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Red John Pumped Storage Hydro Scheme

Volume 5, Appendix 7.2: Invasive Non-Native Species Risk Assessment

ILI (Highlands PSH) Ltd.

November 2018

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September 2018

Quality Information

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Revision History

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V1	19/09/2018	Sent to SEPA & SNH for comments	CA	Catherine Anderson	Associate Director

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1 Introduction

1.1 Background

1.1.1 AECOM was appointed by Intelligent Land Investments (ILI) to carry out an Environmental Impact Assessment (EIA) for the proposed Red John Pumped Storage Hydro Scheme (hereafter also referred to simply as the 'Development').

1.1.2 As part of the EIA process, the Red John Scoping Report identified the potential for Invasive Non-Native Species (INNS) to be present in the vicinity of the Development.

1.1.3 Throughout this Report, species are given their Latin names when first referred to and their common names only thereafter. All distances are cited as the shortest boundary to boundary distance 'as the crow flies' unless otherwise specified.

1.2 Purpose and Scope of this Report

1.2.1 This standalone report has been written to inform the proposals for the project and identify specific risks in relation to INNS, including those identified as of particular concern by Consultees in the Scoping Opinion Report (November 2017), and those identified during surveys of the Site. It describes potential risks through the proposed works in relation to INNS, including those resulting in their spread both within and outside the site boundary. Where appropriate, it provides recommendations for mitigation to minimise the ecological impacts of the Development in relation to INNS, and highlights opportunities for biodiversity enhancement.

1.2.2 As a result of consultation for the Scoping Opinion, several consultees raised concerns about the likely presence of and potential for cross-catchment spread of INNS, as detailed in Table 1.1 below.

Table Error! No text of specified style in document.**.1. Consultee Responses to Scoping Report in relation to INNS**

Consultee	Response to scoping report	Suggested Approach
Scottish Natural Heritage (SNH)	There are a number of invasive non-native species present in Loch Ness.	Appropriate mitigation measures to be included in any application to ensure the movement of these species is not exacerbated by this proposal.
Scottish Environment Protection Agency (SEPA)	Aware of the following invasive non-native species in the Ness catchment: Flatworm (*Phagocata woodworthi*), Freshwater shrimp (*Crangonyx pseudogracilis*) and Nuttall's Waterweed (*Elodea Nuttallii*).	Concern raised over the potential presence of these species, as detailed for Scottish Water below.
Marine Science Scotland (MSS)	There will be a need to prevent impacts from identified and currently unidentified invasive non-native species.	Mitigation proposals should be extended to cover all invasive non-native species, whether they have been identified or not.
Scottish Water (SW)	No mention of the following non-native invasive species: *Phagocata woodworthi* (a flatworm), *Elodea nuttallii* (a type of waterweed) or *Cragonyx pseudogracilis* (a non-native shrimp). These are species which SW has experienced concern from SEPA regarding potential cross-catchment spread.	Further detail required as to how the development will be designed to avoid cross-catchment transfer of INNS, specifically into the Loch Ashie catchment.
	Scope for INNS in Loch Ness to be pumped	Further detail required as to how this risk will

Consultee	Response to scoping report	Suggested Approach
	up into the headpond.	be mitigated.

1.2.3 Forestry Commission Scotland raised concerns about the threat posed to juniper by the fungus-like pathogen *Phytophthora austrocedri*, which poses a threat to juniper trees in Britain. This and other non-native pathogens have not been included in this INNS risk assessment, and will be the subject of assessment in other chapters of the EIA.

1.3 Development and Site Description

1.3.1 A full description of the Development can be found in Chapter 2: Project Description (EIA Report Volume 2). However, in summary, the Development will involve the creation of a new reservoir (the Headpond), to the south-east of the village of Dores. Using associated infrastructure including High pressure Tunnel, Low-pressure Tunnel and the Spillway, water will be pumped from Loch Ness to the Headpond during periods when national power usage is low, and then released through an underground power cavern to supply demand at times of high power usage. The Development will necessitate the diversion of a minor public road.

1.3.2 The location of the headpond reaches a maximum elevation of approximately 278 m above sea level, with Loch Ness being approximately 250 m below. The habitats within the area encompassed by the Development vary with altitude. On the lower slopes up from Loch Ness there is extensive ancient semi-natural, broadleaved woodland while on the higher ground and around the headpond the woodland becomes coniferous, predominantly comprised of Scot's pine *Pinus sylvestris*, which in places is considered to be ancient of plantation origin. Outside of the woodland habitats there are areas of semi-improved grassland, blanket bog and wet heath.

1.3.3 There are a number of waterbodies in the vicinity of the Development, including large oligotrophic lochs as well as smaller ponds. A network of watercourses drains catchments within the site boundary and predominantly feed into the Loch Ness catchment, but also to a lesser extent into the River Nairn catchment to the northeast of Loch Duntelchaig, the latter forming the basis for concerns over the cross-catchment spread of INNS.

1.3.4 The area encompassed by the redline boundary of the Development is hereafter also referred to as the 'Site'.

1.4 Invasive and Non-Native Species Ecology

1.4.1 Invasive Non-Native Species are any animal or plant that have been introduced (deliberately or accidentally) by human activity to an area in which they do not naturally occur, and have the ability to spread rapidly and become dominant in an area or ecosystem, causing adverse ecological, environmental and/or economic impacts. Some animals and plants may have been transported here a long time ago and be considered "naturalised", but these are still non-native species. Others are native to some parts of the UK but not to other parts (for example native to the mainland but not all islands).

1.4.2 Some INNS are often associated with aquatic habitats, and may occur either in watercourses or waterbodies themselves or in the riparian zone. These may include the following species, which are amongst the most invasive and environmentally damaging INNS:

- Japanese knotweed *Fallopia japonica*
- Giant hogweed *Heracleum mantegazzianum*
- Himalayan balsam *Impatiens glandulifera*
- North American signal crayfish *Pacifastacus leniusculus*

1.5 Legislative and Policy Context

1.5.1 This assessment been undertaken within the context of the following relevant legislative instruments, planning policies and guidance documents and legislative instruments.

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive');
- Council Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the 'Water Framework Directive');
- Regulation 1143/2014 on invasive alien species;
- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the 'Habitats Regulations');
- Wildlife and Countryside Act 1981 (as amended) (the 'WCA');
- Nature Conservation (Scotland) Act 2004 (as amended);
- Wildlife and Natural Environment (Scotland) Act 2011 (as amended);
- Scottish Planning Policy (SPP) 2014;
- The Highland Wide Local Development Plan (HwLDP); and
- Inverness and Nairn Local Biodiversity Action Plan (LBAP).

1.5.2 In Scotland, INNS are covered by Section 14 of the Wildlife and Countryside Act 1981, which makes it an offence to:

- release or allow to escape from captivity any animal to a place outwith its native range;
- cause any animal outwith the control of any person to be at place outwith its native range;
- plant or otherwise cause to grow any plant in the wild outwith its native range.

There are exceptions; for example, agricultural land, and private and public gardens are not generally considered to be 'in the wild'; however, areas such as woodlands, road verges or river corridors in the countryside are all considered as being 'in the wild'.

1.5.3 Local planning policies for this region are detailed in the Highland Council's Highland-wide Local Development Plan (HwLDP). Table 1.1 provides a summary of those policies which are of relevance to INNS and the associated conservation of native species and habitats. For the precise wording of each specific policy, refer to the source document.

Table Error! No text of specified style in document.**.2. Summary of Relevant Policies Within the Highland-wide Local Development Plan**

Planning Policy	Purpose
Policy 28 – Sustainable Development	The Council will support developments which promote and enhance the social, economic and environmental wellbeing of the people of Highland. Proposed developments will be assessed on the extent to which they impact on habitats and species.
Policy 58 – Protected Species	Surveys are required to confirm the presence of protected species on a site. A mitigation plan will be required, prior to determining the application, to avoid or minimise any impacts of protected species. Development that is likely to have an adverse effect on protected species will only be permitted where: there is no satisfactory alternative; the development is required for preserving public health or public safety and/or other imperative reasons of over-riding public interest; and/or, the development will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in its natural range.
Policy 59 – Other Important	The Council will have regard to the presence of and any adverse effects of

Planning Policy	Purpose
Species	development proposals on other important species. These include species listed on Annexes II and V of the Habitats Directive, priority species listed in the UK and Local Biodiversity Action Plans (BAP) and species included on the Scottish Biodiversity List (SBL).
Policy 60 – Other Important Habitats	The Council will seek to safeguard the integrity of features of the landscape which are of major importance because of their linear and continuous structure or their importance as corridors for the movement of wild fauna and flora. The Council will have regard to the value of other important habitats, which include: habitats listed on Annex I of the Habitats Directive; habitats of priority and protected bird species; priority habitats listed in UK and Local BAPs; and, habitats included on the SBL.
Policy 67 – Renewable Energy Developments	The Council will support proposals for renewable energy development where it is satisfied that they will not have significant detrimental effects on natural heritage features, species and habitats.

1.5.4 Although the relevant planning policies above do not make specific reference to INNS, it is worth noting that INNS are capable of resulting in significant impacts to both the natural environment and the social, economic and environmental well-being of the people of Highland. These include impacts to protected species and habitats, including those listed in the legislation outlined above, and those included on the Scottish Biodiversity List (SBL).

2 Methodology

2.1 Desk Study

2.1.1 The desk study used data requested from the Scottish Environment Protection Agency (SEPA) and the Highland Biological Recording Group (HBRG) to assess the distribution of aquatic and terrestrial INNS in and around the proposed development area of the Development.

2.1.2 The information provided shall be used when considering the potential environmental impacts of the Development and survey scope.

2.1.3 The desk study was based upon a catchment-wide approach in order to establish the presence of INNS in the Ness and neighbouring Nairn catchment, and therefore the likelihood of INNS being present within or adjacent to the site either presently or in the future.

2.2 Invasive Species Survey

2.2.1 The following aquatic and terrestrial ecology surveys have been completed or are underway to support the Ecological Impact Assessment for the Development:

- Aquatic macroinvertebrate survey, including a survey for INNS invertebrate species and freshwater pearl mussel;
- Aquatic macrophyte survey, including a survey for aquatic and riparian INNS;
- Fish habitat assessment, with the aim of identifying habitat with the potential to support breeding populations of the fish species named in the Scoping Opinion report as of local significance.
- Habitat survey;
- Protected species surveys, including otter *Lutra lutra*, water vole *Arvicola amphibius*, wildcat *Felix sylvestris*, pine marten *Martes martes*, bats, red squirrel *Sciurus vulgaris*, and badger *Meles meles*;
- Breeding bird survey;
- Great crested newt survey *Triturus cristatus*;
- Reptile survey; and
- Butterfly, dragonfly and damselfly surveys.

2.2.2 The proposed aquatic surveys were completed at 12 watercourse locations identified as subject to potential impacts due to access road or pipeline crossing points, together with two locations on the shoreline of Loch Ness at the proposed intake/outfall location.

2.3 Limitations

2.3.1 Desk study information is dependent on records having been submitted for the area of interest. As such, lack of records for particular habitats or species does not necessarily mean they are absent from the area of interest. Similarly, the presence of records for particular species does not automatically mean they still occur within the area of interest or are relevant.

2.3.2 INNS and other species are generally under-recorded, especially in a relatively remote area such as the site, and therefore a lack of records should not be interpreted as an indication of the absence of a particular species.

2.3.3 While terrestrial and aquatic ecology surveys were not always focused on establishing the presence of INNS, these species where present are recorded incidentally as a matter of best practice during all

ecology surveys, and therefore it is considered that an accurate representation of their presence, informed by the desk study, has been established.

3 Results

3.1 Desk Study

3.1.1 SEPA and HBRG provided INNS data which holds 23 records of non-native species including Himalayan balsam, Japanese knotweed and giant hogweed.

3.1.2 No INNS records were found to be within the Development Site. Japanese knotweed was recorded <2km north from the site in 2015 (refer to Table 3.1). There were nine other records of INNS within 10km of the land option boundary with Himalayan balsam and Japanese knotweed found in the River Enrick. Nuttall's waterweed was present in Urquhart bay in Loch Ness and there are 2 records of giant hogweed. The terrestrial New Zealand flatworm *Arthurdendyus trainulatus* was found approximately 6km away from the Development Site in 2010 (**Error! Reference source not found.**).

3.1.3 No records of the invasive flatworm *Phagocata woodworthi* or the freshwater shrimp *Crangonyx pseudogracilis* were provided in the desk study. While this does not confirm that they are absent in the study area, it means that their presence within the Development site is less likely, and this has been assessed further through the aquatic ecology surveys.

Table Error! No text of specified style in document.**.3. INNS species records and distance from the land option boundary. (Data from SEPA and HBRG; records <10km from site boundary only shown).**

Species	Distance from Development Site boundary (km)	Location from boundary	Date recorded
Japanese Knotweed	1.66	North	2015
New Zealand Flatworm	6.05	North	2010
Nuttall's waterweed	6.3	West	2008
Seep monkeyflower *Mimulus guttatus*	6.3	East	2015
Himalayan balsam	6.95	West	2007
Japanese Knotweed	6.95	West	2007
Himalayan balsam	6.99	West	2009
Giant Hogweed	8.3	North	2012
Himalayan balsam	8.65	West	2007
Giant Hogweed	9.3	North	1992

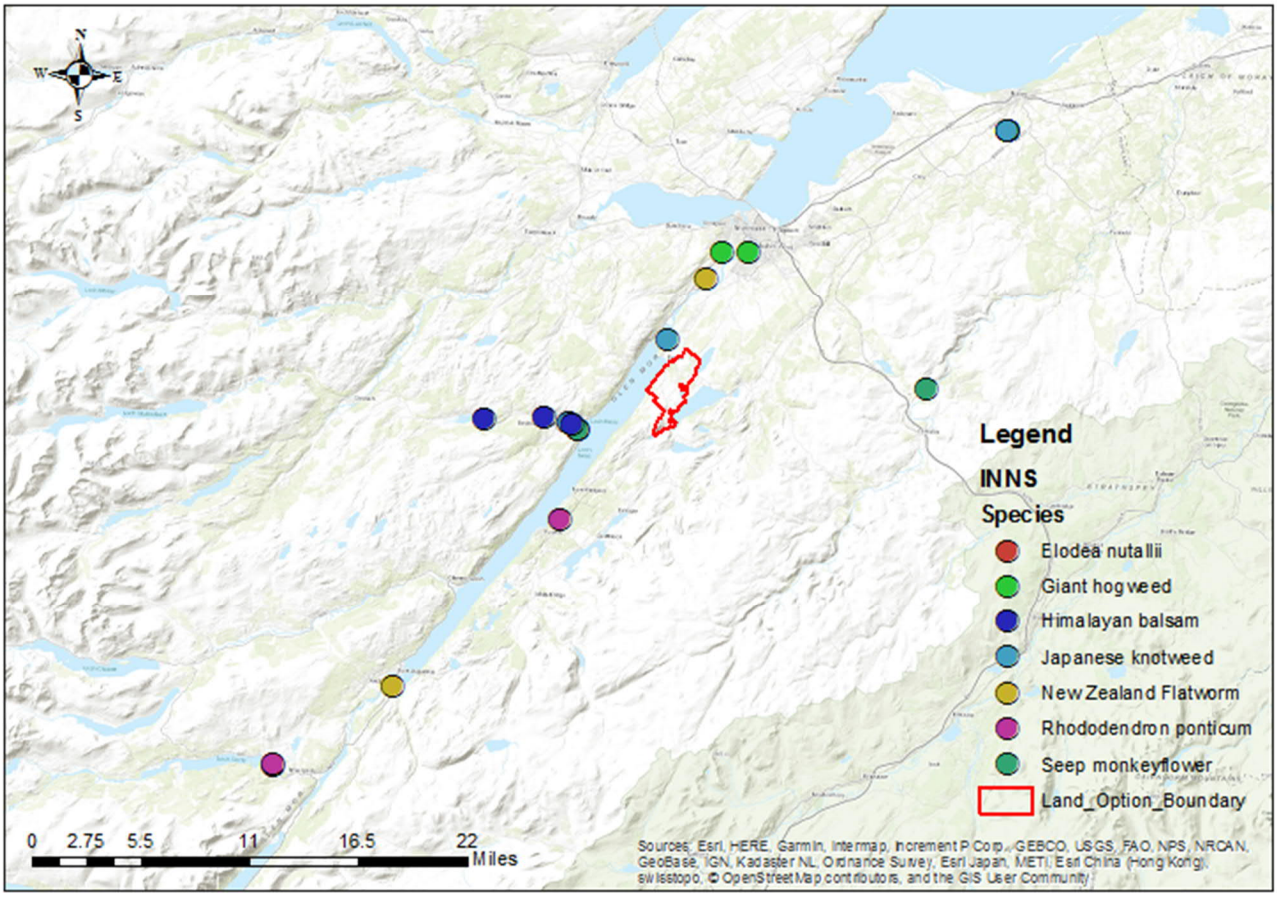

Figure 1. INNS records within the vicinity of the site (Data from SEPA and HBRG).

3.2 Fish

3.2.1 A single record of Artic char (*Salvelinus alpinus*) caught by rod and line in 1991 in Loch Killin approximately 20km from the Development site boundary is the only fish record present from the HBRG dataset (refer to Figure 2). Arctic char (a Scottish Biodiversity Action Plan (BAP) species) are known to be present within Loch Ness along with a number of other protected species including Atlantic salmon (*Salmo salar*), European eel (*Anguilla anguila*) and river, brook and sea lamprey species (*Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus*).

3.2.2 No invasive fish species were identified in the desk study, and none were raised as concerns by consultees.

3.3 Macrophytes

3.3.1 Nineteen records of six different macrophyte species were found in the HBRG dataset. *Ranunculus flammula, Hydrocotyle vulgaris* and *Pontentilla Palustris* were found inside the Development Site (Figure 2**,** Table **Error! No text of specified style in document.**.4).

3.3.2 No designated macrophyte records were present in the HBRG dataset in the proximity of the Development. These species were previously designated under International Union for Conservation of Nature (IUCN) for England from vulnerable, near threatened to *Carex limosa* listed as endangered; however, now all are listed as least concern.

3.3.3 No further invasive macrophyte species were identified in addition to those in Table 3.1.

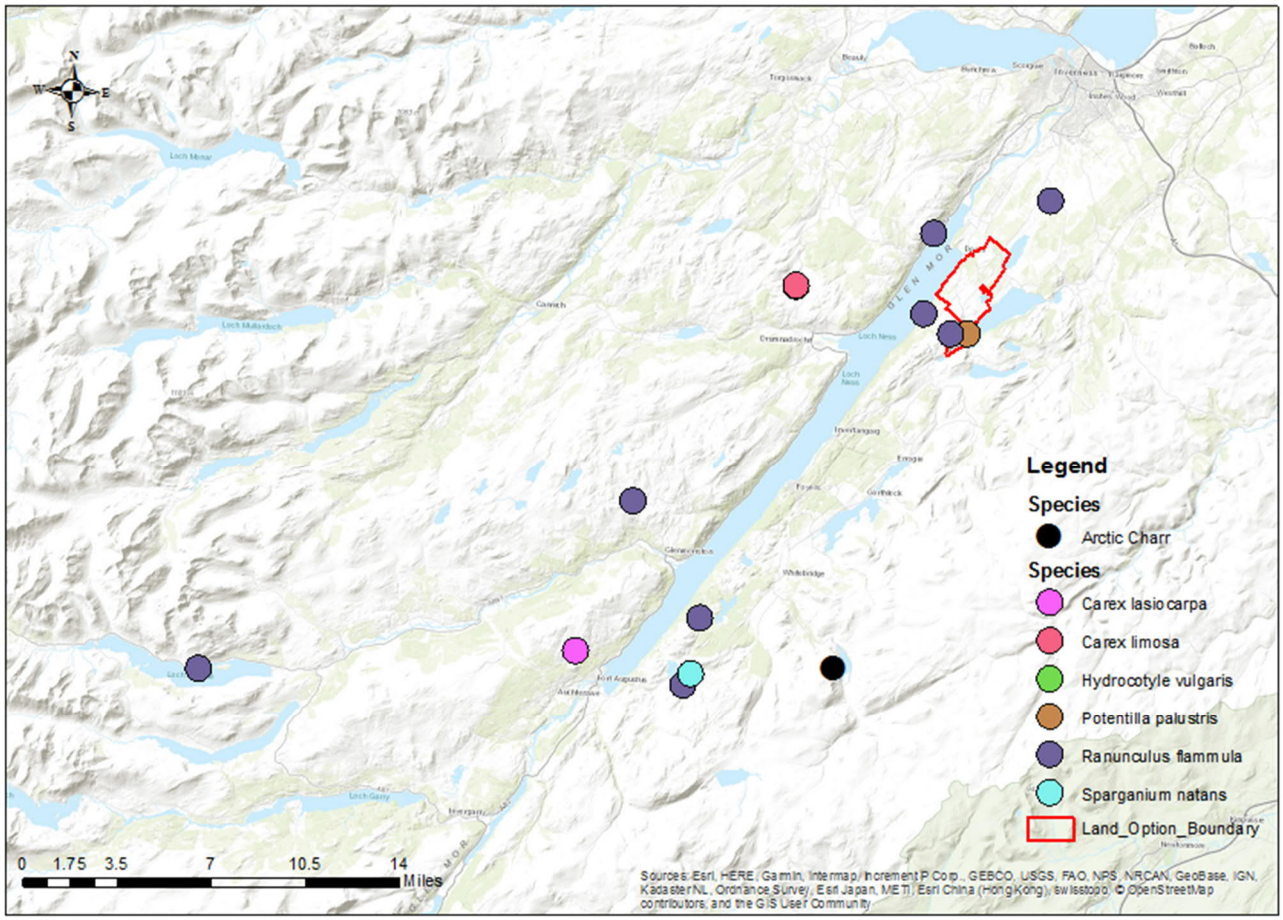

Figure 2. Fish and macrophyte records within the vicinity of the site (Data from HBRG).

Table Error! No text of specified style in document.**.4. Macrophytes species records and distance from the site.**

Species	Number of recordings	Nearest Distance from land option boundary (km)	Nearest Location from boundary	Dates recorded
Marsh pennywort *Hydrocotyle vulgaris*	2	0	Within boundary	2007
Marsh cinquefoil *Comarum palustre*	3	0	Within boundary	2007
Lesser spearwort *Ranunculus flammula*	8	0	Within boundary	1991, 2007
Bog-sedge *Carex limosa*	1	8.4	West	2015
Least bur-reed *Sparganium natans*	1	24	South West	2007
Slender sedge *Carex lasiocarpa*	4	28	South West	2007,2015

3.4 Aquatic Macroinvertebrates

3.4.1 Twelve records of nine different designated macroinvertebrate species were present in the HBRG dataset. None were found within the Development Site boundary (Figure 3**Figure 3**). Two records of *Prionocera pubescens* a Scottish BAP Diptera ('true fly') species was found 4.3km from the Development Site boundary. *Donacia crassipes* and *Cyphon ochraceus* (Scottish BAP water beetle species) were found at around 8km from the site boundary in 1992 and 1993 respectively. The six other species which included another aquatic beetle *Donacia aquatic* and five Diptera species; *Cheilosia chrysocoma, Hypoderma diana, Tanyptera nigricornis, Thereva handlirschi* and *Tipula limbata* were recorded >10km outside the Development Site boundary.

3.4.2 No invasive aquatic macroinvertebrate species were identified in the desk study, including the invasive flatworm *Phagocata woodworthi* or the freshwater shrimp *Crangonyx pseudogracilis*.

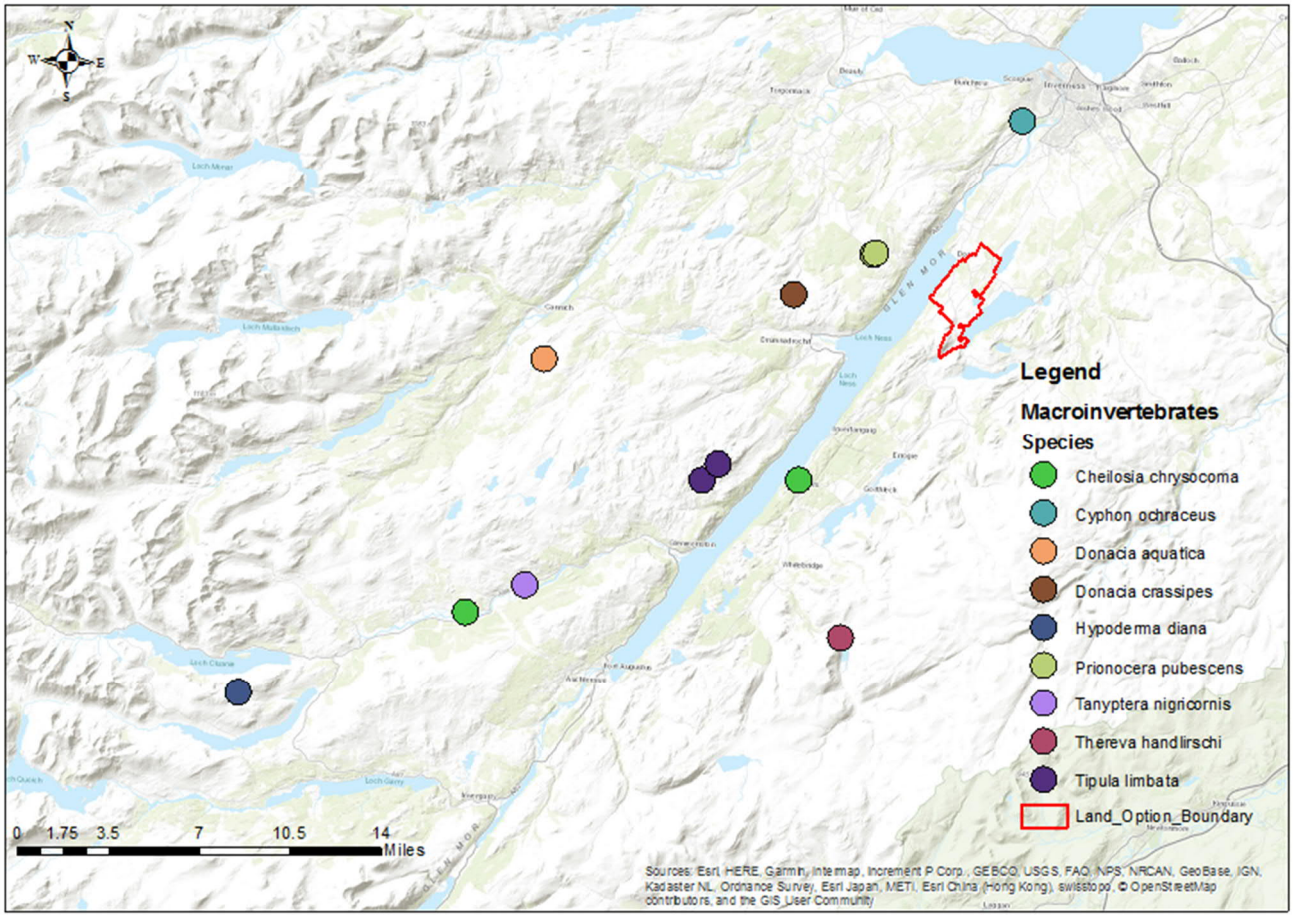

Figure 3. Aquatic macroinvertebrate species within the vicinity of the site (Data from HBRG).

Table. Error! No text of specified style in document.**.5 Aquatic macroinvertebrate species records and distance from the site (Data from SEPA and HBRG).**

Species	Nearest Distance from Development Site boundary (km)	Location from boundary	Dates recorded
Cyphon ochraceus	8	North	1993
Donacia aquatica	24	West	2007
Donacia crassipes	8.6	West	1992
Cheilosia chrysocoma	11.6	South West	2011
Hypoderma diana	48	South West	2009
Prionocera pubescens	4	West	2017
Tanyptera nigricornis	29	South West	2017
Thereva handlirschi	18.8	South	2010
Tipula limbata	15.3	South West	2015

3.4.3 In summary, no INNS records were established within the Development site boundary. The closest INNS record was for Japanese knotweed at 1.66km to the north of the site, with several other INNS including Himalayan balsam and giant hogweed recorded in excess of 6km from the site boundary.

3.4.4 Based on the desk study alone, there are currently no records of INNS within or directly adjacent to the site boundary.

3.5 Field Survey

3.5.1 Two terrestrial INNS and one aquatic INNS were identified within the Development Site boundary during the aquatic ecology surveys in June 2018.

3.5.2 A large rhododendron *Rhododendron ponticum* bush was observed at NH 59896 34557 adjacent to sampling site KS11 on an unnamed watercourse to the east of the B862 at Dores (Figure 4). This INNS tends to be widespread where it is present due to its ability to spread, and therefore it is considered likely to be present elsewhere on the site. It was noted during terrestrial ecology surveys that the landowner had been carrying out removal of rhododendron.

Figure 4. Rhododendron shrub at NH 59896 34557

3.5.3 Variegated yellow archangel *Lamiastrum galeobdolon* subsp. *Argentatum* was identified at NH 59882 34591 to the north-west of the observed rhododendron adjacent to the unnamed watercourse during the aquatic ecology surveys. This constituted a stand of the plant approximately 2m x 6m in size, associated with an area of fly tipping.

Figure 5. Variegated yellow archangel at NH 59882 34591

3.5.4 The INNS freshwater amphipod ('shrimp') *Crangonyx pseudogracilis* was identified in the kick sample from location KS13, Loch Ness Shoreline at NH 58771 33368. Only two individual animals were present in the sample, so it is evident that this species is not present in high abundance but nevertheless is present within Loch Ness.

3.5.5 No further INNS were identified during the field surveys, although it cannot be discounted that other INNS, including those confirmed as present in the wider study area in the desk study, are not be present elsewhere on the site.

4 Summary of Results

4.2 INNS Locations

4.2.1 There are no desk study records of INNS within the Development site boundary. However as INNS have been raised as a specific concern and are known to be present within the catchment, and are likely to be under-recorded, surveys of the site have established their presence/absence, as described above.

4.2.2 Macroinvertebrate sampling has identified high-value watercourses within the Development Site. Fish habitat assessments have indicated areas that have high potential to support spawning habitat for salmonid and lamprey species.

4.2.3 Neither *Phagocata woodworthi* nor *Crangonyx pseudogracilis* were recorded in the desk study within the Loch Ness catchment. These species are likely to be under-recorded, and *Crangonyx*, in particular, is a relatively widespread and established species. This freshwater amphipod was identified in kick sample KS13 on the shore of Loch Ness at NH 58771 33368. The macroinvertebrate survey of the watercourses and Loch Ness shoreline within the scheme boundary has established the likely absence of further invasive species at the sampling locations. However, given the nature of kick sampling at discrete locations, their presence in the site as a whole cannot be fully discounted.

4.2.4 Nuttall's waterweed has been recorded 6.3km to the west of the scheme boundary in Loch Ness, and therefore there is the potential for this species to occur within the Development Site, notably at the intake/outfall location on the shore of Loch Ness. The proposed aquatic macrophyte survey has not confirmed the presence of this species through survey of the sampling locations in the minor watercourses, and through macrophyte survey and grapnel sampling of Loch Ness. Due to the discrete nature of sampling locations, the presence of this INNS in the works area cannot be fully discounted, especially given its confirmed presence in the catchment through desk study.

4.2.5 It should be noted that the risk of cross-catchment spread of INNS during operation has been effectively negated by the choice of Option B, i.e. a closed-loop system with no connection to the waterbodies in the neighbouring catchment, including Loch Duntelchaig. Further details on the operational risk are presented in Section 6 of this Report. There will remain a risk of the spread of INNS through construction works such as site access and earthworks, details of these risks are discussed in Section 5.

4.3 Rhododendron

4.3.1 *Rhododendron ponticum* is listed in Schedule 9 of the Wildlife and Countryside Act 1981. It is therefore an offence to plant or otherwise cause this species to grow in the wild.

4.3.2 Rhododendron species are established INNS in the UK and threaten natural and semi-natural habitats by out-competing and shading native flora and fauna. This large shrub can grow up to 8m in height and can spread to displace other vegetation and native fauna.

4.3.3 The costs of removing rhododendron can be significant, and if allowed to spread it can have significant adverse effects on local habitats and species.

4.3.4 Prior to the implementation of control measures, a management plan should be devised to ensure that appropriate steps are taken to avoid the spread of the INNS and it is fully eradicated.

4.3.5 Control measures for rhododendron include the following:

- Mechanical control: digging up the root material and crushing branches, followed by repeated herbicide applications for at least two years to prevent re-sprouting and recolonisation.
- Chemical control: spray cut stems with herbicide such as Glyphosate, although surrounding vegetation may be affected by this.
- Disposal of contaminated material at a licensed landfill site.
- Disposal through the production of biochar: e.g. on-site charcoal production.
- Biological control: The Centre for Agriculture and Biosciences International (CABI) is currently researching biological control, including the proposed use of a rust fungus from Portugal. This may become an alternative to chemical and mechanical control.

4.3.6 Areas left bare following the eradication of rhododendron can take several years to recolonise due to contamination of soil with phenols and other chemicals in the plant.

4.4 Variegated Yellow Archangel

4.4.1 Variegated yellow archangel *Lamiastrum galeobdolon argentatum* is listed in Schedule 9 of the Wildlife and Countryside Act 1981. It is, therefore, an offence to plant or otherwise cause this species to grow in the wild.

4.4.2 This species is widespread in much of the UK, although it is particularly prevalent in the south west. It spreads by seeds and runners, which root at the nodes, thus spreading rapidly and out-competing native species by forming dense mats. It is considered likely that it hybridises with native subspecies and thereby alters native population genetics.

4.4.3 As with other INNS plant species, soils containing the plant are classified as controlled waste and should be disposed of at licensed landfill sites.

4.4.4 Prior to the implementation of control measures, a management plan should be devised to ensure that appropriate steps are taken to avoid the spread of the INNS and it is fully eradicated.

4.4.5 Control methods for variegated yellow archangel include:

- Mechanical control: relatively easy removal of the shallow-rooted plants, with care taken to remove all root material as fragments can regenerate.
- Disposal of contaminated material at a licensed landfill site.
- Chemical control: herbicide treatment, e.g. with Glyphosate, while the plant is actively growing.

4.4.6 Following removal of the variegated yellow archangel, consideration should be given to seeding bare ground with a suitable local native seed mix to prevent colonisation with unwanted species.

4.5 Crangonyx pseudogracilis

4.5.1 This freshwater amphipod has been present in the UK since 1936 and is now widespread throughout England, Wales and Scotland. It often coexists with native amphipods such as *Gammarus pulex*, but can be outcompeted by *Gammarus* in habitats more suited to the latter, with *Crangonyx* pushed to marginal habitats of reduced water quality and lower levels of oxygen.

4.5.2 There is little evidence of *Crangonyx* causing environmental or economic impacts, and the species has become naturalised in the UK since its arrival. However, there is some evidence that there is a high potential for this species to act as a host for parasites, and therefore its spread should be prevented where possible.

4.5.3 *Crangonyx pseudogracilis* can be spread by boating activity, for example in ballast water or attached to hulls, especially within vegetation, but it may also be spread by water birds.

4.5.4 Eradication of this freshwater species is not feasible without eradicating all invertebrate species at the same time, and at the same time the species is widely distributed so eradication of a local population would be futile. Therefore it is advisable to prevent the spread of this species to waters where it is currently absent through appropriate mitigation and the implementation of biosecurity protocols during construction activities. The current surveys have indicated that this species is present in Loch Ness but absent from all other waterbodies sampled.

5 Construction INNS Risk Assessment

5.1.1 Risks associated with INNS are predominantly associated with the potential for the spread of these species either within the Development site boundary or off-site. Variegated yellow archangel and *Rhododendron ponticum* are listed in Schedule 9 of the Wildlife and Countryside Act 1981, and it is, therefore, an offence to plant or allow these species to spread into the wild. While there are no legislative restrictions on the spread of *Crangonyx pseudogracilis* it is recommended, given consultee concerns, that the following appropriate mitigation measures are implemented to prevent the spread of this species.

5.1.2 Table 5.1 summarises the risks of spreading INNS through the proposed construction activities, and recommended mitigation measures to minimise these risks, primarily through the production of a Biosecurity Management Plan (BMP).

Table Error! No text of specified style in document.**.6. Mitigation measures to reduce the risk of spreading INNS**

Construction Element / Activity	Risk due to INNS	Mitigation Recommendations
Biosecurity Management Plan (BMP)	Will include recommendations to minimise the risks posed by INNS	BMP to be prepared and agreed by construction contractor(s) prior to works commencing on site Will include 'Check, Clean, Dry' protocol for contractor equipment and PPE to ensure biosecurity
Utilities and diversions, including public road diversion, core paths and short section of the B862 to create new crossing	New permanent or temporary route for utilities / diversions passes through areas of INNS	Pre-commencement check for presence of INNS in route of diversion
Four construction compounds will be required across the site Compound 1 is anticipated to be the largest compound and will be the location for the main construction offices and the route to the powerhouse for the main mechanical and electrical components Three out of the four will be required to be left for as permanent compounds during the operation of the scheme. At these locations, the compounds will be reduced in size, sealed (tarred) and reinstated/ landscaped	Compound 1 straddles watercourses including Allt a' Mhinisteir Burn (two watercourse crossings) and unnamed watercourses Compounds 1 and 4 are located entirely in areas of woodland; compounds 2 and 3 include small areas of woodland – potential to spread rhododendron, yellow archangel and other terrestrial INNS Compound 2 is located on the shoreline of Loch Ness – potential for *Crangonyx* and Nuttall's waterweed in Loch, and in stockpiled Loch materials All construction compounds – risk of spread of INNS as yet	Biosecurity measures adhered to according to CEMP: e.g. plant washing prior to movement, temporary silt fencing along watercourses Pre-commencement check for rhododendron, yellow archangel and other INNS in areas of woodland prior to construction Biosecurity measures adhered to according to CEMP: e.g. plant washing prior to movement, storage of loch spoil on site, pre-commencement check for INNS in loch prior to construction Pre-commencement check for presence of INNS in areas of compounds

Construction Element / Activity	Risk due to INNS	Mitigation Recommendations
	unidentified on the site	
Temporary road constructed from the inlet/outlet at Loch Ness to the embankment via Compound 1	Risk of spread of terrestrial INNS, including those as yet unidentified on the site	Pre-commencement check for presence of INNS along road route
Construction and access tunnels, constructed by drill and blast or tunnel boring machine (TBM)	Risks and mitigation as for construction compounds – tunnel portals to be located in construction compounds	
Delivery of large diameter TBM by barge (if not possible by road)	Potential transfer of aquatic INNS by barge on Loch Ness	Barge to adhere to allocated navigable routes; barge to be sourced locally if possible
Transport of excavated tunnel material to headpond via conveyor belt	Negligible risk of transfer of INNS from underground materials; potential transfer of INNS by transport of materials above ground	Biosecurity measures adhered to according to BMP: e.g. plant washing prior to movement, storage of excavated materials in allocated areas, stockpile areas inspected for presence of INNS prior to construction and monitored according to requirements of BMP
Headpond embankment construction by cut and fill methodology – including use of excavated material and construction of landscape embankment	Risk of transfer of INNS through major earthworks and plant movement	Biosecurity measures adhered to according to BMP: e.g. plant washing prior to movement, storage of excavated materials in allocated areas, stockpile areas inspected for presence of INNS prior to construction and monitored according to requirements of BMP
	Low risk of potential cross catchment spread of INNS due to distance from neighbouring catchment (i.e. Loch Duntelchaig and Lochan an Eoin Ruadha	Implementation of measures to prevent the transfer of materials to the neighbouring catchment, i.e. maintenance of effective buffer strip/distance, use of temporary silt fencing
Temporary cofferdam structure to facilitate construction of inlet/outlet structure and TBM machine for tailrace tunnel works; including temporary pier and delivery of materials by barge	Risk of transfer of aquatic INNS including *Crangonyx* and Nuttall's waterweed, including via barge, by de-watering of cofferdam and by removal and stockpiling of loch bed material	Biosecurity measures adhered to according to BMP: e.g. plant washing prior to movement, storage of loch spoil on site, pre-commencement check for INNS in loch prior to construction, monitoring of loch substrate during de-watering for presence of INNS
Spoil management – around 850 000 m^3 of material from tunnelling works	Risk of spread of terrestrial INNS through plant movement and stockpiling of materials	Biosecurity measures adhered to according to BMP: e.g. plant washing prior to movement, storage of excavated materials in allocated areas, stockpile areas inspected for presence of INNS prior to construction and monitored according to requirements of BMP
SUDs, settlement ponds, temporary ditches and other drainage features	Risk of spread of terrestrial and aquatic INNS through construction of drainage features, especially in proximity to existing waterbodies	Biosecurity measures adhered to according to BMP: e.g. plant washing prior to movement, storage of excavated materials in allocated areas, SUDs/drainage areas inspected for presence of INNS prior to construction and monitored according to requirements of BMP

Construction Element / Activity	Risk due to INNS	Mitigation Recommendations
General plant movement throughout the site	Risk of transfer of terrestrial INNS through plant movement	Biosecurity measures adhered to according to BMP: e.g. plant washing prior to movement/transfer
Watercourse crossings for temporary and permanent access roads, including culverting of watercourses	Risk of transfer of INNS via watercourses, including aquatic and terrestrial INNS	CAR licence application to inform watercourse crossing works. Implementation of measures in BMP to prevent the transfer of INNS to watercourses, e.g. temporary silt fencing.
Monitoring of the site for new occurrences of INNS throughout construction (around 5 years total)	Potential for INNS to be spread on site, arrive on site by natural mechanisms or to be brought to site by vehicle movements	BMP to detail appropriate timescale for regular monitoring of construction areas for occurrence of INNS

6 Operational INNS Risk Assessment

6.1.1 During the initial feasibility work for the Development, SEPA and Scottish Water raised the risk of operational transfer of INNS between the Ness and Nairn catchments. Of particular concern was the potential to spread of *Phagocata woodworthi*, *Crangonyx pseudogracilis* and *Elodea Nuttallii* into Loch Ashie and Loch Duntelchaig, which are primary drinking water sources for Inverness.

6.1.2 Early on in the design evolution process, Loch Duntelchaig was determined unsuitable as a Headpond for the Development and design was progressed to the two Headpond Options presented for Scoping Opinion. As part of the scoping design, a 0.5 millimetre (mm) screen was presented within the Tailpond Inlet / Outlet Structure in Loch Ness. The primary function of the screen was to prevent fish egress into the Development operations, but also to minimise the likelihood of INNS transfer.

6.1.3 In further detailed consultation, post-scoping, SEPA and SNH (meeting on the 27 April 2018) confirmed that the screen would not require such small aperture dimensions if the operational cross-catchment transfer risk was determined to be negligible through this INNS risk assessment.

6.1.4 As part of this assessment, *Crangonyx pseudogracilis* and *Elodea Nuttallii* have been identified as present in Loch Ness within and in proximity to the Development Site. However, the risk of their cross-catchment spread by the operation of the Development is negated by the Option B Headpond design being taken forward post-scoping as a closed loop system within the Ness catchment.

6.2 Closed Loop System

6.2.1 The Red John system will act as a closed-loop system between the Headpond and Tailpond. Water that is transferred between Tailpond (Loch Ness) and the Headpond will be contained within the waterways of the system. The components of the waterways are the tailrace, headrace, and spillway pipe. During operation, there may be times when the system is not generating, and subsequently, the Headpond remains at its operational top water level (TWL). Figure 6 shows the arrangement of the closed-loop system of the waterways and spillway pipe.

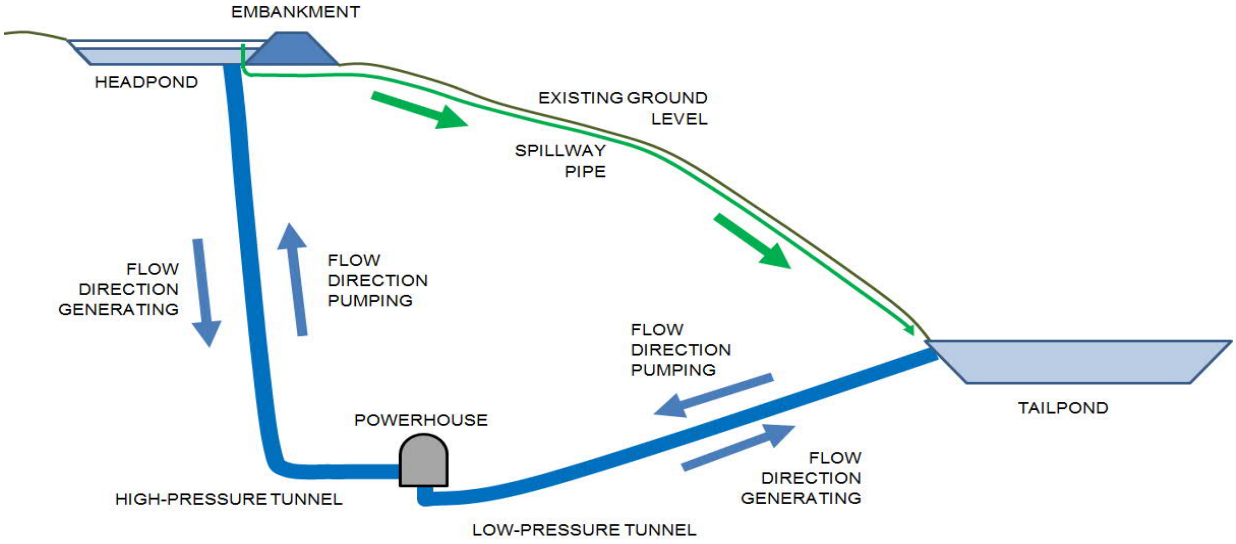

Figure 6: Indicative diagram of the closed-loop system

6.2.2 If during this time the water levels in the Headpond rise due to precipitation, excess water will spill over the spillway at the inlet / outlet structure into the spillway pipe. The spillway pipe will be a large diameter high-pressure cut and cover pipe that will travel from the Headpond to the Tailpond. This is to ensure that the water remains in the closed-loop system between the Headpond and the Tailpond. The spillway pipe will also be used as the scour pipe in the Headpond which will be connected within the inlet/ outlet structure.

6.2.3 Connectivity with the waterbodies in the neighbouring catchment is prohibited in the closed-loop design through the following measures;

- The Headpond is designed to avoid overtopping or breach and will be lined with a waterproof lining system on the inside face of the Headpond, which will isolate the water reserved within the Headpond from the groundwater, embankment structure and surrounding area.
- There is 4m freeboard between the top operating water level and the top of the Embankment of the Headpond. In addition, there is a wave wall on top of the Headpond to stop any water from being transferred by weather or operational conditions;
- There is only one inlet/outlet structure within the Headpond, which is the entrance point for the high-pressure tunnel that conveys water to the Tailpond, as shown in Figure 6;
- Similarly, there is only one Spillway Pipe that will also drain into Loch Ness;
- The Waterways will be lined, preventing any water from getting in or out. Both the high and low-pressure tunnels will be lined with a mixture of concrete and steel and will be designed to withstand large transient forces during operation; and
- The Spillway pipe will be a high specification high-pressure buried pipe in order to minimise the risk of the pipe bursting during operation.

6.2.4 Consequently, a 2 mm aperture screen has been proposed for the Tailpond Inlet / Outlet, which will still prohibit fish entrapment and entrainment.

6.2.5 Given the conclusions above and demonstration of a closed loop system, no further mitigation measures for INNS are proposed.

7 References

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