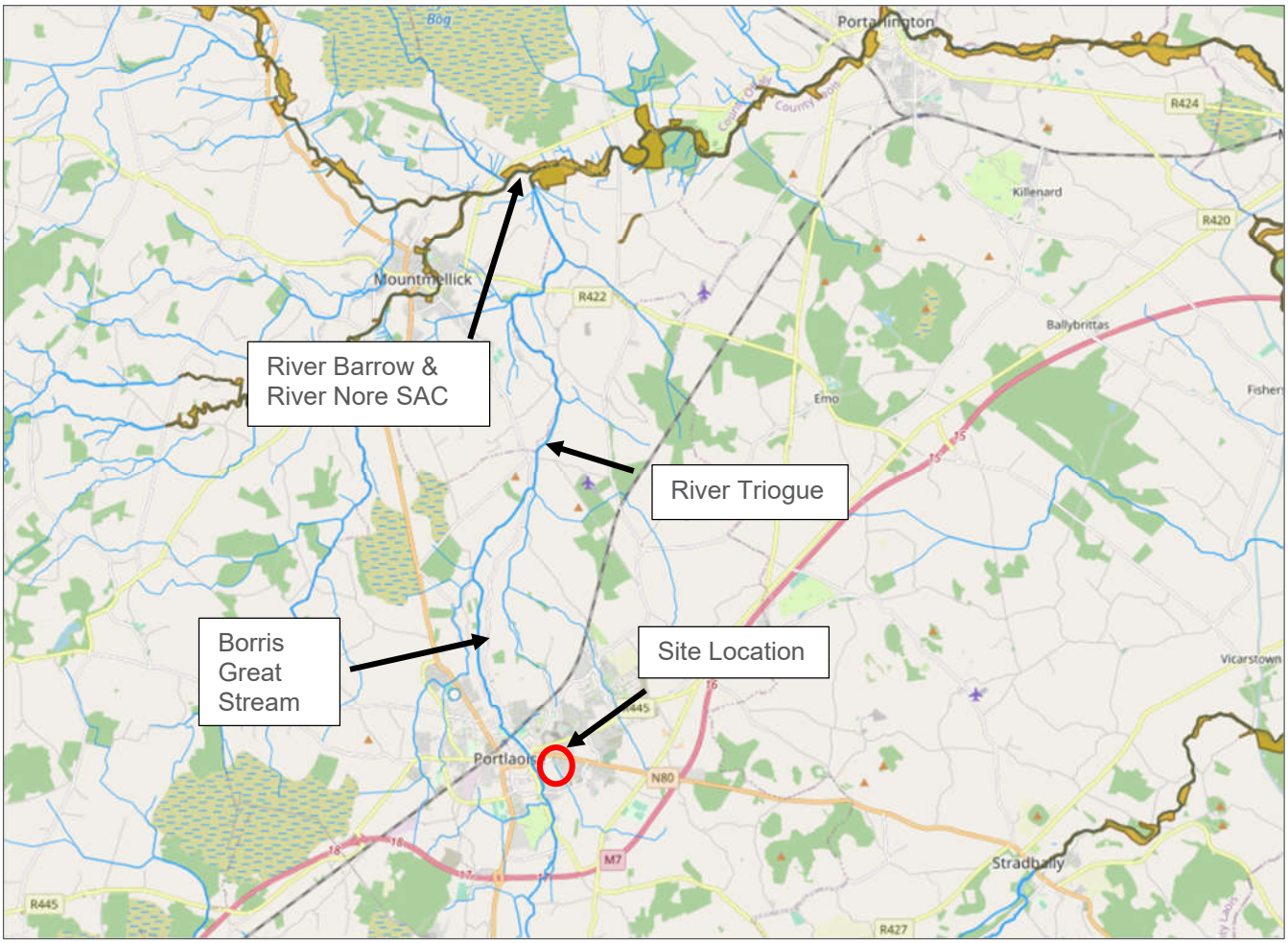

Figure 7.1 Glendowns Pond (red circle) in relation to the River Barrow and River Nore SAC (orange area) (Source: EPA Maps).

Figure 7.2 Glendowns Pond (red circle) in relation to the Slieve Bloom Mountains SPA (orange area)
(Source: EPA Maps).

7.3. Site Descriptions

The description of European sites presented in this section are based on the Site Synopsis, Conservation Objectives and Natura 2000 Standard Data Form documents for the sites concerned, augmented by information from the supporting documents available on the site-specific pages of the NPWS website.

Annex I habitat types marked with an asterisk (*) are “priority habitat types”, i.e. natural habitat types in danger of disappearing and for the conservation of which the EU has a particular responsibility given the proportion of their natural ranges falling within the European territory of Member States.

7.3.1. River Barrow and River Nore SAC

Overview

This site consists of the freshwater stretches of the River Barrow and River Nore, including their main tributaries, as far upstream as the Slieve Bloom Mountains, as well as the tidal elements and estuary as far downstream as Creadun Head, Co. Waterford. The larger of the tributaries include the Lerr, Fushoge, Mountain, Aughavaud, Owenass, Boherbaun and Stradbally Rivers on the Barrow, and the Delour, Dinin, Erkina, Owveg, Munster, Arrigle and King’s Rivers on the Nore. The site is very important for the presence of a number of Annex II animal species including Freshwater Pearl Mussel (both *Margaritifera margaritifera* and *M. m. durrovensis*), White-clawed Crayfish, Atlantic Salmon, Twaite Shad, Sea Lamprey, Brook Lamprey and River Lamprey, the tiny whorl snail *Vertigo moulinsiana* and Otter. This is the only site in the world for the hard-water form of Freshwater Pearl Mussel (*M. m. durrovensis*) and one of only a handful of spawning grounds in the country for Twaite Shad. The freshwater stretches of the River Nore main channel is a designated salmonid river. The Barrow/Nore is mainly a grilse fishery though spring salmon fishing is good in the vicinity of Thomastown and Inistioge on the Nore. The upper stretches of the Barrow and Nore, particularly the Owenass River, are very important for spawning. The old oak woodland at Abbeyleix has a typical bird fauna including Jay, Long-eared Owl and Raven.

Overall, the site is of considerable conservation significance for the occurrence of good examples of habitats and of populations of plant and animal species listed on Annexes I and II to the Habitats Directive.

Qualifying Interests and Conservation Objectives

The River Barrow and River Nore SAC was selected for the following qualifying interests: -

- Estuaries (1130)
- Mudflats and sandflats not covered by seawater at low tide (1140)
- Reefs (1170)
- *Salicornia* and other annuals colonising mud and sand (1310)
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (1330)
- Mediterranean salt meadows (*Juncetalia maritimi*) (1410)
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260)
- European dry heaths (4030)
- Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430)
- *Petrifying springs with tufa formation (*Cratoneurion*) (7220)
- Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles (91A0)

- *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) (91E0)
- Desmoulin's Whorl Snail (*Vertigo moulinsiana*) (1016)
- Freshwater Pearl Mussel (*Margaritifera margaritifera*) (1029)
- White-clawed Crayfish (*Austropotamobius pallipes*) (1092)
- Sea Lamprey (*Petromyzon marinus*) (1095)
- Brook Lamprey (*Lampetra planeri*) (1096)
- River Lamprey (*Lampetra fluviatilis*) (1099)
- Twaite Shad (*Alosa fallax*) (1103)
- Atlantic Salmon (*Salmo salar*) (1106)
- Otter (*Lutra lutra*) (1355)
- Killarney Fern (*Trichomanes speciosum*) (1421)
- Nore Freshwater Pearl Mussel (*Margaritifera durrovensis*) (1990)

The site-specific conservation objectives of the River Barrow and River Nore SAC for the habitats for which the site was selected are to restore the favourable conservation condition of 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)' (1330), 'Mediterranean salt meadows (*Juncetalia maritimi*)' (1410), 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles' (91A0) and '*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)' (91E0) and to maintain the favourable conservation condition of 'Estuaries' (1130), 'Mudflats and sandflats not covered by seawater at low tide' (1140), '*Salicornia* and other annuals colonising mud and sand' (1310), 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' (3260), 'European dry heaths' (4030), 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels' (6430) and '*Petrifying springs with tufa formation (Cratoneurion)' (7220). There is no site-specific conservation objective for 'Reefs' (1170) in the River Barrow and River Nore SAC.

The site-specific conservation objectives of the River Barrow and River Nore SAC for the species for which the site was selected are to restore the favourable conservation condition of Sea Lamprey, Brook Lamprey, River Lamprey, Twaite Shad, Atlantic Salmon, Otter and Nore Freshwater Pearl Mussel and to maintain the favourable conservation condition of Desmoulin's Whorl Snail, White-clawed Crayfish and Killarney Fern. There is no site-specific conservation objective for Freshwater Pearl Mussel in the River Barrow and River Nore SAC. The status of this species as a qualifying interest of the site is currently under review and the outcome of the review will determine whether or not a site-specific conservation objective is set.

Threats, Pressures and Activities

Land use within the SAC consists mainly of agricultural activities, mostly intensive grazing and silage production. Slurry is spread over much of the area. Arable crops are also grown. The spreading of slurry and fertiliser poses a threat to the water quality of the salmonid river and to the populations of Annex II animal species within the site. Many of the woodlands along the rivers belong to old estates and support many non-native species. Little active woodland management occurs. Fishing is a main tourist attraction along stretches of the main rivers and their tributaries and there are a number of angling associations, some with a number of beats. Fishing stands and styles have been erected in places. Both commercial and leisure fishing takes place on the rivers. There is net fishing in the estuary and a mussel bed also. Other recreational activities such as boating, golfing and walking, particularly along the Barrow towpath, are also popular. There is a golf course on the banks of the Nore at Mount Juliet and GAA pitches on the banks at Inistioge and Thomastown. There are active and disused sand and gravel pits throughout the site. Several industrial developments, which discharge into the river, border the site. New Ross is an important shipping port. Shipping to and from Waterford and Belview ports also passes through the estuary.

The main threats to the site and current damaging activities include high inputs of nutrients into the river system from agricultural run-off and several sewage plants, over-grazing within the woodland areas, and invasion by non-native species, e.g. Cherry Laurel (*Prunus laurocerasus*) and Rhododendron (*Rhododendron ponticum*). The water quality of the site remains vulnerable. Good quality water is necessary to maintain the populations of the Annex II animal species listed above and is dependent on controlling fertilisation of the grasslands, particularly along the River Nore. It also requires that sewage be properly treated before discharge. Drainage activities in the catchment can lead to flash floods that can damage many Annex II species. Capital and maintenance dredging within the lower reaches of the system pose a threat to migrating fish species such as lamprey and shad. Land reclamation also poses a threat to the salt meadows and the populations of legally protected species therein.Table Table 7.1 below lists the threats, pressures and activities with negative impacts on the site, as per its Natura 2000 Standard Data Form (NPWS, 2020a).

Table 7.1 Threats, pressures and activities with negative impacts on the River Barrow and River Nore SAC.

Rank	Threat, pressure or activity (code)	Threat, pressure or activity (description)	Inside, outside or both
High	A02.01	agricultural intensification	both
Medium	A04.01.01	intensive cattle grazing	inside
Low	A10.01	removal of hedges and copses or scrub	inside
Medium	B02	Forest and Plantation management & use	both
Medium	B05	use of fertilizers (forestry)	both
Medium	B07	Forestry activities not referred to above	both
Low	C01.01.01	sand and gravel quarries	both
Medium	C01.03	Peat extraction	outside
Low	D03.01	port areas	inside
Low	E02	Industrial or commercial areas	outside
Low	F01.01	intensive fish farming, intensification	inside
Medium	F02	Fishing and harvesting aquatic resources	outside
Low	F02.01.02	netting	inside
Low	F02.03	Leisure fishing	inside
High	H01	Pollution to surface waters (limnic & terrestrial, marine & brackish)	both
Medium	I01	invasive non-native species	inside
Medium	J02	human induced changes in hydraulic conditions	both
Medium	J02.02.01	dredging/ removal of limnic sediments	inside
High	J02.05.02	modifying structures of inland water courses	inside
Medium	J02.06	Water abstractions from surface waters	inside
High	J02.12.02	dykes and flooding defence in inland water systems	inside
Medium	J03.02.01	reduction in migration/ migration barriers	inside
High	K01.01	Erosion	inside
Medium	M01	Changes in abiotic conditions	inside

NPWS (2020a) and Eionet (2022)

8. Likely Significant Effects

8.1. Identification of Potential Impacts

The identification of potential impacts in this section uses the "*source-pathway-receptor*" model. According to this model, for an impact to exist, all three of the following criteria must be met: -

- Some aspect of the plan or project must act as a source of an impact,
- There must be a pathway capable of conveying the impact to a receptor, and
- The receptor must be sensitive to the impact.

The types of impacts likely to arise from the proposed works and their specific sources are described in Section 8.1 and the receptors are the qualifying interests of the European sites concerned, as listed in Section 7.3 above. Given that the sources and the receptors are already known, the following subsections focus on the identification of potential pathways between those sources and receptors.

8.1.1. River Barrow and River Nore SAC

Potential impacts to the qualifying interests of the River Barrow and River Nore SAC are identified in Table 8.1 below.

Table 8.1 Identification of pathways for impacts to the River Barrow and River Nore SAC.

Qualifying interest	Description and location	Pathways for impacts	Potential impact
Estuaries (1130)	The downstream part of a river valley, below the limit of brackish waters, or coastal inlets with significant freshwater influence. The River Nore estuary is located >125km downstream (>80km via straight line distance) of the proposed works, below Inistioge.	The only pathway between the proposed works and this qualifying interest is hydrological. While there is a hydrological link between the works area this qualifying interest, given the small scale and short duration of the works, and the >125km length of river between the source and the receptor, any perceptible impacts can be ruled out at this stage.	No
Mudflats and sandflats not covered by seawater at low tide (1140)	Intertidal sections of the coastline where the substrate is dominate by mud and sand. The nearest examples of this habitat type are in the Barrow-Nore Estuary at New Ross, >110km downstream of the proposed works.	The only pathway between the proposed works and this qualifying interest is hydrological. While there is a hydrological link between the works area and examples of this habitat in the Barrow-Nore estuary, given the small scale and short duration of the works, and the >110km length of river between the source and the receptor, any perceptible impacts can be ruled out at this stage.	No
Reefs (1170)	Marine features with hard substrate available for colonisation by plants and animals. The nearest example of a reef occurs near Duncannon, >100km downstream of the proposed works.	The only pathway between the proposed works and this qualifying interest is hydrological. While there is a hydrological link between the works area and examples of this habitat in the Nore-Barrow estuary, given the small scale and short duration of the works, and the >100km length of river between the source and the receptor, any perceptible impacts can be ruled out at this stage.	No
Salicornia and other annuals colonising mud and sand (1310)	Pioneer saltmarsh community on muddy sediment seaward of established saltmarsh or forming patches within other saltmarsh communities where the elevation is suitable and there is regular tidal inundation. The nearest examples of this habitat type are most likely to be found in the Barrow-Nore Estuary below New Ross, >110km downstream of the proposed works.	The only pathway between the proposed works and this qualifying interest is hydrological. While there is a hydrological link between the works area and examples of this habitat in the Barrow-Nore estuary, given the small scale and short duration of the works, and the >110km length of river between the source and the receptor, any perceptible impacts can be ruled out at this stage.	No
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (1330)	Saltmarshes of the Baltic, North Sea, English Channel and Atlantic shores, occupying the lower, middle and the transition to upper saltmarsh zones, of importance for other wildlife, including waterbirds. The nearest examples of this habitat type are most	The only pathway between the proposed works and this qualifying interest is hydrological. While there is a hydrological link between the works area and examples of this habitat in the Barrow-Nore estuary, given the small scale and short duration of the works, and the >110km	No

Qualifying interest	Description and location	Pathways for impacts	Potential impact
	likely to be found in the Barrow-Nore Estuary below New Ross, >110km downstream of the proposed works.	length of river between the source and the receptor, any perceptible impacts can be ruled out at this stage.	
Mediterranean salt meadows (*Juncetalia maritimi*) (1410)	The upper zone of saltmarshes, usually adjacent to the boundary with terrestrial habitats, widespread on the Irish coastline, though not as extensive as Atlantic salt meadows. Distinguished from Atlantic salt meadows by the presence of rushes such as Sea Rush (*Juncus maritimus*) and Sharp Rush (*J. acutus*). The nearest examples of this habitat type are most likely to be found in the Barrow-Nore Estuary below New Ross, >110km downstream of the proposed works.	The only pathway between the proposed works and this qualifying interest is hydrological. While there is a hydrological link between the works area and examples of this habitat in the Barrow-Nore estuary, given the small scale and short duration of the works, and the >110km length of river between the source and the receptor, any perceptible impacts can be ruled out at this stage.	No
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260)	Broad definition, covering upland, flashy, oligotrophic, bryophyte- and algal-dominated rivers, to tidal reaches dominated by submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses. The stretches of the Borris Great Stream, which conjoins to the Triogue River, the outflow of this lake, and ultimately this SAC, confirm to this habitat type.	Given that the proposed works will take place upstream of examples of this habitat type and potentially give rise to impacts to which this habitat is sensitive, impacts cannot be ruled out at this stage.	**Yes**
European dry heaths (4030)	Vegetation dominated by ericaceous dwarf shrubs, usually on well-drained, nutrient-poor and acidic mineral soils or shallow peats (typically <50 cm deep) on sloping ground. Does not occur near the lake or in the vicinity of the proposed works and is not hydrologically connected to the proposed works.	As this qualifying interest is not present within the zone of impact for any of the potential impacts from the proposed works and there are no ecological links between these areas and any example of this habitat type, any impacts can be ruled out at this stage.	No
Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430)	Community of tall hydrophilous herbs found along edges of slow-moving rivers and the margins of lakes, dominated by species such as Wild Angelica (*Angelica sylvestris*), Meadowsweet (*Filipendula ulmaria*), Yellow Iris (*Iris pseudacorus*), Yellow Loosestrife (*Lysimachia vulgaris*), Purple Loosestrife (*Lythrum salicaria*) and Common Valerian (*Valeriana officinalis*). The River Barrow and River Nore SAC is located ca. 13km downstream from the proposed works.	Given that this habitat is located ca. 13km downstream of the proposed works, via the Borris Great Stream and the Triogue River, any pollutants or sediment that enters the watercourse, will be localised to the immediate environs. Any impacts on this habitat can be ruled out.	No
*Petrifying springs with tufa formation (*Cratoneurion*) (7220)	Hardwater springs where tufa is actively deposited and where characteristic species of bryophytes are dominant or abundant. The nearest known examples of this habitat in the SAC is near Thomastown, c. 57 km south-east of the proposed works. Nearer examples may exist, but they are not present in the vicinity of the proposed works and none were recorded during the site visits.	As no examples of this habitat are located in the vicinity of the proposed works or hydrologically connected to them, there are no pathways for impacts to this qualifying interest. As such, impacts can be ruled out at this stage.	No

Qualifying interest	Description and location	Pathways for impacts	Potential impact
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles (91A0)	Old woodland of Oak (*Quercus* sp.) with Holly (*Ilex aquifolium*) and Hard-fern (*Blechnum spicant*), generally on podsolised soils in upland, southern and western regions, but also on localised, non-waterlogged acid soils elsewhere. This woodland is not located in close proximity to the proposed works. The closest record of this habitat is located south-east of Carlow at Glebe, ca. 39km from the proposed works via straight line distance and > 60km via watercourses.	Given that this habitat is not present in the vicinity of the proposed works, impacts can be ruled out at this stage.	No
*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) (91E0)	Riparian woodlands of Ash (*Fraxinus excelsior*) and Alder (*Alnus glutinosa*) on heavy soils periodically inundated by the annual rise of river levels but otherwise well-drained and aerated during low water. The nearest example of this priority habitat type occur at Ballybrittas ca.13km via straight line distance from the proposed works. However, there is no hydrological or ecological connection from the proposed works to this site.	Given the absence of this qualifying interest in close proximity to the proposed works (not within 10km of the proposed works), impacts can be ruled out at this stage.	No
Desmoulin's Whorl Snail (*Vertigo moulinsiana*) (1016)	Largest of all the *Vertigo* species, favours damp or wet habitats, where it lives on living and dead stems and leaves of tall wetland plants. Requires tall, structured vegetation containing tall riparian grasses and sedges. The habitats in the vicinity of the proposed works, and upstream and downstream, are unsuitable for whorl snails due to the combination of vegetation and hydrological influence being outside the snail's range of tolerance, i.e. the fluctuations in water level are far too great.	As the habitats in the vicinity of the proposed works and habitats along the Borris Great Stream and the Triogue River are not suitable for this species, there are no pathways for impacts on this species from the proposed works. Therefore, impacts can be ruled out at this stage.	No
Freshwater Pearl Mussel (*Margaritifera margaritifera*) (1029)	Large, long-lived (100+ years), bivalve mollusc found in clean, fast-flowing rivers. Glochidial larvae use a temporary salmonid host, juveniles occupy interstitial habitats in the riverbed for 5 years or more. Mussels mature at 7-15 years and have a prolonged fertile period lasting into old age. This qualifying interest includes the population in the River Barrow and its tributaries (the genetically distinct Nore population is included as a separate qualifying interest).	"*The status of the freshwater pearl mussel (*Margaritifera margaritifera*) as a qualifying Annex II species for the River Barrow and River Nore SAC is currently under review. The outcome of this review will determine whether a site-specific conservation objective is set for this species. Please note that the Nore freshwater pearl mussel (*Margaritifera durrovensis*) remains a qualifying species for this SAC. This document contains a conservation objective for the latter species*". There are no records of freshwater pearl mussel in the River Triogue or on the main channel of the Barrow in the environs of the project.	No
White-clawed Crayfish (*Austropotamobius pallipes*) (1092)	Ireland's largest freshwater arthropod. Prefers relatively cool temperatures and adequate dissolved oxygen and lime but tolerating significant fluctuations in these. Juveniles live among submerged tree roots, gravel or macrophytes, while larger	White-clawed crayfish were recorded within Little Borris Stream and Glendowns Pond. Therefore, impacts on this species cannot be ruled out at this stage.	**Yes**

Qualifying interest	Description and location	Pathways for impacts	Potential impact
	crayfish must have stones to hide under, or an earthen bank in which to burrow. Although white-clawed crayfish were recorded in the Little Borris Stream upstream of Glendowns Pond, this species was not recorded within Glendowns Pond and the habitat within the lake was considered sub-optimal due to heavy siltation and enrichment within the lake.		
Sea Lamprey (*Petromyzon marinus*) (1095)	Adults live as external parasites on host fish or marine mammals at sea, migrating in spring into freshwater to excavate redds or spawning nests in gravelled areas of large rivers. Egg laying follows nest excavation and the resulting ammocoetes hatch within days. These move downstream to areas of fine sediment into which they can burrow. Transformation into young adults occurs in late summer, with migration to estuaries and open sea in late autumn-winter.	From the site survey conducted in July 2022, Glendowns Pond was considered to have suitability to support lamprey at the confluence at the Little Borris Stream. Suitable habitat for Brook lamprey (*Lampetra planeri*) was noted (see also Plate 2.5). Given the presence of potentially suitable spawning and ammocoetes habitats in the vicinity of the proposed works and that lamprey species were detected in the composite eDNA sample from the lake, impacts on this qualifying interest cannot be ruled out at this stage.	**Yes**
Brook Lamprey (*Lampetra planeri*) (1096)	Smallest of the lampreys recorded in Ireland. Unlike other lampreys, it is non-parasitic and non-migratory as an adult, living its entire life in freshwater. Adults spawn in spring, excavating shallow nests in relatively fine gravels in areas of reduced flow. Ammocoetes move downstream to areas or margins with fine silt. Young adults overwinter before migrating short distances upstream to spawn. The adult fish die after spawning.		
River Lamprey (*Lampetra fluviatilis*) (1099)	Adults spawn in rivers spring, excavating shallow nests in fine gravels and small stones. The adult fish die after spawning. The ammocoetes move downstream to fine silt deposits where they live as filter feeders over a period of years before transforming into young adults and migrating to estuarine and marine habitats. As adults they are parasitic on larger fish in coastal waters.		
Twaite Shad (*Alosa fallax*) (1103)	A member of the herring family, spends most of its life in estuaries and coastal waters, moves upriver to spawn in late spring. The eggs hatch after a short period and juveniles move down into the estuary. Irish fish may live in estuaries for at least two full years prior to going to sea. The majority of spawning occurs at the first suitable gravels above the tidal limit, but some fish move much further upstream.	It is uncertain how far upstream some individuals of this species may migrate. Therefore, pathways for impacts cannot be ruled out at this stage.	No
Atlantic Salmon (*Salmo salar*) (1106)	Irish population comprises mostly fish that spend two years as sub-adults in freshwater before going to sea as smolts. Most fish	Results from Triturus Aquatic Assessment did not show evidence of Atlantic Salmon within Glendowns Pond or in the inflow or outflow	No

Qualifying interest	Description and location	Pathways for impacts	Potential impact
	spend one winter at sea before returning to their natal rivers, mainly during the summer, as grilse. Smaller numbers spend two winters at sea, returning mainly in spring, hence “spring” salmon. A small proportion of the adult population returns to the sea post-spawning and can return to spawn again. Salmon are considered present throughout the River Triogue system, although no suitable spawning habitat was observed during the site visits.	watercourses of the lake. Given the distance from the proposed works to the River Barrow and River Nore SAC (ca. 13km downstream) impacts on this species are not considered likely as a result of the proposed works. Therefore, impacts on this species can be ruled out at this stage. [Note: brown trout were recorded].	
Otter (*Lutra lutra*) (1355)	Large mustelid found along rivers, lakes and coasts throughout Ireland, where there is abundant prey and habitat providing cover. Feeds on a wide variety of aquatic prey, including fish, crustaceans, molluscs and amphibians. Although there was no a disused otter holt recorded during the 2022 survey, there was no evidence of otters recorded within the NBDC records or evidence of otters using the area in recent years.	As noted there is a disused holt in the north-western corner of the pond. No works are proposed close to this structure. While there are no records from close to the works area on the NBDC map viewer, it is assumed that otter will be widely distributed in the Triogue / Barrow system. Therefore, impacts on this species cannot be ruled out at this stage.	**Yes**
Killarney Fern (*Trichomanes speciosum*) (1421)	A large filmy fern that is extremely sensitive to desiccation and is restricted to damp, shady and humid habitats. Habitats include dripping caves, cliffs, crevices and gullies by waterfalls, crevices in woodland, and occasionally the floor of damp woodland (deeply shaded, humid). No habitats suitable for this species occur near the proposed works.	As no habitats suitable for this qualifying interest are found in close proximity or hydrologically connected to the proposed works, pathways for impacts can be ruled out at this stage.	No
Nore Freshwater Pearl Mussel (*Margaritifera durrovensis*) (1990)	The hardwater form of Freshwater Pearl Mussel (*Margaritifera margaritifera*) (described above). This species occurs exclusively in the River Nore and its distribution does not overlap with the proposed works or the zone of impact of the proposed works.	Given that this species is not found within the watercourses upstream or downstream of the proposed works, impacts can be ruled out at this stage.	No

8.2. Evaluation of Effects

8.2.1. River Barrow and River Nore SAC

The significance of effects on the River Barrow and River Nore SAC are evaluated in view of the relevant conservation objectives in Table 8.2 below (excluding the conservation objectives for qualifying interests for which potential impacts were ruled out in Table 8.1 above).

Given the nature, small scale and short duration of the proposed works, the potential impacts on the receiving natural environment are considered to be limited to the following: -

8.2.1.1. Disturbance to habitats

There will be no works with the River Barrow and River Nore SAC. The SAC is 13km downstream from the proposed works along the Triogue River.

During the proposed works, there will be some disturbance to habitats and species within the area of the proposed works, associated with the main works items and access and egress by vehicles, plant and personnel. The proposed works will not involve the removal of any trees, but some pruning of trees and removal of fallen trees is proposed. While there will be impacts on pondside vegetation at the excavator access points removal of emergent vegetation along the pond banks is not part of this proposal; the main aim of which is to remove accumulated silts within the pond which are reducing habitat quality in the pond.

8.2.1.2. Hydrological impacts

Water quality

Due to the nature of the proposed works, they give rise to potential impacts on water quality through the input or resuspension of fine sediment and input of hydrocarbons, as follows: -

- Sources of potential fine sediment input include release of soil from the banks of the lake due to disturbance during access and working by the excavator. Sources of fine sediment resuspension include disturbance of accumulated silt during its removal from the pond and any silts generated when moving the excavator between working points. Plumes of silt or fine sediment can directly affect aquatic fauna, e.g. by clogging their gills, and can also reduce habitat quality, e.g. by smothering of spawning gravels for salmonid species. Suspended sediment can also interact with other pollutants, magnifying their effects.

- Sources of hydrocarbon input include leaks of substances such as fuel, e.g. petrol or diesel, or lubricating oil from vehicles, plant or equipment, particularly the boat and excavators. Hydrocarbons can have direct toxic effects on the flora and fauna of contaminated waters and soils.

Given the small scale and short duration of the proposed works, and the methods detailed in Section 10, and the probability of any pollution incident occurring is low and such incident would likely be localised and of a small magnitude and short duration.

Flooding regime

The Office of Public Works (OPW) Flood Risk Mapping identifies Stradbally Road at the outflow from Glendowns Pond as an area subject to repeat flooding (MCOS, 2004). A trash gate, often fitted as part of flood relief works is fitted on the outflow channel from the Lake (just before it is culverted under Stradbally Road, N80). No changes are proposed to the inflow stream; to the invert level on the outflow; to the trash gate or to the downstream culvert network.

8.2.1.3. Disturbance to fauna

As noted a disused Otter holt is in the north-western corner of the pond. There were no signs of current Otter activity at the pond. The duration of disturbance will be limited to the duration of the works, estimated at 3-4 weeks.

Due to the nature of the proposed works, they will involve some noise and visual impacts to fauna in the receiving environment. However, they do not involve any physical disturbance to breeding or resting places of any species of conservation concern. Given the scale and duration of the works at each location, any disturbance impacts will be localised, of low magnitude and brief duration. Therefore, there will be no significant effects on fauna arising from such disturbance.

8.2.1.4. Invasive alien species

Any works in and adjacent to watercourses carry a risk of the introduction or spread of invasive alien species, which can negatively affect native ecosystems.

As noted, no invasive species, such as Japanese knotweed (*Fallopia japonica*), have been recorded from Glendowns Pond. All due care must be taken to avoid the introduction of knotweed, or any such species (including aquatic invasive plant species) to the pond. Appropriate biosecurity measures must also be implemented to prevent the introduction of diseases such as aphanomycosis (“crayfish plague”).

Given the results of the site visits, there is minimal risk of spread of invasive species being spread within or exported from the works area as a result of the proposed works. Therefore, the main risk is the import of such species to the area. However, given the scale and duration of the proposed works, and the biosecurity protocol to be followed, the risk from invasive alien species is considered to be low.

Table 8.2 Evaluation of effects on the River Barrow and River Nore SAC (LSE = likely significant effect).

Conservation objective	Description of effects	LSE
To maintain the favourable conservation condition of Water courses of plain to montane levels with the Ranunculion fluitantis *and* Callitricho-Batrachion *vegetation in the River Barrow and River Nore SAC*	This habitat is not recorded within the proposed works area. The works area is 13km upstream of the main channel of the River Barrow which is within the River Barrow and River Nore SAC. This habitat could, however, occur along the Triogue outside of the SAC. The attributes of this conservation objective relate to habitat area and distribution, hydrological regime (flow, groundwater discharge, particle size range), water chemistry (minerals), water quality (suspended sediment, nutrients), vegetation composition (typical species) and floodplain connectivity. Given the nature of the proposed works, they will not cause any change in the area, distribution or water chemistry of this habitat. The potential impacts arising from the proposed works relate to flow, particle size, water quality, vegetation composition and floodplain connectivity. Given the scale of the proposed works and that downstream impacts on the Borris Great Stream, which conjoins to the River Triogue and ultimately the River Barrow and River Nore SAC, changes to water quality are possible in the absence of appropriate mitigation measures. Following completion of a hydrological assessment of the system the proposed design of proposed works were restricted to removal of silt within the pond basin and the outflow – there will be no change to the invert level of the latter.	**Yes**
To maintain the favourable conservation condition of White-clawed crayfish in the River Barrow and River Nore SAC	Inflow: White-clawed crayfish were recorded at low density in the Little Borris Stream. South end of pond: No white-clawed crayfish were recorded during sweep sampling of the lake basin and the habitat was considered sub-optimal due to heavy siltation and enrichment. Crayfish were however detected in the eDNA samples collected from the lake and are likely present at low densities. The species may move between the Little Borris Stream and Glendowns Pond when foraging at night. North end of pond: No white-clawed crayfish were recorded during sweep sampling of the lake basin and the habitat was considered sub-optimal due to heavy siltation and enrichment. Crayfish were however detected in the eDNA sample collected from the lake and are likely present at low densities. Outflow: No white-clawed crayfish were captured during sweep netting of marginal macrophytes. There was no suitable boulder and cobble habitat for the species given gross siltation. The works are 13km from populations within the River Barrow and River Nore SAC. Connection between populations of crayfish in the Little Borris Stream – the Triogue River – and the main channel of the Barrow is assumed. The attributes of this conservation objective relate to distribution, population structure (recruitment), negative indicator species, disease, water quality, and habitat quality (heterogeneity). The main risk to crayfish is through deterioration in water quality. Removal of extensive silt beds in the centre of the pond may result in an increase in habitat quality for crayfish over time. As the proposed works involve instream works and access to the lake itself during the works, there is potential for the introduction of spread of disease, particularly aphanomycosis (crayfish plague). In the absence of biosecurity practices to be followed, there is potential for the spread of this disease within the lake and the associated watercourses. Thus, negative impacts cannot be ruled out without the use of appropriate mitigation measures.	**Yes**
To restore the favourable conservation condition of Sea lamprey in the River	The attributes of these three conservation objectives are the same and have similar targets across the three species. The attributes relate to distribution (extent of migration), population structure of juveniles, juvenile density in fine	**Yes**

Conservation objective	Description of effects	LSE
Barrow and River Nore SAC *To restore the favourable conservation condition of Brook lamprey in the River Barrow and River Nore SAC* *To restore the favourable conservation condition of River lamprey in the River Barrow and River Nore SAC*	sediment, extent and distribution of spawning habitat, and availability of juvenile habitat. Given the nature of the proposed works, the only attribute potentially affected is availability of juvenile habitat. Inflow: The Little Borris Stream also had good habitat quality for brook lamprey (*Lampetra planeri*). Spawning habitat was considered good locally given the presence mixed fine gravels in the interstitial spaces of cobble in the shallow riffle-glide habitat present. Ammocoete nursery habitat was also good with organic rich silt downstream of the spawning areas, particularly at the confluence with Glendowns Pond. The stream also had suitability to support an eel population and the presence of stoney refugia and pool habitat in addition to abundant silt for burial indicated good eel nursery habitat. Both European eel and brook lamprey were detected by eDNA sampling thus supporting the onsite observations (section 3.3 of Appendix B). South end of pond: lamprey were detected in the composite eDNA sample from the lake. North end of pond: - lamprey were detected in the composite eDNA sample from the lake. Outflow: The Little Borris Stream also provided good habitat quality for brook lamprey ammocoetes (i.e. nursery habitat) given abundant organic-rich silt downstream of the lake. Thus, negative impacts cannot be ruled out without the use of appropriate mitigation measures.	
To restore the favourable conservation condition of Otter in the River Barrow and River Nore SAC	The relevant attributes of this conservation objective relate to distribution, extent of terrestrial habitat, extent of freshwater (river) habitat, An inactive otter holt was noted in the north-western corner of the pond. No other otter signs were noted. The main source of potential impact therefore is through deterioration in water quality. In the longer term removal of silts will increase habitat quality within the pond. Thus, negative impacts cannot be ruled out without the use of appropriate mitigation measures.	No

8.2.2. Summary

In the absence of mitigation measures, it is predicted that the water quality of downstream watercourses will be impacted from the proposed works. Further, given that instream works will occur during the proposed works on Glendowns Pond and that White-clawed crayfish were recorded upstream of the lake in Little Borris Stream, during the site surveys conducted in July 2022 of the proposed works site, in the absence of mitigation measures there is potential for diseases such as crayfish plague to spread and have a significant effect on this species. Mitigation measures are discussed further below in Section 10.

9. Potential In-combination Effects

9.1. Requirement for Assessment

The requirement for AA arising out of Article 6(3) of the Habitats Directive covers plans and projects that, "*either individually or in combination with other plans or projects*", are likely to have a significant effect on one or more European sites. This means that AA is required for any plan or project that, in combination with other plans or projects, would have a significant effect on one or more European sites, irrespective of the presence or absence of such effects from that plan or project on its own. Therefore, regardless of the significance of the effects of the plan or project individually, the potential for significant effects in combination with other plans and projects must be considered in all cases.

9.2. Approach and Methodology

The objective of this requirement is to capture significant effects potentially arising from the cumulation or other interaction of non-significant effects from multiple plans and projects. Consequently, the assessment of potential in-combination effects is not a pair-wise assessment, rather, it considers the totality of the effects arising from all plans and projects affecting the Natura 2000 site(s) in question. In identifying the plans and projects to be included in this assessment, it is important to define an appropriate geographical scope and timescale over which potential in-combination effects are to be considered and the sources of information to be consulted, as described below. It is also important to consider the nature of the interactions between effects, which may be additive, antagonistic, synergistic or complex.

9.2.1. Geographical Scope

In defining the geographical scope for identifying potential in-combination effects, it is important to remember that effects are evaluated in view of the conservation objectives of the Natura 2000 site(s) concerned. As such, two or more effects relating to the same conservation objective for a given Natura 2000 site would combine even if their geographical extents did not overlap. For example, the loss of a small area of an Annex I habitat type listed as a qualifying interest of a Natura 2000 site would combine with the loss of an entirely unconnected area of the same habitat type from a remote part of the same site to produce an in-combination effect, the significance of which would need to be evaluated in view of the relevant conservation objective. On that basis, the scope of the assessment of in-combination effects extends to all plans and projects affecting the same conservation objectives as the plan or project under consideration, irrespective of whether those effects are significant or not.

As assessed in Section 8, the proposed works provide for no impacts whatsoever on 'Estuaries', 'Mudflats and sandflats not covered by seawater at low tide', 'Reefs', '*Salicornia* and other annuals colonising mud and sand', 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)', 'Mediterranean salt meadows (*Juncetalia maritimi*)', 'European dry heaths', 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels', 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles', '*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*),'*Petrifying springs with tufa formation (*Cratoneurion*)', Desmoulin's Whorl Snail, Freshwater Pearl Mussel or Killarney Fern in the River Barrow and River Nore SAC. As the proposed works will have no impacts whatsoever on these qualifying interests, there is no possibility of likely significant effects thereon in combination with other plans or projects.

The proposed works do provide for some impacts (not constituting likely significant effects) on 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation', White-clawed Crayfish, Sea Lamprey, Brook Lamprey, River Lamprey, Twaite Shad, Atlantic Salmon, Otter and Nore Freshwater Pearl Mussel in the River Barrow and River Nore SAC.. Thus, the geographical scope of the in-combination assessment covered all areas which influence the conservation condition of these qualifying interests in the Zone of Influence of the proposed works. Following the precautionary principle, a radius of 15km from the proposed works was used.

9.2.2. Timescale

As stated in Section 3, the proposed works are scheduled to be undertaken between 3-4 weeks to complete. As explained in the preceding sections, impacts potentially arising from the proposed works include disturbance to

habitats and species, as well as impacts on water quality and flooding regime. Any non-significant effects arising from disturbance to habitats or species, or water quality impacts, will be brief or temporary, i.e. there will be full recovery of any effects within one year

9.2.3. Sources of Information

The following sources of information were consulted to gather information on other plans and projects:

- Local authority development plans and their AA documents
- Local authority online planning enquiries (Laois County Council)
- EIA Portal (DHLGH, 2022)
- Floodinfo.ie (OPW, 2022)

The threats, pressures and activities with negative impacts on the River Barrow and River Nore SAC are listed in Table , along with the relative importance of each threat, pressure or activity and whether it occurs inside or outside the site concerned. This information was used to identify plans and projects which, by their nature, are likely to give rise to potential impacts on the sites concerned.

9.3. Assessment

Plans

The Laois County Development Plan 2021-2027 sets out the vision, core strategy, aims and policy objectives for the proper planning and sustainable development of County Laois. The plan contains a large number of policy objectives relating to biodiversity. The plan was subject to AA, including the preparation of a Natura Impact Report (CAAS, 2022), which assessed, at a strategic level, the implications of the plan for European sites, including the River Barrow and River Nore SAC. Where potential adverse effects were identified, the plan was amended to mitigate those effects. Following these amendments, the adopted plan now contains specific text in relation to the protection of these and other European sites, as well as river corridors, floodplains and wetlands. These includes restrictions on development within riparian corridors, requirement for assessment under Article 6 of the Habitats Directive for development likely to have a significant effect on European sites, use of sustainable urban drainage systems (SUDS), and commitments to develop green infrastructure to support European sites and biodiversity generally, in line with Article 10 of the Habitats Directive and Article 3 of the Birds Directive.

The policy objectives in the Laois County Development Plan contribute to mitigating the negative effects of development on the River Barrow and River Nore SAC and other European sites, and provide for the enhanced resilience of these sites through the development of green infrastructure/ecological networks. Therefore, there will be no adverse effects from the proposed works in combination with this plan, which will itself mitigate any in-combination effects arising from other projects.

Projects

Projects identified on the EIA Portal (https://www.gov.ie/en/publication/9f9e7-eia-portal/; 2023) within the geographical scope of this assessment included: -

- Construction of 11 No. wind turbines and associated infrastructure, including a switch room, equipment compound, site access tracks, site entrances, meteorological mast, 110kV electricity substation, c. 2km of access tracks, underground electricity and communications cabling and site drainage works near the Laois-Kilkenny county bounds at Knockardagur/Crutt;
- Installation of c. 34km of 38kV cable ducting, associated electrical cabling and ancillary works including joint bays, culverts and maker posts from near Ballyragget, Co. Kilkenny to the Co. Tipperary boundary;
- Removal of vegetation and overburden, extraction of sand and gravel, upgrading of existing entrance and site lines, construction of screening berms, erection of an office/canteen, construction of wheel-wash and refuelling area, landscaping and restoration near Abbeyleix, Co. Laois;

- Extraction and processing (including size reduction, grading and heating) of minerals, recommencement of underground zinc and lead mining, including the refurbishment of a number of surface structures, two new wells and associated ancillary infrastructure for the supply of supplementary water to the Galmoy-Rathdowney Public Water Supply;

- Continued use and operation of an existing quarry, including deepening of the quarry, at Knockbaun, Spink, Co. Laois;

- Provision and maintenance of drainage and silt Lakes, provision of temporary peat stockpiles and rail lines at various locations within the production area and other associated works at Coolnacarton Bog, Portlaoise, Co. Laois;

- Anaerobic digestion facility, designed to treat biodegradable and organic material, to include a renewable gas facility, peat deposition area and road upgrades at Cúil na Móna Bog, Portlaoise, Co. Laois; and

- Development of a plastic bottle and aluminium can recycle facility, with an annual intake of 35,000 tonnes, at the J17 National Enterprise Park, Knockmay, Portlaoise, Co. Laois.

Some of these projects are too small in scale or located too remotely from the River Barrow and River Nore SAC to have any impacts whatsoever on this site and, therefore, have no potential to give rise to any in-combination effects. Taken together, given the nature, scale and geographical spread of these projects, they are not likely to give rise to significant effects in combination with the proposed works.

Other projects within the scope of this assessment include construction of new domestic dwellings or extensions to such dwellings, and retention of existing developments, typically extensions to domestic dwellings. Regarding potential water quality impacts, these projects will have to comply with the EPA's *Code of Practice for Wastewater Treatment Systems for Single Houses* (EPA, 2009, 2018) and have conditions attached to their planning permission, such as siting of septic tanks, foul and surface water drainage, and clean surface water run-off drainage facilities. Projects of this scale are not expected to give rise to significant disturbance of hydrological impacts. Therefore, the proposed works are not likely to significantly affect the River Barrow and River Nore SAC other European sites in combination with these projects.

Other activities

Farmers and landowners undertake general agricultural operations in areas adjacent to the Triogue River and its tributaries, including the Borris Great Stream the outflow of Glendowns Pond, that could potentially give rise to effects on the same qualifying interests the proposed works. Most such operations are periodic, not continuous, and qualify as 'activities requiring consent' that require prior consultation with the NPWS, e.g. reclamation, infilling or land drainage within 30 m of a river, removal of trees or any aquatic vegetation within 30 m of a river, and harvesting or burning of reed or willow (NPWS, 2022a). Such operations must also comply with the European Communities (Environmental Impact Assessment) (Agriculture) Regulations, 2011 (as amended) in relation to:

- Restructuring of rural land holdings,

- Commencing use of uncultivated land or semi-natural areas for intensive, and

- Land drainage works on lands used for agriculture.

Stage 2 AA is required under Section 9 of those Regulations if the activity is likely to have a significant effect on a Natura 2000 site. The drainage or reclamation of wetlands is controlled under the Planning and Development (Amendment) (No. 2) Regulations, 2011 and the European Communities (Amendment to Planning and Development) Regulations, 2011. Therefore, any in-combination effects from agricultural operations and the proposed works are not likely to be significant.

9.4. Conclusion

As detailed in the preceding sections, it can be concluded that, based on the small scale of the proposed works and the brief duration of both the works themselves and any impacts arising from them, they will not give rise to likely significant effects on the River Barrow and River Nore SAC or any other Natura 2000 site, in combination with other plans or projects.

10. Mitigation

This section describes the environmental protective measures required to ensure there are no residual effects on the integrity of the European site.

Section 8 of this Report found that, in the absence of appropriate mitigation, the proposed works have the potential to adversely affect the conservation objectives for a number of qualifying interests of River Barrow and River Nore SAC and River Nore SPA. The potential for such effects arises in the main due to the risk of water quality impacts associated with the works. This section prescribed environmental protection measures to address these impacts and, thereby, eliminate the possibility of adverse effects.

The development of the environmental protection measures prescribed in this section has followed the "*mitigation hierarchy*", which prioritises avoidance over reduction, and actions at source over pathway over receptor, as follows: -

1. Eliminate the source of the impact,

2. Minimise or reduce the impact at its source,

3. Block or weaken the pathway for effects, and

4. Abate effects at the receptor.

This approach assists with more complete removal of the effects, minimises the risk of effects occurring by less obvious pathways, also protects non-target receptors, and minimises the risks of unintended harm associated with measures focussed at or near the receptors.

10.1.1. General Measures

1. An Ecological Clerk of Works (ECoW) will be appointed and will supervise all aspects of the critical works on site, in particular initial site set up, use of cement, demobilisation etc.

2. The ECoW appointed must have demonstrable experience in providing ecological/environmental oversight on construction sites, including sites where sensitive watercourses are present.

3. The ECoW will ensure compliance with required environmental protection measures on site and liaise with IFI and NPWS staff where required. The ECoW will be required to report on their site attendance / findings to Laois County Council.

4. All site staff will be informed of best practice methodologies to be employed on site via the dissemination of a tool-box talk to be given by the ECoW. This shall include the requirement for protection of aquatic habitats, the sensitivity of the SAC. No invasive species were recorded in the vicinity of the works area.

5. A Temporary Traffic Management zone will be created within the road corridor. This shall be used for parking and deliveries of materials.

6. The site compound is as shown in Figure 3.1

7. Works will be carried out during day-time hours, except in the event of an emergency (to be agreed with Laois County Council).

8. Operators will check the excavator on a daily basis before starting work to confirm the absence of leakages. Any leakages should be reported immediately. Any items of plant machinery found to be defective will be removed from site immediately or positioned in a place of safety until such time that it can be removed. All items of plant will be checked prior to use before each shift for signs of wear/damage.

9. No grout or cement is to be used on site.

10. There can be no entry of debris and / or waste material from the works area to the live channel. The debris must be collected within the dry work area, removed from the work area and disposed of appropriately off site.

11. All material used on site, including the silt fences / sedimats, will be removed from site and disposed of at an appropriate offsite facility.

10.1.2. Specific Measures

10.1.2.1. Vegetation

1 Removal / pruning of any shrubs in the vicinity of the compound / works area should be kept to a minimum during proposed works. Trees along banks of the pond form effective shelter belts which create areas of high local insect abundance which will be exploited by foraging bats. Lines of trees create wildlife corridors along which bats may navigate and commute between roost and foraging sites. The access points to the river should be kept to an absolute minimum. As noted, rubber mats will be used where necessary to prevent damage to the ground where machine will be working/travelling. This shall be supervised by the ECoW.

2 Removal of emergent vegetation along the banks of the pond is to be minimised. This shall be supervised by the ECoW.

3 No works are to take place in the inflow stream (Little Borris Stream).

4 Works are to be avoided at the confluence of the inflow stream (Little Borris Stream) and the pond. Works in this area shall be supervised by the ECoW. These initial works will also allow the ECoW to observe and advise the excavator operator on undertaking works while minimising ecological impacts.

5 All works are undertaken in accordance with the procedures contained within the relevant HSE Forestry Industry Safety Accord (FISA) leaflets. These procedures are monitored and reviewed to incorporate up to date knowledge and experience as necessary. Clients' own health and safety standards and procedures can take precedence when they are of an equal or higher standard.

10.1.2.2. Waste

Parklawn Tree Services Ltd. only use companies who carry a permit under the Waste Management Act 1996 to dispose of waste. Wherever possible, arisings are stored at the depot in purpose built holding bays and utilised as a renewable energy source. Alternatively, wood chip may be put back onto the land as mulch, where it will benefit the local Eco-system. Mature timber may be stacked for use by the owner or occupier of the land as a source of fuel or as a habitat.

Silts to be removed from the pond are equivalent to "*17 05 06 dredging spoil other than those mentioned in 17 05 05*" as per *Waste Classification List of Waste & Determining if Waste is Hazardous or Non-hazardous* (EPA, 2018). As noted, once removed from the pond wastes will initially be placed on the bank to allow both water and aquatic organisms to return to the pond. Initially, this will be supervised by the ECoW to ensure it is being done correctly. Waste silt will then be transferred to a truck for removal offsite under licence and disposal at an appropriately licence facility.

10.1.2.3. Water Quality

The following measures shall apply to prevent water quality impacts generally: -

1 During all stages of construction, site management shall ensure that good housekeeping is maintained at all times and that all site personnel are made aware of the importance of the freshwater environments and the requirement to avoid pollution.

1. Tools and equipment shall not be cleaned in any watercourse and wash water shall not be discharged directly into any watercourse or road drains without appropriate treatment.

2. The Contractor shall make daily checks for elevated water levels/flows in the stream and weather warnings or flood alerts from Met Éireann and/or Laois County Council. All areas of exposed soil (slippage) shall be securely covered with hessian matting if heavy rain is predicted. Works may resume once any flood waters have receded and any warning/alert been lifted.

3. If heavy rainfall is predicted, works carrying the greatest risk of pollution (e.g. any works involving wet concrete or other cementitious material) shall be suspended and all plant, equipment, construction materials and personnel shall be removed from the potential flood zone.

4. The Contractor shall undertake daily visual checks of water coloration (turbidity) for signs of silt escapement from the works area downstream of silt control measures. Should signs of silt escapement be identified works will be suspended until remedial measures are put in place.

In addition, the measures in the following sub-sections shall apply to control the risk of water quality impacts from specific sources.

10.1.2.4. Silt / Run-off

The following measures shall be implemented to minimise the quantity of surface water run-off from the works area entering the stream, and to minimise any potential contamination of such run-off by fine sediment or other deleterious matter: -

1. The works will generate silt within the water column. The following measures are proposed to prevent silt laden waters entering the River Triogue (see Figure 3.1): -

    a. A series of 3 no. silt fences / sedimats will be placed along the length of the Outflow Stream – starting from close to the brash screen and working backwards up the stream. These will be placed ca. 10m apart.

    b. The placement of these measures will be supervised by the ECoW.

    c. The proposed arrangement would be to place a Sedimat initially to absorb the bulk of the silt followed by 2 no. silt fences.

    d. Silt fences will be checked daily by the site foreman and also by the ECoW when they attend site. Should signs of silt escapement be identified works will be suspended until remedial measures are put in place.

2. At no point will any equipment be washed out within the work area or adjacent to a watercourse.

10.1.2.4.1. Concrete

No concrete it to be used on site. No mitigation measures are required.

10.1.3. Biosecurity protocols

No invasive species were recorded in the vicinity of the culvert.

Biosecurity protocols shall be implemented during the construction phase of the proposed project to prevent the introduction of invasive species listed on the third schedule of the EC (Birds and Natural Habitats) Regulations 2011 to site and the further spread of diseases.

1. All equipment intended to be used at the site shall be dry, clean and free from debris prior to being brought to site.

2. If drying out of equipment is not feasible, equipment should be either: -

    i. power steam washed at a suitably high temperature or at least 65 degrees, or

ii. disinfected with an approved disinfectant, e.g. Virkon or an iodine-based product. It is important that the manufacturer's instructions are followed and if required, the correct contact times are allowed for during the disinfection process. Items that are difficult to soak should be sprayed or wiped down with disinfectant.

3. During the duration of the proposed project, if equipment is removed off-site to be used elsewhere, the said equipment shall be cleaned and disinfected prior to being brought back to the works area of the proposed project.

4. Appropriate facilities shall be used for the containment, collection and disposal of material and/or water resulting from washing facilities of vehicles, equipment and personnel.

5. Importation of materials shall comply with Regulation 49 of the EC (Birds and Natural Habitats) Regulations 2011.

A pre-construction invasive species survey will be conducted prior to the commencement of works on site. If any invasive species are recorded, these shall be fenced off using a 7m buffer from the outermost edges of the invasive species plant(s).

11. Conclusion

This Natura Impact Statement Report has examined the details of the proposed removal of silts and limited pruning of trees at Glendowns Pond, Portlaoise, Co. Laois and the European sites in their Zone of Influence. It has analysed the potential impacts of the proposed works on the receiving natural environment and evaluated their effects, both individually and in combination with other plans and projects, in view of the conservation objectives of the relevant European sites. This report has been prepared in line with the Habitats Directive, as transposed into Irish law by the Habitats Regulations, relevant case law and guidance from the European Commission, the Department of the Environment, Heritage and Local Government and the Office of the Planning Regulator, on the basis of objective information and adhering to the precautionary principle.

Following a comprehensive evaluation of the potential direct, indirect and cumulative impacts on the qualifying interests for the SAC, and the implementation of the proposed environmental protection measures , it has been concluded by the authors of this report that there will be no residual impacts and the proposed project will not have an adverse effect on the integrity of River Barrow and River Nore SAC or any other European site.

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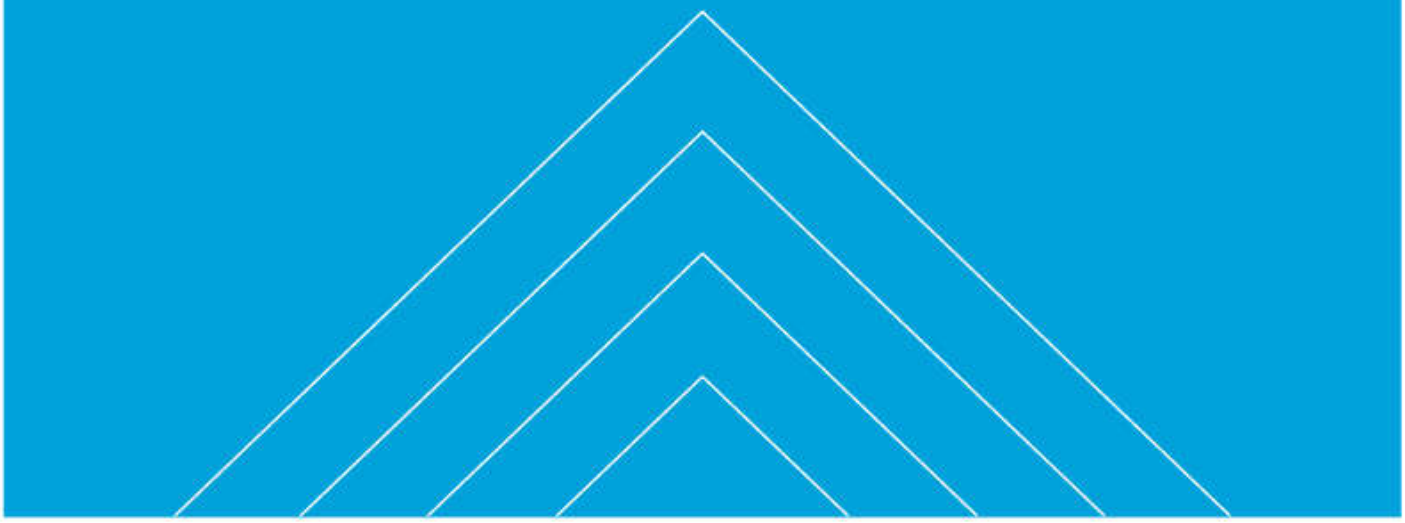
Appendices



Appendix A. Method Statement

PARKLAWN
TREE SERVICES

Site-Specific Method Statement
And
Risk Assessment

For

Desilting and Maintenance works
In Glendownes Portlaoise

Laois Co Co

Contents

1. General Method Statement

Parklawn Tree Services Ltd undertakes tree and landscaping maintenance works for Laois Co Co. The work entails the dredging and removal of silt and vegetation from a man-made shallow lake using an excavator and pruning of light timber for access in a publicly accessible area woodchipping of brash, processing of timber and removal of all arisings. The work also entails the setting up and maintenance of pedestrian control measures.

The work is carried out by skilled, trained and competent individuals working in groups of not less than two and usually three or more at the work site as dictated by a task/job risk assessment.

All works procedures incorporate safe systems of working and form part of the internal quality control. These include the Forestry Industry Safety Accord (FISA) (Formerly the Arboricultural & Forestry Advisory Group (AFAG)) guidelines published by the HSE (UK) and the Guide to Good Climbing Practice.

Parklawn Tree Services Ltd expects all clients to comply with the statutory requirements of Health and Safety Legislation and inform us of all known hazards and risks that may affect health and safety whilst at the client's location.

Tree works are potentially hazardous by nature. The training in work procedures, safe systems of working and management systems ensure that the works are completed in a safe manner.

2. Health and Safety

All Parklawn Tree Services Ltd employees have received health and safety training and basic First Aid training (to a minimum of CPR), or First Aid Response (Occupational first aid) applicable to their responsibilities. Training records are held at Parklawn Tree Services Ltd office in each employee's personnel file. The health and safety policy indicates the way that Parklawn Tree Services Ltd manages health and safety. All employees are empowered to take whatever action they deem appropriate to ensure the health and safety of themselves, their work colleagues and others that may be affected by their actions or the actions of others. Parklawn Tree Services employs a full time Health and Safety Officer:

Bernard Lyster 087 1251994

3. Associated Documents

This method statement should be read in conjunction with the following documents:
1 Parklawn Tree Services Ltd Health and Safety Policy,
2 Parklawn Tree Services Ltd Generic Risk Assessments.
3 Parklawn Tree Services Ltd Generic Method Statements for relevant activities.

4. Management Structure

Parklawn Tree Services Ltd operations are under the control of the Managing Director, Enda Stephens based at Church Park, Tremane, Co. Roscommon. All field operatives are under the direct control of the Person in charge of works (PICW) on site. All operatives are trained and skilled in their respective work. Work at the site is allowed only when the PICW and at least one other operative is present. Some works require at least three team members to be present. Specific detail is given in the works instructions.

5. Training

All Parklawn Tree Services Ltd employees receive training appropriate to the task that they will undertake. The training requirements and objectives are detailed in the employee manual and are guided by FISA 805. All employees are supervised to ensure the correct methods of working are used during site operations and regular Site Safety Audits are undertaken to monitor the use of these systems. Further training is identified during regular staff job reviews and recorded on staff profile sheets. The standard staff training includes:
NPTC Certificates of Competence for chainsaw use, aerial rescue and safe tree climbing.
NPTC Certificates of Competence for Land Based Machinery
HSA Approved First Aid to at least CPR;
Manual Handling Training,
CSCS for applicable machinery

6. Communications

Continuous communication between site operatives, Parklawn Tree Services Ltd office and the client is vital at all times. Each PICW is equipped with a mobile telephone to ensure that this contact is maintained. Operational instructions may be by any means, e.g. verbal, written or electronic. The PICW is required to maintain communication with landowners and site occupiers. Mobile telephones are used as emergency communications and when working in areas with no mobile coverage the Risk Assessment will be reviewed to provide alternative means of communication.

7. Site Access

Parklawn Tree Services Ltd expect all clients to provide whatever information and supervision is necessary to ensure the safety of their employees during all site works. Work will be carried out between 8.00am and 6pm Mon-Fri and 8am – 5pm Saturdays. Noisy work will be restricted before 8.30am each morning. Alternative work patterns will be arranged directly with clients, site owners, occupiers or other stakeholders, should it be required.

8. Work Procedures

All works are undertaken in accordance with the procedures contained within the relevant HSE Forestry Industry Safety Accord (FISA) leaflets. These procedures are monitored and reviewed to incorporate up to date knowledge and experience as necessary. Clients' own health and safety standards and procedures can take precedence when they are of an equal or higher standard.

9. Tools and Personal Protective Equipment

All tools and personal equipment in use by field operatives are regularly inspected by the PICW and during site and supervisory visits. Daily visual and weekly checklists are carried out on all tools and equipment. All field operatives are under instructions to replace faulty equipment immediately.

10. Depot

Parklawn Tree Services Ltd Main Office and Depot are located in Church Park, Tremane, Co. Roscommon. This includes office, workshop, parking of vehicles, storage of logs, woodchip and other associated material for the purpose of arboriculture operations.

11. Plant and Machinery

Plant and machinery operating instructions are included in the operations procedures. These procedures include inspections prior to use and operational testing. All plant and machinery is regularly inspected by a competent person as required by legislation and the team leader and during quality and supervisory visits. Faulty equipment is withdrawn from service and repairs undertaken prior to return to field operational use.

12. Transport

Parklawn Tree Services Ltd provides vehicles suitable for the use that will be made of them. Generally, these vehicles are equipped with sufficient storage space for small items of plant and equipment. The vehicles are equipped with towing facilities for Woodchippers, machines or general-purpose trailers. The vehicles are under the control of the team leader and are regularly inspected both during field operations and during site and supervisory visits. The vehicles are regularly maintained and meet the requirements of road traffic legislation. The weight limits and towing capacities of any vehicle combination is the responsibility of the team leader. Vehicles are only driven on and off site by operatives holding a current and relevant full driver's licence appropriate to the class/weight and configuration of vehicle being driven.

13. Environmental Policy

Parklawn Tree Services Ltd will endeavour to minimise disruption to the natural environment in which they work. All works undertaken, by their very nature, will cause some change to the local environment. Parklawn Tree Services Ltd operate in a way that minimises the effects of their work on the local environmental infrastructure.

14. Waste

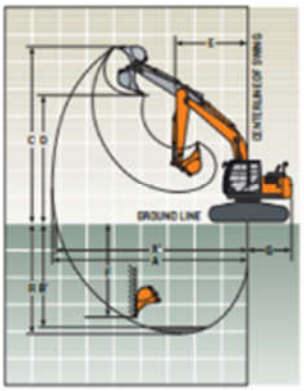
Parklawn Tree Services Ltd only use companies who carry a permit under the Waste Management Act 1996 to dispose of waste. Wherever possible, arisings are stored at the depot in purpose built holding bays and utilised as a renewable energy source. Alternatively, wood chip may be put back onto the land as mulch, where it will benefit the local Eco-system. Mature timber may be stacked for use by the owner or occupier of the land as a source of fuel or as a habitat.
Disposal of waste in the form of silt is to be agreed with Laois CoCo.
("17 05 06 dredging spoil other than those mentioned in 17 05 05" as per Waste Classification List of Waste & Determining if Waste is Hazardous or Non-hazardous APPLICABLE FROM 5 JULY 2018)

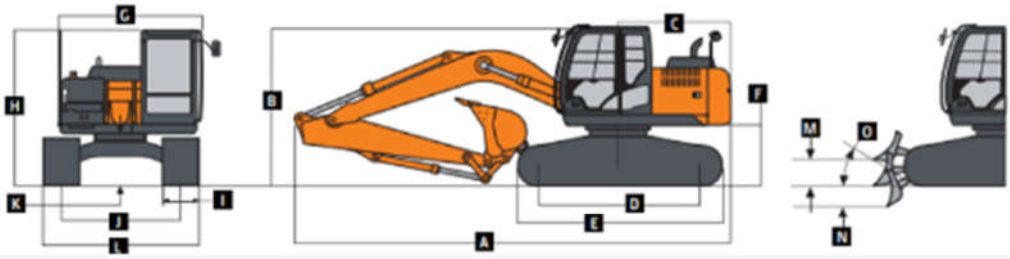
15. Excavator Specifications

ZX130-5

ZAXIS | DASH-5 UTILITY-CLASS EXCAVATORS

Operating Dimensions		
Arm Length	2.52 m (8 ft. 3 in.)	3.01 m (9 ft.11 in.)
Arm Digging Force		
SAE	67 kN (14,991 lb.)	60 kN (13,470 lb.)
ISO	69 kN (15,476 lb.)	62 kN (13,845 lb.)
Bucket Digging Force		
SAE	91 kN (20,525 lb.)	91 kN (20,525 lb.)
ISO	104 kN (23,435 lb.)	104 kN (23,435 lb.)
A Maximum Reach	8.32 m (27 ft. 4 in.)	8.79 m (28 ft. 10 in.)
A' Maximum Reach at Ground Level	8.2 m (26 ft. 11 in.)	8.67 m (28 ft. 5 in.)
B Maximum Digging Depth	5.57 m (18 ft. 3 in.)	6.06 m (19 ft. 11 in.)
B' Maximum Digging Depth at 2.44-m (8 ft.) Flat Bottom	5.35 m (17 ft. 7 in.)	5.88 m (19 ft. 3 in.)
C Maximum Cutting Height	8.6 m (28 ft. 3 in.)	8.93 m (29 ft. 4 in.)
D Maximum Dumping Height	6.19 m (20 ft. 4 in.)	6.52 m (21 ft. 5 in.)
E Minimum Swing Radius	2.4 m (7 ft. 10 in.)	2.62 m (8 ft. 7 in.)
F Maximum Vertical Wall	5.02 m (16 ft. 6 in.)	5.5 m (18 ft. 1 in.)
G Tail-Swing Radius	2.19 m (7 ft. 2 in.)	2.19 m (7 ft. 2 in.)





Machine Dimensions	ZX130-5
A Overall Length w/ Arm	
2.52 m (8 ft. 3 in.)	7.70 m (25 ft. 3 in.)
3.01 m (9 ft. 11 in.)	7.71 m (25 ft. 4 in.)
B Overall Height w/ Arm	
2.52 m (8 ft. 3 in.)	2.87 m (9 ft. 5 in.)
3.01 m (9 ft. 11 in.)	2.87 m (9 ft. 5 in.)
C Rear-End Length/Swing Radius	2.19 m (7 ft. 2 in.)
D Distance Between Idler/ Sprocket Centerline	2.88 m (9 ft. 5 in.)
E Undercarriage Length	3.58 m (11 ft. 9 in.)
F Counterweight Clearance	840 mm (33 in.)
G Upperstructure Width	2.46 m (8 ft. 1 in.)
H Cab Height	2.79 m (9 ft. 2 in.)
I Track Width w/ Triple Semi-Grouser Shoes	600 mm (24 in.)
	700 mm (28 in.)

Machine Dimensions	ZX130-5
J Gauge Width	1.99 m (6 ft. 6 in.)
K Ground Clearance	410 mm (16 in.)
L Overall Width w/ Triple Semi-Grouser Shoes	
600 mm (24 in.)	2.59 m (8 ft. 6 in.)
700 mm (28 in.)	2.69 m (8 ft. 10 in.)
M Blade Lift Height	523 mm (21 in.)
N Blade Cut Below Grade	488 mm (19 in.)
O Blade Lift Angle	27 deg.
Blade Length	2.51 m (8 ft. 3 in.)
Blade Height	523 mm (21 in.)
Blade Width w/ Triple Semi-Grouser Shoes	
600 mm (24 in.)	2590 mm (8 ft. 6 in.)
700 mm (28 in.)	2690 mm (8 ft. 10 in.)

16. Method Statement, Contact Sheet and Best Practice Guidance

Site address	Glendownes Portlaoise, Co. Laois
Description of works	Dredging and removal of silt and reeds from the edge of a man-made shallow lake in a publicly accessible area using a 13t Excavator w/ 8.32m maximum reach. The works also entail the pruning of light timber for access. The work also entails the set up and maintenance of exclusion zones and public interface.
Site Personnel	TBC
Date/s and time of works	TBC
Duration:	TBC
Emergencies:	A minimum of two staff members on site at any given time. A minimum of two staff members will be trained in first aid. The staff on site will have at least one mobile telephone.
First Aid:	A squad first aid kit will be carried in all the vehicles used for these works. If individual staff are working more than 30m from a vehicle they will have a personal first aid kit. If the squad is working more than 30m from the vehicle the first aid kit will be positioned at location decided by PICW
Vehicles:	TBC
Plant:	Hitachi EX130 Excavator 13t Lorry and lowloader Woodchipper
Hand tools:	Stihl MS241 x 3, Stihl MS201T x 2 Leaf Blowers, Rakes, Shovels, Brushes, Spanners, Screwdrivers Ladders Pulling Ropes
Staff:	These works will be carried out by staff experienced in this type of work. All staff have received NPTC for Chainsaw use, as a minimum or are working under the supervision of trained staff. There will be a minimum of two people on site at all times.

Method:	1. Parklawn's PICW will ensure that the Safe Systems of Work Plan (risk assessment) is completed before any commencement of work each day. The Risk Assessment will detail all precautions to be taken to minimise the risks associated with the work. All Parklawn staff on site will participate in the completion of the risk assessment. All staff must agree that it is safe to carry out the work. Particular consideration must be given to: a. The presence or potential presence of children b. The presence of ground level, underground or overhead services. c. Severe weather conditions. d. Vehicular and Pedestrian Traffic. e. The condition and general health of the tree. Pay particular attention to rotten timber, tree defects, crown die-back, dead wood, hangers, or broken/fractured limbs. Check that the root-plate is intact and check for the presence of or evidence of fungal fruiting bodies. f. Assess the presence of any hazards below trees, such as property, cars, septic tanks. Remove all hazards where reasonably practicable. 2. The crew will be informed about the order in which the work will take place and their duties will be assigned to them. Work equipment will be visually inspected prior to the commencement of work. 3. When the method has been decided the site will be secured, and a Controlled Entry Zone (CEZ) will be established. The CEZ must be sufficient to prevent unauthorised access to the site at all foreseeable approaches and must be large enough to ensure no persons can come into contact with the working excavator. Where necessary, physical barriers and signage shall be put in place to prevent access. Where it is not possible to erect physical barriers on all approaches, sufficient staff shall be available to monitor the CEZ and prevent unauthorised access. 4. The site will be cleared of loose debris and trip hazards and ground conditions thoroughly inspected prior to work being carried out. Staff will pay particular attention to the presence of underground/ground level services or structures which might be damaged by falling timber. **<u>Sequence of Works:</u>** **<u>Work Methods:</u>** **Pruning** 1. Tree branches may need to be pruned to clear a pathway for the excavator to enter the site. 2. Pruning will be carried out by fully trained NPTC Operatives that are certified in the use of Chainsaws/ Polesaws. 3. All waste arisings from the pruning operations will be removed from site by Parklawn Tree Services. **Woodchipping** 1. All brash <100mm in diameter shall be processed by a tracked woodchipper positioned within a reasonable distance of the landing zone. 2. All timber woodchip shall be directed away from the lake and chipped to the back of a woodchip lorry for removal.

	Excavator Dredging 1. Lake will be assessed prior to work commences to gauge depths and safe travel distance for excavator. 2. Route for excavator will be walked before travelling with machine to ensure ground is suitable and free of hazards. 3. All hazards will be removed if practicable or marked and noted on SSRA. 4. Rubber mats will be used where necessary to prevent damage to the ground where machine will be working/travelling. 5. Machine will move to position beside bank of lake and remain a minimum of 1.5m from the edge. 6. Silt traps will be put in place to minimise the silt travelling down stream. 7. Barriers and signage will be set up at least 10m outside the slew radius of the machine to the rear. 8. Machine will clear silt and debris within its reach and stack/pile in neat stacks on the bank. This will allow for natural drainage of material and allow insects to make their way back into the habitat. 9. Once an area is clear, barriers will be broken down in the direction of travel and machine will move under the supervision of an observer to the next location. 10. When in place, barriers will be placed again around the machine and signs set up. This process will be repeated as many times as necessary until work is complete. 11. Observer will remain in place to ensure no unauthorised access while machine is working. 12. Observer will be in communication with machine operator via 2-way radio for the duration of machine operation. 13. No persons will be permitted to approach the machine slew radius until the machine is powered down and the observer has received a clear positive signal that it is safe to approach. 14. It will be the responsibility of the observer to ensure that no persons enter the CEZ when the machine is in operation. 15. The observer will not approach closer than 1.5m to the edge of the bank. 16. Small light debris will be removed manually using a hook attached to fibreglass rods. **End of Shift Site Inspection** 1. At the end of each work shift and before completion of each site, the site will be inspected for hazards and all hazards removed before crews leave site. 2. On completion of works, site will be inspected for remaining hazards, cleaned and cleared, and all making good completed before crews withdraw from site
Site risk assessment:	The team leader will complete an onsite risk assessment on the day to take account of the weather and any change of circumstances during the operations, brief the squad and review daily or in the event of significant site changes. The team leader will be responsible for ensuring the health and safety of everyone within the working area or who may be affected by the works.
Risk prevention	Staff trained and certificated with a minimum experience of 6 months or under direct

	supervision of team leader. Signing and organisation of the works to notify those at risk in advance and during the works, and/or organise works to avoid busy times of day. Site risk assessment to assess daily site hazards i.e. weather affecting visibility of the works and awareness of third persons. Equipment will be well maintained and in safe working order. Keys will be removed from plant when it is unattended. Keep the minimum amount of fuel on site at any time: transport enough fuel for one day's work and keep fuel away from buildings, etc. when refuelling or storing. Gloves to be worn at all times, particularly in scrub areas where there is high volume of rubbish, waste and other unknown items. Generic Risk Assessments will be available to crews in site safety folders. **Covid 19 Coronavirus:** • HSE Guidelines will be followed.
PPE:	**Staff will have the following personal protective equipment:** **When using chainsaws:** Chainsaw Trousers, Hi-Vis Top Hard Hat and Visor/Face shield. Chainsaw boots

Hazardous Substances: (Attach MSDS if required)	 Very Toxic	 Harmful/ Irritant	 Corrosive	 Dangerous For the environment	 Oxidising	 Highly flammable	 Explosives
Applicable:	NA	Petrol Diesel 2-Stroke GEM Multi-purpose Grease Hydraulic Oil	NA	Petrol Diesel Hydraulic Oil 2-Stroke	NA	Petrol Diesel	NA
Storage Arrangements:	Flammable liquids will be kept in suitable containers and secured in vehicles. Spill kits will be available in vehicles where fuels are stored.						
Details of Permits to Work:	N/A						
Required Personnel Protective Equipment:	 Yes	 Yes	 Yes	 Yes	 Yes	 N/A	**Other:** Chainsaw trousers, hi vis PPE, face visor

Emergency Procedures:	To follow Parklawn Tree Services Emergency Plan located in Site Safety Folders	
 **First Aid Facilities:**	**Name of On-Site First Aider:**	TBC
	First Aid Box Location:	Located in Vehicles. Staff will carry personal first aid kits.
	Location of Nearest Hospital:	Midland Regional Hospital, Portlaoise Block Rd, Ballyroan, Portlaoise, Co. Laois (057) 862 1364
First Aid	A squad first aid kit will be carried in all the vehicles used for these works. If individual staff are working more than 30m from a vehicle they will have a personal first aid kit. If the squad is working more than 30m from the vehicle the first aid kit will be positioned at location decided by PICW Tree climbers carry personal first aid kits. At least two members of staff on site will have completed a course as a nominated First Aider.	
Welfare Requirements:	To be arranged with client	

Other information & Comments:	

Contact Sheet

	Company Name	Individual	Address	Emergency Phone no.
Client	Portlaoise Co Co	TBC	TBC	TBC
Main Contractor	Parklawn Tree Services Ltd.	Enda Stephens	Church Park Tremane, Co. Roscommon	086 8125165
Main Contractor (on site foreman)	Parklawn Tree Services Ltd.	TBC	TBC	TBC
Contractor Health and Safety Officer	Parklawn Tree Services Ltd.	Bernard Lyster	Church Park Tremane, Co. Roscommon	087 1251994
Client Inspector	TBC	TBC	TBC	TBC
Site Agent/ Manager	Parklawn Tree Services Ltd.	John Nolan	Church Park Tremane, Co. Roscommon	086 6077302
Local Hospital	Midland Regional Hospital,		Portlaoise Block Rd, Ballyroan, Portlaoise, Co. Laois	(057) 862 1364

Safe Methods of Work.	The relevant HSE Forestry Industry Safety Accord Guides are as follows:		
	AFAG No.	Title	Relevant (Tick)
	103	Planting	
	104	Fencing	
	105	Hand held Power Posthole Borer	
	201	Hand Tool Weeding, Brashing and Pruning	✓
	202	Application of Pesticides by Hand Held Equipment	
	203	Clearing Saw	✓
	204	Flails & Mulchers in Tree Work	
	301	Using Petrol Driven Chainsaws	✓
	302	Basic Chainsaw Felling and Manual Takedown	
	303	Chainsaw Snedding	
	304	Chainsaw Cross Cutting & Manual Stacking	
	306	Chainsaw clearance of Wind blow	
	307	Chainsaw Felling of Large Trees	
	308	Top Handled Chainsaws	
	310	The Use of Winches in Directional Felling and Takedown.	
	401	Tree Climbing Operations	
	402	Aerial Tree Rescue	
	403	Mobile Elevating Work Platforms (MEWPS) for Tree Work	
	404	Electrical Utility Arboriculture	
	501	Tractor Units in Tree Work	
	604	Wood Chippers	✓
	606	Mobile Stump Grinders	
	702	All-Terrain Vehicles	
	703	De-bogging and Recovery of Forest Machines	
	704	Excavators in Tree Work	✓
	802	Emergency Planning	✓
	804	Electricity at Work: forestry and arboriculture	
	805	Training and Certification	✓
	Other applicable Best Practice Guidance as issued by Arboricultural Association.		
	Guide to Good Climbing Practice		✓
	Guide to the use of MEWPS on Arboriculture		

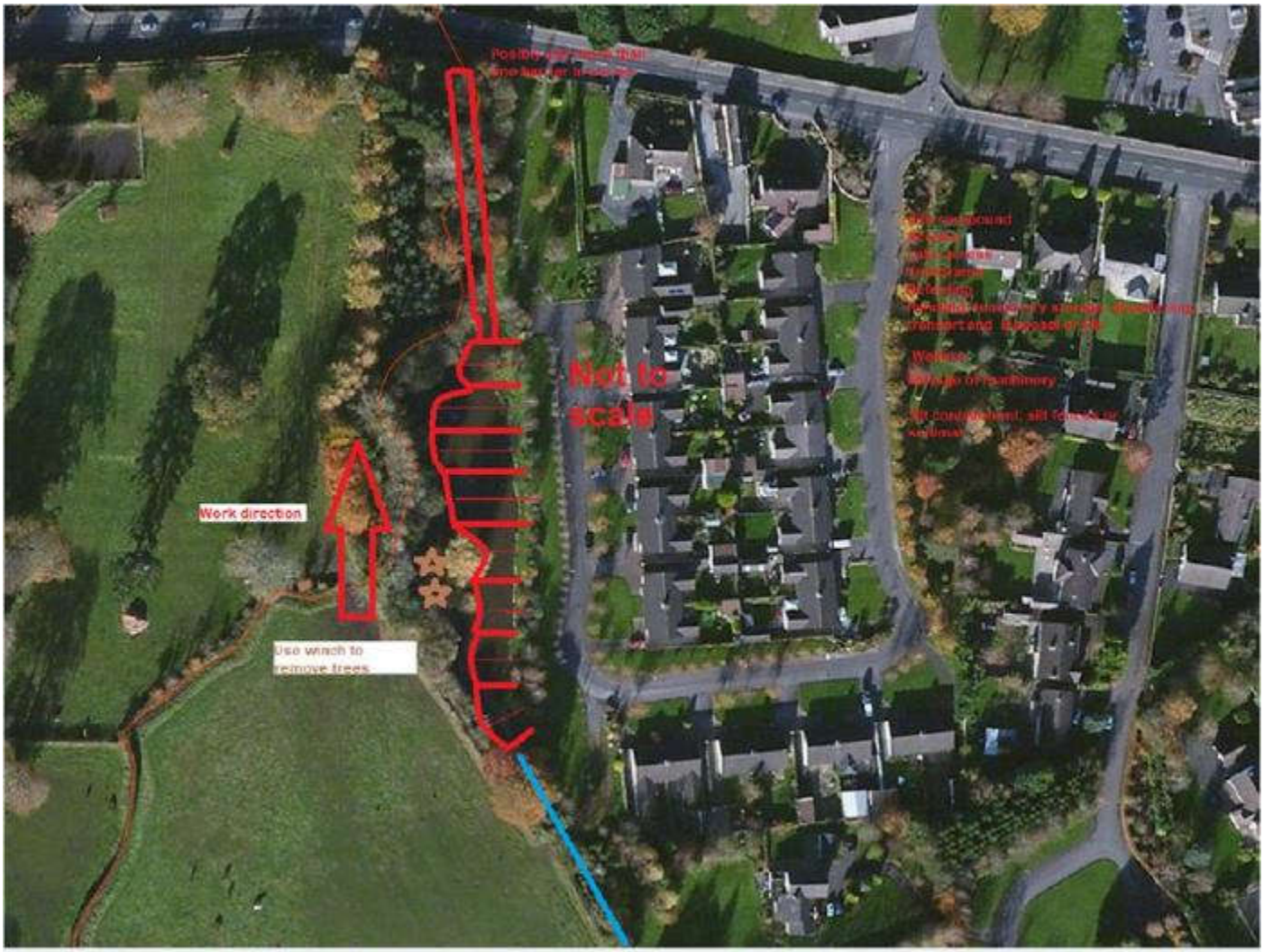
Relevant Generic Risk Assessment

Ref	Activity/Location	Relevant (Tick)
RA01	Tree cutting & chainsaw use	✓
RA02	Tractor Winch	
RA03	Stinging Insects	✓
RA04	Working alongside water	✓
RA05	Stump Grinder	
RA06	Tree Climbing	
RA07	Tree Cutting Near Overhead Power Lines	
RA08	Mobile Elevated Work Platform	
RA09	Tractor/Machine Mounted Cutting Implements	
RA10	Woodchipper	✓
RA11	Mobile Access Tower	
RA12	Machine Servicing & Maintenance Work	✓
RA13	Tractor Use in Tree Works	
RA14	Company Vehicles	✓
RA15	Pedestrian & Vehicle Controls	✓
RA16	Hook & Fibreglass Pole	✓
RA17	Quad Bikes	
RA18	Silky Saw	✓
RA19	General Plant Operation & Maintenance	✓
RA20	Operation of Telehandler	
RA21	Low-Loader (Tractor or Lorry)	✓
RA22	Excavator Use	✓
RA23	Whole Body Vibration	✓
RA24	Septic Tanks	
RA25	Work at Height	
RA28	Engulfment in Swampland	
RA29	Confrontation & Violence	✓
RA30	Hazards in the Open Countryside	✓
RA31	Polesaw Use	✓
RA32	Hand Tool Use	✓
RA33	Use of Ladders	✓
RA34	Weil's Disease	✓
RA35	Needlestick Injury	✓
RA36	Railway Work	
RA37	Windblow Storm Damage	
RA38	Manual Handling	✓
RA40	Excavator With Tree Shear Attachment	
RA41	Staff with Expired Certs	
RA42	Using Hand Held Blowers	✓
RA43	Mechanical Harvester	
RA44	Mechanical Forwarder	
RA45	Covid-19 Coronavirus	✓

Site-Specific Risk Assessment								
Activity/Hazard	**Who Might be Harmed**	**Risk Rating (No Controls) (RR)**			**Control Measures**	**Residual Risk Rating (RRR)**		
		Severity	**Likelihood**	**RR**		**Severity**	**Likelihood**	**RRR**
Tree Pruning	CTL, SP, MP, P&ED, V	3	3	9	• No timber will be cut where there is a possibility of timber falling outside the Controlled Entry Zone. • Cutter will follow procedure ensuring agreement from all staff that it safe to proceed before doing so..	3	1	3
Chainsaw laceration	CTL, SP	3	3	9	• Trained staff only to operate chainsaws • Trauma kit and first aid kits available in work vehicles including large wound dressings • Trained First Aiders on site. • Chainsaws in good repair, inspected and all safety features present and correct before use. • Rated chainsaw protective PPE (Trousers, boots, gloves, face shield. Ear defenders) must be worn when operating a chainsaw. • Chainsaws operated according to training.	3	1	3
Contracting or spreading COVID-19	CTL, SP, V	3	3	9	• All personnel are to follow HSE Covid 19 Guidelines. • RA45 outlines the	3	1	3
Publicly accessible work site.	MP, P&ED	3	3	9	• Exclusion zone set up to prevent access to work area. • Signage in place to warn members of the public of danger or falling timber and working machinery. • Adequate personnel assigned to monitor all approaches during aerial timber cutting and tree felling.	3	1	3

					• Keys removed from plant and machinery and units powered down if left unattended for any reason or length of time. • Machinery positioned to prevent operation interfering with publicly accessible areas outside exclusion zones. • Pedestrians stopped at site entrance and worked halted before pedestrians escorted through site. • Pedestrian walkway of 1.2m to be provided.			
Excavator Use	SP, PICW, V, P&ED	3	3	9	• CSCS card holder only to operate machine. • 10m exclusion zone set up. • Route walked before travelling with machine. Hazards removed or highlighted and recorded on SSRA • Machine will remain a min of 1.5m from bank of lake. • Rubber mats will be used to prevent damage to ground where necessary.			
Shallow Lake	SP	3	2	6	• Machine to remain a minimum of 1.5m from water's edge. • All persons to remain a minimum of 1.5m from edge of bank. • Loose debris will be removed using hook on rods.			

Method statement completed by:	Bernard Lyster
Checked by:	Enda Stephens
Date:	14/12/22


Not to scale
Work direction
Use winch to remove trees


50 m
N80
Silt Trap / Curtains
BORRIS LITTLE
Silt dewatering areas
Glendowns
Site Compund


NO DUMPING
OF GRASS

Appendix B. Aquatic Ecology Report

Glendowns Pond aquatic assessment report

Prepared by Triturus Environmental Ltd. for Atkins

January 2023

Please cite as:

Triturus (2023). Glendowns Pond aquatic assessment report. Report prepared by Triturus Environmental Ltd. for Atkins. January 2023

Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were contracted by Atkins to conduct an aquatic baseline & fisheries survey of Glendowns Pond, Portlaoise during August 2022. Glendowns Pond is suffering from gross siltation due to infilling by sediment from allochthonous sources (Atkins, 2018). This includes silt carried in suspension from the inflowing Little Borris Stream and organic material from the surrounding treelines, inclusive of large woody debris (tree limbs) and leaf litter.

The baseline aquatic and fisheries report would build on the data collated in the options report prepared by Atkins (Atkins, 2018) and help to inform robust pond management proposals which would improve the water quality and the biodiversity value of the pond, while minimising any associated flood risk.

1.2 Study site

Glendowns Pond is located adjacent to the Glendowns Estate, south of the Stradbally Road (N80), Portlaoise, Co. Laois (**Figures 1.1 & 2.1**). The small 0.2ha pond is situated immediately west of the Glendowns Estate. The pond is a shallow eutrophic waterbody fed by the Little Borris Stream (EPA code: 14L26) that enters the pond from the southeast. The pons is also fed by a small unnamed stream from the west. The Little Borris Stream exits the pond along the northern shore and is culverted at its junction with Stradbally Road (N80). The path of the stream is unclear following culverting under the N80 given that it is not mapped by the EPA. According to Atkins (2018), the stream is considered to be culverted through/under St. Fintan's Psychiatric Hospital, the Dublin Road (R445) and the Prison, before remerging in Ballyroan (southeast of the railway line) where it is known as the as Borris Great Stream (14B15).

Glendowns Pond is hydrologically linked to the River Barrow and River Nore SAC (002162) via the Little Borris Stream, the connecting Borris Great Stream and the Triogue River, a tributary of the River Barrow (c. 13km downstream distance to the European site). The Ridge of Portlaoise pNHA (000876), a site designated as an esker, is located approximately 120m to the west of Glendowns Pond but has no hydrological connectivity with the study area.

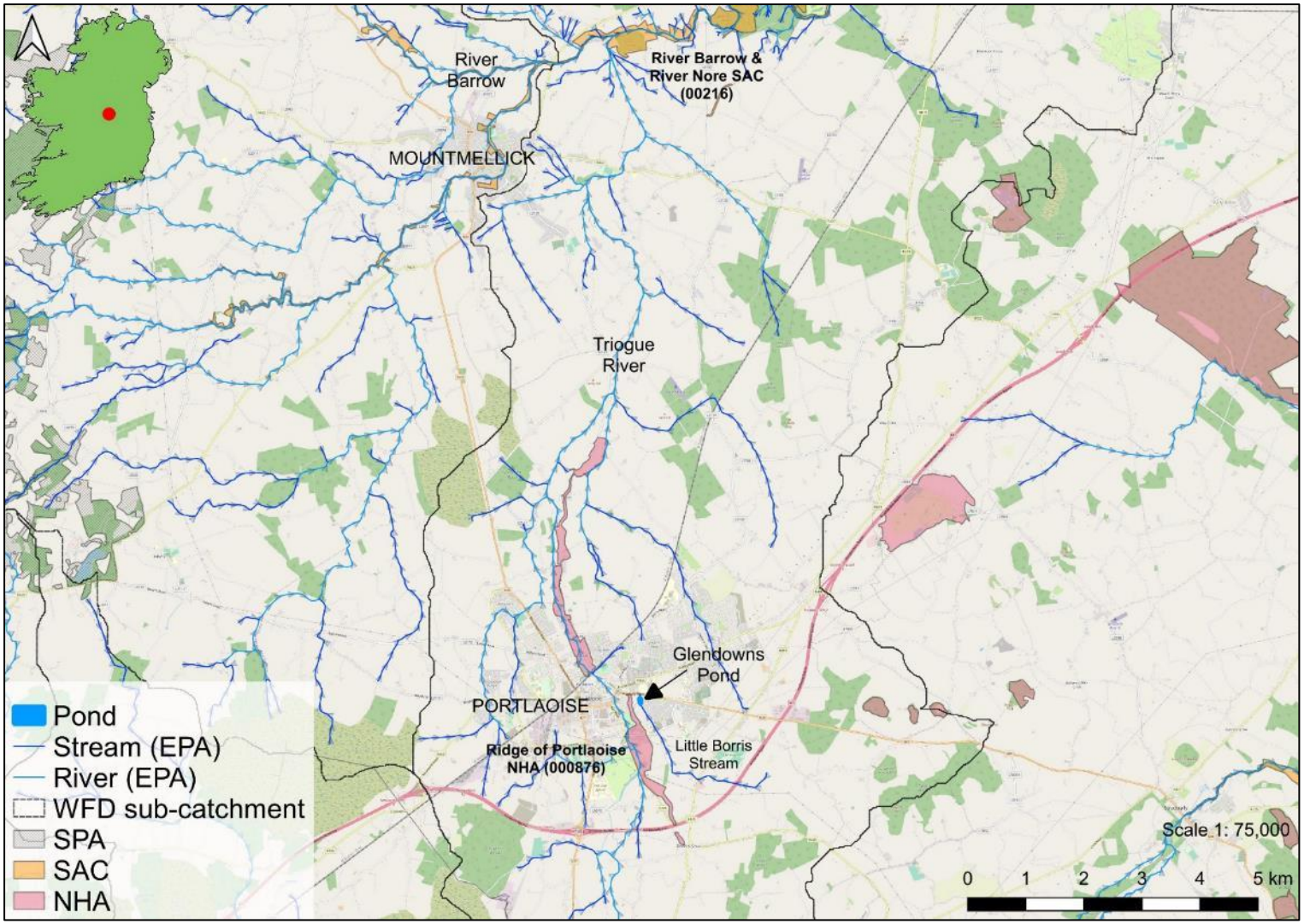


Figure 2.1 Location of the Glendowns Pond Study area in the context of protected sites

2. Methodology

2.1 Desktop review

A desktop survey of published and unpublished data for the study area in the vicinity of Glendowns Pond was undertaken in respect of rare and or protected aquatic flora and fauna. This included a review of data held by the BSBI, NBDC and NPWS.

2.2 Site visit

A site visit of Glendowns Pond was undertaken on 9th July 2022. Glendowns Pond and the Little Borris Stream were broadly characterised in terms of their physical habitats, fish, macro-invertebrate and macrophyte (aquatic plant) communities. Environmental DNA (eDNA) was also collected to help validate the present of cryptic fish and invertebrate species including European eel (*Anguilla anguilla*), lamprey (*Lampetra* sp.) and white-clawed crayfish (*Austropotamobious pallipes*). The adjoining habitats were noted according to Fossitt (2000) to provide a baseline. These approaches are detailed below.

Table 2.1 Location of *n*=4 aquatic survey sites in the vicinity of Glendowns Pond, Portlaoise, Co. Laois

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
1	Little Borris Stream	14L26	Pond inflow	647838	698240
2	Glendowns Pond	n/a	South basin	647817	698298
3	Glendowns Pond	n/a	North basin	647811	698348
4	Little Borris Stream	14L26	Pond outflow	647807	698433

2.3 White-clawed crayfish survey

White-clawed crayfish surveys were undertaken at the aquatic survey sites in July 2022 under a National Parks and Wildlife (NPWS) open licence (no. C31/2022), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2021), to capture and release crayfish to their site of capture, under condition no. 6 of the licence. As per Inland Fisheries Ireland recommendations, the crayfish sampling started at the uppermost site(s) of the study area to minimise the risk of transferring invasive propagules (including crayfish plague) in an upstream direction.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). An appraisal of white-clawed crayfish habitat at each site was conducted based on physical channel attributes, water chemistry and incidental records in mustelid spraint.

2.4 Macro-invertebrates (sweep samples)

The BMWP (Biological Monitoring Working Party) and Average Score Per Taxon (ASPT) biotic indices were used to assess the current biological water quality of Glendowns Pond (July 2022). Whilst not equating to WFD status, these indices provide a qualitative indication of the overall health of the pond. The BMWP score is based on the presence of pollution-tolerant to pollution-sensitive families

(Hawkes, 1998; Armitage et al., 1983). Each family is assigned a score. The BMWP score is the sum of these family scores. Families that are sensitive to pollution are assigned higher scores than pollution-tolerant families. A high overall score indicates that the water quality is good.

The total BMWP score can also be divided by the number of taxa to produce the Average Score Per Taxon (ASPT), yielding a score between 1 and 10. A BMWP score greater than 100 generally indicates very good water quality (Chapman & Jackson, 1996). A high ASPT score i.e. >5.5 is considered indicative of a clean site containing large numbers of high-scoring taxa (pers. obs.). Please note that BMWP scores will vary at a geographical scale due to the natural geology, water chemistry, gradient, time of sampling, size and depth of pond site in addition to biotic factors such as macrophyte diversity. As no national study for pond water quality has been adopted the BMWP and ASPT provides a good reference system to establish relative biological water quality.

A composite macro-invertebrate sample (from a number of sweep samples) was collected from Glendowns Pond on the 9th July 2022 (**Figure 2.1**). The composite sample was taken with a standard kick sampling hand net (250mm width, 500µm mesh size), which was used to sweep the macrophytes/sediment to capture macro-invertebrates. The net was also moved along the bed to collect epibenthic and epiphytic invertebrates from the substratum (as per Cheal et al., 1993). A 3-minute sampling period was divided amongst the range of meso-habitats present to get a representative sample for sub-habitats (e.g., macrophyte beds, silt, gravel areas etc.). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), stoneflies (Feeley et al., 2020), mayflies (Kelly-Quinn & Regan, 2012) and other relevant taxa (e.g., Byrne et al., 2009; Nelson et al., 2011).

2.5 Macro-invertebrates (Q-sampling)

Kick samples were collected in the inflowing (site 1) and outflowing Little Borris Stream (site 4) and assessed for biological water quality through Q-sampling in July 2022 (**Figure 2.1).** All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising 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. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD status classes. 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 2.1 Reference categories for EPA Q-ratings (Q1 to Q5)

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 Macrophyte and aquatic bryophyte survey

Macrophyte (aquatic plant) and bryophyte (aquatic mosses and liverworts) surveys were conducted during the site visit, from both the bank and via a macrophyte grapnel. Specimens were identified to species level, where possible, using relevant taxonomic keys. Species were cross-referenced with relevant red lists (i.e. Lockhart et al., 2012; Wyse-Jackson et al., 2016).

2.7 Otter signs

The presence of otter (*Lutra lutra*) at each aquatic survey site was determined through the recording of otter signs. The presence of signs was also investigated from the small bridge crossing of the Little Borris Stream upstream of Glendowns Pond to the Stradbally Road (N80) crossing. Notes on the age and location (ITM coordinates) were made for each otter sign recorded, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, crustaceans, molluscs etc.). The survey in particular also focused on the detection of otter holt (potential breeding areas) and couch sites (resting areas).

2.8 Environmental DNA (eDNA)

To validate site surveys (e.g. physical supporting habitat appraisals) and to detect potentially cryptically low populations of lamprey, brown trout, European eel, white-clawed crayfish and smooth newt (*Lissotriton vulgaris*) within the study area, *n*=4 composite water samples were collected from Glendowns Pond[1] and the Little Borris Stream upstream and downstream of the pond (**Figure 2.1**). This would help validate the presence and or absence of these species given populations are often mobile, seasonal and therefore cryptic meaning they can be missed during site surveys. Environmental DNA provides a mechanism to detect cryptic populations and can help support traditional survey effort. The water samples were collected on the 29th July 2022, with the sites strategically chosen to maximise longitudinal (instream) coverage within the catchment (i.e. facilitating a greater likelihood of species detection).

In accordance with best practice, a composite (500ml) water sample was collected from the sampling point, maximising the geographic spread at the site (20 x 25ml samples at each site), thus increasing the chance of detecting the target species' DNA. The composite sample was filtered on-site using a

[1] Glendowns Pond was tested for 6 no. species, which required two individual samples (maximum of 4 species per samples)

sterile proprietary eDNA sampling kit. The fixed sample was stored at room temperature and sent to the laboratory for analysis within 48 hours of collection. A total of *n*=12 qPCR replicates were analysed for the site. Given the high sensitivity of eDNA analysis, a single positive qPCR replicate is considered as proof of the species' presence (termed qPCR No Threshold, or qPCR NT). Whilst an eDNA approach is not currently quantitative, the detection of the target species' DNA indicates the presence of the species at and or upstream of the sampling point. Please refer to **Appendix A** for full eDNA laboratory analysis methodology.

2.9 Biosecurity

In keeping with standard best practice for environmental surveys, 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 mobilisation of invasive propagules or disease. Cognisance in this respect was aimed in particular towards preventing the spread or introduction of crayfish plague given the known historical distribution of white-clawed crayfish in the wider survey area (Atkins, 2018) and also in light of known crayfish plague in the wider River Barrow catchment. 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.

Figure 2.1 An overview map of the aquatic survey sites at Glendowns Pond and the Little Borris Stream

3. Results

3.1 Desktop review – rare and protected aquatic species

A comprehensive desktop review of aquatic species of high conservation value identified a low number of rare and or protected aquatic species records in the vicinity of the study area, including 10km grid square W97. Furthermore, hydrologically connected hectads were examined for macrophyte plant species with ecological preferences that would potentially occur within the enriched, clear alkaline conditions of the study area.

3.1.1 Macrophytes (including charophytes)

A review of the online Atlas of British and Irish Flora was undertaken on the 15th January 2023 to review contemporary records for aquatic plants of high conservation value that may occur in the vicinity of the study. Opposite-leaved pondweed (*Groenlandia densa*), a perennial herb of base rich, clear water that benefits from low levels of competition from other macrophytes, protected under the Flora (Protection) Order 2022 is known from the River Barrow catchment (e.g. nearest hectad N61 IE). Conditions that could support the species were present in the study area. However, the species is not known in the vicinity of Portlaoise.

The habitats in the study area had some suitability to support the regionally scarce *Ranunculus circinatus*, a perennial herb of clear, base rich sluggish streams and lake habitats. This species is known from the River Barrow catchment from hectads N41 IE and N51 IE according to the online Atlas of British and Irish Flora, but is not known from the Portlaoise area.

Horned pondweed (*Zannichellia palustris*) is a pondweed species of clear eutrophic ponds, canals and slow-moving rivers, including tidal rivers. Primarily the botanical of interest with regards this species relates to *Zannichellia palustris* subsp. *palustris* and *Zannichellia palustris* subsp. *pedicellata.* The nearest occurrence of the species is in hectad N40 IE but it is not known in the vicinity of Portlaoise.

No charophytes (stoneworts) were observed during the site survey and the mobile, heavily silted, eutrophic conditions of Glendowns Pond were unsuitable to support red listed or regionally uncommon species including *Tolypella, Chara* and *Nitella* species. These species are considered the main groups associated with clear alkaline ponds but generally not in eutrophic conditions with high silt loading. Where charophyte communities occur they can be representative of the Annex I habitat 'Hard oligo-mesotrophic waters with benthic vegetation of *Chara* (stonewort) species (3140)' and as such are of very high conservation value. The red list for Irish charophytes is currently under review (Nick Stewart, pers. comm.).

3.1.2 Fish

No fisheries data was available for Glendowns Pond. However, fisheries data was available for the nearby Triogue River (14T01) where Inland Fisheries Ireland (IFI) collected fisheries data at three sites, at Kyle Bridge, Knocknagroagh Bridge and Eyne Bridge north of Portlaoise in 2020 (Gordon et al., 2020). Six species of fish were recorded during the survey including brown trout, Atlantic salmon (*Salmo salar*), lamprey, minnow (*Phoxinus phoxinus*), stone loach (*Barbatula barbatula*) and three-spined stickleback (*Gasterosteus aculeatus*). While invasive dace (*Leuciscus leuciscus*) and roach

(*Rutilus rutilus*) are known from the River Barrow catchment downstream they are not known from the Triogue sub-catchment.

During preliminary site surveys of the study area carried out by SNC Lavalin during April 2018 lamprey (*Lampetra* sp.) were observed spawning in the Little Borris Stream upstream of Glendowns Pond (SNC Dunlavin, 2018). The record is considered to be brook lamprey (*Lampetra planeri*) given the significant downstream barriers in the catchment that would preclude the presence of either sea lamprey (*Petromyzon marinus*) or river lamprey (*Lampetra fluviatilis*). Predominantly these anadromous populations of are restricted to below the weir at Graiguenamanagh on the River Barrow.

3.1.3 White-clawed crayfish

A review of the online NBDC data (accessed 15th January 2022) revealed white-clawed crayfish (*Austropotamobious pallipes*) were available for the downstream-connecting Triogue catchment in 1997 at EPA station RS14T010100, east of Portlaoise Golf Club. The species was also recorded immediately east of Mountmellick on the lower Triogue River at EPA station (RS14T010400) during 2011.

3.1.4 Amphibians

According to the NBDC database no smooth newt (*Lissotriton vulgaris*) records are known in the vicinity of the study area, with the nearest records 6.5km northeast of the study area at Garryduff in 2020. There are no records for common frog (*Rana temporaria*) in the vicinity of the study area apart from a record from a local garden pond (S4798) (SNC Lavalin, 2018).

3.1.5 Otter

No otter (*Lutra lutra*) records were available from the NBDC in the vicinity of the study area. All records were historical only and situated in the Triogue catchment north of Portlaoise. These were sourced from the National Otter Survey of Ireland carried out in 1980, according to the NBDC database. More contemporary records were not available.

3.2 Site description

3.2.1 Site 1 - Little Borris Stream (pond inflow)

Survey site 1 was situated on the inflowing stream to Glendowns Pond, known as the Little Borris Stream (14L26). The stream was a small 4m wide lowland depositing (FW2) channel. The historically straightened channel had 0.5m bankfull heights but retained semi-natural flow characteristics with shallow riffle and glide present (typically 0.1m deep). Pool habitat (c. 0.3-0.5m deep) was very localised and largely restricted to the small bridge crossing area and offered refugia for fish during the low summer flows. The stream bed was dominated by small cobble with frequent mixed medium and fine gravels bedded between cobble and scattered isolated small boulder. The bed was heavily compacted with moderate to heavy siltation. The channel supported the frequent branched bur-reed (*Sparganium erectum*), occasional blue water-speedwell (*Veronica anagallis-aquatica*) and occasional narrow-fruited watercress (*Nasturtium microphyllum*) upstream of its confluence with Glendowns Pond. Macrophyte vegetation became sparse moving upstream towards the bridge crossing. No

submerged macrophyte species were present in the channel. Instream cobble and scattered boulder supported occasional clumps of the moss *Rhynchostegium riparoides* with the liverwort *Pellia endiviifolia* being locally frequent. These are common bryophytes in midlands rivers. No rare macrophytes or bryophytes were recorded in the survey area and no examples of Annex I Habitat, 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260)' were recorded.

The riparian zone of the west bank supported mature beech (*Fagus sylvatica*) with a dense ivy (*Hedera helix*) carpet in the understory. The west bank supported scattered mature beech and sycamore with a recently cut dry grassy margin (GS2: Fossitt, 2000).

The Little Borris Stream had capacity to support a small brown trout population given its semi-natural character. However, the shallow depth, high siltation and enrichment evidently reduced the quality of the salmonid habitat overall. The nursery value was thus moderate at best given that the low summer flow reduced the available oxygenation in the riffle-glide area downstream of the bridge. Spawning habitat quality was considered moderate due to embedded substrata and moderate siltation pressures. Holding habitat was poor overall with it being limited to pool under the small bridge crossing. Despite evident hydromorphological pressures in the Little Borris Stream, brown trout were detected as present in the eDNA sample results (**section 3.3**).

The Little Borris Stream also had good habitat quality for brook lamprey (*Lampetra planeri*). Spawning habitat was considered good locally given the presence mixed fine gravels in the interstitial spaces of cobble in the shallow riffle-glide habitat present. Ammocoete nursery habitat was also good with organic rich silt downstream of the spawning areas, particularly at the confluence with Glendowns Pond. The stream also had suitability to support an eel population and the presence of stoney refugia and pool habitat in addition to abundant silt for burial indicated good eel nursery habitat. Both European eel and brook lamprey were detected by eDNA sampling thus supporting the onsite observations (**section 3.3**).

White-clawed crayfish were recorded at low density in the Little Borris Stream with *n*=4 adults captured during a search of 30 refugia. This equates to 1 crayfish per 7.5 refuges which is considered a low density population. One of the four crayfish captured exhibited porcelain disease, a pathogen of crayfish caused by the microsporidian parasite *Thelohania contejeani* (**Plate 3.4**). In summary the Little Borris Stream has high local biodiversity value with a semi-natural character supporting brown trout, lamprey and crayfish populations.

Plate 3.1 The Little Borris Stream downstream of the old bridge crossing

Plate 3.2 *Pellia endiviifolia* growing on instream cobble and small boulder covered with blue cyanobacterial crust, a common feature of alkaline midland rivers and a useful indicator of the presence of white-clawed crayfish

Plate 3.3 *Rhynchostegium riparioides* on instream cobble and small boulder in the Triogue River upstream of Glendowns Pond

Plate 3.4 Adult white-clawed crayfish recorded in the Little Borris Stream upstream of Glendowns Pond. The specimen on the right shows evidence of porcelain disease caused by the microsporidian parasite *Thelohania contejeani*

3.2.2 Site 2 – Glendowns Pond, south basin

The southern basin of Glendowns Pond included the confluence of the Little Borris Stream and the adjoining open water of the basin, inclusive of the small, wooded island. The pond basin was broadly oval in shape with a simple pond margin (i.e. no regular breaks with points and secluded bays etc.). The pond's summer depths averaged 0.1m and the basin supported clear water. The pond bed was heavily silted and had a green filamentous algae carpet covering 90% of the pond bed (as with the

north basin), indicating gross eutrophication[2] (refer to site 3 below). The south basin was even shallower than the north, with a very heavy build-up of exposed silt from the inflowing Little Borris Stream. The south side of the basin featured low gradient margins and supported a heavily vegetated littoral, particularly along the east bank and at the confluence of the inflowing stream. The margins supported macrophytes that graded into a herb and damp weed community characteristic of wet and paludal areas of ponds. Branched bur-reed was frequent with more localised common water starwort (*Callitriche stagnalis*). Water mint (*Mentha aquatica*) was occasional on the littorals of the island along with frequent blue water-speedwell. The confluence of the inflowing Little Borris Stream supported small patches of narrow fruited watercress. The pond margins also supported frequent great willowherb (*Epilobium hirsutum*), hedge bindweed (*Calystegia sepium*), clustered dock (*Rumex conglomeratus*) and purple loosestrife (*Lythrum salicaria*). The southern basin was lined by mature trees, particularly along the west bank where mature sycamore (*Acer pseudoplatanus*), ash (*Fraxinus excelsior*) and ivy were present. The central island supported mainly grey willow (*Salix cinerea* sp. *oleifolia*) and sycamore with a very mature white willow (*Salix alba*) also present. The adjoining eastern bank of the pond graded into the parkland of the Glendowns Estate and supported scattered weeping willow (*Salix babylonica*), large-leaved lime (*Tilia playphyllus*), birch (*Betula* sp.), sergeant's cherry (*Prunus sargentii*), copper beech (*Fagus sylvatica purpurea*) and sycamore.

A number of small fish species were recorded via sweep samples. These included three-spined stickleback (*Gasterosteus aculeatus*), ten-spined stickleback (*Pungitius pungitius*) and stone loach (*Barbatula barbatula*). Glendowns Pond was considered to have suitability to support lamprey at the confluence with the Little Borris Stream. The pond also supports a small brown trout population that may migrate between the pond and the Little Borris Stream, dependent on water levels. The pond also had high suitability for European eel. Brown trout, lamprey and European eel were all detected in the composite eDNA sample from the pond (**section 3.3**).

No white-clawed crayfish were recorded during sweep sampling of the pond basin and the habitat was considered sub-optimal due to heavy siltation and enrichment. Crayfish were however detected in the eDNA samples collected from the pond and are likely present at low densities (**section 3.3**). The species may move between the Little Borris Stream and Glendowns Pond when foraging at night.

[2] Eutrophication is an oversupply of nutrients to an aquatic system, usually causing undesirable changes in aquatic ecosystems such as toxic algal blooms, decrease in water transparency, oxygen depletion or anoxia due to decomposition of organic matter, changes in species composition, increased incidence of fish kills and reduced species diversity (Smith & Schindler, 2009)

Plate 3.5 Representative image of the south basin facing towards the Little Borris Stream confluence illustrating dense growth of branched bur-reed on the east bank

Plate 3.6 Profuse growth of branched bur-reed and blue water speedwell on the muddy paludal areas of Glendowns Pond (south basin) at the Little Borris Stream confluence point

3.2.3 Site 3 – Glendowns Pond, north basin

The northern basin of Glendowns Pond had a heavily vegetated littoral particularly along the east bank and at the outflow of the Little Borris Stream. This included a dense reed swamp littoral comprising branched bur-reed with great willowherb and bittersweet (*Solanum dulcamara*) on the immediate pond littoral. Small patches of common water starwort and the narrow leaved pondweed species *Stuckenia pectinata* were present in the margins of the open water of the basin. Water mint was present in the small bay in the north-west corner of the pond. Given the very shallow nature of the pond basin (average 0.15m deep) and clear water conditions, the soft silt bed had a high coverage (90%) of green filamentous algae (**Plate 3.7**). The west bank was lined by overhanging mature trees, where mature 30m-high black poplar (*Populus nigra*), crack willow and sycamore were present.

Scattered ornamental trees were present on the east bank including weeping willow, goat willow (*Salix caprea*), copper beech, large-leaved lime, and downy birch (*Betula pubescens*).

As with the south basin, the north basin also supported populations of three-spined stickleback, ten-spined stickleback and stone loach. The north basin was also considered to have suitability for lamprey particularly at the outflowing Little Borris Stream. The north basin likely also supports a small brown trout population that may migrate between the pond and Little Borris Stream, dependent on water levels. There was high suitability for European eel. Brown trout, lamprey and European eel were all detected in the composite eDNA sample from the pond (**section 3.3**).

No white-clawed crayfish were recorded during sweep sampling of the pond basin and the habitat was considered sub-optimal due to heavy siltation and enrichment. Crayfish were however detected in the eDNA sample collected from the pond and are likely present at low densities (**section 3.3**).

Plate 3.7 Heavily silted and shallow nature of Glendowns Pond showing very high cover of blanket filamentous green algae.

Plate 3.8 Heavily silted margins of the north basin of Glendowns Pond near the outflow

Plate 3.9 Heavily vegetated littoral of the east bank in the northern basin of Glendowns Pond showing branched bur-reed, great willow herb, bittersweet and hedge bindweed bordering recently cut dry grassy meadow (GS2 vegetation)

Plate 3.10 Disused otter holt (background) in poorly accessible west bank of Glendowns Pond adjacent to old fishing net and waders

3.2.4 Site 4 – Little Borris Stream, pond outflow

The Little Borris Stream (14L26) exited Glendowns Pond in the north-eastern corner and continued in a historically widened and straightened channel before it entered a culvert under the Stradbally Road (N80). The outflowing stream was predominantly 4-5m wide in narrow sections of the channel but widened to 15m in a small muddy bay adjoining mixed broad-leaved woodland (WD1) on the west bank. The stream was very shallow at 0.1m to 0.2m deep and the substrata comprised deep silt to 0.5m depth. The stream had been historically widened and realigned as part of historical drainage works and thus flow rates were very low and the profile comprised exclusively of very slow-flowing glide and or stagnating water. The slow flows resulted in high growth of common duckweed (*Lemna*

minor) that covered 15% by surface area of the channel, forming large floating rafts in the margins along with biofilms. The stream was evidently enriched (exhibiting eutrophic conditions) and suffered from heavy siltation but the water was clear and no hydrocarbon slicks or foul smell was observed during the survey. Instream, the channel supported brooklime (*Veronica beccabunga*) and fool's watercress (*Apium nodiflorum*) locally. Branched bur-reed was frequent at the pond outflow in addition to occasional blue-water speedwell and bittersweet in muddy paludal areas. No rare macrophytes or bryophytes were recorded in the survey area and no examples of Annex I Habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260)' were recorded.

The riparian zone of the west bank was open with dry grassy verges (GS2) that were recently cut back and scattered mature trees including weeping willow, silver birch (*Betula pendula*), sergeants cherry, downy birch, grey willow, sycamore and ash. The east bank comprised mixed broadleaved woodland with sitka spruce (*Picea sitchensis*), ash and sycamore with a shaded understory supporting mainly nettle (*Urtica dioica*).

The shallow nature of the outflowing stream (with deep silt accumulations) offered poor suitability for brown trout due to the absence of spawning, nursery and or holding habitat. The Little Borris Stream also provided good habitat quality for brook lamprey ammocoetes (i.e. nursery habitat) given abundant organic-rich silt downstream of the pond. The outflowing stream also had suitability to support an eel population given eels often bury in silt (like lamprey) and can use silty streams as nursery areas (pers. obs.). Indeed, both European eel and brook lamprey were detected by eDNA sampling downstream of the pond, thus supporting the onsite observations.

No white-clawed crayfish were captured during sweep netting of marginal macrophytes. There was no suitable boulder and cobble habitat for the species given gross siltation.

Plate 3.11 The Little Borris Stream downstream of Glendowns Pond showing gross siltation

Plate 3.12 The Little Borris Stream at the culvert crossing of the Stradbally Road (N80) showing low summer flows and heavy siltation

3.3 Otter

An otter survey was undertaken around the full circumference of the pond and in the adjoining Little Borris Stream. No otter signs were recorded apart from a disused otter holt (ITM 647801, 698379) in the northwest corner of Glendowns Pond in dense tree cover and scrub (Plate 3.10). A local resident stated that an otter was killed on the road during 2020. It is unknown whether the same otter used the otter holt recorded during the July 2022 survey.

3.4 Environmental DNA (eDNA)

Site 1 the Little Borris Stream upstream of Glendowns Pond tested positive for European eel, lamprey, brown trout and smooth newt. Very strong eDNA signatures were recorded for eel, lamprey and brown trout which is considered evidence of these species' presence. Only a single qPCR replicate was positive for smooth newt indicating low concentrations of the species eDNA. The result indicates a small local population present in the Little Borris Stream at or upstream of the survey area with no eDNA detected downstream in Glendowns Pond or in the outflowing Little Borris Stream (**Table 3.1; Appendix A**). As white-clawed crayfish were recorded present during the site surveys no eDNA sample was collected as the species presence was already confirmed.

Site 4 on the Little Borris Stream downstream of Glendowns Pond also had strong eDNA signatures for European eel, lamprey and white-clawed crayfish (**Table 3.1; Appendix A**). While upstream populations of these species could spike the samples, the strong signatures recorded (i.e. high number of positive replicates) likely support these species' presence. Brown trout eDNA was not collected given the very poor habitat and water quality that was not considered suitable to support the species in the outflowing Little Borris Stream. No smooth newt eDNA was recorded present which is considered evidence of the species' absence at site 4 (i.e. present in the pond or upstream habitats).

The composite eDNA samples collected from Glendowns Pond tested positive for white-clawed crayfish, lamprey, brown trout and European eel (**Table 3.2; Appendix A**). The strong eDNA signatures

(i.e. 12 positive qPCR replicates out of 12) supports the presence of these species within the pond. The oxygenation from the Little Borris Stream likely helps support these high conservation value species within the pond basin, which suffers from eutrophication pressures and heavy siltation. No pike (*Esox lucius*) eDNA was detected and the shallow nature of the pond and poor water quality would likely be incapable of supporting the species. No smooth newt eDNA was recorded which is considered evidence of the species' absence at Glendowns Pond.

Table 3.1 eDNA results for the Little Borris Stream (positive qPCR replicates out of 12 in parentheses)

Sample	Watercourse	European eel	*Lampetra* sp.	Brown trout	White-clawed crayfish	Smooth newt
FK608	Little Borris Stream (site 1, u/s pond)	**Positive (12/12)**	**Positive (12/12)**	**Positive (12/12)**	**Recorded present**[3]	**Positive (1/12)**
FK610	Little Borris Stream (site 4, d/s pond)	**Positive (9/12)**	**Positive (12/12)**	No BT sample[4]	**Positive (12/12)**	Negative (0/12)

Table 3.2 eDNA results for Glendowns Pond (positive qPCR replicates out of 12 in parentheses)

Sample	Species	Result
FK590	Smooth newt	Negative (0/12)
FK590	White-clawed crayfish	**Positive (12/12)**
FK590	Brown trout	**Positive (12/12)**
FK590	European eel	**Positive (12/12)**
FK607	*Lampetra* sp.	**Positive (12/12)**
FK607	Pike	Negative (0/12)

3.5 Macro-invertebrate (Q-sampling)

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from *n*=2 sites in July 2022 from the Little Borris River (**Table 3.3**). Neither of the samples 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) (**Table 3.3**).

The sample collected from site 1 had a single clean water indicator (EPA Group A) stonefly species, present, namely *Nemoura cinerea*. The sample also had abundant mayflies with a moderate tolerance to water pollution including *Serratella ignita* and *Baetis rhodani* (both EPA Group C). The sample

[3] White-clawed crayfish were recorded present during the survey and thus there was no requirement for eDNA testing at site 1 on the Borris Stream

[4] Due to very poor suitability given highly degraded stream habitat at site 4 on the Little Borris Stream an eDNA sample for brown trout was not collected

contained high numbers of gammarid shrimps and New Zealand mud snails (both EPA Group C). The dominance of group C species was indicative of enrichment and siltation pressures in the Little Borris Stream. However, overall the stream biological water quality at site 1 was representative of moderate status (**Q3-4**) biological water quality.

Site 4 on the Little Borris Stream downstream of Glendowns Pond had much poorer water quality than at site 1 upstream of Glendowns Pond, reflected by the community composition recorded (**Table 3.3**). The sample composition had fair numbers of EPA Group C moderate water quality indicators, including corixids and gammarids, but was dominated by highly pollution tolerant (EPA Group D and E) species. The enriched and heavily silted nature of the stream at site 4 also supported the **Q2-3** (poor status) biological water quality recorded at the site.

Table 3.3 Summary of invertebrate composition recorded on the Little Borris Stream, August 2022

Family	Species	Site 1	Site 4	EPA group
Nemouridae (stonefly)	*Nemoura cinerea*	1		A
Baetidae (mayfly)	*Baetis rhodani*	2		C
Ephemerellidae (mayfly)	*Serratella ignita*	28		C
Elmidae (riffle beetle)	*Elmis aenea*	3		C
Halipliidae (crawling water beetle)	*Brychius elevatus*	3		C
Chironomidae (non-biting midge)	Non-*Chironomus* spp.	1	4	C
Corixidae (water boatman)	Corixidae nymph		2	C
Corixidae (water boatman)	*Siagara* sp.		5	C
Hydrometridae (water measurer)	*Hydrometra stagnorum*	1		C
Gammaridae (freshwater shrimp)	*Gammarus duebeni*	52	2	C
Hydrachnidiae (water mite)	sp. indet.	1		C
Tateidae (New Zealand mud snail)	*Potamopyrgus antipodarum*	39		C
Physidae (bladder snail)	*Physa fontinalis*		1	D
Glossiphoniidae (leech)	sp. indet.	1	3	D
Chironomidae (non-biting midge)	*Chironomus* spp.		15	D
Asellidae (freshwater hog-louse)	*Asellus aquaticus*	1	3	D
Naididae (Tubificidae) (tubificid worm)	Naididae (Tubificidae)		20	E
Oligochaeta (freshwater worm)	sp. indet.	3		n/a
Taxon richness *n*		**14**	**9**	
Total abundance		**136**	**55**	
Q-rating		**Q3-4**	**Q2-3**	
WFD status		**Moderate**	**Poor**	

3.6 Macro-invertebrate (pond samples)

In July 2022, a composite macro-invertebrate sweep sample was collected from Glendowns Pond. A total of *n*=21 species were recorded between the two samples (**Table 3.4**). The BMWP average score per taxon (ASPT) scores of 4.4 and 4.2 would indicate the pond is 'moderately impacted'. This was supported by the observed anoxic sediment, exuberant filamentous algae growth and the presence of abundant common duckweed in the pond The poorer water quality is also reflected in the more pollution tolerant invertebrate community composition as described below.

No rare or protected macro-invertebrate species were recorded in the Glendowns Pond sample when compared to national red lists for aquatic beetles (Foster et al., 2009), stoneflies (Feeley et al., 2020), mayflies (Kelly-Quinn & Regan, 2012) and other relevant taxa (e.g., molluscs; Byrne et al., 2009).

The invertebrate community at Glendowns Pond was dominated by pollution-tolerant species such as corixids (water boatmen), chironomids (bloodworm), freshwater hog-louse (*Asellus aquaticus*), gastropod snails and tubificid worms (**Table 3.4**). A single specimen of the ubiquitous blue-tailed damselfly (*Ischnura elegans*) was recorded with an absence of any notable rare damselfly or dragonfly species. Blue-tailed damselfly are considered tolerant to pollution (enrichment) and are a very widespread species across Ireland in vegetated shallow, and enriched ponds.

The beetle species *Haliplus lineatocollis*, *Helophorus brevipalpis* and a member of the *Haliplus ruficollis* group[5] were recorded during the survey. These species are widespread species of shallow enriched ponds with weedy margins. A single mayfly species, the pond olive (*Cloeon simile*), was recorded in fair numbers during the survey. This species is common in ponds where oxygen levels are good but the species is notably tolerant of enrichment and siltation.

Plate 3.13 Great pond snail (*Lymnaea stagnalis*) and other gastropod species were common at Glendowns Pond

[5] *Haliplus ruficolis* group specimens can only be speciated from male specimens

Plate 3.14 Three-spined stickleback (*Gasterosteus aculeatus*) (top), and ten-spined stickleback (*Pungitius pungitius*) (bottom) recorded from Glendowns Pond

Table 3.3 Macro-invertebrate community recorded from Glendowns Pond (sites 2 & 3), August 2022

Taxon	Family	Species	Common name	Site 2	Site 3	BMPW score	Pollution tolerance
Ephemeroptera	Baetidae	*Cloeon simile*	Pond olive	11	3	6	Moderately tolerant
Trichoptera	Limnephilidae	*Limnephilus lunatus*	Caddis fly	3		7	Moderately tolerant
Odonata	Coenagrionidae	*Ischnura elegans*	Blue-tailed damselfly	1		6	Moderately tolerant
Hemiptera	Corixidae	*Corixid* nymph	Water boatman	26	9	5	Tolerant
Hemiptera	Corixidae	*Hesperocorixa sahlbergi*	Water boatman	1		5	Tolerant
Hemiptera	Corixidae	*Siagara* sp.	Water boatman	12	6	5	Tolerant
Hemiptera	Notonectidae	*Notonecta glauca*	Common backswimmer	6	2	5	Tolerant
Hemiptera	Gerridae	*Gerris* sp.	Water strider		2	5	Tolerant
Hemiptera	Hydrometridae	*Hydrometra stagnorum*	Water measurer	1		5	Tolerant
Crustacea	Gammaridae	*Gammarus duebeni*	Freshwater shrimp	1	3	6	Tolerant
Coleoptera	Haliplidae	*Haliplus lineatocollis*	Water beetle	5		5	Tolerant
Coleoptera	Haliplidae	*Haliplus ruficollis* group	Water beetle	13	11	5	Tolerant
Coleoptera	Hydrophilidae	*Helophorus brevipalpis*	Water beetle	1	2	5	Tolerant
Hydracarina	Hydrachnidiae	sp. indet.	Water mite	2	1	n/a	Tolerant
Gastropoda	Hydrobiidae	*Potamopyrgus antipodarum*	New Zealand mud snail	2	5	3	Tolerant
Crustacea	Asellidae	*Asellus aquaticus*	Freshwater hoglouse	4	16	3	Very tolerant
Gastropoda	Lymnaeidae	*Ampullacaena* (*Radix*) *balthica*	Wandering snail	2		3	Very tolerant
Gastropoda	Lymnaeidae	*Lymnaea stagnalis*	Great pond snail	11	16	3	Very tolerant
Gastropoda	Physidae	*Physa fontinalis*	Common bladder snail	7		3	Very tolerant
Diptera	Chironomidae	*Chironomus* sp.	Bloodworm	9	6	2	Most tolerant
Oligochaeta	Naididae (Tubificidae)	sp. indet.	Oligochaete worm	1	9	1	Most tolerant
			Abundance	**119**	**91**		
			Taxon richness	**20**	**14**		
			BMWP score	**83**	**54**		
			ASPT score	**4.4**	**4.2**		

4. Discussion

Glendowns Pond is a shallow, clear water, alkaline pond that supports both fish and invertebrates of high conservation value. These include European eel, lamprey, brown trout and white-clawed crayfish which also are present in the Little Brosna Stream that supplies water to the pond. Environmental DNA (eDNA) helped to identify the presence of these species, which supported the observations of the site surveys. Neither the Little Borris Stream or Glendowns Pond supported any rare or protected macrophytes or Annex I aquatic habitats. No rare or protected macro-invertebrate species were recorded in the Glendowns Pond sample or from the Little Borris Stream when compared to national red lists for aquatic beetles (Foster et al., 2009), stoneflies (Feeley et al., 2020), mayflies (Kelly-Quinn & Regan, 2012) and other relevant taxa (e.g., molluscs; Byrne et al., 2009). The average score per taxon (ASPT) derived for Glendowns Pond indicated 'moderately impacted' water quality while the Little Borris Stream was of **Q3-4 (moderate status)** upstream of Glendowns Pond and of **Q2-3 (poor status)** downstream. Therefore, neither of the two samples collected from the Little Borris Stream 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). No otter signs were recorded during the site surveys apart from a disused holt in the northwest corner of the pond basin. The pond and Little Borris Stream has capacity to support otter but the downstream trash screen on the Stradbally Road may act as an otter barrier and thus movement into the catchment can only occur from the south.

This aquatic baseline survey of Glendowns Pond has highlighted a number of key issues relating to its future management, both in terms of its function as a biodiversity asset, as well as a recreational amenity site. The most significant threats to the pond are enrichment and the siltation (infilling) of the shallow pond basin. The combination of a shallow, alkaline pond with high rates of siltation and significant nutrient enrichment (eutrophication) has resulted in a self-perpetuating ecosystem with high levels of nutrients and excessive filamentous algae growth (as observed during the surveys). Excessive algal growth is likely causing fluctuations in dissolved oxygen through oxygen depletion over-night and limited wind exposure on the pond's surface (due to the basin being highly sheltered) reduces natural oxygenation of the pond. Excessive growth and decomposition of aquatic plants (and algae) results in a significant source of phosphorus and organic nitrogen within the sediment and a perpetual cycle of growth and decay that diminishes the biodiversity value of the pond over time.

In light of the observed significant siltation issue and enrichment, desilting works would vastly improve the biodiversity and recreational value of Glendowns Pond. Siltation will result in a continued infilling (shallowing) of the pond, causing increased macrophyte and algal growth, warmer water temperatures and further impact dissolved oxygen levels and water quality. Given the key role of phosphorus (P) in the eutrophication process, one of the effective restoration methods, especially for small shallow lakes, is the removal of sediments enriched with nutrients (Kiani et al., 2020) and improving the quality of the lake bed through the application of a calcium carbonate based commercial pond application such as Siltex. Furthermore, enhancement of the Little Borris Stream through instream random boulder placement to improve flow heterogeneity and the option of creating a two stage channel would be very beneficial.

A high-level summary of some recommended management measures, their rationale, indicative costs, indicative labour and predicted efficacy are summarised below in **Table 4.1.**

Table 4.1 Summary of potential management options for the Borris Little Stream & Glendowns Pond. * = likely ineffective, ** = likely effective, *** = very likely effective

Management issue	Management option	Rationale	Indicative cost	Labour input	Predicted efficacy
Reduce nutrient inputs					
Eutrophication & siltation	Sediment removal	Physically remove nutrient source from lakebed via dredging	High	Low	***
Eutrophication	Chemical control (liming)	Inactivate phosphorus in sediment (by encouraging formation of calcium phosphate), thus reducing availability to plants and limiting growth. Can be used post dredging to settle the pH of the pond	Medium	Medium to high	***
Eutrophication	Nutrient management plan	Prevent/reduce nutrient run-off to the lake via surface water pathways e.g. Little Borris Stream	Medium	Medium	**
Reduce aquatic algal growth and coverage					
Filamentous green algae	Chemical control (liming) using a commercial pond friendly product such as Siltex	Inactivate phosphorus in sediment (by encouraging formation of calcium phosphate), thus reducing availability to plants and limiting growth. Undertake on phased, trial basis in localised areas	Medium	Medium to high	***
Duckweed (*Lemna minor*)	Selected tree felling by arborist	Improve wind fetch and oxygenation of the lake basin. Achieved through mechanical disturbance of surface by wind that reduces floating duckweed proliferation. These mats prevent oxygenation of the water column.	Low	Low	**
Improve instream quality Little Borris Stream					
Sedimentation & eutrophication pressures	Install two stage channels at inflow and outflow with random boulder installations	Improves summer flows, increases flow heterogeneity and two-stage channel facilitates accommodation of flood flow levels while also creating important low bank wetter meadow establishment	Medium to High	High	***
Otter passage	Remove two bars from the trash screen on the N80 culvert	Otters can migrate surprisingly long distances through culverted streams and thus trash screens can result in barriers to population movements	Low	Low	***

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6. Appendix A – eDNA laboratory report

SureScreen Scientifics

Folio No: E15194
Report No: 1
Client: Triturus Environmental Ltd
Contact: Ross Macklin

TECHNICAL REPORT

ANALYSIS OF ENVIRONMENTAL DNA IN WATER FOR AQUATIC SPECIES DETECTION

SUMMARY

When aquatic organisms inhabit a waterbody such as a pond, lake or river they continuously release small amounts of their DNA into the environment. By collecting and analysing water samples, we can detect these small traces of environmental DNA (eDNA) to confirm the presence or absence of the target species within the waterbody.

RESULTS

Date sample received in laboratory: 02/08/2022
Date results reported: 09/08/2022
Matters affecting result: None

TARGET SPECIES: Brook Lamprey *(Lampetra planeri)*

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK607	Glendowns Pond B	-	Pass	Pass	Pass	Positive	12/12
FK608	1B Downsteam Glendowns Pond	-	Pass	Pass	Pass	Positive	12/12
FK610	1A Upstream Glendowns Pond	-	Pass	Pass	Pass	Positive	12/12

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SureScreen Scientifics

TARGET SPECIES: Brown (Sea) Trout *(Salmo trutta)*

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK590	Glendowns Pond A	-	Pass	Pass	Pass	Positive	12/12
FK610	1A Upstream Glendowns Pond	-	Pass	Pass	Pass	Positive	12/12

TARGET SPECIES: European eel *(Anguilla anguilla)*

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK590	Glendowns Pond A	-	Pass	Pass	Pass	Positive	12/12
FK608	1B Downsteam Glendowns Pond	-	Pass	Pass	Pass	Positive	9/12
FK610	1A Upstream Glendowns Pond	-	Pass	Pass	Pass	Positive	12/12

TARGET SPECIES: Northern pike *(Esox lucius)*

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK607	Glendowns Pond B	-	Pass	Pass	Pass	Negative	0/12

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TARGET SPECIES: Smooth Newt *(Lissotriton vulgaris)*

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK590	Glendowns Pond A	-	Pass	Pass	Pass	Negative	0/12
FK608	1B Downsteam Glendowns Pond	-	Pass	Pass	Pass	Negative	0/12
FK610	1A Upstream Glendowns Pond	-	Pass	Pass	Pass	Positive	1/12

TARGET SPECIES: White-clawed crayfish *(Austropotamobius pallipes)*

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK590	Glendowns Pond A	-	Pass	Pass	Pass	Positive	12/12
FK608	1B Downsteam Glendowns Pond	-	Pass	Pass	Pass	Positive	12/12

If you have any questions regarding results, please contact us: ForensicEcology@surescreen.com

Reported by: **Chelsea Warner** Approved by: **Gabriela Danickova**

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METHODOLOGY

The samples detailed above have been analysed for the presence of target species eDNA following scientifically published eDNA assays and protocols which have been thoroughly tested, developed and verified for use by SureScreen Scientifics.

The analysis is conducted in two phases. The sample first goes through an extraction process where the filter is incubated in order to obtain any DNA within the sample. The extracted sample is then tested via real time PCR (also called q-PCR) for each of the selected target species. This process uses species-specific molecular markers (known as primers) to amplify a select part of the DNA, allowing it to be detected and measured in 'real time' as the analytical process develops. qPCR combines amplification and detection of target DNA into a single step. With qPCR, fluorescent dyes specific to the target sequence are used to label targeted PCR products during thermal cycling. The accumulation of fluorescent signals during this reaction is measured for fast and objective data analysis. The primers used in this process are specific to a part of mitochondrial DNA only found in each individual species. Separate primers are used for each of the species, ensuring no DNA from any other species present in the water is amplified.

If target species DNA is present, the DNA is amplified up to a detectable level, resulting in positive species detection. If target species DNA is not present then amplification does not occur, and a negative result is recorded.

Analysis of eDNA requires scrupulous attention to detail to prevent risk of contamination. True positive controls, negative controls and spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared and reported. Stages of the DNA analysis are also conducted in different buildings at our premises for added security.

SureScreen Scientifics Ltd is ISO9001 accredited and participate in Natural England's proficiency testing scheme for GCN eDNA testing. We also carry out regular inter-laboratory checks on accuracy of results as part of our quality control procedures.

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INTERPRETATION OF RESULTS

SIC: **Sample Integrity Check** [Pass/Fail]
When samples are received in the laboratory, they are inspected for any tube leakage, suitability of sample (not too much mud or weed etc.) and absence of any factors that could potentially lead to inconclusive results.

DC: **Degradation Check** [Pass/Fail]
Analysis of the spiked DNA marker to see if there has been degradation of the kit or sample, between the date it was made to the date of analysis. Degradation of the spiked DNA marker may indicate a risk of false negative results.

IC: **Inhibition Check** [Pass/Fail]
The presence of inhibitors within a sample are assessed using a DNA marker. If inhibition is detected, samples are purified and re-analysed. Inhibitors cannot always be removed, if the inhibition check fails, the sample should be re-collected.

Result: **Presence of eDNA** [Positive/Negative/Inconclusive]

Positive: DNA was identified within the sample, indicative of species presence within the sampling location at the time the sample was taken or within the recent past at the sampling location.

Positive Replicates: Number of positive qPCR replicates out of a series of 12. If one or more of these are found to be positive the pond is declared positive for species presence. It may be assumed that small fractions of positive analyses suggest low level presence, but this cannot currently be used for population studies. Even a score as low as 1/12 is declared positive. 0/12 indicates negative species presence.

Negative: eDNA was not detected or is below the threshold detection level and the test result should be considered as evidence of species absence, however, does not exclude the potential for species presence below the limit of detection.

Inconclusive: Controls indicate inhibition or degradation of the sample, resulting in the inability to provide conclusive evidence for species presence or absence.

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Appendix C. Hydrology Report

HYDROLOGY REPORT

Glendowns Pond, Portlaoise, County Laois

Prepared for: **Atkins**

SLR Ref: 501.0822.64431
Version No: Rev.01
March 2023

BASIS OF REPORT

This document has been prepared by **SLR Environmental Consulting (Ireland) Limited** with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with **Atkins** (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

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1.0 INTRODUCTION

SLR Consulting (SLR) has been appointed by Atkins (the Client) to prepare a Hydrology Report for the Glendowns Pond, Portlaoise, Co. Laois which has become heavily silted. The report will assist in developing better understating on hydrology at the pond with the aim of restoring the pond at a future date to obtain a better ecological value for the site.

1.1 Scope

The purpose of this report is as follows:

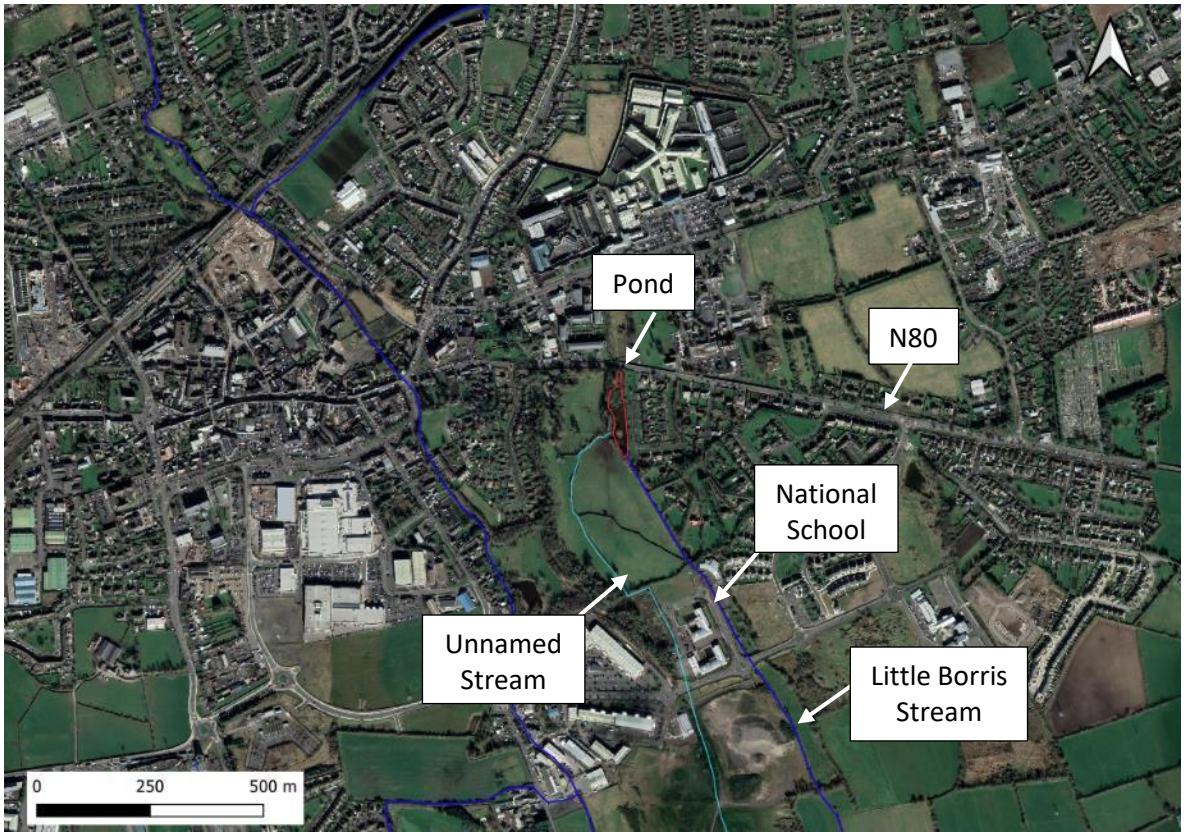
- Review the existing hydrology of the pond through hydrological analysis of flows into and from the pond;
- Identify hydrology features within the pond's influence area; and
- Estimate of index flood and hydrograph shape using various hydrology methods for ungauged catchments.

1.2 Site Location and Setting

The Glendowns Pond is located in Glendowns Estate, off the Stradbally Road, Portlaoise, Co. Laois. The pond location and immediate surroundings are shown on Figure 1-1 below. Site photos taken in July 2022 are provided in Appendix A.

The pond is situated southeast of the town centre of Portlaoise. Fields to the west and south, and dwellings to the east surround this semi-urban area. National Road N80 runs along the northern boundary of the pond. The area is becoming rapidly urbanized as seen by recent growth of houses and schools.

Figure 1-1
Site Surrounding



1.3 Hydrology Features

The pond is fed by two small streams entering from the southwest (unnamed) and southeast1 (Little Borris Stream) as shown on Figure 1-2. There is one outflow point from the north of the pond which is culverted under the N80 to the north and re-emerges approximately 950 m north of the pond as the Borris Great Stream.

Little Borris Stream rises in the townland of Derry to the southeast of the M7. It is culverted under the M7 and continues in a westerly direction, before turning to the north / northwest into the townland of Downs and Summerhill, where the Glendowns Pond is located.

After exiting Glendowns Pond through a trash screen the stream passes under the N80. The stream appears to be largely culverted through / under St. Fintan's Psychiatric Hospital, the R445 Dublin Road and the Prison site, before remerging in Ballyroan (southeast of the railway line).

The distance from source to Glendowns Pond is approximately 3.2 km. Its confluence with the Triogue River is approximately 5.8km from the pond outlet. Before joining the Triogue River the Borris Great Stream joins with a number of other small watercourses which drain lands to the north and east of Portlaoise.

The second inflow, unnamed stream, enters the western side of Glendowns Pond. It appears to start in the environs of the new school on the Southern Circular Road; upstream of this point it appears to receive contributions from a network of drainage ditches from woodlands and disused quarry.

Figure 1-2
Hydrology Features

1.4 Topography and Land Use

From where it rises in Derry, Little Borris Stream runs though lands primarily managed as improved agricultural grassland (GA18) and arable land (BC1).

Just south of Southern Circular Road (southeast of Portlaoise Retail Park) the stream forms the eastern boundary of a disused aggregate quarry. North of Southern Circular Road it borders a new school campus and agricultural grassland before entering residential lands at Glendowns Estate and the pond.

It is assumed that the stream receives storm surface water runoff from housing estates to the east; namely Glendowns, Glenlahan, Aghnaharna Drive and Summerhill (all south of the Stradbally Road) as well as from the school grounds.

The unnamed western stream also passes through lands used for agriculture (grassland), as well as residential and commercial development. It also crosses local roads such as the Southern Circular Road.

1.5 Soil and Hydrogeology

The catchment area of the pond is underlain by till derived from limestones, gravels derived from limestones and alluvium material.

There are a number of spring karst features within the catchment and karst enclosed depressions to the south of the catchment area.

Figure 1-3
Catchment area and known Karst Features

1.6 Nominated Hydrologists

This report has been prepared by:

- Kristian Divjak MSc (Water Resources) – Senior flood risk engineer; and
- EurGeol Dr. Peter Glanville PGeo. PhD (Geomorphology) MSc (GIS) - SLR Technical Director Hydrology.

Kristian is a hydrologist with SLR with over 6 years' experience in the sector, specialising in hydraulic modelling, flood risk assessment and hydrology environmental assessments for planning applications. He has undertaken and prepared flood risk assessments and the water environment chapters of EIARs for a wide range of projects across Ireland and Croatia.

Peter is a Technical Director (Hydrology) with SLR and has over 20 years' experience in the area of hydrology and flood risk assessments. Peter has undertaken and prepared flood risk assessments for a wide range of projects. He has also been involved as a hydrologist in a range of environmental monitoring projects for Environmental Baseline Studies, exploration operations, quarry site operations and infrastructure projects – this work has typically included hydrology monitoring (flow) and water quality sampling and testing.

2.0 FLOOD HAZARD

2.1 National Flood Hazard Mapping

The Catchment Flood Risk Assessment and Management (CFRAM) Programme has been implemented for seven areas across Ireland termed River Basin Districts (RBDs) which cover the whole country. Each RBD is divided into a number of River Basins (Units of Management, or 'UoMs'), where one Plan has been prepared for each River Basin. The OPW CFRAM flood mapping has been undertaken at the national level.

The subject site is within Flood Risk Management Plan for the Barrow River Basin (UoM No. 14), and Portlaoise AFA (Area for Further Assessment).

The CFRAM flood mapping indicates that the streams and pond do not cause flooding for the 1% AEP (annual exceedance probability). There is a minor flooding at the confluence of the unnamed stream and the pond for the 0.1% AEP events.

The surround area of the site is within Flood Zone C (low risk of flooding).

2.2 Historical Flooding

The Office of Public Works (OPW) Flood Risk Mapping identifies Stradbally Road at the outflow from Glendowns Pond as an area subject to repeat flooding (MCOS, 2004). A trash gate, often fitted as part of flood relief works is fitted on the outflow channel from the pond (just before it is culverted under Stradbally Road, N80).

This recurring flood incident at the outflow from the pond is recorded under ID-2646. According to the Minutes of Meeting report[1] the flooding at this location has been mitigated.

> *A tributary of the river Triogue overflows its banks after very heavy rainfall. Last occurred in the winter of 1994/1995. The council and a developer have undertaken redial work and has not flooded since.*

[1] https://s3-eu-west-1.amazonaws.com/floodmaps.floodinfo.ie/Reports/F310%20Data%20Collection/019%20Laois%20County%20Council/004%20Minutes%20Verbal%20Report/lao_mm_ab_0000002131.pdf

3.0 ESTIMATION OF INDEX FLOOD

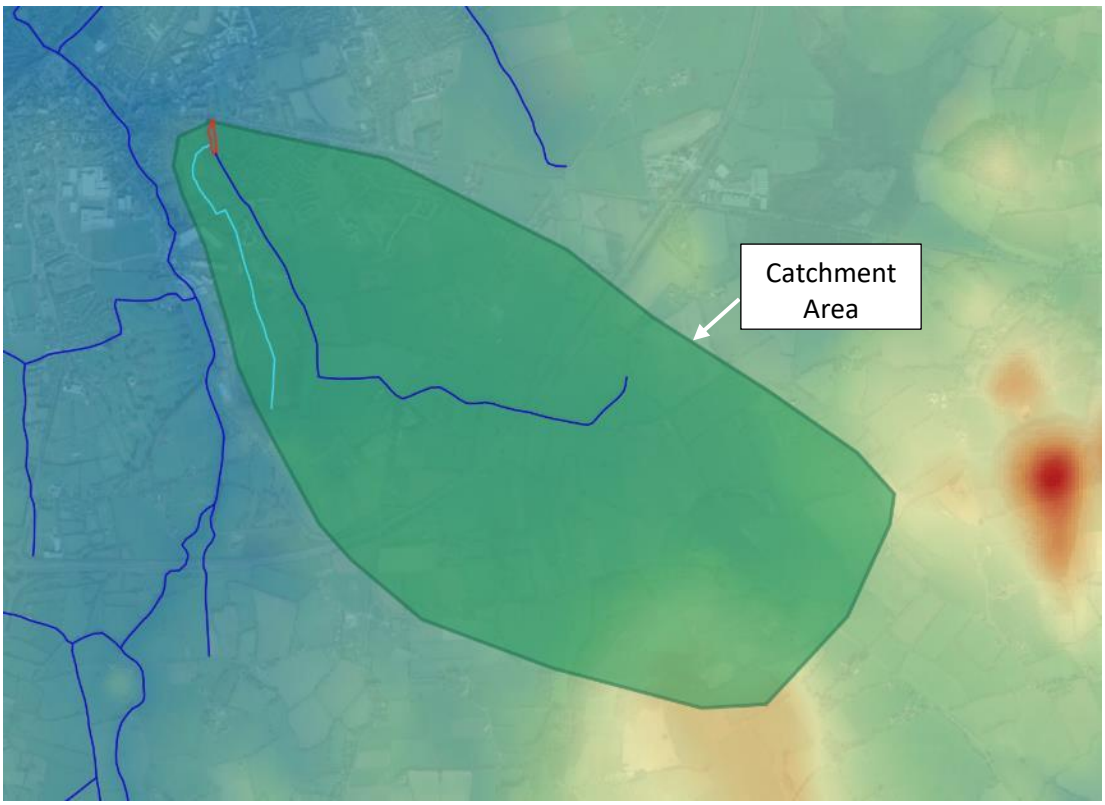
In order to undertake the flood flow estimation, it is necessary to establish a number of Hydrological Estimation Points (HEPs) at appropriate locations along the watercourse. HEPs are typically located at confluences, and at the upstream and downstream end of modelled watercourses. Hydrological analysis is then carried out on the catchments contributing to each HEP in order to calculate the design flows at the HEP.

For this exercise the HEP has been defined at the Glendowns Pond.

The Little Borris Stream is within a gauged catchment. The closest downstream hydrometric station is Portarlingron 13005. The catchment area at the station is 406 km^2.

As part of Work Package 5.3 of Flood Studies Update, catchment descriptors were generated at 500 m intervals or less, on watercourses across the country. HEPs (also known as FSU Nodes) are points at these intervals along a watercourse at which flow estimates are derived, based on catchment descriptors. The catchment area at the Glendowns Pond is 6.55 km2 according to the FSU Web Portal, at the FSU Node 14_474_7. The catchment area has been also delineated using DTM data, where the draining area appears to be as well 6.55 km^2, as shown on Figure 3-1.

Figure 3-1
Catchment Area at Glendowns Pond



The estimation of design flows and hydrographs has followed the OPW Flood Studies Update (FSU) methods and processes as set out in the FSU Web Portal (https://opw.hydronet.com/). If the catchment areas are less than 25 km^2, the FSU methods indicate that alternative methods should also be considered to estimate flood flows. Such methods are typically based on regression equations linking flood flows to key catchment descriptors. In this study, the redeveloped FSU4.2a regression equation[2], FSU 3v equation, and IH 124 equation were used in order to provide comparable peak event flowrates.

[2] National Hydrology Conference 2012: 09 - Flood estimation in small and urbanised catchments in Ireland, Gebre, 2012

3.1 Growth Curves

The growth factors have been determined through the FSU Web Portal using the pooling group method, please refer to Appendix A for details. The growth factors are listed in Table 3-1 below. GEV distribution has been applied.

Table 3-1
Growth Curves

Return Period	Growth Factors
2	1.00
10	1.72
30	2.20
50	2.43
100	2.75
1000	3.93

3.2 Flood Studies Update (FSU) – Web portal

The principal flood estimation method set out in the FSU is a statistical method, using donor (pivotal) gauged sites and pooling groups of hydrologically similar catchments in order to estimate the peak flowrates of probabilistic events. The output derived from the FSU Web Portal has been provided in Appendix B.

The FSU method is a 7-variable method used to estimate Q_{med} for catchments greater than 25 km^2. The regression equation is based on seven physical catchment descriptors (PCD), in conjunction with an urban adjustment factor. The FSU approach to estimating the peak flow for a given return period (T) involves three steps:

- estimation of the index flood, which is the median annual maximum flood (QMED);
- estimation of an appropriate flood growth curve;
- derivation of the flood frequency curve which relates the index flood to the growth curve to provide an initial estimate of the peak flow for the required return period (T)/annual exceedance probability (AEP).

Figure 3-2, below, shows an extract from the OPW FSU Web portal which presents the catchment area and catchment characteristics at the FSU node at the pond (node 14__474_7).

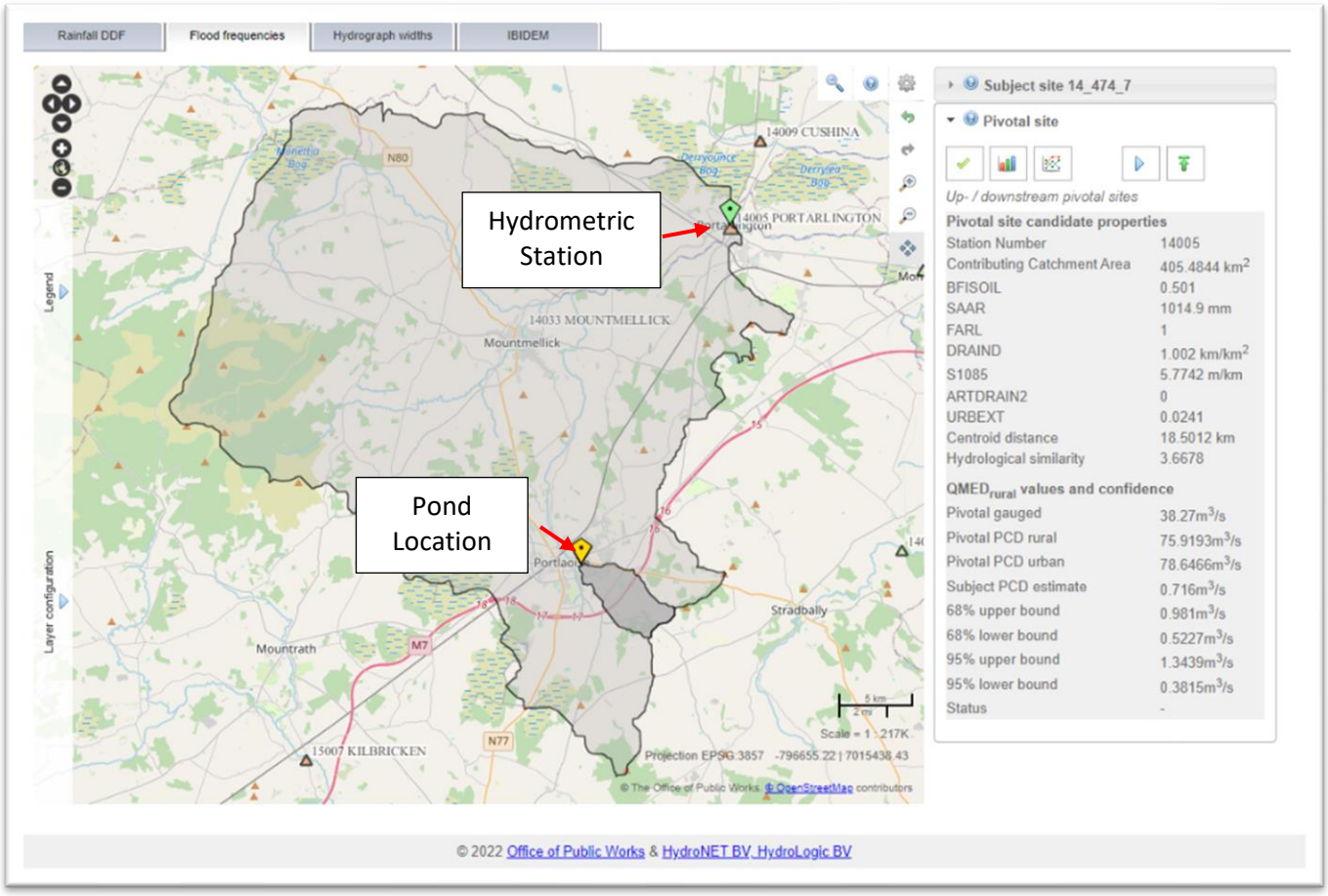
The location the principal gauging site used in flood flow estimation is 14005 Portarlington, at the River Barrow. This is approximately 23.3 km downstream of the pond.

Factorial standard error of the FSU-7v equation is 1.37. However, this has not been applied since a donor catchment has been used.

Based on this method the Q_{med} at the inflow to the pond is estimated to be approximately 0.37 m^3/s.

The key details of the FSU donor adjustment method are provided in Appendix B.

Figure 3-2
FSU Web Portal – Estimation of Q_{med}



3.3 Flood Studies Update (FSU) – 3v equation

The FSU 3-variable equation was developed as part of the FSU. It was developed as a 'shortcut' equation for the estimation of flow in ungauged catchments and was used to test the applicability of different types of adjustments to statistical flood estimations.

A factorial standard error of 1.60 has been applied.

$$Q_{med} = 0.000302 \times AREA^{0.829} \times BFI_{soil}^{-1.539} \times SAAR^{0.898}$$

Based on this method the Q_{med} at the inflow to the pond is estimated to be approximately 1.13 m^3/s.

3.4 Flood Studies Update (FSU) – Small and Urbanised Catchments

The FSU equation for small catchment has been development as part of the WP4.2 Flood Estimation in Small and Urbanised Catchments Study. This equation is also referred to as FSU4.2a equation.

$$Q_{med,rural} = 2.3848 \times 10^{-5} \times AREA^{0.9245} \times BFI_{soil}^{-0.9030} \times SAAR^{1.2695} \times FARL^{2.3163} \times S_{1085}^{0.185}$$

The regression equation can take in to account urban extent within a catchment in the same manner as in the FSU method with seven variables.

$$Q_{med,final} = Q_{med} \times (1 + URBEXT)^{1.482}$$

URBEXT is a proportion of the catchment that is urbanised. For this exercise it was estimated to be 5%.

A factorial standard error of 1.674 has been applied.

Based on this method the Q_{med} at the inflow to the pond is estimated to be approximately 1.33 m^3/s.

3.5 IH 124

The IH 124 Report examined the response of small catchments, less than 25 km^2, to rainfall and derived an improved flood estimation equation (Marshall & Bayliss, 1994). A total of 87 sites were used to develop the method. The report developed a new equation to estimate the mean annual flood, Q_{BAR} (in m^3/s), for small rural and urban catchments.

It should be noted that Q_{BAR} has a return period of approximately 1 in 2.3 years, however, a conservative Q_{BAR} peak runoff rate has been estimated assuming a 1 in 2 year return period.

$$Q_{bar} = 0.0108 \times AREA^{0.89} \times SOIL^{2.17} \times SAAR^{1.17}$$

A factorial standard error of 1.65 has been applied.

The Q_{bar} at the inflow to the pond is estimated to be c. 2.13 m^3/s.

3.6 Peak Flow Summary

The flood index has been estimated using four seperate equations. The results for Q_{med}, 1% AEP (annual exceedance probability), and 0.1% AEP with factorial standard error applied are provided in Table 3-2.

Table 3-2
Peak Flows

Method	2	10	30	50	100	1000
FSU	0.37	0.64	0.81	0.90	1.02	1.45
FSU – 3v	1.80	3.10	3.97	4.38	4.96	7.08
FSU – SC	2.23	3.83	4.90	5.41	6.12	8.75
IH 124	3.52	6.06	7.75	8.55	9.68	13.84

Analysis of the Q_{MED} (and hence the peak flow) derived from the four methods indicated that the FSU4.2a method, FSU 3v and IH 124 resulted in significantly higher values than the donor adjustment method (FSU Web Portal).

The FSU -3v and FSU-SC provide similar results, the difference is only 20%, yet still almost 5 times higher than peak flows determined through the FSU Web Portal.

According to the WP4.2 Flood Estimation in Small and Urbanised Catchments report[3], the FSU-3varibale method wasn't developed with small catchment in mind and hasn't been tested.

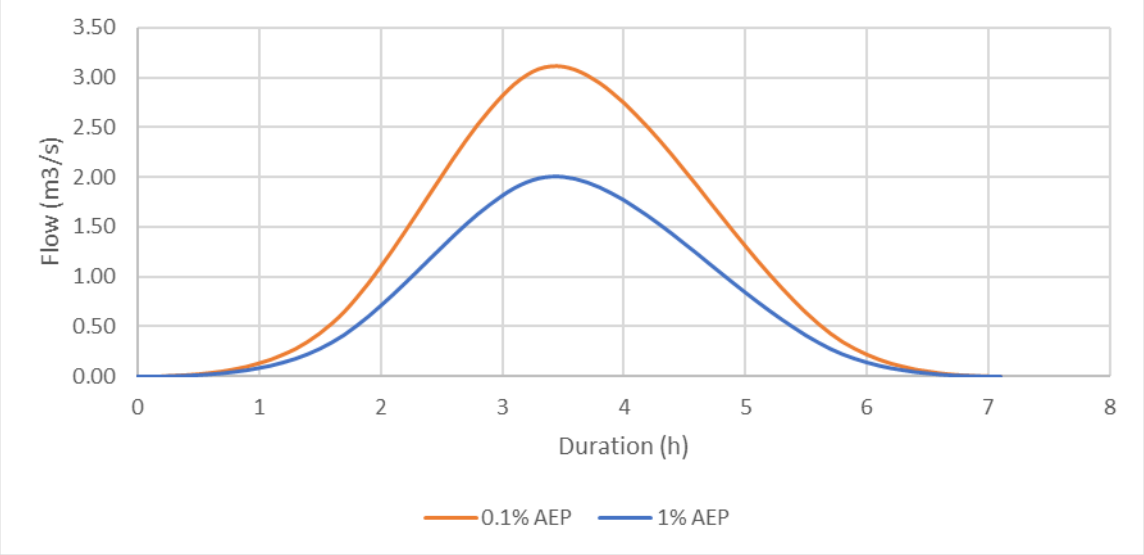
Gebre (2012)[4] concluded that the FSU equation is preferred for all catchments with an area greater than 5 km^2 and that benefits of using a single equation outweighs those obtained by using a second equation for catchments between 5 and 30 km^2.

Given the conclusion and recommendation, the peak flows determined via the FSU Web portal have been adopted.

3.7 Design Flow Hydrographs

Design hydrographs for 1% AEP and 0.1% AEP have been developed at the entrance to the pond using the FSU Web portal, refer to Figure 3-3 below.

Figure 3-3
Design Hydrographs



[3] https://opw.hydronet.com/data/files/FSU%20Work%20Package%204_2.pdf
[4] https://hydrologyireland.ie/wp-content/uploads/2016/11/09-Flood-Estimation-in-Small-and-Urbanised-Catchments-1.pdf

4.0 SUMMARY

The Glendowns Pond is located in Glendowns Estate, off the Stradbally Road, Portlaoise, Co. Laois. The Little Borris stream and Unnamed Stream feed into the pond. Hydrology analysis has been carried out to develop better understanding of the flows entering the pond.

The pond has been heavily silted, likely due to the increased urbanisation at the surrounding of the pond and alluvium deposits within the Little Borris Stream which has occurred in the past.

The catchment area at the location of the pond is c. 6.55 km^2 according to the FSU web portal. The catchment area has been verified using DTM data. The growth curves for various flow return period have been determined using pooling methodology.

The flood index has been estimated using various regression equations. The peak flows determined through the FSU Web Portal have been deemed suitable for defining the inflow at the Glendowns Pond.

5.0 CLOSURE

This report has been prepared by SLR Consulting (Ireland) with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

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SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

APPENDICES

Appendix A
Site Photographs

	Fallen trees and heavy vegetation at Glendowns Pond.
	Silts deposit within the pond.

	Sediment deposits at Little Borris Stream looking upstream. Photo taken at the location of the inflow to the pond.
	Erosion of the right bank of the Little Borris Stream.

Appendix B
FSU Web Portal – Output

Flood Estimation Report #15068 (Glendownes Pond)

Generated 23-03-2023 09:51

Subject site

Attributes

Name	Unit	Value
Coordinate [X]		-811191.667764457
Coordinate [Y]		6989111.68806607
Distance	km	73.9294121045653
Station Number		14_474_7
Location		
Water Body		
Catchment		
Hydrometric Area		
Organisation		
FSU Rating Classification		
Drainage works	year	
Contributing Catchment Area	km^2	6.554
Center Northing	m	196730
Center Easting	m	249770
Northing	m	198244
Easting	m	247879
A-Max series gap in years	year	
A-Max series number of years	year	
A-Max series number of usable years	year	
A-Max series end year	year	
A-Max series start year	year	
FARL		1
ALLUV		0.0177
PEAT		0
FOREST		0.0613
PASTURE		0.9299
S1085	m/km	4.14267
MSL	km	3.224
DRAIND	km/km^2	0.492
ALTBAR		121.7
NETLEN	km	3.224
T4		
T3		

SAAPE	mm	504.18
T2		
ARTDRAIN2		0
ARTDRAIN		0
TAYSLO		0.293008
STMFRQ		1
BFISOIL		0.677338258
SAAR	mm	859.84
RWSEG_CD		14_474
TOP_RWSEG		
Bankfull		
HGF	m^3/s	
MAF	m^3/s	
FAI		0.3407
FLATWET		0.58
URBEXT		0.0344
HGF/QMED		
centroidx3857		-808068.092339708
centroidy3857		6986712.1238655
x3857		-811191.667764457
y3857		6989111.68806607

Pivotal site

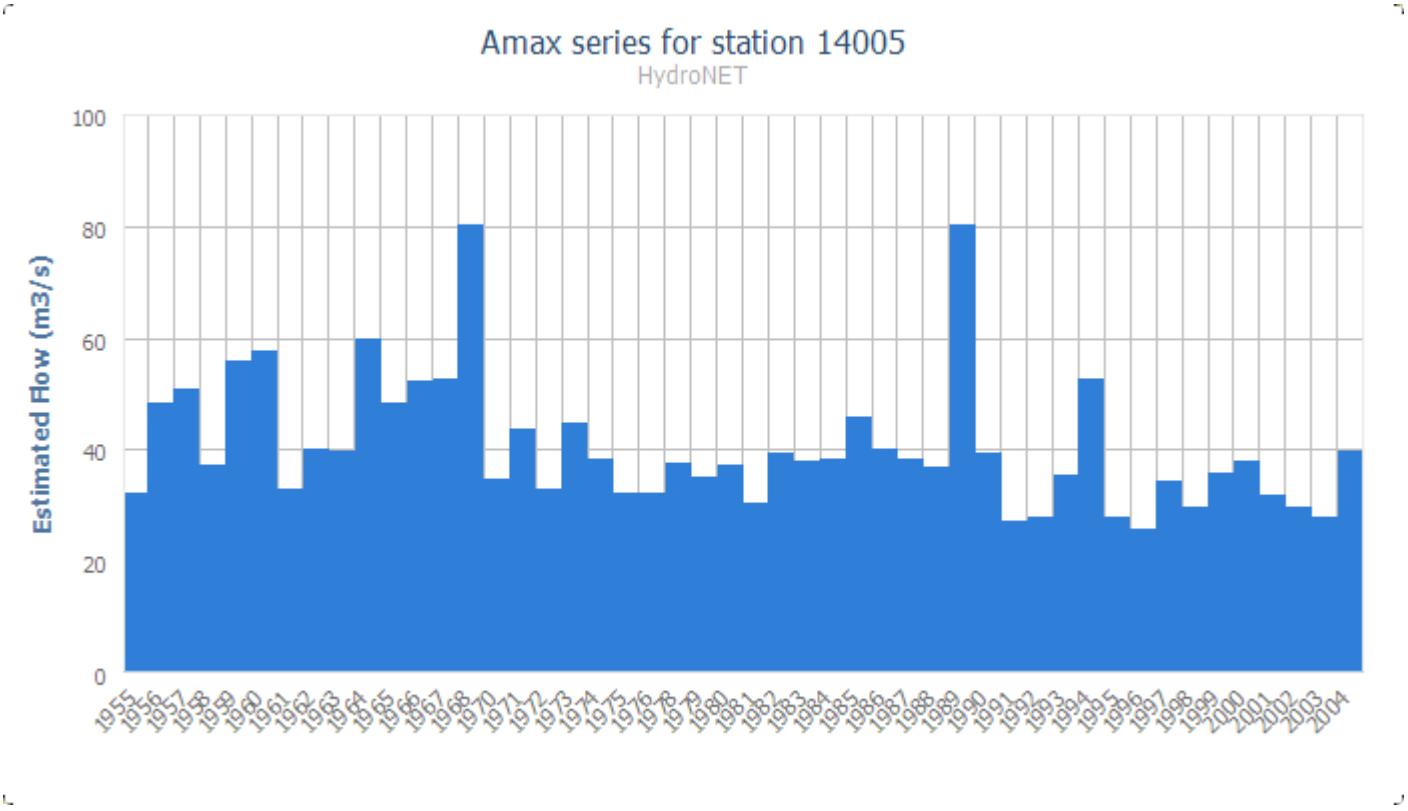
Attributes

Name	Unit	Value
Coordinate [X]		-800715.428079951
Coordinate [Y]		7012985.19943729
Station Number		14005
Location		PORTARLINGTON
Water Body		BARROW
Catchment		Barrow
Hydrometric Area		14
Organisation		OPW
FSU Rating Classification		A2
Drainage works	year	No
Contributing Catchment Area	km^2	405.4844
Center Northing	m	203470
Center Easting	m	243520
Northing	m	212642
Easting	m	254031
A-Max series gap in years	year	0
A-Max series number of years	year	50
A-Max series number of usable years	year	48
A-Max series end year	year	2004
A-Max series start year	year	1955
FARL		1
ALLUV		0.0445
PEAT		0.0833
FOREST		0.1534
PASTURE		0
S1085	m/km	5.77424
MSL	km	42.662
DRAIND	km/km^2	1.002
ALTBAR		0
NETLEN	km	406.098
T4		0.22244043466611
T3		0.29073928180182
SAAPE	mm	501.13
T2		0.14888281220577
ARTDRAIN2		0
ARTDRAIN		0.005
TAYSLO		0.255092
STMFRQ		468
BFISOIL		0.501
SAAR	mm	1014.9
RWSEG_CD		14_1820
TOP_RWSEG		14_511
Bankfull		2.57 from survey
HGF	m^3/s	55
MAF	m^3/s	50
FAI		0.45
FLATWET		0.59
URBEXT		0.0241
HGF/QMED		1.4371570420695
x3857		-800715.428079951
y3857		7012985.19943729

centroidx3857		-817857.034337496
centroidy3857		7002411.51405033
Distance	km	18.5011955724933

Map

Amax Series Chart



QMED Estimates

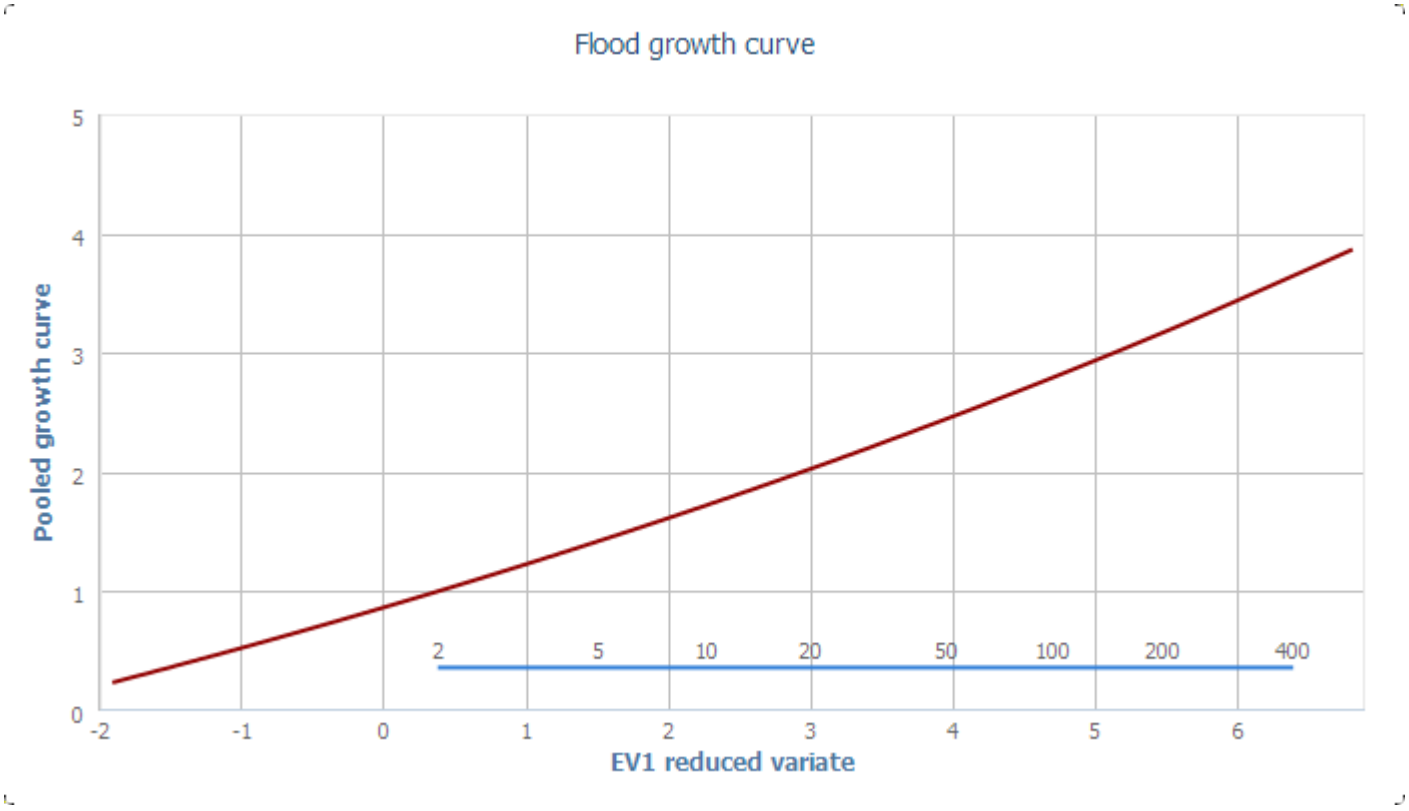
Subject rural QMED	0.72
Subject urban QMED	0.75
Pivotal gauged QMED	38.27
Pivotal adjustment factor QMED	0.49
Subject adjusted QMED	**0.37**

Pooling Group

Station	Amax years
10022 CARRICKMINES	17
25034 ROCHFORT	26
09011 FRANKFORT (Post 21/08/19	16
16051 CLOBANNA	13
10021 COMMONS ROAD	24
25040 ROSCREA	19
09035 KILLEEN ROAD	9
08002 NAUL	21
09002 LUCAN	25
08005 KINSALEY HALL	18

08012 BALLYBOGHIL	19
06031 CURRALHIR	18
14009 CUSHINA	25
24022 HOSPITAL	20
26022 KILMORE	33
26058 BALLINRINK BR.	24
30020 BALLYHAUNIS	16
08009 BALHEARY	15
13002 FOULKS MILL	19
06033 CONEYBURROW BR.	25
25023 MILLTOWN	33
22009 WHITE BRIDGE	24
14007 DERRYBROCK	24
09010 WALDRONS BRIDGE	19

Selected Flood Growth Curve



Pooled growth curve	EV1 reduced variate
0.24	-1.92
0.29	-1.75
0.32	-1.66
0.34	-1.6
0.35	-1.55
0.37	-1.5
0.38	-1.47
0.39	-1.43
0.4	-1.4
0.41	-1.38
0.42	-1.35
0.42	-1.33
0.43	-1.31
0.44	-1.28
0.44	-1.26
0.45	-1.25
0.46	-1.23
0.46	-1.21
0.47	-1.19
0.47	-1.18
0.48	-1.16
0.48	-1.15
0.49	-1.13
0.49	-1.12
0.5	-1.1
0.5	-1.09
0.5	-1.08
0.51	-1.07
0.51	-1.05

0.52	-1.04
0.52	-1.03
0.52	-1.02
0.53	-1.01
0.53	-1
0.54	-0.98
0.54	-0.97
0.54	-0.96
0.55	-0.95
0.55	-0.94
0.55	-0.93
0.56	-0.92
0.56	-0.91
0.56	-0.9
0.57	-0.89
0.57	-0.88
0.57	-0.88
0.57	-0.87
0.58	-0.86
0.58	-0.85
0.58	-0.84
0.59	-0.83
0.59	-0.82
0.59	-0.81
0.59	-0.81
0.6	-0.8
0.6	-0.79
0.6	-0.78
0.61	-0.77
0.61	-0.76
0.61	-0.76
0.61	-0.75
0.62	-0.74
0.62	-0.73
0.62	-0.73
0.62	-0.72
0.63	-0.71
0.63	-0.7
0.63	-0.7
0.63	-0.69
0.64	-0.68
0.64	-0.67
0.64	-0.67
0.64	-0.66
0.65	-0.65
0.65	-0.65
0.65	-0.64
0.65	-0.63
0.65	-0.62
0.66	-0.62
0.66	-0.61
0.66	-0.6
0.66	-0.6
0.67	-0.59
0.67	-0.58
0.67	-0.58
0.67	-0.57

0.68	-0.56
0.68	-0.56
0.68	-0.55
0.68	-0.54
0.68	-0.54
0.69	-0.53
0.69	-0.53
0.69	-0.52
0.69	-0.51
0.7	-0.51
0.7	-0.5
0.7	-0.49
0.7	-0.49
0.7	-0.48
0.71	-0.48
0.71	-0.47
0.71	-0.46
0.71	-0.46
0.71	-0.45
0.72	-0.44
0.72	-0.44
0.72	-0.43
0.72	-0.43
0.72	-0.42
0.73	-0.41
0.73	-0.41
0.73	-0.4
0.73	-0.4
0.73	-0.39
0.74	-0.38
0.74	-0.38
0.74	-0.37
0.74	-0.37
0.74	-0.36
0.75	-0.36
0.75	-0.35
0.75	-0.34
0.75	-0.34
0.75	-0.33
0.76	-0.33
0.76	-0.32
0.76	-0.31
0.76	-0.31
0.76	-0.3
0.77	-0.3
0.77	-0.29
0.77	-0.29
0.77	-0.28
0.77	-0.28
0.78	-0.27
0.78	-0.26
0.78	-0.26
0.78	-0.25
0.78	-0.25
0.79	-0.24
0.79	-0.24
0.79	-0.23

0.79	-0.22
0.79	-0.22
0.8	-0.21
0.8	-0.21
0.8	-0.2
0.8	-0.2
0.8	-0.19
0.8	-0.19
0.81	-0.18
0.81	-0.18
0.81	-0.17
0.81	-0.16
0.81	-0.16
0.82	-0.15
0.82	-0.15
0.82	-0.14
0.82	-0.14
0.82	-0.13
0.83	-0.13
0.83	-0.12
0.83	-0.11
0.83	-0.11
0.83	-0.1
0.84	-0.1
0.84	-0.09
0.84	-0.09
0.84	-0.08
0.84	-0.08
0.84	-0.07
0.85	-0.07
0.85	-0.06
0.85	-0.06
0.85	-0.05
0.85	-0.04
0.86	-0.04
0.86	-0.03
0.86	-0.03
0.86	-0.02
0.86	-0.02
0.87	-0.01
0.87	-0.01
0.87	0
0.87	0
0.87	0.01
0.88	0.02
0.88	0.02
0.88	0.03
0.88	0.03
0.88	0.04
0.88	0.04
0.89	0.05
0.89	0.05
0.89	0.06
0.89	0.06
0.89	0.07
0.9	0.07
0.9	0.08

0.9	0.09
0.9	0.09
0.9	0.1
0.91	0.1
0.91	0.11
0.91	0.11
0.91	0.12
0.91	0.12
0.92	0.13
0.92	0.13
0.92	0.14
0.92	0.15
0.92	0.15
0.93	0.16
0.93	0.16
0.93	0.17
0.93	0.17
0.93	0.18
0.93	0.18
0.94	0.19
0.94	0.2
0.94	0.2
0.94	0.21
0.94	0.21
0.95	0.22
0.95	0.22
0.95	0.23
0.95	0.23
0.95	0.24
0.96	0.25
0.96	0.25
0.96	0.26
0.96	0.26
0.96	0.27
0.97	0.27
0.97	0.28
0.97	0.28
0.97	0.29
0.97	0.3
0.98	0.3
0.98	0.31
0.98	0.31
0.98	0.32
0.98	0.32
0.99	0.33
0.99	0.34
0.99	0.34
0.99	0.35
0.99	0.35
1	0.36
1	0.36
1	0.37
1	0.38
1.01	0.38
1.01	0.39
1.01	0.39
1.01	0.4

1.01	0.4
1.02	0.41
1.02	0.42
1.02	0.42
1.02	0.43
1.02	0.43
1.03	0.44
1.03	0.45
1.03	0.45
1.03	0.46
1.03	0.46
1.04	0.47
1.04	0.47
1.04	0.48
1.04	0.49
1.05	0.49
1.05	0.5
1.05	0.5
1.05	0.51
1.05	0.52
1.06	0.52
1.06	0.53
1.06	0.54
1.06	0.54
1.07	0.55
1.07	0.55
1.07	0.56
1.07	0.57
1.07	0.57
1.08	0.58
1.08	0.58
1.08	0.59
1.08	0.6
1.09	0.6
1.09	0.61
1.09	0.62
1.09	0.62
1.09	0.63
1.1	0.63
1.1	0.64
1.1	0.65
1.1	0.65
1.11	0.66
1.11	0.67
1.11	0.67
1.11	0.68
1.12	0.69
1.12	0.69
1.12	0.7
1.12	0.71
1.13	0.71
1.13	0.72
1.13	0.73
1.13	0.73
1.14	0.74
1.14	0.75
1.14	0.75

1.14	0.76
1.15	0.77
1.15	0.77
1.15	0.78
1.15	0.79
1.16	0.79
1.16	0.8
1.16	0.81
1.16	0.82
1.17	0.82
1.17	0.83
1.17	0.84
1.17	0.84
1.18	0.85
1.18	0.86
1.18	0.86
1.18	0.87
1.19	0.88
1.19	0.89
1.19	0.89
1.2	0.9
1.2	0.91
1.2	0.92
1.2	0.92
1.21	0.93
1.21	0.94
1.21	0.95
1.22	0.95
1.22	0.96
1.22	0.97
1.22	0.98
1.23	0.98
1.23	0.99
1.23	1
1.24	1.01
1.24	1.02
1.24	1.02
1.24	1.03
1.25	1.04
1.25	1.05
1.25	1.06
1.26	1.06
1.26	1.07
1.26	1.08
1.27	1.09
1.27	1.1
1.27	1.11
1.28	1.11
1.28	1.12
1.28	1.13
1.28	1.14
1.29	1.15
1.29	1.16
1.29	1.16
1.3	1.17
1.3	1.18
1.3	1.19

1.31	1.2
1.31	1.21
1.31	1.22
1.32	1.23
1.32	1.24
1.33	1.25
1.33	1.25
1.33	1.26
1.34	1.27
1.34	1.28
1.34	1.29
1.35	1.3
1.35	1.31
1.35	1.32
1.36	1.33
1.36	1.34
1.37	1.35
1.37	1.36
1.37	1.37
1.38	1.38
1.38	1.39
1.38	1.4
1.39	1.41
1.39	1.42
1.4	1.43
1.4	1.44
1.41	1.45
1.41	1.47
1.41	1.48
1.42	1.49
1.42	1.5
1.43	1.51
1.43	1.52
1.44	1.53
1.44	1.54
1.44	1.56
1.45	1.57
1.45	1.58
1.46	1.59
1.46	1.6
1.47	1.62
1.47	1.63
1.48	1.64
1.48	1.65
1.49	1.66
1.49	1.68
1.5	1.69
1.5	1.7
1.51	1.72
1.51	1.73
1.52	1.74
1.52	1.76
1.53	1.77
1.53	1.79
1.54	1.8
1.55	1.81
1.55	1.83

1.56	1.84
1.56	1.86
1.57	1.87
1.57	1.89
1.58	1.9
1.59	1.92
1.59	1.93
1.6	1.95
1.61	1.97
1.61	1.98
1.62	2
1.63	2.02
1.63	2.03
1.64	2.05
1.65	2.07
1.65	2.09
1.66	2.11
1.67	2.12
1.68	2.14
1.68	2.16
1.69	2.18
1.7	2.2
1.71	2.22
1.72	2.24
1.73	2.26
1.73	2.29
1.74	2.31
1.75	2.33
1.76	2.35
1.77	2.38
1.78	2.4
1.79	2.42
1.8	2.45
1.81	2.47
1.82	2.5
1.83	2.53
1.84	2.55
1.86	2.58
1.87	2.61
1.88	2.64
1.89	2.67
1.91	2.7
1.92	2.73
1.93	2.77
1.95	2.8
1.96	2.84
1.98	2.87
1.99	2.91
2.01	2.95
2.03	2.99
2.05	3.04
2.07	3.08
2.09	3.13
2.11	3.17
2.13	3.23
2.15	3.28
2.18	3.34

2.2	3.4
2.23	3.46
2.26	3.53
2.29	3.6
2.33	3.68
2.36	3.76
2.4	3.85
2.45	3.95
2.5	4.06
2.56	4.19
2.62	4.33
2.7	4.5
2.8	4.7
2.91	4.95
3.08	5.28
3.33	5.77
3.87	6.8

Adopted Growth Factors

Return Period	Growth Factor	Design Peak Flow (m^3/s)
1.3	0.74	0.27
2	1	0.37
5	1.42	0.52
10	1.72	0.63
20	2.02	0.74
30	2.2	0.81
50	2.43	0.89
100	2.75	1.01
200	3.09	1.13
500	3.55	1.3
1000	3.93	1.44

Hydrograph Width Estimation Summary

Hydrograph summary is not available for this report because the hydrograph was not transferred to the subject site.

Hydrograph Plots

Hydrographs are not available for this report because module 3 was not finished.

IBIDEM Plots and Tables

No IBIDEM plots were saved by the user.

Audit Trail Report #15068 (Glendownes Pond)

User ID:	kristian.divjak@ftco.ie
Name:	Divjak, Kristian
Company:	
Address:	
Report date & time:	23-03-2023 09:51
Start of Calculation:	23-03-2023 10:38

Decisions made by the user:

Decision	User comment	System information	Date
2.1 Subject site accepted	N/A	Location 14_474_7	23-03-2023 10:42
2.2 Subject site with area < 25km2 accepted	N/A		23-03-2023 10:42
2.4 Pivotal site accepted	Reason for accepting: Factorial difference mostly less than 1.3, besides for catchment area Reason for ignoring warnings:	Station: 14005 PORTARLINGTON The user has been notified that 113 candidates where either hydrologically or geographically closer to the subject site than the chosen pivotal site. The user has accepted to reject these sites in preference of the chosen pivotal site.	23-03-2023 10:43
2.8 QMED data transfer performed	N/A		23-03-2023 10:43

2.11 Pooling group accepted	N/A	Pooled group accepted with the following stations: [10022, 25034, 09011, 16051, 10021, 25040, 09035, 08002, 09002, 08005, 08012, 06031, 14009, 24022, 26022, 26058, 30020, 08009, 13002, 06033, 25023, 22009, 14007, 09010] and distribution: EV1	23-03-2023 10:47
2.13 Module 2 finalized	N/A	Finished pooled analysis with the following distribution selected: GEV.	23-03-2023 10:48

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