

Glyn Rhonwy Pumped Storage Development Consent Order

Deadline 3 – Biosecurity Plan



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Biosecurity Plan – Construction and Operation

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1 INTRODUCTION

1.1 Introduction

- 1.1.1 The objective of this Biosecurity Plan is to outline the Biosecurity Management principles throughout the construction and operational periods of the Development at Glyn Rhonwy Pumped Storage.
- 1.1.2 The Biosecurity Plan is designed to ensure that the requirements of legislation, Requirement 7 of the Development Consent Order (DCO) and the Environmental Statement are complied with. It shall be the policy of the Applicant to ensure the Development is executed in a manner that demonstrates its commitment to the care and protection of the environment.
- 1.1.3 This draft Biosecurity Plan has been developed by the Applicant and will be adopted by the Principal Contractor (PC) upon the award of the contract. All personnel and sub-contractors working on the project shall perform their duties in accordance with the requirements of the Biosecurity Plan.
- 1.1.4 It is proposed that this Biosecurity Plan will be finalised and submitted to Gwynedd Council and Natural Resources Wales (NRW) for approval, as per Requirement 7. The finalised Biosecurity Plan must be read in conjunction with the approved CoCP and the Water Management Plan.

1.2 Responsibilities

- 1.2.1 The responsibility for delivery of this plan will lie with the Principal Contractor who as yet has not been appointed and therefore these responsibilities will be completed at a later date.

1.3 The Development

- 1.3.1 The Glyn Rhonwy Site is situated approximately 1.5km north west of Llanberis in Gwynedd, North Wales centred at the approximate National Grid Reference (NGR) SH 56268 60660. The Development Order Limits

encompasses; a series of disused slate quarries, the Glyn Rhonwy Industrial Estate platforms, and an area adjacent to Llyn Padarn.

1.3.2 The Development comprises:

- An upper reservoir (head pond) on Chwarel Fawr (Q1), its dam and spillway infrastructure to the Nant y Betws (the Nant y Betws connects the Development to the Afon Gwyrfaï Special Area of Conservation (SAC));
- A lower reservoir (tail pond) at Glyn Rhonwy Quarry (Q6) its dam and spillway infrastructure to Llyn Padarn Site of Special Scientific Interest (SSSI);
- A underground turbine hall and above ground power house at Platform 5 of the Glyn Rhonwy Industrial Estate;
- A penstock consisting of a 4m diameter steel lined pipe connecting Q1 to the turbine house and 'tailrace' pipe joining the turbine house to Q6, which in total will be approximately 1.8km long;
- Spillway infrastructure will be constructed using open cut as they will be laid close to the surface;
- A pumping station near Llyn Padarn SSSI for abstraction to 'top up' Q6 as required; and
- Temporary construction compounds at Q1 and Q6;

1.3.3 The Development will have an operational life of approximately 125 years after which it will be decommissioned, unless a future application is made to extend the life of the pumped storage facility.

2 INVASIVE NON-NATIVE SPECIES

2.1 Introduction

2.1.1 Invasive Non-Native Species (INNS) are defined as species that do not occur naturally in Great Britain, but have been introduced by human activity (intentionally or accidentally); they have subsequently become established in natural or semi-natural ecosystems or habitats, are agents of change and can adversely impact the environment, the economy, and health.

2.1.2 INNS of particular concern are those listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) (WCA). Under the legislation the following applies:

- You must not release into the wild animals listed in Schedule 9 Part 1 of the WCA or animals of a kind not ordinarily resident in, or not a regular visitor to, the UK;
- You must not transfer between locations any animals listed in Schedule 9 Part 1 of the WCA or animals of a kind not ordinarily resident in, or not a regular visitor to, the UK. This is best practice unless the animal becomes captured/contained as part of transport, in which case it becomes an offence under the WCA (see previous bullet point);
- Plants listed on Schedule 9 Part 2 of the WCA, must not be planted or allowed to spread into the wild. If taken offsite, any such material is classified as controlled waste and there is a duty of care for its proper disposal; and
- Plants listed in Schedule 9 Part 2 of the WCA, even when located in managed land, must be kept under control and properly managed.

2.1.3 Biosecurity is a set of precautions to prevent the introduction and spread of harmful organisms, including invasive species. The Great Britain Invasive Non-native Species Strategy (Defra, 2015) and EU Regulation 1143/2014 on Invasive Alien Species (entered into force on 1 January 2015) direct landowners and managers to adopt a proactive biosecurity driven approach to INNS management. NRW advocate this proactive approach. In order of priority, emphasis is placed on:

- Prevention (including reducing the probability of accidental spread and identifying spread pathways);
- Early detection and rapid response; and
- Control of established populations.

2.2 Invasive Non-Native Species Surveys

2.2.1 The construction of the Development presents potential risks with regards to cross contamination between water bodies, and the spread of INNS via terrestrial and aquatic pathways. The potential for this could be encountered during the following construction activities:

- Dewatering of Q1 into the Nant-Y-Betws and Q6 into Llyn Padarn;
- Preparatory works for and construction of the spillway infrastructure within Llyn Padarn;
- Water abstraction from Llyn Padarn/infilling of the Development; and
- Terrestrial-based construction activities in the vicinity of INNS such as stabilisation and reprofiling of the quarry walls.

2.2.2 The operation of the Development presents risks with regards to cross contamination between water bodies, and the spread of INNS via aquatic pathways. The potential for this could be encountered during the following operation activities:

- Top up abstraction from Llyn Padarn into Q6;
- Normal operational releases of water via the Q6 spillway infrastructure;

- Emergency drawdown releases of water via the Q1 spillway infrastructure; and
 - Maintenance works.
- 2.2.3 To help establish presence of INNS within and adjacent to the Order Limits a series of surveys were undertaken in 2013 and 2015.
- 2.2.4 Evidence of any terrestrial invasive non-native species (INNS) was recorded during the Phase 1 Habitat Survey (JNCC, 2010) of the Order Limits by AECOM on 11th September 2013 and 31st March 2015.
- 2.2.5 To establish the presence/absence of INNS within the aquatic environment of Q1 and Q6 the following surveys were conducted in April, May and June 2015:
- Aquatic plant survey;
 - Fish survey; and
 - Aquatic invertebrate survey.
- 2.2.6 To establish presence/absence of INNS within the water within Llyn Padarn freshwater plant surveys were conducted around the area of the proposed spillway infrastructure.
- 2.2.7 The methodologies for the surveys are summarised in Chapter 7 Ecology and detailed in Appendix 7.19 of the Environmental Statement (AECOM, 2015).
- Invasive Non-Native Species Survey Results*
- 2.2.8 The 2013 and 2015 Phase 1 surveys identified a stand of Himalayan balsam *Impatiens glandulifera* and two stands of Rhododendron *Rhododendron ponticum* to the east of the Order Limits near to Llyn Padarn (Figure 1).
- 2.2.9 The surveys listed above and report of Llyn Padarn, Q1 and Q6 concluded the following:

- Aquatic plants were common within the sheltered areas of the Llyn Padarn lagoons with Nuttall's waterweed *Elodea nuttallii* being the most common species encountered;
- The aquatic invertebrate populations of Q1 and Q6 are similarly typical to the surrounding aquatic habitats and the species therein pose no ecological threat if transferred to nearby protected sites as a result of the works;
- No higher plants were recorded growing in either Q1 or Q6 waterbodies;
- Two commonly occurring liverworts were recorded growing below the waterline and in the splash-zone of Q1 waterbody. These are common throughout the region and pose no ecological threat to nearby sites;
- The presence of *Cotoneaster* sp. was noted on the rocky outcrops surrounding Q1 and Q6;
- No significant accumulations of fine sediments in Q1 and Q6 were found although multiple attempts were made to collect samples all over the quarries;
- No fish were recorded in Q1 waterbody;
- Fish were recorded in Q6 (stickleback *Gasterosteidae* sp. and European eel *Anguilla anguilla*), but the community was species poor and of low abundance, which is typical of such a water body. It is likely that Q6 waterbody was seeded by fish eggs transported from Llyn Padarn by birds and a viable population then developed; and,
- Whilst the deep areas of the Q6 waterbody were not sampled, there is confidence in the findings of the fisheries survey that no INNS have been missed for the following reasons:
 - The lake is isolated from other water sources and illegal introductions of fish by anglers could be the main potential source of further fish species being introduced;

- However transporting fish into the quarry would pose a considerable challenge which would likely prevent any casual attempts to introduce fish; and,
- There was no evidence of any angling activity on the water (e.g. discarded or snagged line or floats), whereas there was other evidence of recreational use including small dinghies, oars and lilos that had been discarded.

2.3 Invasive Non-Native Species Pathways

2.3.1 To aid identification, mitigation and management of INNS based risks, INNS that are confirmed to be present within or adjacent to the Order Limits are listed in Table 1.1 along with their potential spread pathways.

Table 1.1: Invasive Non-Native Species			
Common Name	Scientific Name	Location	Potential Pathway
Himalayan balsam	<i>Impatiens glandulifera</i>	Figure 1, Point 1 within Order Limits.	Spreads via seeds. Disturbance to ripe seed heads – seeds are spread by explosive seeds pods, via water flow, wind, propelled through the air, and in contaminated soil.
Rhododendron	<i>Rhododendron ponticum</i>	Figure 1, Points 2 and 3, within Order Limits.	Spreads via seeds and stem layering. The seeds are spread by wind and occasionally in contaminated soil.

Table 1.1: Invasive Non-Native Species			
Common Name	Scientific Name	Location	Potential Pathway
Nuttall's waterweed	<i>Elodea nuttallii</i>	Figure 1 Points 4 – 41, outside of Order Limits.	Disturbance during construction causing the spread of species – spread and persist via vegetative growth and fragmentation. Vegetative fragments readily attach to vehicles, equipment, clothing, footwear, waterfowl and other animals.
Small-leaved cotoneaster	<i>Cotoneaster microphyllus</i> .	Occurring occasionally in isolated pockets on the rocky outcrops of the quarry cliffs in Q1 and Q6.	Spread via seeds. The seeds are spread by birds and in soil contaminated with seeds.

3 BIOSECURITY PLAN

3.1 Introduction

3.1.1 This section describes the general biosecurity precautions and the control techniques for the prevention of the spread of INNS that have found to be present within or adjacent to the Order limits and may be encountered during the construction and operation of the Development.

3.2 General Biosecurity Precautions

3.2.1 The following biosecurity precautions must be implemented as a minimum, especially during disruptive construction works and any disruptive maintenance works during operation.

3.2.2 Any soil/sediment used in works must be sourced from an area known to be free of INNS. If the soil/sediment originated from offsite, it should be obtained from a source confirmed as uncontaminated with INNS and/or their propagules.

3.2.3 Even though some INNS are extremely easy to overlook, it is essential to implement straightforward precautions, greatly reducing the risk of transmitting most INNS. INNS and their propagules can be present in soil, organic material (e.g. plant debris) and water. Such material can be carried on footwear, clothing, vehicles and other equipment.

3.2.4 All site staff and contractors should be made aware of the biosecurity risks and issued with a photographic reference guide to the known INNS occurring within the site. Steps should be taken to remove, eradicate or fence off known terrestrial INNS where possible within the working areas.

3.2.5 Any additional positive or suspected identification of INNS should be reported immediately to the Environmental Clerk of Works (ECoW).

3.2.6 Good hygiene is essential, especially when moving around or off of a site. Precautions must be taken to minimise the transfer of plant and animal species including:

- Planning activity/works to minimise the risk of picking up and spreading INNS. For example, modify the work plan so that works in risk areas are carried out last;
- Avoiding the need to create a risk situation in the first place. For example, modifying the work plan so that a risk area does not need to be entered;
- Checking equipment, clothing and footwear for soil, seeds and live organisms, focussing particularly on areas that are damp or hard to inspect;
- Cleaning and washing all equipment, footwear and clothing thoroughly. Cleaning should take place in the location (or immediate vicinity) where the soil or living material originated;
- Drying all equipment and clothing; some species can live for many days in moist conditions. Make sure not to transfer potentially contaminated water elsewhere onsite or offsite. This is particularly important when water bodies are present onsite; and
- Disinfect all equipment and clothing where the spread of INNS propagules is possible.

3.2.7 If vehicles are being used:

- Before being used for works within INNS buffer zones, all vehicles should be thoroughly cleaned prior to entering the buffer zone, with all soil and plant debris being removed;
- Clean vehicles regularly; do not let mud and organic debris accumulate on tracks, tyres or under wheel arches;
- Before leaving INNS buffer zones, all vehicles should be thoroughly cleaned, with all soil and plant debris being removed;
- Avoid vehicular access to risk areas if possible. If it is not possible, a mitigation strategy must be in place to help prevent spread; and

- If necessary (e.g. INNS contaminated soil spans the width of the development route) geotextiles and ply can be used to create access routes across buffer zones.

General Precautions for Carrying Out Excavations in Areas with INNS

- 3.2.8 Either the Environmental Manager / Environmental Clerk of Works of a suitably quality and experienced ECoW must oversee any excavations that take place in soils containing invasive plants, or their propagules.
- 3.2.9 Excavation based management works can be carried out using on site personnel/ equipment/ vehicles, under the supervision of an experienced ECoW, at the onset of development works near infested areas. Alternatively, a specialist could be contracted.
- 3.2.10 The amount of waste generated that contains invasive plants, or their propagules, should be minimized (Defra, 2013). For example:
- Care should be taken not to mix INNS waste into other waste (separation of bunds etc.); and
 - The amount of soil to be excavated when digging out an invasive plant shall be as little as is practical, e.g. by having an experienced ECoW, expert in the identification of INNS underground plant material, on site during such work.
- 3.2.11 Any waste containing INNS shall be treated on site where possible, e.g. herbicide treatment, stockpiling or burial. Herbicide treated soils can be re-used in landscaping (once control is achieved). Prior to the burial of invasive plant waste, NRW must be contacted in order to check if burial is permitted at the location.
- 3.2.12 Any waste containing Schedule 9 invasive plant propagules that is taken off site will may be classified as Controlled Waste and, where appropriate (as determined by an appropriately trained ecologist), must be taken by a licensed waste carrier and must go to a suitably authorised waste disposal facility.
- 3.2.13 INNS contaminated soil is not to be stockpiled:

- Within 10 m of a watercourse; or
- Within 7 m of a construction area (area involving excavation and/or moving of soil materials).

3.2.14 If contaminated soils are being moved around a site as part of mitigation works (e.g. transport to a suitable location for burial), then a haulage route must be set out in advance (clearly marked on site maps and on the ground) and an experienced ECoW must oversee haulage along such routes. The length of haulage routes shall be as short as possible and precaution must be taken to prevent any spillage of contaminated soil/material. Vehicles not involved in INNS remediation must not enter the haulage route until an appropriately qualified ECoW has stated that it is permissible to do so.

3.2.15 Vehicles involved in haulage of INNS contaminated material shall not enter a buffer zone. Rather, the haulage vehicle shall be positioned outside of the buffer zone and be loaded across the buffer zone boundary by an excavator with a suitable reach. If a haulage vehicle does enter a buffer zone, the biosecurity precautions outlined in Section 3.2.7 must be followed.

3.2.16 If aquatic INNS are present within an onsite water body that is connected to an offsite water body, then strict biosecurity precautions must be taken to prevent spread from the site by water flow. Avoid working in areas with aquatic INNS and, if unavoidable, take steps to avoid fragmenting plant INNS. For example, a fine mesh can be used to cover culverts and drains etc., which will help to reduce the spread of plant fragments if they do occur. This is especially important if the species is not present downstream or in connecting water bodies.

3.2.17 If carrying out works under such a scenario, a survey must be carried out to determine if the species is present downstream or in connecting water bodies in areas where INNS material is likely to spread (approximately 100 m depending on topography as determined by a suitably qualified ecologist). Evidence of downstream INNS, which were present prior to

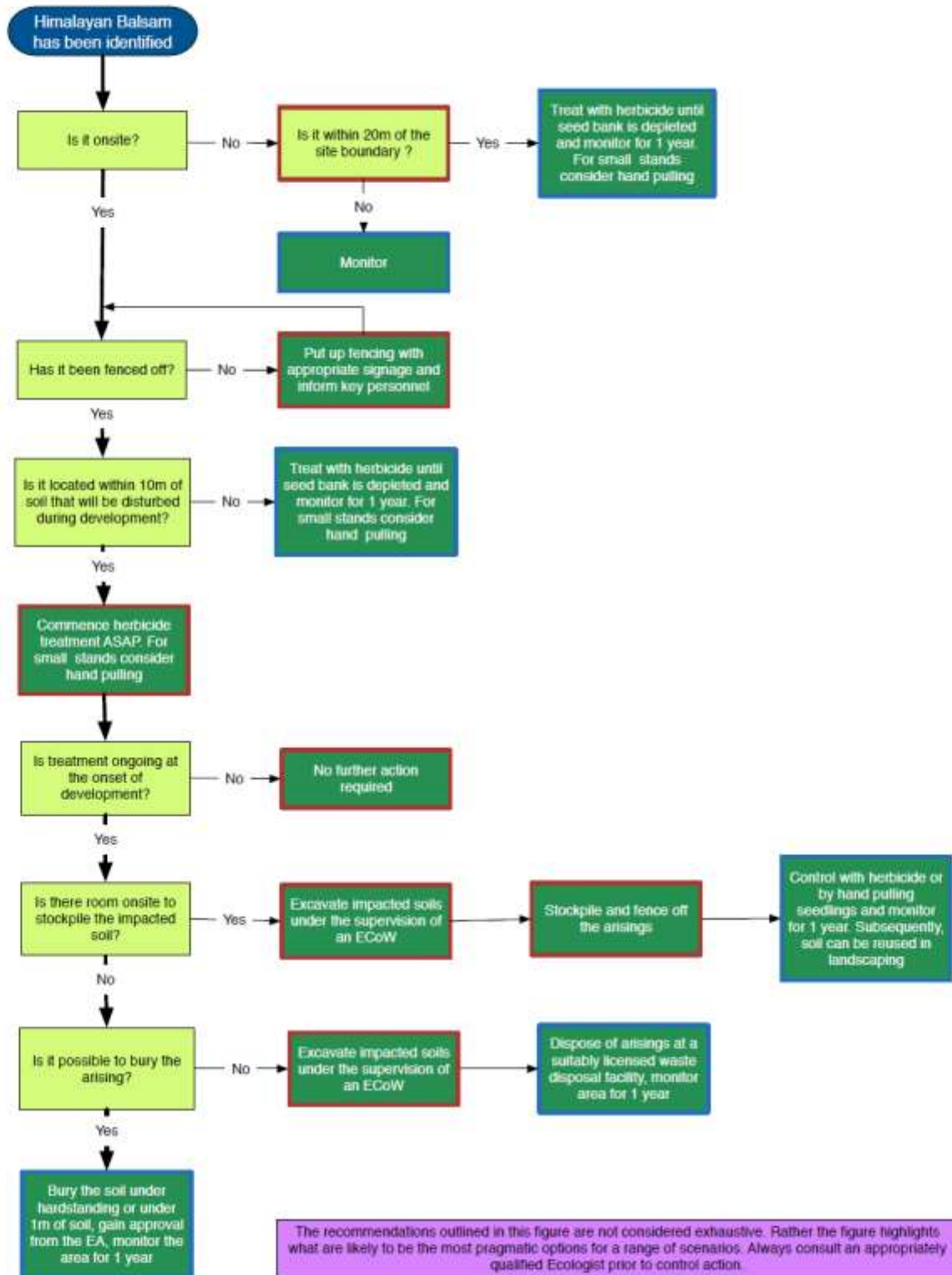
development works, will provide protection against an accusation of facilitating spread subsequently.

- 3.2.18 All herbicide treatment in or adjacent to water should follow the recommendations set out in Appendix A.
- 3.2.19 Following the completion of works in a contaminated area, a monitoring programme shall be initiated.
- 3.2.20 All control, treatment and/or removal works should be conducted by an appropriately qualified and licensed contractor.
- 3.2.21 Over the course of INNS control action, a report is to be produced at the end of each year or completion of works (whichever is sooner) detailing the works carried out. Any amendments required to this Biosecurity Management Plan can be included at this stage based on field conditions. The aim of this document is to show that a Biosecurity Plan is in place and being followed.

3.3 Himalayan Balsam

- 3.3.1 There is the potential for disturbance of this species during vegetation clearance, movement of construction traffic for the installation of the abstraction pipe, and any disruptive maintenance works during operation in the vicinity of the species causing the spread of seeds and/or the spread of soil contaminated with seeds.
- 3.3.2 Any Himalayan balsam must be fenced off, with appropriate signage. Fencing must create a 10 m buffer zone around visible plants. If fencing is not possible then the plant must first be eradicated before works can commence.
- 3.3.3 Once treatment commences, it must be carried out to completion as, if control is stopped or delayed, the plant will recover and, often within a short period of time, return to the initial state. Management is considered complete once one full growth season has passed without new seedlings sprouting. Use the Himalayan balsam control options decision tree (Figure 3.1) to determine the best control option.

Figure 3.1: Himalayan balsam control options decision tree



- 3.3.4 If Himalayan balsam is located where it will be disturbed as part of development or any operational or maintenance works (including access routes), management must commence as far in advance of site works as is practicable. This will start the process of depleting the seed bank and minimise the risks associated with subsequent mitigation works. Himalayan balsam can usually be effectively controlled in two years; however, an additional year of monitoring will be required. Use Figure 3.1 to determine the best control option and see Appendix B for details on potential implementation methods for each option.
- 3.3.5 If management is complete once site works commence in the area, then no further precautions are required.
- 3.3.6 If management is not complete once site works commence in the area, impacted material must be excavated and in order of decreasing priority (also see Appendix B):
- Buried under 1 m of soil or at formation level under hard standing;
 - Stockpiled and treated; or
 - Disposed of to landfill. If disposal to landfill is chosen, a detailed explanation as to why no other remediation option was suitable must be provided.
- 3.3.7 Areas where Himalayan balsam management has taken place must be monitored until one full growth season has passed without re-growth.
- 3.3.8 The Property Care Association (PCA) 2015 Guidance Note – Management of Himalayan balsam outlines best practice for Himalayan balsam control.

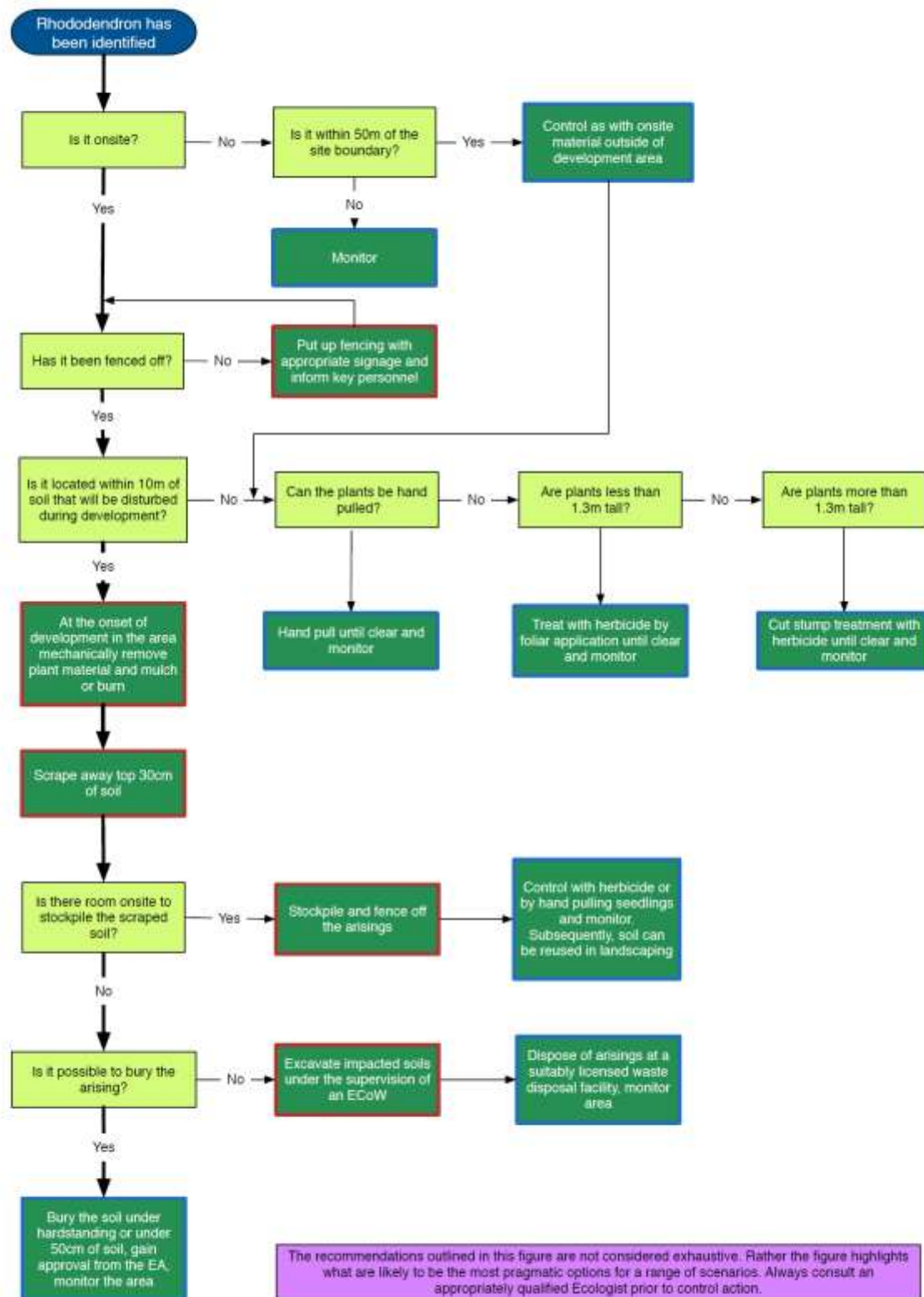
3.4 Rhododendron

- 3.4.1 The following recommendations are equally applicable to *Rhododendron ponticum* and its hybrids. All species are referred to as 'Rhododendron'.
- 3.4.2 Rhododendron is an evergreen woody shrub which spreads via seeds and stem layering. The seeds spread by wind and occasionally in contaminated

soil. Rhododendron plants produce seeds at age 10 years or more, usually 12 to 20 years. The seed bank can persist for up to 3 years; however, seeds rarely remain viable for more than 1 year (particularly in wetter soil). Seed germination can occur on many substrates; however, germination requires constant humidity and good light availability. Germinant establishment is less frequent and requires specific conditions, generally being restricted to thin layers of bryophytes covering bare ground. Cut stumps readily sprout new shoots and such shoots can produce seeds after 2 years.

- 3.4.3 There is the potential for disturbance of this species during vegetation clearance, movement of construction traffic for the installation of the abstraction pipe, and any disruptive maintenance works during operation in the vicinity of the species causing the spread of seeds and/or the spread of soil contaminated with seeds.
- 3.4.4 Any Rhododendron must be fenced off, with appropriate signage. Fencing must create a 10 m buffer zone around visible plants.
- 3.4.5 If fencing is not possible then the plant must first be eradicated before works can commence. A control programme must be initiated to eradicate/remove Rhododendron from the site. Once treatment commences, it must be carried out to completion. If control is stopped or delayed, the plant will recover and, in time, return to the initial state.
- 3.4.6 Use the Rhododendron control options decision tree (Figure 3.2) to determine the best broad management option. Use Figure 21 in 'Managing and controlling invasive rhododendron' (Edwards, 2006) to determine the specific control method.

Figure 3.2: Rhododendron control options decision tree



3.4.7 Management is considered complete once:

- One full growth season has passed without new seedlings sprouting in damp soils;
- Two full growth seasons have passed without new seedlings sprouting in dry soils; and
- Two full growth seasons have passed without cut stumps sprouting shoots.

3.4.8 If Rhododendron is located where it will be disturbed as part of development or any operational maintenance works (including access routes), then, at the onset of development in the area, it shall be dug up mechanically, ripped up or hand pulled. Plant material is to be mulched or burnt. If seeds are present, and mulching is carried out, then the mulch is to be monitored for regrowth. Ideally carry out remediation when ripe seeds are not present. Generally, ripe seeds will be present between December and April.

3.4.9 The top 300 mm of soil shall be scraped and, in decreasing order of preference:

- Stockpiled and treated (light exclusion, hand pulling of seedlings or herbicide application);
- Buried under 500 mm of soil or at formation level under hard standing; or
- Disposed of to an appropriately licensed landfill. If disposal to landfill is chosen, a detailed explanation as to why no other remediation option was suitable must be provided.

3.4.10 Areas where Rhododendron control has taken place shall be monitored until the completion criteria above are met. Any regrowth must be hand pulled or treated with herbicide. Monitoring must be carried out twice per year in May and August.

3.4.11 The following guidance outlines best practice for Rhododendron control:

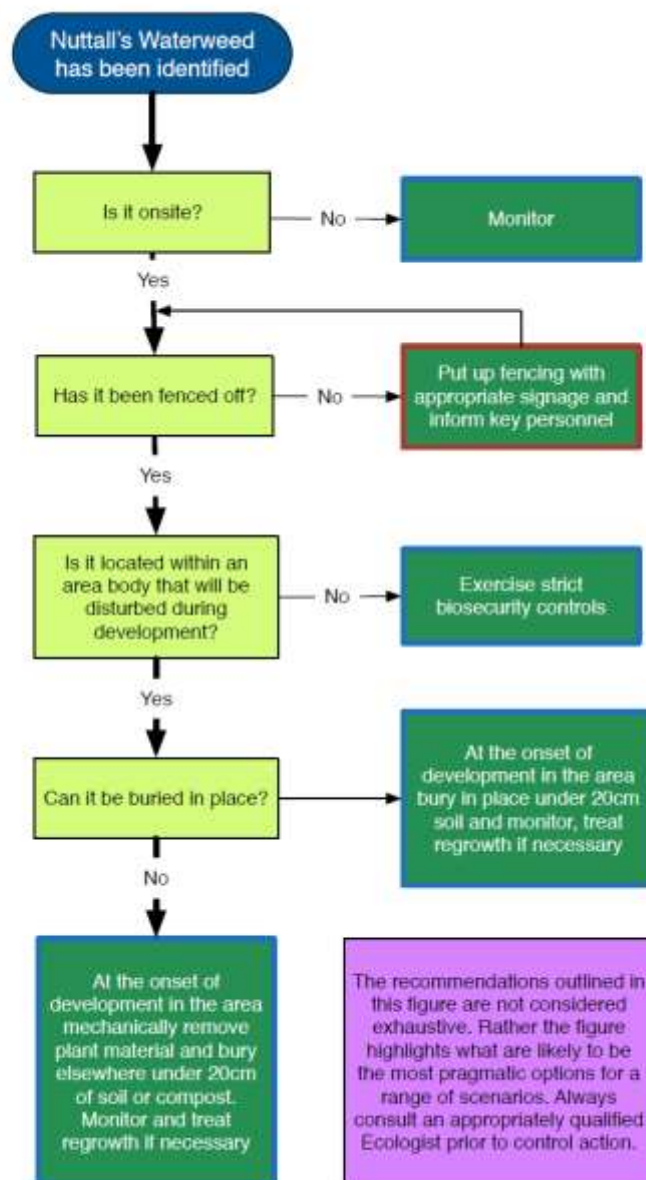
- Managing and controlling invasive rhododendron - Forestry Commission (2006).

3.5 Nuttall's Waterweed

- 3.5.1 The Nuttall's waterweed is a widespread fleshy aquatic perennial plant that spreads and persists via vegetative growth and fragmentation. Vegetative fragments readily attach to vehicles, equipment, clothing, footwear, waterfowl and other animals (e.g. the hooves of animals drinking from infested water bodies).
- 3.5.2 Nuttall's waterweed is dioecious, with male and female flowers on different plants. Currently there is no evidence that male plants occur in the UK and therefore the risk of seed dispersal need not be considered (NNSS, 2011).
- 3.5.3 The primary aim is to prevent spread around or between water bodies; and to eradicate where required to achieve this aim.
- 3.5.4 There is the potential for spread of this species during:
- Any in-water construction works in Llyn Padarn;
 - The initial abstraction process and infilling of Q6 and Q1;
 - Top up of Q6 from Llyn Padarn (vegetative matter getting drawn into the abstraction pipe and deposited in Q6 or Q1) during operation;
 - Normal operational releases of water via the Q6 spillway during operation;
 - Emergency drawdown releases of water via the Q1 spillway during operation; and,
 - Operational in-water maintenance works in Llyn Padarn.
- 3.5.5 The location of any of Nuttall's waterweed species must be clearly demarcated with appropriate signage at the water edge during construction and at any maintenance access route during operation.
- 3.5.6 A control programme must be initiated to contain Nuttall's waterweed, preventing it from spreading around and offsite.

- 3.5.7 The risk and locations of Nuttall's waterweed must be included in any maintenance manuals for the Development.
- 3.5.8 A monitoring programme must be initiated in areas where infestation is possible, followed by management if introduction occurs (see below).
- 3.5.9 Use the Nuttall's waterweed control options decision tree (Figure 3.3) to determine the best control option. Management is considered complete once one full growth season has passed without regrowth.

Figure 3.3: Nuttall's waterweed control options decision tree



- 3.5.10 If Nuttall's waterweed is located in areas required to construct/operate the proposed scheme, but in a location where it will not be disturbed as part of development then strict biosecurity protocols must be followed.
- 3.5.11 If Nuttall's waterweed is located in water bodies where it will be disturbed as part of construction and/or operation of the Development then Nuttall's waterweed material should be excavated/dredged and composted or buried in place or elsewhere on site under 20cm of soil.
- 3.5.12 Offsite disposal as green waste (for composting) will disrupt the pathway of spread and, as such, it is appropriate to dispose of Nuttall's waterweed as green waste.
- 3.5.13 Water bodies where Nuttall's waterweed control has taken place are to be monitored until one full growth season has passed without re-growth. Regrowth, which is most likely to occur on the water's edge, should be scraped from the soil and the material should be composted.

3.6 Cotoneaster

- 3.6.1 Cotoneaster spreads by seeds inside berries, which are primarily transported by birds or fall within a couple of metres of parent plants. Seeds are produced in autumn, but can be retained on plants for much of the following year. Cotoneaster can occasionally spread via cuttings and can re-sprout from cut stumps and shallow roots.
- 3.6.2 The only location of Cotoneaster on site is on the rocky outcrops of the quarry faces of Q1 and Q6. During construction the quarry faces will be blasted, and the material crushed for use in the dam and spoil mounds within the Order Limits. As such, any plants and seeds will be destroyed during this process. Plants that avoid the blasting works and remain in situ in the quarries will be immersed with water during the in-filling process, and as Cotoneaster is not known to spread via water there is deemed to be no pathway between the Order Limits and the wider environment.

4 REFERENCES

- 4.1.1 AECOM (2015). Glyn Rhonwy Pumped Storage Development Consent Order 6.02 Environmental Statement Volume 2 Chapter 7 Ecology. October 2015.
- 4.1.2 Defra (2015). The Great Britain Invasive Non-native Species Strategy. August 2015.
- 4.1.3 Defra (2013). Environmental management – guidance Prevent harmful weeds and invasive non-native plants spreading. <https://www.gov.uk/japanese-knotweed-giant-hogweed-and-other-invasive-plant>
- 4.1.4 Edwards, C. (2006). Managing and controlling invasive rhododendron; Practice Guide. Forestry Commission, Edinburgh [online]. Available at: [http://www.forestry.gov.uk/PDF/fcpg017.pdf/\\$FILE/fcpg017.pdf](http://www.forestry.gov.uk/PDF/fcpg017.pdf/$FILE/fcpg017.pdf) (accessed 05/04/2016).
- 4.1.5 GB Non-Native Species Secretariat (2015). Nuttall's Waterweed, *Elodea nuttallii* factsheet. Available at: <http://www.nonnativespecies.org/factsheet/factsheet.cfm?speciesId=1304> (accessed April 2016)
- 4.1.6 Property Care Association (PCA) (2015). PCA Guidance Note – Management of Himalayan Balsam [online]. Available at: <http://www.property-care.org/wp-content/uploads/2014/12/PCA-Guidance-Note-on-Himalayan-Balsam-Control.pdf> (accessed 05/04/2016)

FIGURE 1: INNS LOCATIONS

APPENDIX A: HERBICIDE USE IN OR NEAR WATER

Prior to the application of herbicide in or near water (1 m from the top of the bank), approval must be granted in writing by the NRW. The 'AqHerb01: Agreement to use herbicides in or near water' form (<https://naturalresources.wales/media/1297/agreement-to-use-herbicides-aqherb01.doc>) must be filled in and sent to NRW (permitreceiptcentre@naturalresourceswales.gov.uk). NRW aims to deal with the application within two weeks. However in certain circumstances (for example extensive spraying, unusual or complex uses, or where we may need to consult Natural England for cross-border sites) the process may take longer.

All relevant Health and Safety protocols must be followed.

A herbicide must be used only in accordance with the directions on the product label. The user assumes the risk to persons or property that arises from any such use of herbicide products.

Any person involved in the professional application of herbicides in aquatic environments should possess the appropriate pesticides certificate of competence for the safe use of herbicide and hand-held herbicide applicators, e.g. NPTC Level 2 Award in the Safe Use of Pesticides (PA1 and PA6aw).

Only certain herbicides are approved for use in or near water, the most effective and least environmentally damaging being those based on the active ingredient Glyphosate.

Glyphosate based herbicides must be used and the adjuvant Topfilm must be added. All directions on the product labels must be followed.

Apply by foliar application to emergent and marginal growth.

Apply glyphosate at 6L product/ha mix with Topfilm at 1L product/ha.

For aquatic weeds, regular treatment is required over several years.

Plants shall be treated at least 3 times per year in April/May, June/July and September.

Monitoring and treatment of regrowth is critical (see species specific sections for further details).

APPENDIX B: HIMALAYAN BALSAM CONTROL OPTIONS

Small local infestations can be controlled reasonably easily.

Where the probability of re-infestation is high, e.g. the species is also present upstream from a site; a catchment level approach may be required to achieve long term control. Additionally, if the species is present on a neighbouring property within approximately 6m of the property boundary, seeds may be propelled back onto the site following local removal. An assessment of the re-infestation potential from the wider environment is critical. A single seed arriving on a site following control action could return the site to its original state rapidly. In the space of two years, one plant can become hundreds and then hundreds of plants can become thousands.

Due to the species preference for growth on riverbanks and in wet woodland, access can frequently be problematic. In such scenarios, control options may be limited (i.e. plants may not be accessible for hand pulling or herbicide treatment) and all appropriate health and safety precautions must be taken.

In order to control Himalayan balsam in situ it must be prevented from producing seeds until the seed bank is exhausted (i.e. no viable seeds remain in the soil). The existing plants can be killed relatively quickly by hand pulling, cutting the stem below the first node or by applying herbicide (see below for further details). As the seed bank is short lived (usually 18 months), two years of control action (taking place before plants set seed) should eradicate the species. Monitoring with follow up treatment, when necessary, should be maintained until at least one year has passed with no Himalayan balsam growth.

Control carried out after the plants have set seed is unlikely to have long-term benefits; in fact, spread will likely be facilitated by carrying out control action when seed pods are present and mature. If plants containing seeds must be removed, great care should be taken not to facilitate seed dispersal by triggering off the expulsion of seeds from the seed pods, e.g. the seed heads must be bagged.

Removal, or herbicide treatment, of plants that have already shed their seeds is pointless, as the plants will die at the end of the growing season regardless.

It is likely, particularly in the first year of control, that new plants will sprout following the initial removal/treatment, either because shade suppression will be reduced or due to soil disturbance. Accordingly, several additional visits will likely be required. Three visits, May/June, July/August and September/October should be sufficient to catch all regrowth. Plants that germinate after September/October are very unlikely to have sufficient time to complete their life cycle and produce seeds. However, this will depend on the control method chosen (see below) and weather conditions, so a cautionary approach is advisable.

If there is insufficient time to allow the seed bank to become exhausted, contaminated soil can be removed quickly by excavation. Arisings should be retained onsite (e.g. banded or buried) whenever possible and only disposed of offsite as a last resort. Disposal offsite is environmentally unsound and expensive.

Using a cheaper approach can be highly effective but would take several years.

The three stages for a control programme are:

- killing the growing plants to prevent any further seed production using one of the methods described below
- follow up monitoring in the same growing season to deal with any regrowth (e.g. post-cutting) or plants missed in the initial treatment
- physically remove the seed bank or undertake annual treatment of seedlings growing from the seed bank until it is completely destroyed.

In order of preference, Himalayan balsam should be controlled by:

- hand pulling
- cutting/trimming
- herbicide application
- onsite burial (or other methods relating to excavation and retention onsite)
- excavation and offsite disposal

Grazing (cattle and sheep) or mowing can also be effective, but are more suitable for containment rather than eradication.

Hand Pulling

Himalayan balsam can be easily hand pulled as the species has very shallow roots growing to a depth of 100 mm-150 mm. This method is particularly useful for smaller infestations and in high ecological value areas where the use of herbicides, or indiscriminate cutting, should be avoided. While hand pulling is time consuming, as other species can be easily avoided, the re-establishment of native vegetation should be facilitated by using this approach.

A gentle tug is usually enough to remove the entire root system. Multiple plants can be pulled simultaneously. Gloves should be worn to avoid injury, including stings from nettles which are often found growing beside Himalayan balsam.

Hand pulling should ideally commence in May/June when plants can be easily found/identified and they will not have set seed. However, it can be carried out sooner (although identification can be tricky) and there will typically be more plants, as numbers reduce with time due to competition.

Repeat treatments will likely be required over a period of 2 years.

Pulled plants should not be placed on soil or in damp areas as they can readily re-root. The plants can be allowed to dry out or be composted. Once dried, the remains can be left onsite as they reduce to small amounts, if fully desiccated and seedless, and they can then be disposed of as inert waste, or burnt,

Cutting/strimming

As with hand pulling, if the species is cut back prior to setting seed for two consecutive years, control should be achieved. In order to prevent vigorous regrowth, plant stems should be cut below the first node, which is often very close to ground level. Cutting below the first node will be much easier once the plants have reached approximately 500 mm in height in about May.

Compared to hand pulling, cutting/strimming will likely cause more collateral damage to other, potentially desirable, plant species.

Repeat treatments will likely be required over a period of 2 years.

Plant remains should be dealt with as above.

Mowing

As with cutting/strimming, if the species is mown for two consecutive years preventing seed production and seed setting, control can be achieved.

However, mowing is less likely to cut the stem below the first node than strimming and, accordingly, the potential for vigorous regrowth is increased. Consequently, mowing will likely require more treatments per year than strimming and/or hand pulling. Additionally, mowing will likely cause significant bushy regrowth and stimulate the growth of short seeding plants (due to cutting above the first node), increasing the potential of seeds persisting from year to year.

As with cutting/strimming, mowing will likely cause collateral damage to other, potentially desirable, plant species.

Grazing

Cattle and sheep have been observed to eat young Himalayan balsam. Grazing is unlikely to result in total control, but will likely reduce the density of the infestation and reduce the potential for range expansion.

Grazing could be of particular relevance in rural situations where there is no urgency to remove the Himalayan balsam straightaway and the area concerned is relatively large.

Herbicidal control

Where in situ physical removal is not feasible, potentially due to stand density/size or location/inaccessibility, the species can be successfully treated with herbicide.

Several herbicides have been shown to be effective at killing Himalayan balsam and often just one application is sufficient. Nevertheless, re-application in the same season should be planned for, as new growth from seed is likely.

Herbicide application should be carried out during periods of active growth, before flowering but late enough to ensure that germinating seedlings have grown up sufficiently to be adequately covered by the herbicide (500+mm would be suitable). The initial application should ideally be carried out in May/June with subsequent

treatments/monitoring likely being required in July/August and September/October, as above.

Herbicide application could be used as a follow up to hand pulling, e.g. later in the year to deal with any missed plants or regrowth from seed banks.

Due to Himalayan balsam's preference for habitats near water, this limits herbicide selection to products approved for use near water, e.g. glyphosate based herbicides and certain formulations of 2,4-D Amine.

The herbicide can be applied as a spot treatment to individual plants, using hand-held equipment, or as an overall spray using machine-mounted spray booms. In the latter instance, total weed control of all vegetation will occur, increasing the requirement for revegetation (see the Revegetation section below).

Where accessibility is problematic, e.g. river banks, a long lance sprayer is useful. Weed wiping reduces the risk of damaging surrounding vegetation but is only feasible for relatively small infestations.

Herbicide application will not kill seeds in the seed bank and monitoring with follow-up control must be repeated annually over 2-3 years to eradicate new plants growing in subsequent years, though the numbers decrease significantly from one year to the next (see Seed bank and dispersal section above).

For additional information on the use of herbicide to control invasive species see 'PCA Guidance Note on Japanese Knotweed Control: Guidance Notes for Herbicide Treatment'.

Excavation

Where immediate eradication is required, for example in a location that is shortly to be developed, the most appropriate solution is likely to be excavation.

Following excavation, if possible, contaminated soil should be retained onsite, e.g. stockpiled elsewhere on the site and regrowth treated as above. This stockpile area should be cordoned off from the rest of the site with appropriate signage put in place. Once control is achieved, the soil will be suitable for use as backfill or in landscaping.

If material is stockpiled, it is very important to monitor and carry out control prior to plants setting seed, or new areas of the site can be infested. Stockpiles should be at least 10 m from the property boundary.

Arising can also be buried. As per Defra (2013) guidance, soil containing Himalayan balsam seeds should be buried at a depth of at least 1 m. Burial at this depth is sufficient to prevent regrowth. Prior to the burial of invasive plant waste, the appropriate authority (e.g. the Environment Agency in England) must be contacted and approval granted. Himalayan balsam seeds do not contain sufficient energy reserves to allow them to germinate and grow up through hard substrates; accordingly, burial immediately beneath hardstanding (e.g. poured concrete) is appropriate.

Where offsite disposal is unavoidable, you should: 'Try to minimise the amount of waste you generate that contains invasive plants, or their seeds and rhizomes' (Defra, 2013). The Environment Agency will accept the removal of soil as controlled waste from Himalayan balsam infested areas less than the stated limits (6m from visible plants and down to 500 mm) if the methodology can be adequately justified. Any contaminated waste that is taken offsite must be taken by a licensed waste carrier and must go to a suitably authorised landfill site (as per the Environmental Protection Act).

An experienced ECoW should supervise excavation and disposal ensuring that the work is undertaken under controlled conditions and that appropriate health and safety measures are implemented.

Revegetation

Bare ground is often left following Himalayan balsam control. This exposes the soil to erosion, e.g. over winter and/or along a watercourse, and to re-invasion by Himalayan balsam and/or other undesirable plant species. The revegetation of such bare areas provides an opportunity to re-establish biodiverse habitat. A dense grass sward tends to discourage Himalayan balsam seed germination.

The nature of the revegetation will depend on the short, medium and long term objectives, e.g. rapid soil stabilisation along a river bank or reinstating an area of playfield. The use of residual herbicides could inhibit revegetation (e.g. of

broadleaved species); accordingly, the use of non-persistent herbicides will likely be more appropriate.