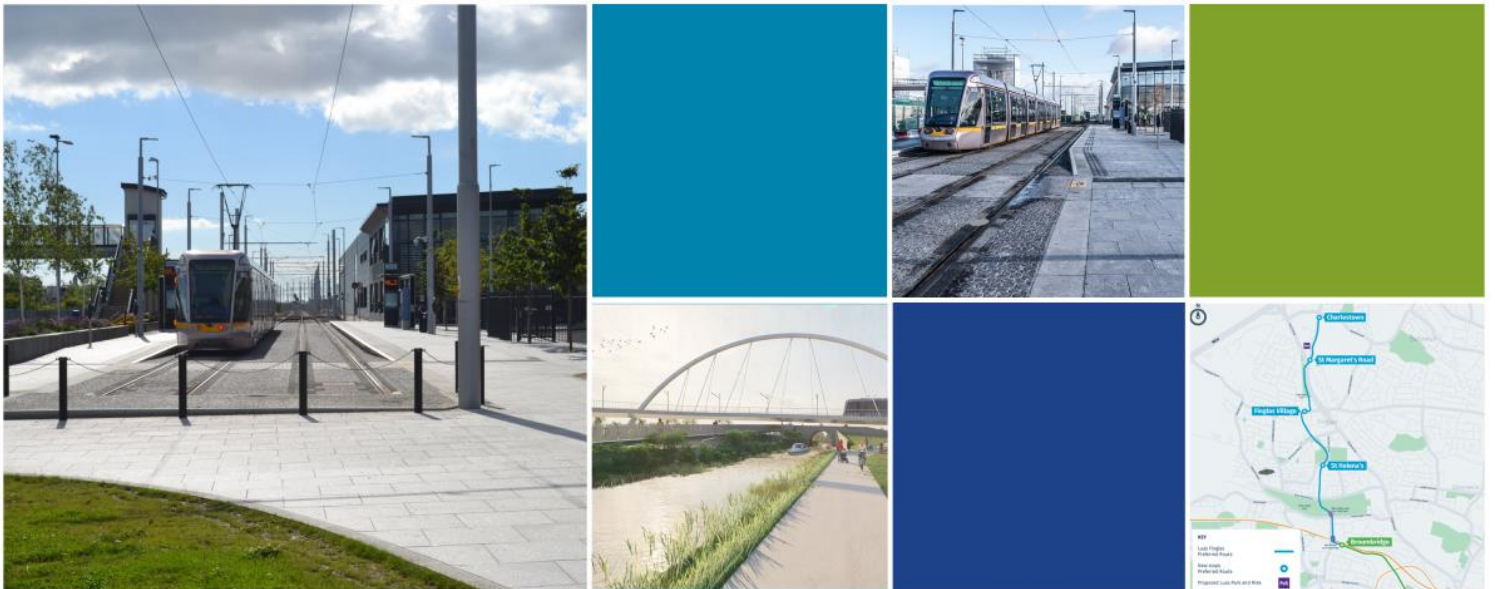


Luas Finglas

Environmental Impact Assessment Report 2024

Appendix A6.3: Invasive Species Management Plan

Luas Finglas Preliminary Design & Statutory Process



EIAR Appendix A6.3: Invasive Species Management Plan



Table of Contents

GLOSSARY OF FREQUENTLY USED TERMS	iii
Section 1: INVASIVE SPECIES MANAGEMENT PLAN	4
1.1 Introduction	4
1.1.1 Legislative Context.....	4
1.1.2 Limitations	5
1.2 Methodology	5
1.2.1 Guidance.....	5
1.2.2 Surveys	5
1.3 Results 6	
1.4 General Measures to Control and Prevent the Spread of Non-Native Invasive Plan Species 6	
1.4.1 Pre-construction Survey.....	6
1.4.2 General Measures to Avoid the Spread of INNS	8
1.4.3 Post-construction Monitoring	11
1.5 Assessment of Management Options for Third Schedule Non-native Invasive Species.....	11
1.5.1 Selected Management Controls	11
1.5.2 Japanese knotweed (<i>Reynoutria japonica</i>).....	11
1.5.3 Giant hogweed (<i>Heracleum mantegazzianum</i>)	13
1.5.4 Himalayan balsam (<i>Impatiens glandulifera</i>).....	15
1.6 References.....	17

List of Figures

Figure 1-1: INNS Recorded from Surveys.....	7
---	---

List of Tables

Table A6 3.1: INNS Recorded Within or Adjacent to the proposed Scheme's Boundary	6
Table A6 3.2: Assessment of Management Methods for Japanese Knotweed	12
Table A6 3.3: Assessment of Management Methods for Giant hogweed	14
Table A6 3.4: Assessment of Management Methods for Himalayan Balsam	15

GLOSSARY OF FREQUENTLY USED TERMS

Acronym	Term
BCI	Bat Conservation Ireland
BCT	Bat Conservation Trust
BoCCI	Birds of Conservation Concern in Ireland
BWI	BirdWatch Ireland
BSBI	Botanical Society of Britain & Ireland
CIEEM	Chartered Institute of Ecology and Environmental Management
CSZ	Core Sustenance Zone
DCC	Dublin City Council
ECoW	Ecological Clerks of Works
EEA	European Economic Area
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
FCC	Fingal County Council
IAS	Invasive alien species
INNS	Invasive non-native species
IUCN	International Union for Conservation of Nature
KER	Key ecological receptor
NBDC	National Biodiversity Data Centre
NHA	Natural Heritage Area
NPWS	National Parks and Wildlife Service
NTA	National Transport Authority
OCS	Overhead Catenary System
OPR	Office of Planning Regulator
pNHA	Proposed Natural Heritage Areas
QI	Qualifying Interest
RO	Railway Order
SAAO	Special Amenity Area Order
SAC	Special Area of Conservation
SPA	Special Protection Area
SSRS	Small Steam Risk Score
TII	Transport Infrastructure Ireland
WFD	Water Framework Directive
ZoI	Zone of Influence

Section 1: INVASIVE SPECIES MANAGEMENT PLAN

1.1 Introduction

This document is the Invasive Species Management Plan (ISMP) for the Luas Finglas Scheme, hereafter referred to as the proposed Scheme.

The ISMP will be updated by Transport Infrastructure Ireland (TII) (the Employer for the construction works) prior to the commencement of the Construction Phase, so as to ensure that any additional measures required pursuant to conditions attached to any decision to grant approval are included in the plan. The TII shall set out the Employer's Requirements in the construction contracts including all applicable mitigation measures identified in this EIAR, as well as additional measures required pursuant to conditions attached to any decision to grant approval.

The ISMP comprises the construction mitigation measures, which are set out in the Environmental Impact Assessment Report (EIAR) and the Natura Impact Statement (NIS) and will be updated to include any additional measures required pursuant to conditions attached to An Bord Pleanála's decision.

Following appointment, the contractor(s) will be required to develop more specific Method Statements and submit an updated ISMP that is cognisant of the proposed construction activities, equipment and plant usage and environmental monitoring plan for the proposed Scheme. The appointed contractor(s) may only propose modifications to the ISMP which will not give rise to any impacts which are more significant than those already identified and assessed in the EIAR or NIS.

All of the measures set out in this ISMP will be implemented in full by the appointed contractor(s) and its finalisation will not affect the robustness and adequacy of the information presented and relied upon in the EIAR and NIS.

1.1.1 Legislative Context

The Birds and Natural Habitats Regulations 2011 (S.I No. 447/2011) contain specific provisions that govern control of listed invasive species. It is an offence to release or allow to disperse or escape, to breed, propagate, import, transport, sell or advertise species listed on the Third Schedule of the Birds and Natural Habitats Regulations without a Licence.

The two regulations that deal specifically with this scheduled list of species are:

- Regulation 49: Prohibition of introduction and dispersal of certain species; and
- Regulation 50: Prohibition on dealing in and keeping certain species.

Following on from that, the following are strictly prohibited:

- Dumping invasive species cuttings anywhere other than in facilities licensed to accept them;
- Planting or otherwise causing to grow in the wild - hence the landowner (in respect of the proposed Scheme, this being the NTA and the appointed contractor) should be careful not to cause further spread;
- Disposing of invasive species at a landfill site without first informing the landfill site (that is licensed under Number 10 of 1996 - Waste Management Act, 1996 (as amended) (hereafter referred to as the Waste Management Act, as amended) to take such Third Schedule material (plant or soil) that the waste contains invasive species material (this action requires an appropriate licence);
- Moving soil which contains Third Schedule-specific non-native invasive species in the Republic of Ireland, unless under licence from the National Parks and Wildlife Service (NPWS) (this licence is separate from and does not discharge any person being in receipt of other necessary waste permits/licences etc.); and
- Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species (hereafter

referred to as the IAS Regulation) lists specific Species of Union Concern, some of which overlap with the Third Schedule species.

The IAS Regulation conveys the rules to prevent, minimise and mitigate the adverse impacts of the introduction and spread (both with and without intention) of IAS on biodiversity and the related ecosystem services, as well as other adverse impacts on human health or the economy. Target 4.4 of Ireland's third National Biodiversity Action Plan 2017-2021 (Department of Culture, Heritage and the Gaeltacht, 2017) requires that '*harmful invasive alien species are controlled and there is reduced risk of introduction and / or spread of new species*'.

1.1.2 Limitations

It should be noted that any decision on efficacy of chemical treatments can only be provided by a registered pesticides advisor. A suitably-qualified specialist will be engaged by the appointed contractor to monitor the treatment of non-native invasive species. This ISMP shall be updated as necessary by the specialist.

1.2 Methodology

1.2.1 Guidance

The mitigation measures for invasive non-native species (INNS) will utilise the below best practice management guidance documents, where relevant:

- The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (TII, 2020a);
- The Management of Invasive Alien Plant Species on National Roads – Standard (TII, 2020b);
- Invasive Species Ireland (ISI) - Best Practice Management Guidelines for Japanese Knotweed (ISI, 2008a);
- Invasive Species Ireland Invasive Species Ireland - Best Practice Management Guidelines for Giant Hogweed (ISI, 2008c); and - Best Practice Management Guidelines for Himalayan Balsam (ISI, 2008b);
- Inland Fisheries Ireland - Biosecurity Protocol for Field Survey Work (IFI, 2010)
- Managing Invasive Non-Native Plants in or near Freshwater (EA 2010);
- Invasive Species Ireland (ISI) Best Practice Management Guidelines for Japanese knotweed (ISI 2008a);
- Best Practice Management Guidelines for Himalayan balsam (ISI 2008b);
- Best Practice Management Guidelines for Giant hogweed (ISI 2008c); and
- *The Environment Agency (EA) Managing Japanese knotweed on development sites - the Knotweed Code of Practice* (Version 3, amended in 2013, withdrawn from online publication in 2016) (EA 2013) (This document, although no longer supported by the EA, is nonetheless a practical document in determining the approach and control mechanisms for Japanese knotweed).

1.2.2 Surveys

Three invasive species surveys have been undertaken to date between 2021 and 2023 to determine and record coverage within the study area of the proposed Scheme. Refer to Chapter 9 (Biodiversity) in relation to the surveys undertaken.

1.3 Results

In summary, the surveys included the identification of species listed in Table A6.3-1 below.

Table A6 3.1: INNS Recorded Within or Adjacent to the proposed Scheme's Boundary

Invasive Non-Native Species	Impact	Regulation S.I. 477/2011
Canadian Waterweed <i>Elodea canadensis</i>	High	Yes
Nuttall's Waterweed <i>Elodea nuttallii</i>	High	Yes
Himalayan Balsam <i>Impatiens glandulifera</i>	High	Yes
Japanese Knotweed <i>Reynoutria japonica</i>	High	Yes
Giant Hogweed <i>Heracleum mantegazzianum</i> (Located upstream of Tolka Valley Park bridge, the presence of seeds deposited within the riverbanks by the bridge must be considered)	High	Yes
Sycamore <i>Acer pseudoplatanus</i>	Medium	No
Cherry Laurel <i>Prunus laurocerasus</i>	High	No
Butterfly-bush <i>Buddleja davidii</i>	Medium	No

Two species of INNS recorded inside the boundary during the INNS survey of the proposed Scheme, namely Himalayan Balsam and Japanese knotweed. The onsite presence of potentially undiscovered Giant hogweed cannot be ruled out due to observation of the INNS upstream Tolka Valley Park Luas bridge; as such, these species will be the focus of biosecurity measures going forward.

Of these species, the Japanese knotweed and Giant hogweed boast salinity tolerances which may allow them to colonise saltmarsh habitats, and therefore pose a threat to the Dublin Bay Natura 2000 sites. As the Japanese Knotweed along the River Tolka will need to be removed to allow for the installation of the new bridge in this area, it is the most likely invasive species to be accidentally spread downstream into the Natura 2000 sites.

It is recognised that other non-native invasive species, not listed in the Third Schedule, can and do occur within the footprint of the proposed Scheme and the wider metropolitan surrounds of Dublin. These are not ordinarily dealt within an ISMP, and there is separate legislation and guidance for the control of noxious weeds e.g., Noxious Weeds Act 1936 – No. 38 of 1936 and Noxious Weeds (Thistle, Ragwort and Dock) Order 1937 – S.I. No. 103 of 1937. Species such as Butterfly bush *Buddleia davidii* can quickly become established and spread in suitable urban areas, including gaps in the built environment such as the sides of old buildings, pavements, and on derelict ground. Where large populations occur, it may be a requirement of some local authorities within the Greater Dublin Area that they be managed to ensure no excessive spread e.g., Dublin City Council (DCC). The implementation of the general measures provided in Section 1.4 will minimise the risk of any spread of these species as a result of the construction of the proposed Scheme.

1.4 General Measures to Control and Prevent the Spread of Non-Native Invasive Plan Species

1.4.1 Pre-construction Survey

An updated invasive species baseline survey as outlined in the Biodiversity chapter of the accompanying EIAR, shall be conducted prior to the commencement of the development's enabling works. This updated baseline is required as invasive species may have continued to spread within and adjacent to the proposed Scheme since the last invasive species or habitat survey was conducted on-site.

As per TII guidance (TII, 2020a), this additional invasive species survey will include detailed maps of the precise location of each individual invasive species plant, as well as photos of these specific locations.

During the interim between the original non-native invasive species surveys and the commencement of construction following grant of planning permission, it is possible that the existing stands of Third Schedule non-native invasive species may have expanded (if unmanaged) or decreased (if there is an active management regime in place), or that newly established Third Schedule non-native invasive species may have become established within the footprint of the proposed Scheme. A confirmatory pre-construction invasive species survey will be undertaken by a suitably qualified specialist, arranged by the contractor(s), to confirm the absence, presence and / or extent of all Third Schedule non-native invasive species within the footprint of the proposed Scheme. Where an infestation is confirmed / identified within the footprint of the proposed Scheme, this will require the implementation of the final ISMP.

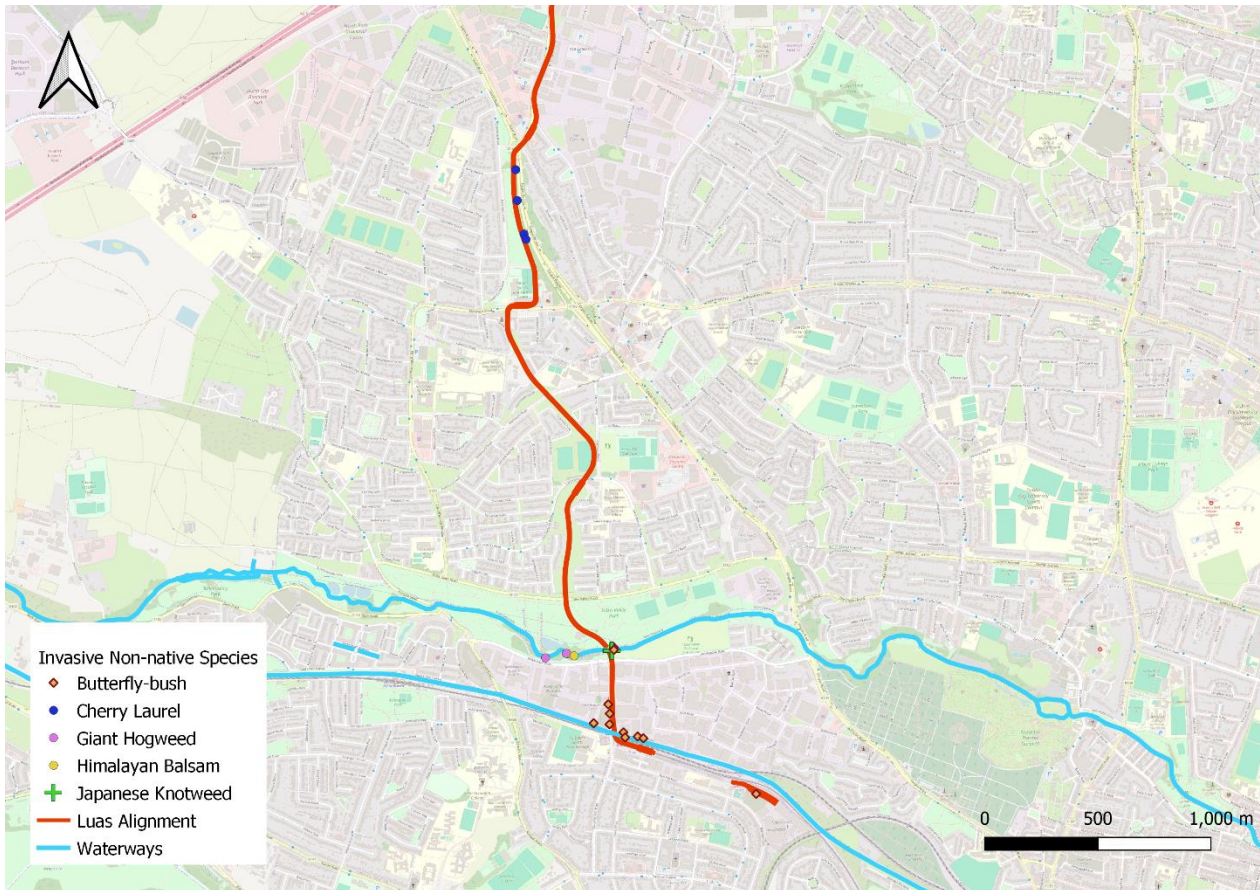


Figure 1-1: INNS Recorded from Surveys

Figure 1-1 shows the recorded INNS found on or around the site through several surveys conducted in lead up to the start of the project.

1.4.1.1 Final Invasive Species Management Plan (ISMP)

Following appointment, the contractor(s) will be required to develop more specific Method Statements and submit an updated ISMP that is cognisant of the proposed construction activities, equipment and plant usage and environmental monitoring plan for the proposed Scheme. The updated ISMP is referred to as the 'final ISMP' in this document. The appointed contractor(s) may only propose modifications to the ISMP which will not give rise to any impacts which are more significant than those already identified and assessed in the EIAR or NIS.

All of the measures set out in this ISMP will be implemented in full by the appointed contractor(s) and its finalisation will not affect the robustness and adequacy of the information presented and relied upon in the EIAR and NIS.

The ISMP will be updated following the pre-construction invasive species survey to detail the exact measures for any non-native invasive species population present within the footprint of the proposed Scheme. Depending on the extent and nature of the works, a number of approaches / treatments may be approved, all following the measures in the ISMP.

All control measures specified in the final ISMP shall be implemented by a suitably qualified and licenced specialist prior to the Construction Phase of the proposed Scheme to control the spread of any newly established INNS within the footprint of the proposed Scheme. Furthermore, the appointed contractor will adhere to control measures specified within the final ISMP throughout the Construction Phase of the proposed Scheme. The Site will be monitored by the appointed contractor after control measures have been implemented. Any re-growth will be subsequently treated by the contractor. All measures that are prescribed in the final ISMP shall be equally applicable to advance works as to construction works.

1.4.2 General Measures to Avoid the Spread of INNS

The unintentional spread of INNS during construction works (within the proposed Scheme, originating from outside the proposed Scheme, such as through the importation of materials, poor biosecurity practices regarding plant and machinery or natural processes) can be a significant issue, and if not managed properly, can result in the spread of non-native invasive species to uninfested areas (within or adjacent to works areas). This would increase the future cost and effort required to control the species and could pose further public health and safety risks (Japanese knotweed can cause damage to weaknesses in built environment, whilst Giant hogweed is an environmental public health hazard).

Listed below is a brief detailing of necessary measures to be undertaken to ensure biosecurity within this section of the development, all of which will need to be included within the proposed Scheme ISMP:

- The adherence to a set of biosecurity measures, including:
 - the fencing off / demarcating of the individual invasive species;
 - communicating the location, risk and hazards associated with invasive species to construction personnel (e.g., Giant hogweed);
 - identifying dedicated access points into and out of fenced-off areas;
 - the installation of designated decontamination facilities (where appropriate);
 - protocols around the removal of contaminated soils; and
 - seed and fragment checks on boot, tyres and tracks entering and leaving the work site.
- Best practice measures for the treatment of soils contaminated with invasive species (including potential seeds and fragments of mature plants) to prevent the accidental spread of INNS;
- As required by law, licences for the disposal of contaminated materials will be obtained, as well as the utilisation of licensed facilities;
- In regard to the importation of soil and other materials, the principal contractor will only utilise traceable topsoil for landscaping that has been cleared of any invasive species material; and
- Measures to be implemented during the application of herbicides – Commitment to the appointment of a suitably qualified/registered/licensed pesticides advisor for any works requiring the use of pesticides, and safety precautions for consideration in the use of pesticides near watercourses.

Areas which contained invasives species, where invasives were treated on-site or removed, prior to the enabling and construction works will require an on-going post-construction monitoring programme to ensure that there is no reestablishment of any invasive species within these areas.

1.4.2.1 Biosecurity Mitigations

Prior to commencement of the enabling works in the Tolka valley Park area, a series of biosecurity measures will have to be undertaken to prevent spread of invasive species, namely Japanese knotweed, Himalayan Balsam and potentially undiscovered Giant hogweed. Japanese knotweed is present along the southern bank of the River Tolka, within immediate vicinity of the proposed bridge's southern abutment. Himalayan balsam is present on both banks but closer to the water's edge and not in the immediate vicinity of the works.

There is the potential for Giant hogweed seeds to be present in both banks. While not listed on Third Schedule list of the European Communities (Birds and Natural Habitats) Regulations 2011 [S.I.477/2011], the invasive Butterfly-bush present in this area should also be removed in the interest of the site's native floral composition.

Unwashed construction equipment, plant and vehicles, and footwear can provide a vector for the spread of non-native invasive species within the proposed Scheme and from areas outside the scheme where INNS are present or where vector material potentially containing seed / root material is attached to plant or personnel. The following hygiene measures shall be undertaken for the proposed Scheme.

- Known or potentially infested areas within the working area of the proposed Scheme shall be clearly demarcated and fenced off in advance of works and access restricted until such time that treatment has commenced and / or construction works are monitored in accordance with the ISMP in the area. In relation to Japanese knotweed, the guidance recommends an exclusion buffer of 7m (metres) in all directions (within the works area and 3m vertically underground);
- The implementation of clear signage in accordance with TII IAPS standards will be erected at compounds, and at the boundary of the exclusion fencing. These signs will be briefed out at toolbox talks specific to each INNS to personnel on site and particular attention will be given to INNS that have the potential to cause injuries such as Giant hogweed.
- Identify and create access points into exclusion areas for INNS. These are only to be used by specialist personnel for the removal of INNS and are not to be used by general site workers until such a time as all contaminated material has been removed from site and it is safe to enter.
- Where it is practicable, a wheel wash and footwear washing facilities will be provided to ensure biosecurity measure are preventing the further potential spread of INNS. These locations are to be provided by the contractor. Where a dedicated / bespoke wheel wash cannot be installed owing to space limitations, the appointed contractor will ensure that no excavated loose material is allowed off site from within an exclusion zone.
- Where plant that is used to excavate soils, it shall be visually checked for loose soil before movement to another part of site (where possible, the movements of tracked machinery should be restricted within the non-native invasive species exclusion zone). Loose soil shall be scraped off and disposed of, and a solution of Virkon© (or similar approved disinfectant) applied to machinery to ensure that no obscured seed / root material remains viable. Vehicular movements within the exclusion area shall be minimised as far as is practical;
- Unless in the exceptional circumstance that direction is given from a suitably qualified ecologist, no storage of contaminated soil on site. Instead, being disposed of in a licenced soil waste facility.
- Where small volumes (e.g. volumes capable of being double bagged in quarantine bags such as cut plants, bulbs or loose soil occur), it may be practical to bag the material and bring it to a clearly demarcated and dedicated quarantine area within the Construction Compounds until such time that the material is disposed of to an authorised facility, similar to the process of disposing of bulk excavated infected soil.

1.4.2.2 Soil Excavation

No excavation or removal of soil within areas demarcated as having INNS present is to be permitted unless under strict supervision by a suitably qualified ecologist or INNS specialist. Buffer zones to be installed by the contractor(s) will be advised by a suitably qualified ecologist or INNS specialist and strictly adhered to. Guidance regarding Japanese knotweed recommends a buffer of 7m from the plant due to its expansive rhizomes.

Where mechanical means of removal are required to dispose of INNS (treated or un-treated by chemicals) a suitably qualified ecologist or INNS specialist will be present to supervise and provide support to the contractor(s) for the duration of the operation.

There should be no temporary storage on-site of bulk excavated infected material. Where the final ISMP calls for shallow / deep burial, this material shall be removed from the excavated area and transported

immediately to approved receptor area on-site. Furthermore, the temporary storage of uninfected material should not occur within a European or National designated site nor within 10m of any watercourse and any land within an identified flood zone.

Plant and machinery used in the control, excavation and transport of infected material shall also be subject to the recommendations described in Section 1.4.2.2.

The installation of industry-rated non-native invasive species-proof membrane before infilling construction of road / paths surface may be required. All waste arising out of this process which has been in contact with the excavated ground shall be treated as infected waste and disposed of at a facility that is authorised to accept such waste (See Section 1.4.2.3).

Where the movement of any Third Schedule non-native invasive species is required off site, a licence will be required from NPWS in advance of any movement to a site / facility licensed to accept such waste, as per the Birds and Natural Habitats Regulation. This licence is separate to and does not negate the need for licences / permits / authorisations required under waste legislation.

1.4.2.3 Disposal of Material

Where any INNS related material is collected and is required to be disposed of, it is essential to dispose of said material in a manner that does not afford it the potential to spread further either within the proposed Scheme or in the nearby vicinity of Site.

The movement of invasive plant material, off site, requires a licence from the NPWS, as per the Birds and Natural Habitats Regulations. Invasive species (particularly roots, flower heads or seeds) must be disposed of at licensed waste facilities or composting sites, appropriately buried, or incinerated having regard to relevant legislation (e.g. Waste Management Act, as amended, Section 4 of Number 6 of 1987 - Air Pollution Act, 1987, relevant local authority bylaws and any other relevant legislation). All disposals must be carried out in accordance with the relevant waste management legislation, as per guidance Guidelines for the Management of Waste from National Road Construction Projects (TII 2017).

It should be noted that some invasive species plant material or soil (vector material) containing residual herbicides may be classified as either 'hazardous waste' or 'non-hazardous waste' under the terms of the Waste Management Act, as amended, and both categories may require special disposal procedures or permissions. Advice should be sought from a suitably qualified waste expert regarding the classification of waste and the suitability of different disposal measures.

1.4.2.4 Measures to be Implemented During the Application of Herbicides

If the application of herbicides is the expert advice given and then implemented during the lifespan of the proposed Scheme then a suitably qualified pesticides advisor, registered with the Department of Agriculture, Food and the Marine must be employed.

The appointed contractor is required to refer to the appropriate guidance documents, including but not limited to those listed in Section 1.4.2.1 & 1.4.2, which provide detailed recommendations for the control of invasive species and noxious weeds. The appointed contractor (or specialist license holder) will update the final ISMP in accordance with current and relevant guidelines before commencing works.

It should be noted that where a chemical treatment is to be used, there is a risk of contaminating a watercourse. The choice of herbicide is typically limited to formulations of Glyphosate or 2,4-D amine that are approved for use near water. Full details of any chemical used, where required and as advised by a registered pesticides advisor, will be included in the final ISMP prepared in advance of construction of the proposed Scheme.

1.4.3 Post-construction Monitoring

Following the construction of the proposed Scheme, there may be ongoing treatment programmes which extend for a number of years into the Operational Phase. In the Operational Phase, the management of the infrastructure will be the responsibility of the local authority and the control of invasive species will be as per their plans and procedures, and responsibilities under The Birds and Natural Habitats Regulations.

The above measures are important for all Third Schedule non-native invasive species, and in particular Japanese knotweed, where it occurs, as maintenance works associated with landscaping, such as mowing and hedge cutting have the potential to spread this plant via the dispersal of very small amounts of shredded plant material.

If invasive plants are found, then they shall be treated as per the measures outlined in the ISMP and any species-specific guidelines.

1.5 Assessment of Management Options for Third Schedule Non-native Invasive Species

The general measures included in the sections above are required to ensure good on-site practices in respect of known or potential Third Schedule non-native invasive species as per Regulations 2011 [S.I.477/2011],

The following sections further identify practical management controls. It is acknowledged that more than one potential control measure exists and that a single or combination of measures may be required.

The recommendations presented in this ISMP provide the minimum requirements for the likely control measures and the measures outlined in this ISMP shall be developed (with further detail on methodology used at each location, timing, practical management etc.) by the appointed contractor(s) (or the specialist as appropriate) by way of producing and implementing the final ISMP.

The use of chemical treatments is recognised as a potential treatment option. However, the services of a registered herbicide advisor must be employed in the specifying named chemicals including those rated for use adjacent to aquatic environments where required, treatment type, dosage, and timing etc., and / or use of pesticides in the management of potential Third Schedule non-native invasive species within the proposed Scheme.

1.5.1 Selected Management Controls

The selected management control to be defined for each non-native invasive species stand within the proposed Scheme will depend on:

- Results of the pre-construction survey;
- Construction requirements – timing of works at specific locations, level of infestation and practical considerations such as reducing disturbance to road users / homeowners; and
- Feasibility of control measure, where possible the most practicable method (with regards to the environmental impact and human health) will be used eg; if mechanical methods of removal are not feasible due to access. Then a step back and assess approach will be employed to remove INNS.

The ISMP, which will be updated (in the form of the final ISMP) following on from the pre-construction surveys, may require the utilisation of a number of controls that are described below.

1.5.2 Japanese knotweed (*Reynoutria japonica*).

Japanese knotweed is a high impact non-native invasive species that is particularly effective at colonising disturbed ground (e.g. construction sites) and can spread by the re-growth of cut fragments or root material. Therefore, if it is broken up during site clearance or other earthworks, it can readily re-grow in new areas to which contaminated soil is moved. Japanese knotweed reproduces asexually (in Ireland insofar as only

Female plants have been recorded) and regrowth can occur from plant material weighing as little as 0.7g (grams) of viable material. It is acknowledged to be very difficult to effectively control and an even more difficult to fully eradicate.

Given the nature of Japanese knotweed, chemical treatments are often preferred over physical methods as they can, if implemented properly, reduce the disturbance of the plant / population, thus reducing the chances of its spread. If herbicide is applied as the treatment option, it will need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective or monitored for a minimum of two years during which no regrowth is recorded. However physical removal may be necessitated when timely interventions are required.

Table A6 3.2 assessed the potential management methods for Japanese Knotweed with colour coding of the potential to implement on the proposed Scheme. The methods to be used will be fully detailed in the Contractors ISMP after the recommended pre-construction survey of the proposed Scheme have been undertaken.

Table A6 3.2: Assessment of Management Methods for Japanese Knotweed

Approach	Treatment options	Comment	Potential for Implementation on the proposed Scheme
Physical	Dig and dispose offsite, under licence	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorized to accept it. In addition to waste permits / authorizations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species offsite. Depending on the nature of the excavation the proximity of services etc, the use of root barrier membrane could be required.	Likely – given the nature of the scheme, there may be a need to excavate soil and plant material to enable construction works to go ahead in timely manner.
	Dig and dispose onsite. - Shallow burial - Deep burial	A wildlife licence from NPWS is not ordinarily required if the burial of collected material is proposed for within the consented proposed Scheme. Shallow burial in a constructed pit such as a dedicated sealed cell within a constructed berm will allow for periodic monitoring and of easy chemical treatment of any regrowth. Deep burial entails a dedicated sealed cell within a constructed excavation, that is at least 2m below the surface of the ground. The landscaping regime should not specify trees or scrub to be planted above. Either shallow or deep option could require the use of root barrier membrane. The use of chemical pretreatment of deep / shallow cells could also be required.	Unlikely – given the lack of suitable lands within the largely developed metropolitan area.
	Screen on site – remove fragments offsite and reuse soil.	A control option that can be used to reduce the volume of soil / sediment to be moved elsewhere for burial, this option requires suitable plant, adequate space and volumes of soil to make the operation at a location cost effective. This option often requires the use of root barrier membrane owing to reuse of screened soil. The use of chemical pre-treatment of deep / shallow cells could also be required.	Possible but unlikely given the space requirements for a screener (unless a bespoke small-scale screener is available).
	Cutting and / or strimming	Not recommended and does not apparently diminish vigour of plants over time. Largely cosmetic and can result in considerable spread of	Not Recommended.

Approach	Treatment options	Comment	Potential for Implementation on the proposed Scheme
		viable vegetative material that can readily regenerate on suitable conditions.	
Chemical	Spot	Used for isolated plants – knapsack or weep sprayers. Chemical treatments for infestations near water should be rated for use near aquatic locations.	Chemical treatments are often a preferred option for treating Japanese knotweed, but the process can take between 3 to 5 years before eradication can be guaranteed and requires at least 2-year post implementation monitoring. However, given the nature of the proposed Scheme, the use of chemical treatment alone is unlikely to be adequate unless treatment regime begins a number of years before construction commencement.
	Spray/Stem Injection	Used for isolated plants or large populations using knapsack or weep sprayers. In accessible areas including along riverbanks, lance sprayers can be used. Chemical treatments for infestations near water should be rated for use at or near aquatic locations. Can result in chemical drift. Stem Injection is considered very effective, if the injection is timed appropriately for growth phase. However, it is labour-intensive (sometimes) requiring some cutting and is usually only carried out on small / isolated populations. Chemical treatments for infestations near water should be rated for use at or near aquatic locations.	

1.5.2.1 Root Barrier Membrane

Following the excavation of Japanese knotweed, there may be a need to install a root barrier membrane. These are specialised products that can provide protection to structures / services etc. from regrowth from within or outside a site, if suitably rated and properly installed. Thereafter, any small adjacent infestation can be more readily treated with chemical treatment for example. This durable material can be used to line spoil pits and prevent rhizome lateral root spread or effective growth in the plant and can keep it contained to an area where suitable chemical treatment can be undertaken.

1.5.2.2 Reseeding Following Eradication

This is not strictly a control method. However, where treated ground is not being built upon, planting or resowing mixtures of native grass species helps to restore the original vegetation and aids post-control management of affected sites. A grass sward established in autumn will compete with germinating Japanese knotweed seedlings in the following spring.

1.5.3 Giant hogweed (*Heracleum mantegazzianum*)

This is a high-risk invasive species, that is also a biohazard in that it can pose a threat to humans. The chemistry of its sap is such that exposure to it on skin can result in prolonged photosensitizing reactions with blistering.

Thus, a clearly demarcated exclusion buffer, in excess of 4m, is recommend for any individual / populations of this species before commencing works.

It spreads via heavy seeds which can easily be transported by water. Hence, it is often found along river corridors. While the plant favours riverbanks, it is known to be found on waste / derelict ground as well as railway lines for instance. Its presence can impact local biodiversity and undermine bankside integrity. The seedling stage is the most vulnerable. Mortality of seedlings is comparable to many other plants and its seed bank is considered to be persistent for a short number of years only. Since Giant hogweed can only reproduce via seed, control measures applied before flowering and fruit set will limit subsequent generations (and even then, only with favourable conditions). The ideal time to control Giant hogweed via chemical treatment is April, with follow on monthly applications targeting regrowth, although for this treatment options, it can require up to five years before successful eradication.

Table A6 3.3 assessed the potential management methods for Giant Hogweed with colour coding of the potential to implement on the proposed Scheme. The potential treatment option is to be fully detailed in the contractor’s ISMP for the treatment of Giant hogweed.

Table A6 3.3: Assessment of Management Methods for Giant hogweed

Approach	Treatment options	Comment	Potential for Implementation on the proposed Scheme
Physical	Dig and dispose offsite, under licence	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorized to accept it. Given the phytotoxic nature of the plant, it should not be buried onsite nor disposed of with general Construction and Demolition waste. In addition to waste permits / authorisations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species offsite.	Possible and may be required.
	Above ground cutting	Not recommended. Largely cosmetic and prolongs flowering until such time that control halted. However, if digging is used, it is recommended that the removal be attempted in April / early May when the plant is usually less than 30cm tall. However, the root must be captured also.	Unlikely - requires specialist equipment to enable working alongside the biohazardous plant
	Root Cutting	Individual plants may be killed by cutting at a 45-degree angle 15cm below ground level with a spade in April or May. Can be laborious unless small/isolated stands. Can be effective if combined with chemical treatment over 4-5 years repeat treatment.	Given the nature of the proposed Scheme, could be used to remove biohazard plant and thereafter allow for chemical control against any regrowth. Requires specialist equipment to enable working alongside the biohazardous plant.
	Pulling	Hand pulling is only suitable for small / immature plants (and with suitable PPE to protect exposure of bare skin). Potential remains for tap root to remain underground and regenerate. Recommended in April - May	Unlikely for mature plants. Requires specialist equipment to enable working alongside the biohazardous small / immature plants.
	Strimming/Grazing	Not recommended owing to spread of sap.	Not recommended or practical given the nature of the river and metropolitan landscape and nature of the proposed Scheme.
Chemical	Spot	Used for isolated plants – knapsack or weep sprayers. Chemical treatments for infestations near water should be rated for use near aquatic locations.	Most widely used method, but to be wholly effective, requires total control over ~5 years of treatments within a river catchment or the isolated location. Is weather dependent and can result in chemical drift to adjacent vegetation or watercourses.
	Spray/Stem Injection	More suitable for large stands, where machine-mounted blanket sprays are used. Chemical	Possible but unlikely owing to nature and size of population

Approach	Treatment options	Comment	Potential for Implementation on the proposed Scheme
		treatments for infestations near water should be rated for use near aquatic locations. Stem Injection can only be carried out on young stems. Due to difficulties with the timing of application and the potential safety risk of contact with the large leaves this method requires specialist safety equipment.	recorded on proposed Scheme.

1.5.3.1 Temporary Storage of Collected Material

Given the phytotoxic nature of Giant hogweed, cut material should not be discarded. Ideally it should be disposed of immediately with similar non-native invasive species waste to a facility authorised to accept such waste. However, given the nature and relative sizes of Giant hogweed infestations, it may be suitable to collect cut biomass (where not disposed of immediately to a facility authorised to accept such waste), and to double bag it for transport to a dedicated quarantine area (location to be approved as part of the ISMP) to decompose before disposal with similar non-native invasive species waste in a facility authorised to accept such waste. The locations of areas for which Giant hogweed has been eradicated should be notified to the local authority, so that any future public health issue involving similar symptoms can be tracked.

1.5.3.2 Reseeding Following Eradication

This is not strictly a control method. However, where treated ground is not being built upon, planting or resowing mixtures of native grass species helps to restore the original vegetation and aids post-control management of affected sites. A grass sward established in autumn will compete with germinating Giant hogweed seedlings in the following spring and retard its establishment.

1.5.4 Himalayan balsam (*Impatiens glandulifera*)

This high-risk invasive species is easily disturbed, particularly if in flower and readily becomes re-established along riparian corridors, which are annually subject to alluvial flooding. Unlike Japanese knotweed though, it does not reproduce asexually. Plants can produce in excess of 6,000 seeds, and it aggressively colonises bare ground along riverbanks, including wet woodlands, as well as waste ground where suitable conditions exist. Due to its rapid growth, it can outcompete most native species. While its seedbanks are viable for up to 18 months, the resupply of seed is often achieved through annual river flooding and riparian inundation with freshly deposited soil-laden alluvium.

Table A6 3.4 assessed the potential management methods for Himalayan Balsam with colour coding of the potential to implement on the proposed Scheme. The potential treatment options available for the treatment of Himalayan balsam should aim to prevent flowering and are therefore shall be undertaken before June. However, eradication may take up to five years. It should be noted that successful localised management of Himalayan balsam is difficult along watercourses, as the spread of this non-native invasive species from upstream areas (e.g. outside of the proposed Scheme) onto bare ground often occurs after winter flooding.

Table A6 3.4: Assessment of Management Methods for Himalayan Balsam

Approach	Treatment options	Comment	Potential for Implementation on the proposed Scheme
Physical	Dig and dispose offsite, under licence	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorized to accept it. In addition to waste permits / authorisations, a wildlife licence issued by NPWS is required for the transport of Third Schedule non-native invasive species offsite.	Possible given the nature of the proposed Scheme, this may be an optimal control measure.

Approach	Treatment options	Comment	Potential for Implementation on the proposed Scheme
	Hand Pulling	Small isolated and immature infestations, such as in gardens or roadsides can usually be readily pulled prior to flowering e.g., care must be taken not to leave lower plant sections as these can regrow rapidly. Additionally, any flower heads (if present) should be covered by a tied bag before pulling to ensure no seed drop.	Possible, ideal for smaller areas adjacent to the proposed Scheme boundary.
	Mechanical	Repeated cutting or mowing is effective for larger stands, but plants can regrow if the lower parts (above lowest node) are left intact. Regeneration can be further halted by ensuring full ground vegetative layer through reseeding.	Possible but unlikely main option given the nature of works along existing river.
	Grazing	Regular grazing is said to suppress the plant over time.	Not practical given the nature of the river and metropolitan landscape and nature of the proposed Scheme.
Chemical	Spot / weed wiper	Can be used for smaller infestations in spring before flowering occurs, but as late as to allow germinating seedlings to have become established and thus be able to uptake the chemical treatment. Adjacent to the works boundary, chemical treatments for infestations near water should be rated for use near aquatic locations.	Possible, within the proposed Scheme boundary, where ground is to be excavated, may require physical control also.
	Foliar spray	Can be applied to larger infestations via knapsack spray / lance spray etc. in spring before flowering occurs, but as late as to allow germinating seedlings to have become established and thus be able to uptake the chemical treatment. Chemical treatments for infestations near water should be rated for use near aquatic locations.	

1.5.4.1 Temporary Storage of Collected Material

Given the nature and relative extent of Himalayan balsam infestations in some urban situations, collected biomass (pulled stems / roots and bagged flower heads), where not disposed of immediately to a facility authorised to accept such waste, could be double bagged and put in dedicated quarantine areas (locations to be approved as part of the final ISMP). Here, the material could be left to decompose before disposal with similar Non-native Invasive Species waste at an authorised facility.

1.5.4.2 Reseeding Following Eradication

Areas devoid of or cleared of vegetative cover near watercourses should be reseeded with appropriate riparian ground cover species in summer months to ensure that bare banks do not provide favourable conditions for Himalayan balsam to become re-established and to protect banks from accelerated erosion.

For any area of ground that is cleared of this non-native invasive species, and which is not subsequently constructed upon, follow-on mechanical cutting regimes and / or chemical treatments may be required to ensure the seed bank is fully exhausted.

1.6 References

Inland Fisheries Ireland: A Guide to the Protection of Watercourses through the use of Buffer Zones, Sustainable Drainage Systems, Instream Rehabilitation, Climate / Flood Risk and Recreational Planning (IFI, 2020)

Inland Fisheries Ireland - Biosecurity Protocol for Field Survey Work (IFI, 2010)

Invasive Species Ireland (ISI) - Best Practice Management Guidelines for Japanese Knotweed (ISI, 2008a)

Invasive Species Ireland - Best Practice Management Guidelines for Himalayan Balsam (ISI, 2008b)

Invasive Species Ireland - Best Practice Management Guidelines for Giant Hogweed (ISI, 2008c)

Managing Invasive Non-Native Plants in or near Freshwater (EA 2010)

Managing Japanese knotweed on development sites (Version 3, amended in 2013)

The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (TII, 2020a)

The Management of Invasive Alien Plant Species on National Roads – Standard (TII, 2020b)

The Management of Waste from National Road Construction Projects - GE-ENV-01101 December 2017

Directives and Legislation

Birds and Natural Habitats Regulations S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011.

Ireland's third National Biodiversity Action Plan 2017-2021 (Department of Culture, Heritage and the Gaeltacht 2017)

Noxious Weeds Act, Order 1937 – S.I. No. 103 of 1937

Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species

Waste Management Act, 1996 (as amended)

