TOBIN

Leitrim County Council
Dromahair Flood Relief Scheme
Invasive Species Management Plan

Leitrim County Council
Comhairle Chontae Liatroma

BUILT ON KNOWLEDGE

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1. INTRODUCTION

This Invasive Species Management Plan (ISMP) has been prepared by TOBIN, on behalf of Leitrim County Council. This ISMP was prepared to accompany an Invasive Alien Plant Species (IAPS) survey carried out within the survey area at three proposed development sites for the construction of flood protection and embankments proposed all of which are situated in the townland Dromahair, County Leitrim.

During the survey carried out on 26th of July 2023, the IAPS Japanese knotweed (*Reynoutria japonica*) and Himalayan balsam (*Impatiens glandulifera*) were detected within the site. This ISMP was then prepared to provide a sufficiently detailed account of the infestation and the management measures required for the control and eradication of this species.

This Invasive Species Management Plan (ISMP) describes the strategy that will be adopted during the construction and operation of the proposed development to manage the knotweed and the other invasive species. This ISMP is a working document. Following the appointment of the contractor, and prior to commencing works on site, the ISMP will be further developed by the contractor. The main objective of the ISMP is to control and prevent the spread of invasive species during the construction phase.

1.1 LEGISLATIVE BACKGROUND

The definition of invasive species as described by the Convention on Biological Diversity (CBD)[1] is*; "Species whose introduction and/or spread outside their natural past or present distribution threatens biological diversity"*. Invasive species are found in all taxonomic groups including animals, plants, fungi and microorganisms and can affect both terrestrial and aquatic ecosystems around the world. Invasive species can be classified as High Impact Species[2] or Medium Impact Species[3].

The control of invasive species in Ireland comes under the Wildlife (Amendment) Act 2000, where it states that *'Any person who plants or otherwise causes to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora, otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.'*

The Birds and Natural Habitats Regulations 2011 (SI 477 of 2011), Section 49(2) prohibits the introduction and dispersal of species listed in the Third Schedule, which includes Japanese knotweed as follows: *any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow shall be guilty of an offence".*

Ireland has ratified a number of treaties and conventions, including the Convention on Biological Diversity, under which Ireland is obligated to address issues on Biological Diversity, including invasive alien species. Through various pieces of legislation including the Wildlife Acts 1976 (as amended) and the European Communities (Birds and Natural Habitats) Regulations

[1] Invasive Alien Species (cbd.int)
[2] Species Profile Browser · Species Profile (biodiversityireland.ie)
[3] Species Profile Browser · Species Profile (biodiversityireland.ie)

2011, S.I. No. 477/2011 (commonly referred to as the Birds and Habitats Regulations), Ireland sets out legal implications associated with invasive alien species.

Articles 49 and 50 of the Habitat Regulations details the legal requirements for the control of alien invasive species. Under Article 49 and 50 of these regulations, it is an offence to:

- Plant, disperse, allow or cause to disperse, or grow any plant listed in Part 1 of the Third Schedule (i.e. High Impact Species);
- Possess the plant or any component of the plant for sale, reproduction, propagation, transportation, distribution, introduction or release any plant listed in Part 1 of the Third Schedule;
- Import or transport any plant listed in Part 1 of the Third Schedule; and/or
- Possess any vector material (e.g. soil, plant material) for the purposes of breeding, sale, distribution, introduction or release as listed in Part 3 of the Third Schedule.

Note, licences may be granted for certain activities associated with invasive species.

High Impact Species

These include species designated as high-risk species recorded in Ireland and those listed on the Third Schedule, Part 1 of the Birds and Habitats Regulations (2011)[4]. Japanese knotweed is listed under Irish legislation i.e. the Third Schedule: Part 1 of the European Union (Birds and Natural Habitats) Regulations 2011 to 2015. Japanese knotweed is also listed on the Third Schedule: Part 3 which governs the movement of soil or spoil taken from places infested with Japanese knotweed (http://www.irishstatutebook.ie/eli/ 2011 si/477/made/en/print).

Plants listed under the Third Schedule: Part 1: Plants and Part 3: Vector Materials are subject to restrictions under Regulations 49 & 50. Part 3: Vector Materials refers to soil or spoil taken from places infested with Japanese knotweed (Fallopia japonica). Regulation 49 deals with the '*Prohibition on introduction and dispersal'* while Regulation 50 deals with the '*Prohibition on dealing with and keeping certain species'*. Regulation 50 has yet to be enacted into Irish law. A licence is required from NPWS under Regulation 49(2) to transport vector material off a site. A Waste License is required under the Waste Management (Licensing) Regulations 2004 from the EPA to bury soil contaminated with vector material within a site.

Medium Impact Species

Medium risk species include those that are amber listed[5] by Invasive Species Ireland and are identified as those species that, under the right ecological conditions, may have an impact on the conservation goals of a site or impact on a water body achieving good/high ecological status under the Water Framework Directive. Additionally, medium impact species include those that are assessed as having a risk score of between 14 -17 in a risk prioritization study, undertaken for invasive and non-native species on the Island of Ireland[6].

[4] http://www.irishstatutebook.ie/eli/2011/si/477/made/en/print
[5] https://invasives.ie/app/uploads/2022/01/Invasives_taggedMediumImpact_2013RA-2.pdf
[6] Kelly, J., O'Flynn, C., & Maguire, C. (2013). Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland. Report prepared for the Northern Ireland Environment Agency and National Parks and Wildlife Service as part of Invasive Species Ireland.

The key aim of the invasive species survey was to therefore identify species of High and Medium risk, including those listed on the Third Schedule, Part 1 of the Birds and Habitats Regulations, which may occur in the vicinity of the survey area[7].

1.2 METHODOLOGY

This plan applies the most relevant and current guidance in relation to the treatment and management of invasive plant species in construction projects. The following guidance was referred to in preparation of this plan:

- Transport Infrastructure Ireland (TII 2020) The Management of Invasive Alien Plant Species on National Roads – Technical Guidance[8];
- Chapter 7 and Appendix 3 of the TII Publication: The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA, 2010[9]);
- Best Practice Management Guidelines for Himalayan Balsam[10];
- Best Practice and Management Guidelines for Japanese Knotweed (Invasive Species Ireland, 2015[11]);
- Managing Japanese knotweed on development sites - The Knotweed Code of Practice produced by the Environmental Agency (2013[12]); and
- Circular Letter NPWS 2/08 Use of Herbicide Spray on Vegetated Road Verges (National Parks and Wildlife Service 2008[13]).

1.3 DESCRIPTION OF THE SURVEY AREA

The survey area included three proposed development sites, which are all located near Dromahair village in County Leitrim, to the south of the Bonet River. The sites are within a number of townlands including (from west to east) Friarstown, Ardakaip more, Killananima and Corcusconny. The three sites are shown in Figure 1-1 and listed in Table 1-1 below and are located at the corresponding grid references. The sites are a mixture of amenity/recreational/commercial and residential properties with some semi-natural vegetation. The wider area is predominantly made up of small pastoral farms with hedgerows and residential land.

Table 1-1: Location of the Proposed Development Sites

Site No.	Location	Grid reference
1	Residential Property No. 1	G 82435 30513
2	The Clubhouse Bar & Riverbank	G 80713 30281
3	Residential Property No. 3	G 80616 30118

[7] S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011. (irishstatutebook.ie)
[8] GE-ENV-01105 (tiipublications.ie)
[9] https://www.tii.ie/technical-services/environment/construction/Management-of-Noxious-Weeds-and-Non-Native-Invasive-Plant-Species-on-National-Road-Schemes.pdf
[10] Himalayan-Balsam-BPM.pdf (invasivespeciesireland.com)
[11] https://invasivespeciesireland.com/wp-content/uploads/2012/01/Best-practice-control-measures-for-Japanese-knotweed.pdf
[12] Environment Agency (2013). Managing Japanese knotweed on Development Sites (version 3, amended in 2013 and withdrawn in 2016): The Knotweed Code of Practice.
[13] https://www.npws.ie/sites/default/files/general/circular-npws-02-08.pdf

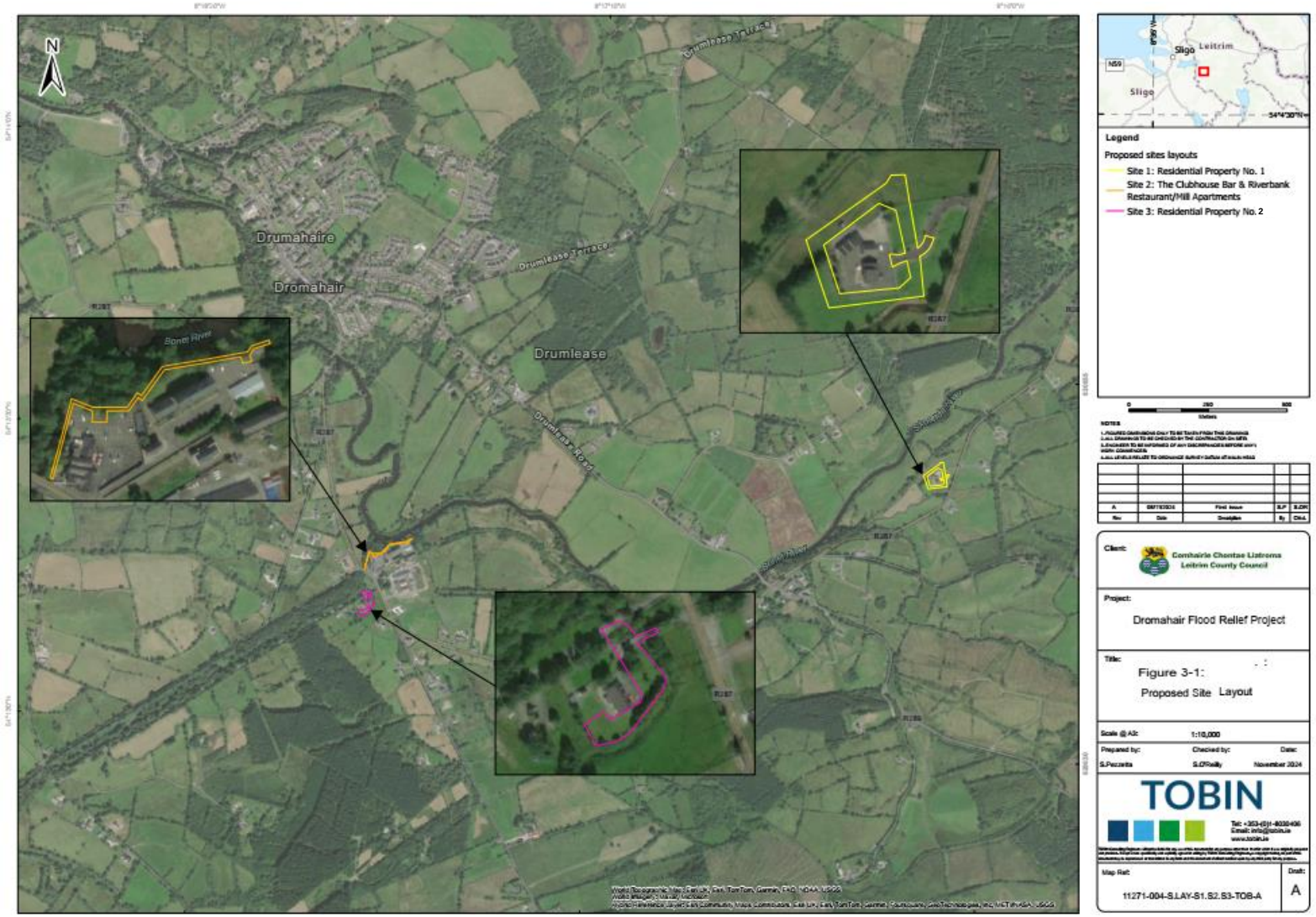


Figure 1-1: Site Location of Proposed Developments within the Study Area

2. FIELD SURVEY

2.1 SURVEY METHODS

The invasive species survey was undertaken by TOBIN Senior Ecologist Sinead O'Reilly on the 26th of July 2023. The survey was undertaken in order to assess the existing environment, to identify and verify the presence of non-native species of high and medium risk, including those listed in the Third Schedule of S.I. No. 477 of 2011, EC (Birds and Natural Habitats) Regulations 2011, and establish the distribution of these species within the site. The data collected was robust and allowed TOBIN to draw accurate, definitive and coherent conclusions on the possible impacts of the proposed development and the potential for likely significant effects.

No standard methods exist for an invasive plant species survey. The survey was based on an ecological walkover survey approach, whereby all accessible areas of the survey site were walked by the surveyor in daylight hours, with a visual search for the target species undertaken.

The vegetative parts of the plants (growing above ground) can be absent during the colder months of the year, with the plant persisting over winter and below ground as rhizomes or lying dormant in the seed bank. The invasive species survey was carried out within the optimal botanical survey season, therefore the presence of Third Schedule, high risk invasive species did not go undetected.

During the survey, any high risk IAPS that are listed on the Third Schedule were identified and their location and abundance recorded onsite. Medium risk IAPS were also recorded. A distribution map containing the presence and extent of IAPS recorded within the survey area was then created.

2.2 SURVEY RESULTS

During the site visits, a total of two IAPS were recorded including Japanese knotweed and Himalayan balsam.

Both these species are high impact non-native invasive species by the National Biodiversity Centre (NBDC) and both of which are listed in Part 1 of the Third Schedule of S.I No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations 2011 and the IAS Regulations. Where non-native invasive species were identified, the distribution of the species within the site was mapped (see Figure 2-1 below).

Japanese knotweed and Himalayan balsam are included in the NRA Guidelines on the Management of Noxious Weeds and Non-native Species on National Roads (NRA, 2010[14]; TII, 2020[15]) as these species have been shown to have an adverse impact on landscape quality, native biodiversity or infrastructure due to their invasive qualities.

[14] Noxious weeds Test_Layout 1 (tii.ie)
[15] https://www.tiipublications.ie/library/GE-ENV-01105-01.pdf

Table 2-1: Description of IAPS Recorded within the Survey Area

IAPS	No. of Stands	Approximate Area Size	Description
Japanese Knotweed			
Site 2	3-5	1m^2	Located behind wall, young shoots, approximately 50cm in height and not in flower.
Site 2	3-5	1m^2	Located behind wall, young shoots, approximately 100cm in height and not in flower.
Site 2	3-5	1m^2	Located behind wall, young shoots, approximately 80cm in height and not in flower.
Site 2	3-5	0.5m^2	Located near bridge on riverbank, young shoots under dense bramble foliage, approximately 80cm in height and not in flower.
Site 2	3-5	0.5m^2	Located near bridge, on riverbank young shoots under dense bramble foliage, approximately 80cm in height and not in flower.
Himalayan Balsam			
Site 2	70-100	5m^2	Located within the woodland behind Mill Apartments. The Himalayan balsam was in flower at time of survey and size of stand were estimated to range from 10cm-70cm in height.

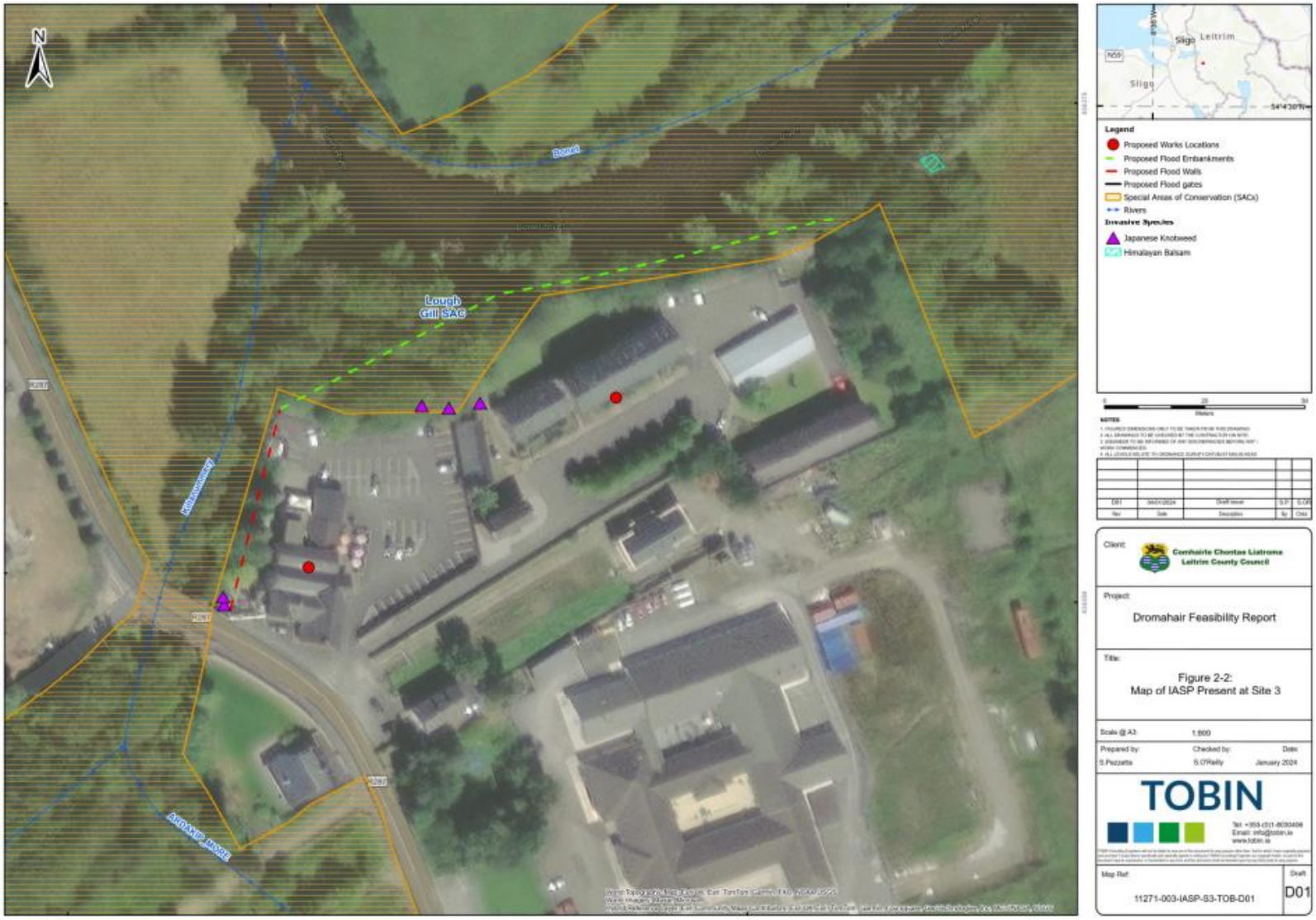


Figure 2-1: Map of IAPS Throughout the Study Area at Site 2

2.3 Description of Invasive Species Distribution on Site

2.3.1 Japanese Knotweed

Japanese knotweed was recorded at five locations at Site 2 at the Clubhouse Bar & Riverbank Restaurant/ Mill Apartments. The distribution of the IAPS within the study area and the exact location of each cluster is shown in Figure 2-1. A description of abundance and size of each Japanese knotweed infestation is presented in Table 2-1 and Plate 3-1.

The infestation here is apparent from seed transportation and germination along the river. At Site 2, Japanese knotweed was located behind the perimeter wall of the carpark within the mixed woodland at three locations and also along the riverbank at the bridge on the R287 regional road, southwest of the Riverbank Restaurant. Its presence here may be from dumping of garden waste as there is evidence of fly tipping over the wall. A 7m buffer has been established around each cluster, to indicate the maximum lateral extent of the rhizome network from each plant. Dormant seeds and plant material may be present withing the soils at these locations.

2.3.2 Himalayan Balsam

Himalayan balsam was recorded at one location at Site 2, The Clubhouse Bar & Riverbank Restaurant/ Mill Apartments. It was located within the woods behind the Mill apartments. The distribution of the IAPS within the study area and the exact location of each cluster is shown in Figure 2-1. A description of abundance and size the Himalayan balsam infestation is presented in Table 2-1 and Plate 3-1. The infestation here is apparent from seed transportation and germination along the river.

At Site 2, Himalayan balsam was located within the woodland behind the Mill apartments near the banks of the Bonet River. A 7m buffer has been established around this cluster, to indicate the maximum lateral extent of the rhizome network from each plant. Dormant seeds and plant material may be present withing the soils at these locations.

3. BACKGROUND TO INVASIVE ALIEN PLANT SPECIES

3.1 IDENTIFICATION OF JAPANESE KNOTWEED

Accurate identification of Japanese knotweed, both the aerial and underground parts, is extremely important. The following information is provided as a guide. However, it is recommended that a suitably qualified person be engaged where confirmation of presence or absence of an invasive species is required.

Plate 3-1: Stands of Japanese Knotweed Located Within The Woodland at Site 2 (Bottom Photo).

3.1.1 Aerial parts

During the summer, Japanese knotweed has pointed, heart shaped leaves, approximately the size of a human hand, which are staggered on the stem. In late summer/early autumn, small clusters of white/cream flowers will appear. The stems, which are hollow and bamboo-like, are green with red spots and have a distinctive zigzag appearance. Mature canes are hollow and have a characteristic pattern of purple speckles. These stems can grow up to 3m in height.

During late autumn and the beginning of winter, the Japanese knotweed canes die off and the weed becomes dormant. The leaves turn from green to yellow to brown and then fall off. The canes are hollow, dark brown and brittle.

3.1.2 Identification of Rhizomes

Japanese knotweed rhizomes are the underground part of the plant. A rhizome is a modified plant stem that sends out roots and shoots from its nodes. The outside of the Japanese knotweed rhizome is dark brown while the inside is bright orange/yellow in colour. The rhizome system can spread up to 3m in depth and 7m laterally from the parent plant in certain circumstances, it may extend further this if the plant is particularly well established. The rhizomes are responsible for spreading the plant by vegetative means. As small fragments of rhizomes can re-sprout, the principal means of spread of this plant has been through the deliberate or accidental movement of rhizome fragments or cut stems.

3.1.3 Background to Japanese Knotweed

The following brief description is included in order to assist those who may be operating on site, to better understand the nature of Japanese knotweed, the extent of the problems it causes, and the importance of the fastidious management of contaminated sites.

Japanese knotweed is a perennial plant that was introduced to Ireland in the 19th century as a garden shrub. In recent years, this species has spread extensively throughout Ireland. Japanese knotweed is commonly carried by watercourses and along road networks. Fly-tipping of hedge-cuttings on roadsides is one of the main methods by which Japanese knotweed spreads. A small fragment (the size of a fingernail) is enough to cause the growth of a full new plant[16], resulting in its successful colonisation of our habitats, where it outcompetes native vegetation.

The plant is a robust, herbaceous perennial with deeply penetrating woody rhizomes and bamboo-like stems that can grow up to 3m tall and can survive in all soil types. Propagation occurs via fragmentation (of stems and rhizomes) and underground rhizome growth. These powerful rhizomes are capable of penetrating loose aggregates and growing through existing small cracks, openings or voids in asphalt/concrete. As a result, Japanese knotweed is extremely difficult to control.

As Japanese knotweed is naturally found on volcanic sites and fumaroles (openings in or near a volcano), its rhizome network is known to be heat resilient, therefore, burning does not destroy the plant. Cutting or any disturbance of Japanese knotweed plant material must be avoided unless a clear management plan is in place for dealing with the cuttings. All fragments of the plant material must be treated as a biohazard on site. Furthermore, due to the high risk of spread via rhizome fragments, soil which may contain rhizomes cannot be moved off site (without an appropriate licence), as to do so would be in contravention of Regulation 49 of the Birds and Natural Habitats Regulations.

Other negative impacts of this invasive species include:

- Loss of biodiversity;
- Increased flooding risk by impeding river-water flow;
- Increased riverbank erosion;
- Economic loss, primarily associated with control costs in the construction sector;
- Delays to development;

[16] Japanese knotweed removal / How to remove japanese knotweed / Clearway

- Aesthetic damage to gardens and landscaping; and
- Loss of amenity and recreational space.

3.2 IDENTIFICATION OF HIMALAYAN BALSAM

3.2.1 Description

Himalayan balsam has been identified as one of the highest risk non-native invasive species in Ireland. It was first introduced to Ireland in 1839 as an ornamental garden plant. Native to the Himalayas, it can grow up to three metres tall and has large pale pink flowers which appear in June-October. Seeds are easily spread by both wind and water and so it can quickly colonise new areas. When mature and dry, the pods split open explosively if touched, flinging the seeds over 6m away from the parent plant, thus helping the species to quickly spread to new sites. Each plant can produce hundreds of seeds which explode from ripe seed pods and spread easily by wind, water, animals and humans[17].

Himalayan balsam has spread throughout Ireland. This highly invasive species is a cause for concern as it grows in thick monospecific stands, outcompeting native plants for space, light and nutrients resulting in the elimination of local biodiversity. This in turn can have a detrimental effect on local tourism and amenity use. This plant exerts significantly negative ecological impacts on river corridors. It can become particularly dominant along riverbanks, shading out native vegetation, reducing biodiversity, and attracting pollinating insects away from native species. The banksides of many Irish rivers are now dominated by this species.

It impedes access to riverbanks for both inspection and recreational use. In winter when the plants die back, banksides can be left bare and vulnerable to erosion which can result in detrimental effects on native aquatic flora and fauna due to siltation.

3.2.2 Identification

Identification is easiest, particularly in mixed vegetation, from May onwards. The key identification features are described below[18].

- Height: Plant grows up to 3 metres (approx. 10ft).
- Leaves: Large lanceolate-oval pointed dark green leaves with highly serrated edges. Leaves opposite, or in whorls of 3-5, may have reddish mid-rib.
- Stem: Fleshy hollow stems which are green to red early in the year, turning pink to red in
- summer, and hexagonal in cross-section.
- Flower: Between June and October produces pink trumpet- shaped flowers.
- Roots: The plant has very shallow roots, making it very easy to pull out of the ground.
- Seeds: Flowers are followed by hanging seedpods from June onwards which when ripe explode when touched. Each plant can produce up to 800 seeds which can be dispersed up to 7 metres from the parent plant.

[17] Invasive Species Ireland (2021). Invasive Species I.D Sheets- Himalayan Balsam. Invasive Species ID Sheets - Himalayan Balsam (invasivespeciesireland.com). Accessed: December 2021.
[18] https://www.environetuk.com/identify-himalayan-balsam

Plate 3-2: Stands of Himalayan Balsam Located Within the Woodland at Site 2

4. CHOOSING APPROPRIATE METHODS OF ERADICATION

4.1 JAPANESE KNOTWEED

There are seven options which are considered to be effective in the control and eradication of Japanese knotweed. The method by which each of the seven options could be applied to the considered survey area, is described herein as part of this ISMP.

The Japanese knotweed onsite covers less than 0.1% of the survey area. It is proposed to erect fencing around each cluster of the IAPS (with a buffer zone of a minimum of 7m) until it has been fully eradicated from the area.

4.1.1 Option 1 – Herbicide Treatment

The control of Japanese knotweed will require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, it is essential that a competent and qualified person carries out the herbicide treatment. A qualified and experienced contractor will be employed to carry out all treatment work.

The contractor must follow the detailed recommendations of the following documents for the control of invasive species and noxious weeds:

- Chapter 7 and Appendix 3 of the TII Publication: The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA, 2010[14]);
- Best Practice Management Guidelines for Japanese knotweed (Invasive Species Ireland, Kelly *et al.* 2008[6]); and
- Circular Letter NPWS 2/08 Use of Herbicide Spray on Vegetated Road Verges (National Parks and Wildlife Service 2008[13]).

These documents include measures to aid the identification of relevant species, with details for the timing, chemicals and methodology for chemical control, and for measures to avoid environmental damage during the use of herbicides.

Chemical treatment involves the application of a herbicide to invasive species plant such as Japanese knotweed stands without any excavation or removal of the plant material. The preferred types of herbicides to be used in the treatment of Japanese knotweed are Glyphosate and 2,4-D Amine.

If herbicide is applied as the treatment option, it may need to be reapplied for up to five years after the first application, to ensure the plant control measures have been effective. Glyphosate is non-persistent and can be used near water, but it is not selective (i.e. it is a broad spectrum chemical and will impact all plant species) whereas 2,4-D Amine can be persistent for up to one month and can also be used near water but is more selective on certain plants. The selection of chemical by the contractor and supervising ecologist will depend on seasonal factors, site conditions, proximity to water, surrounding habitats etc.

The most effective time to apply Glyphosate is from July to September (or before cold weather causes leaves to discolour and fall). The majority of herbicides are not effective during the winter dormant stage because they require living foliage to take up the active ingredient.

Reapplication rates will depend on site specific considerations including the extent of the infestation, its location, and the time of year treatment commences. Details of the proposed chemical treatment plan will be included in the updated ISMP.

4.1.1.1 Foliar Treatment

Foliar treatment (spraying) is usually applied with a sprayer such as a knapsack sprayer or a larger spray system. It is important to use a treatment dye to identify clearly all areas treated. Foliar treatment is an efficient way to treat large monocultures of IAPS, or to spot-treat individual plants that are difficult to remove mechanically, such as Japanese knotweed.

To ensure the optimal uptake of the herbicide into the rhizome system of Japanese knotweed, a second similar treatment will be required. This second treatment will need to be carried out within ten days of the initial treatment, before the vascular system is no longer capable of translocating the herbicide to the root system. Treatment is also weather and temperature dependent.

While the upper surface of the leaves will be easier to treat, it is also important to treat the leaf under surface as Japanese knotweed possesses many stomata openings on the underside of the leaf. Dead stems can then be cut, removed and burned on/off site in accordance with the relevant legislation.

4.1.1.2 Stem Injection

The stem injection method is sometimes used for Japanese knotweed control. This treatment requires a higher concentration of the active ingredient than what is used in foliar applications. It involves the use of a specialist herbicide injection tool whereby the herbicide is injected directly into each of the canes approximately 20-30cm from the base of each cane (between the 1st and 2nd nodule).

Subsequently approximately 10ml of herbicide mix is injected into each cane at a ratio of 5:1 through the use of a specialist stem injection tool. The application of glyphosate-based products by injection is most effective when applied in the early Autumn (mid to late Sept).

Regrowth will occur in subsequent years, albeit much less vigorously, which will require follow up treatment at the appropriate time of year. Spot treatment will be required each year until no regrowth is observed.

In order to ensure that the use of herbicides does not contravene legislation, the contractor must comply with Circular Letter NPWS 2/08 Use of Herbicide Spray on Vegetated Road Verges from the National Parks and Wildlife Service (NPWS) dealing with the application on to non-target areas.

Chemical treatment of Japanese knotweed must run for a duration in excess of three years, during this time the area will be fenced off until the Japanese knotweed has been successfully treated and fully eradicated from the area.

The following criteria need to be fulfilled for the successful herbicide treatment of Japanese knotweed:

- It is essential that treatment is undertaken by a competent and qualified person and overseen by an Ecological Clerk of Works (ECoW).
- Successful treatment requires a long-term Japanese Knotweed Management Plan for herbicide treatment, this ISMP should be updated by a suitably qualified person.

- Glyphosate is considered to be non-persistent and can therefore be used on materials that are being buried. Other herbicides are more appropriate for spot treatment and stem injection. The choice of herbicide to use is site and situation-specific and must be written into the Method Statement once the contractor has been appointed, and the timescale of the work made clear.
- Contractors working on the site must be fully informed as to the treatment plan and the potential consequences of mishandling plant parts and contaminated soil.
- Chemical treatment helps to contain the spread of the plant. Once chemical treatment begins, the rhizomes will cease to spread and underground damage will be limited.
- Chemical treatment is a long-term measure and is only suitable when the site is not predicted to be disturbed for more than three years. Even after all growth has stopped, rhizomes may remain viable and future disturbance could potentially reactivate growth.
- Failing to allow plants to reach a certain stage prior to herbicide treatment can increase the amount of time required for treatment, along with associated costs. It should be noted that water stress can reduce the herbicide uptake of the plants.

4.1.2 Option 2 – Combined Treatment

Combined treatment involves digging and a herbicide treatment. This method is employed in situations where treatment of the Japanese knotweed is required to be completed in a shorter timeframe[19]. The plant must be cut and then the cut material is left on top of plastic sheeting to dry out and then this material is then subsequently monitored for any sign of regrowth. The storage of cut material should not take place within flood risk zone of a river. The cut material should not be placed in a green waste recycling bin or leave the site.

Once the cut material has been dried out, it should then be burned on site in accordance with the relevant legislation. The surface of the affected area should be raked to remove crowns and surface material and in order to break up the rhizomes. An excavator can be used to scrape the surface crowns and rhizomes into a pile and then to cultivate the ground to stimulate rhizomes to produce a higher density of stems for treatment. Bringing the rhizomes to the surface will stimulate leaf production. This will make the plant more vulnerable to herbicide treatment. The more rhizomes that are brought to the surface, the more growth will occur, allowing for a more successful treatment.

Reapplication of herbicide may be required for up to five years after initially application, subject to the site-specific management plan. Best practice guidelines state that the treatment of the site is carried out over a timeframe greater than 18 months. However, after consultation with specialist contractors it is recommended that a three-year treatment programme followed by two years of no growth is carried out. The area with Japanese knotweed should be treated accordingly using herbicide treatments.

The following criteria need to be fulfilled for the successful combined treatment of Japanese knotweed:

- Break up the rhizome and bring it to the surface by digging, this stimulates leafy growth and maximises the uptake of subsequent herbicide treatments to the rhizome.

[19] Irish Water (IW-AMT-009). Irish Water Report. Information and Guidance on Japanese Knotweed Asset Strategy and Sustainability.

- Repeat the treatment to continuously weaken growth and expose deeper rhizomes which could not otherwise be as effectively treated.
- Digging while the ground is wet should be avoided as it will compact the soil and slow down growth, reducing uptake of herbicide and compromising treatment.
- It requires the treatment of the entire contaminated area.
- Good site hygiene practices and decontamination of vehicles and equipment is essential.
- This method cannot guarantee complete destruction of the rhizomes.
- Crown removal can be integrated into these works, including prior to the commencement of herbicide treatment. Crown removal will involve transportation offsite and will be subject to licencing from NPWS.
- Rhizome dormancy can be induced by a poor herbicide treatment, however, ground disturbance will encourage regrowth, so this does not happen.

4.1.3 Option 3 – Bund Method

Excavated material is transferred to a bund, where it is contained and chemically treated for at least 18 months.

The following criteria need to be fulfilled for successful bunded treatment of knotweed:

- This method is suitable when deep burial is not an option.
- It requires adequate available area for construction of a suitable bund. The bund should ideally be 0.5m deep and not greater than 1m deep. Rhizomes buried any deeper than this are likely to go dormant and not respond to herbicide treatment.
- The underlying site must be protected by a root barrier C3 membrane. A clear area around the bund must be provided to facilitate the monitoring and treatment of any accidental spread.
- The root barrier C3 membrane shall contain all rhizomes and it should be a requirement of the contract that it is specified, designed, supplied, supervised and certified at completion by a suitably qualified person.
- The bund should not be built within 50m of a watercourse, or adjacent to trees.
- Chemical treatment of Japanese knotweed should be carried out prior to excavation to minimise the risk of the aerial parts of the plant being spread, and to weaken the rhizome, optimising successful treatment of contaminated soil.
- Fertiliser should be applied several weeks before herbicide is applied, if time allows, encouraging growth and maximising uptake of herbicide.
- The choice of herbicide should be specific to the site and ISPM.
- The bunded area should be chemically treated for an adequate time to effectively eradicate all rhizome and crown material.
- Full eradication must be confirmed by a suitably qualified person before treatment measures are abandoned. The length of treatment period is likely to be less than two years as the rhizome will have been weakened by chemical treatment of the vegetation.
- Good site hygiene practices and decontamination of vehicles and equipment is essential.

4.1.4 Option 4 – Deep Burial Method

Excavated material containing Japanese knotweed can also be buried on site. This method requires the "deep burial" of contaminated soil on-site to a depth whereby there is a minimum of 5m of uncontaminated overburden above the contaminated material. Assuming good site hygiene practices are followed, this option minimises the possibility of material escaping by accidental wind-blow or wash-off.

The following criteria need to be fulfilled for successful herbicide treatment of knotweed:

- Dig a trench or pit, adequate to contain all excavated material at a depth greater than 5m.
- All machinery should be decontaminated on site after contaminated material has been placed in the trench and before a root barrier membrane is placed over it and the backfilling takes place with uncontaminated soil or inert material to a depth of 5m. The manufacturer's guarantee is required that the membrane will stay intact for at least 50 years.
- Good site hygiene practices and decontamination of vehicles and equipment is essential.
- Accurately map and record the location of the burial site to prevent any future accidental disturbance. Inform future owners of its position on the site.
- If soil containing Japanese knotweed is stockpiled, the material must be stored in a manner that will not harm health or the environment.
- The stockpile should be located in an area of the site that will remain undisturbed. The area should be clearly fenced and marked with warning signs. The stockpile should be regularly treated with herbicide to prevent any regrowth or re-infestation.
- Off-site transport of material does not take place, and therefore material is not spread outside of the contaminated area.
- Pre-treat the area with herbicide before burial to speed up die-off. Persistent herbicides must not be used prior to burial.
- As a precaution, the stockpiled material should be laid on a root barrier membrane and covered to avoid contaminating the site further.
- The contractor must also comply with all waste legislation.
- After 50 years, the material should have died off completely, but the site and its contents must be clearly communicated to future land-users to avoid accidental disturbance.
- If the ground is disturbed before complete die-off is achieved, the dormant rhizome could be reactivated.

4.1.5 Option 5 – Root Barrier Membrane Method

This method requires the excavation of a "root-barrier membrane cell" which will contain the contaminated material and is buried beneath a minimum of 2m overburden. The procedure is similar to that described in Section 4.1.5 above.

The following criteria need to be fulfilled for successful root membrane treatment of Japanese knotweed on this site:

- Where there is a risk of knotweed encroaching from neighbouring sites, a root barrier C3 membrane shall be used to protect the site from further encroachment.
- The root barrier C3 membrane shall contain all rhizomes and it should be a requirement of the contract that it is specified, designed, supplied, supervised and certified at completion by a suitably qualified person.
- The minimum design life of the root membrane must be 50 years. A manufacturer's guarantee must be supplied by the contractor and be suitable for the containment of Japanese Knotweed.
- The root membrane must be used for creating the cell(s) for burial, for preventing spread from the encapsulated area and original excavated area, and for protecting services and infrastructure in these areas.
- Excavated contaminated material and the wash down from any machines and tools which have come into contact with the excavated material must be contained in this root barrier cell, ensuring that all material is wrapped in a suitable membrane and buried beneath a minimum of 2m deep of overburden within the development site.
- The contractor must also comply with all waste legislation.
- Good site hygiene practices and decontamination of vehicles and equipment is essential.

It is noted that the membrane treatment will be present on-site after all vegetation is dead, and the contractor will be required to document all activities in this regard so that any potential legacy issues can be managed in the future.

4.1.6 Option 6 – Off-site Disposal

Where the above treatment options are not possible due to logistics, such as the site is too small to contain excavated material, too shallow for burial, or lacks space where the infestation simply cannot be avoided by the construction works, then the removal of excavated material may be the only option. Off-site disposal of material is only to be considered as a last resort when none of the other treatment options can be carried out.

If any invasive species plant material is collected (e.g., by hand-pulling or mowing), it is important that its disposal will not lead to a risk of further spread. Where there are small amounts of Japanese knotweed material to be removed, it is possible to double bag the material and send to a licenced waste facility for disposal. Where the amount of material is larger in volume, it will be necessary to haul it from site to a suitably licenced waste facility.

The following criteria need to be fulfilled for successful off-site disposal of Japanese knotweed from this site:

- Invasive species material, particularly roots, flower heads or seeds, must be disposed of at a licensed waste facility and appropriately buried, or incinerated in compliance with the relevant legislation.
- Disposal must be carried out in accordance with the relevant waste management legislation. Invasive species plant material or soil containing residual herbicides may be classified as either 'hazardous waste' or 'non-hazardous waste' under the terms of the Waste Management Acts, and both categories may require special disposal procedures or permissions.
- If the material has been treated with a persistent herbicide, the excavated material must be classified as hazardous waste and must be disposed of to a hazardous waste facility.

- Advice would need to be sought from a suitably qualified waste expert regarding the classification of the waste and the suitability of different disposal measures.
- Any movement of material into areas where infestation has not already occurred carries the risk of introducing Japanese knotweed to the area, in contravention of Regulation 49 of the Birds and Natural Habitats Regulations.
- Contaminated soil and plant material can only be transported under licence from the National Parks and Wildlife Service (NPWS) under Section 49 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended).
- Material must only be brought to a licenced landfill which has acknowledged the nature of the infestation and has agreed in writing, in advance, to accept and treat the material appropriately.
- The ISMP must outline all biosecurity and treatment measures to be taken to prevent escape of contaminated material.
- Monitoring of the area will still be required, and any regrowth should be treated by herbicide.
- Good site hygiene practices and decontamination of vehicles and equipment is essential.

4.1.7 Option 7 – Soil Screening

This method requires all viable parts of Japanese knotweed to be extracted and removed off-site to a licenced facility or destroyed by incineration. Soil screenings and sieving methods can provide effective means on rhizome removal.

This method is viable in areas with large amounts of infected soils and materials and can be carried out at any time of the year. It is recommended that this treatment option is carried out over a three-year treatment programme followed by two years of no growth is carried out.

The following criteria need to be fulfilled for successful soil screening of Japanese knotweed on this site:

- Material that is removed off-site, must only be brought to a licenced landfill which has acknowledged the nature of the infestation and has agreed in writing, in advance, to accept and treat the material appropriately.
- The ISMP must outline all biosecurity and treatment measures to be taken to prevent escape of contaminated material.
- Monitoring of the area will still be required, and any regrowth should be treated by herbicide.
- Contaminated soil must show two years of no growth before it can be disturbed by construction works.
- This method should be combined with the herbicide treatment if re-growth is recorded after screening.
- Good site hygiene practices and decontamination of vehicles and equipment is essential.

Re-surveying/monitoring provides information on the success of the management methods and allows for the planning of follow-up treatments. Sites with a strong likelihood of reinvasion should be surveyed every year and treated appropriately.

4.2 HIMALAYAN BALSAM

As shown in Figure 2-1, Himalayan balsam is present within the woodland between the Mill Apartments and the Bonet River. This plant is also located 20m northeast of the proposed defence wall. It is required that this plant is treated to avoid the recolonisation of this plant within the proposed development site. The area that is contaminated with Himalayan balsam is outside of the eastern boundary and has no associated time constraints. Therefore, there is options available for its treatment outside of the proposed development site. The eradication of Himalayan balsam from this site shall be carried out by a licenced professional over the course of two years.

4.2.1 Option1 : Physical and Mechanical Control

Physical and mechanical control methods are preferable near watercourses, where chemical spraying may pose a greater risk to the environment.

4.2.1.1 Hand pulling

Smaller infestation of Himalayan balsam can be controlled by hand-pulling. Himalayan balsam plants have very shallow roots (10-15cm), therefore, can be pulled straight from the ground[20].

As the species frequently occurs along watercourses, this is a preferable form of treatment as it limits the potential impacts on the surrounding environment and facilitates the reestablishment of native vegetation. It is also the best method where the species occurs in mixed-stands of vegetation.

Hand pulling should be carried out in late April or May when plants can be easily identified but will not have developed seedpods. The plant stems should be gripped 0.5 metres above ground and carefully pulled which will normally remove the entire root. While the species does not spread by vegetative means, e.g. from fragments of root or stem, uprooted plants left in moist conditions can re-root from nodes on the stem. The plants removed should be placed in an area away from any watercourses and covered with jute material (or buried as described below). By blocking out light the plants will degrade naturally, eliminating the potential to re-root or set seed.

The infested area should be regularly monitored for new growth during the duration of the management plan. It is still possible to hand-pull isolated plants after May, but the plant tops should be covered with a plastic bag to prevent seed spread.

4.2.1.2 Mechanical cutting

Repeated cutting is an effective control measure for large stands of Himalayan balsam[6]. Plant stems should be cut at ground level (below the first node), which is easier on plants 50cm or greater. When the stem is cut above the first node, the species will regrow extremely vigorously and potentially produce more flowers and seeds than it would have otherwise.

As above, the plants removed should then be placed in an area away from any watercourses, covered with jute material and left to degrade naturally. If using this method, extreme care must be taken adjacent to watercourses to ensure that plant or soil material is not released into the water.

[20] https://www.wiseknotweed.com/services/himalayan-balsam/control/

Mechanical cutting is only likely to be effective where good access is available and the ground smooth enough to permit either mowing or cutting back. Where accessible plants can be cut, mown or strimmed back to ground level before flowering in June when plants have reached 50cm but have not yet developed seedpods. A scythe, flail, strimmer or mower can be used. Repeated mowing or cutting may be required annually until no more growth occurs.

Unless the plant is cut to below the lowest node, it will resprout. Regular mowing will control the plant provided the frequency of mowing is regular enough to prevent sprouting and flower formation. Repeat annually until complete control is attained. Himalayan balsam will regrow more vigorously and produce seeds after cutting particularly if it is cut too early.

4.2.2 Option 2 : Chemical Control

The use of herbicide is the most economical and efficient method means of control. Because infestations are usually in the vicinity of water courses great care must be taken to use only approved chemicals. Chemical control using glycophosate or 2,4-D amine, undertaken in the spring prior to flowering but late enough for germinating seedlings to be affected (typically late April/early May), is a suitable treatment method where physical control is not possible. Repeat treatment for a minimum of two to a maximum of five years may be required for complete eradication of the species. Treatment by herbicide can be achieved with a weed wiper in mixed stands, or by foliar spray in dense stands which should be applied during active growth in late spring but late enough to ensure that germinating seedlings have grown sufficiently to be covered by the spray. Repeat checks will be required on a monthly basis for any late germinating seeds. Repeat checks should be carried out each year throughout the growing season to prevent any new plants from setting seed until no further growth is found. Monitoring of the site will be required in mid-spring and mid-summer to assess the occurrence of seedlings and determine appropriate control. Spraying in the second year will be necessary because not all seeds germinate in their first year. Further monitoring in year three will be required, although few plants should be present. A long-lance sprayer may assist in the spraying of less accessible areas out of the reach of conventional knapsack sprayers. Herbicide application should only be carried out by suitably qualified contractors or operators with strict reference to the product label, local land use, health and safety considerations.

It is important to note that certain herbicides may not be suitable for stands of Himalayan balsam occurring adjacent to watercourses. Some brands of glyphosate are not approved for use near water so it is essential to check the label. Glyphosate products however are broad-spectrum herbicides which also kill other species, and care should be taken where sensitive species are present, or where killing off grasses poses a risk to slope stability. Most products which contain the active ingredient 2, 4- d amine are not approved for use near water; however they may be more appropriate for use away from water as they do not affect grasses.

4.2.3 Option 3 : Excavation

4.2.3.1 On-site Burial

Soil contaminated with Himalayan balsam plant or seed material can be buried on a development site to a depth of at least one metre. For burial of contaminated material on-site, the provisions of the Waste Management Act 1996 (as amended) requiring a waste license, permit or registration certificate must also be considered and complied with. Under Article 11 of the Waste Management (Facility Permit and Registration) Regulations 2007 (amended by SI

86 of 2008) the EPA can be requested for its view on whether a waste license, waste permit or registration certificate is required.

4.2.3.2 Off-site Disposal

Off-site disposal is considered a last resort option for this species. Any excavated soil which contains seed material must be transported to a licenced waste facility which has the capacity to accept the proposed waste volumes generated. Before transportation of seed material can commence, a licence must be obtained from National Parks and Wildlife Service (NPWS) for the transportation of contaminated material. Information required by the Wildlife Licensing Unit, NPWS includes:

- Methods of removal;
- Methods of transport;
- Biosecurity measures;
- Copy of Management Plan;
- Timeframe for completion of works; and
- Documentary evidence that chosen landfill facility will accept the material.

In addition to this, if the Himalayan balsam material to be disposed of at a licenced waste facility has been treated through chemical means it will need to be classified as hazardous waste and transported and disposed to a fully licenced hazardous waste facility in accordance with Waste Collection Permit Regulations (S.I. No.820/2007 & Amended SI.No.87/2008) and European Communities (Shipments of Hazardous Waste exclusively within Ireland) Regulations, S.I. No.324/2011.

4.2.4 Option 4 : Exclusion Zone

An exclusion zone is an option should the proposed works area not encroach into the potential seed bank and plant itself. It is particularly important to consider Himalayan balsam in the wider environment around a particular site. If this species is growing in an adjacent site, or upstream of a site on a riverbank, then no matter how good on-site control is, re-colonisation is likely. An understanding of distribution in the wider area is necessary to determine if eradication or control efforts are likely to be successful. In some situations, eradication of all Himalayan balsam on site might not be possible due to the likelihood of re-colonisation. For example, where Himalayan balsam occurs close to a proposed site boundary, it is very likely that seeds will be projected from plants on the adjacent land. In a riverbank situation, seeds can also be washed down from further upstream.

As discussed in Section 4.2, this plant is located 20m from the proposed works area and site boundary. This invasive exclusion zone relates to any site where works are required to enter within a 7m buffer from an invasive plant, as it is illegal to cause invasive plant dispersal.

Should there be no plans to treat or eradicate this species, it is recommended that an exclusion zone is put in place around this plant.

- Prior to any works commencing on the site, the appointed Contractor must ensure that the weed is not disturbed or interfered with until a definite biosecurity and control plan is instituted. Avoidance of excavation of stands of Himalayan balsam and surrounding soils is the preferred option for the existing stands located outside the works area.

- The stands of Himalayan balsam must have a minimum 7m buffer zone all around them where possible. This will include isolating the infected areas with secure fencing and warning signs to ensure that no unauthorised personnel enter the infested area.
- Fence off the identified Himalayan balsam locations, where appropriate, using a robust and secure fencing system, and erect appropriate warning/advisory signage at points of access to the riverbanks (see Plate 4-1). All stands of Himalayan balsam will be clearly delineated with hazard tape and fenced in a manner visible to machine operators prior to the commencement of works. Fencing should be sturdy and include appropriate warning / advisory signage.
- Appropriate signage will be put in place to deter any entrance by people or machinery into the areas within which the Himalayan balsam is growing.
- No ground works or any other ground disturbance should take place within the zones of infestations, without prior consultation with, and the direction of, an invasive alien plant species specialist, and then only under strict supervision.
- Prior notification will be given to all contractors that parts of the works area are contaminated with Himalayan balsam and that they must adhere to this protocol to avoid the spread of the plant within and more importantly, outside of the works area. This includes any site investigation works in advance of commencement of excavation works.
- If access to the infested area is necessary, and particularly if any essential work has to be carried out within the surveyed sites, or fenced or signed locations, then this must only be done following formal approval in advance, and after the preparation and agreement of a "task specific" method statement. No viable plant material or rhizome should be disturbed in, or removed from, the zones of infestation.
- All biosecurity measures listed in Section 5.1.1 below must be adhered to.

Plate 4-1: Heavy Duty Heras Fencing

5. MANAGEMENT OBJECTIVES

The purpose of this document is to provide the client (Leitrim County Council) and appointed contractor with a sufficiently detailed account of the control and management measures required to eradicate and prevent the further spread of invasive species during the course of the proposed works. Details of the necessary steps that must be taken to ensure the proposed works do not lead to the spread of Invasive Alien Species are discussed in Section 5-1 below. The requirements to avoid spreading Himalayan balsam and Japanese knotweed will be addressed in turn.

The objectives of this Invasive Species Management Plan are:

- Objective 1 – To prevent the further spread of all two invasive species to areas off-site.
- Objective 2 – To prevent the further spread of all two invasive species within the site.
- Objective 3 – To completely eradicate all two invasive species within the site.

Should any risk of contaminated material escaping be observed, the management plan for the site must be modified by an appropriately qualified person to mitigate against that risk. Prior to both ISMP works and construction works commencing onsite, a Risk Assessment Method Statement (RAMS) must be produced by the appointed contractor. The following guidelines, while comprehensive, are not exhaustive, and shall be followed by all personnel on site.

5.1 MITIGATION MEASURES FOR THE TREATMENT OF INVASIVE SPECIES

During construction works, the spread or introduction of alien invasive species and noxious weeds will be avoided by adopting appropriate biosecurity measures, as per guidance issued by the Transport Infrastructure Ireland (TII) (2010)[21], Invasive Species Ireland Best Practice Management Guidelines[22] and Inland Fisheries Ireland (IFI)[23] with respect to the protocols developed for the control of the spread of alien invasive species to both the aquatic and terrestrial environment, including the following measures:

The presence of alien invasive species and requirement for actions (if any new invasive species are found to be present onsite) will be confirmed by a suitably invasive species specialist or qualified ecologist.

Depending on the timescale for the construction of the proposed scheme, it may be possible to eradicate some species prior to the onset of construction on the site via an advance treatment contract. This would be preferable.

In addition to the possible advance treatment works and pre-construction survey, areas identified as requiring specific invasive species treatment will be demarcated and the designated control measures implemented at the earliest possible stage to reduce the risk of spread along the proposed scheme or beyond the land take.

There are a number of management options that may be implemented to control and prevent the spread of invasive species (Sections 6-7 below). Those involved in the application of

[21] https://www.tii.ie/tii-library/environment/construction-guidelines/Management-of-Noxious-Weeds-and-Non-Native-Invasive-Plant-Species-on-National-Road-Schemes.pdf
[22] http://invasivespeciesireland.com/wp-content/uploads/2012/01/Himalayan-Balsam-BPM.pdf
[23] https://www.fisheriesireland.ie/Biosecurity/biosecurity.html

herbicides/pesticides will be competent to do so and, consequently, will have sufficient training, experience and knowledge in the area of herbicides/pesticides application.

All staff involved in the application of herbicides/pesticides will have received appropriate training, which may include achieving competency certification in the safe use of herbicides/pesticides through a National Proficiency Tests Council registered assessment centre or achieving an appropriate FETAC award in this area.

However, if control programmes have not been achieved before construction begins, then site hygiene measures listed below in Section 5.1.1.1 will need to be put in place to ensure that the further spread of invasive species is avoided. As mentioned previously, it may be necessary to implement an advance works contract to commence treatment of IAPS before construction starts. By treating in advance there will be much more control over the spread of infestations. Infestations if left untreated, may spread further by the time construction commences. The specific treatment method needs to be established.

5.1.1 Invasive Species on Site Management

Measures to implement the eradication and prevent the spread of invasive species are listed in the ISMP. Within this ISMP, an advanced removal and eradication treatment programme is in place in order to remove species prior to the onset of construction on the site via an advance treatment contract.

In addition to the advance treatment works and pre-construction survey, areas identified as requiring specific invasive species treatment will be demarcated and the designated control measures implemented at the earliest possible stage to reduce the risk of spread within the proposed development site or beyond the land take.

Those involved in the removal of plants as part of the ISMP will be competent to do so and, consequently, will have sufficient training, experience and knowledge in the area of invasive species removal.

The purpose of this plan is to:

- Identify the extent of the infestation on the site;
- Ensure further growth and spread of the plants on the site does not occur;
- Ensure the plants are not spread to other sites, either adjacent to the infested site or through transportation of contaminated soil to another site;
- Identify the best method for managing and controlling Japanese knotweed and Himalayan balsam on the site with regard to the proposed site works and construction methods;
- Communicate the plan to all site operatives to ensure success of the plan;
- Document and record the treatment and management methods carried out on site for future reference, for future site owners and site users and to avoid litigation;
- The contractor will employ a suitably qualified ecologist to update the plan prior to the commencement of construction. The updated plan will contain the following:
    - Site background including proposed works;
    - Extent of the Japanese knotweed and Himalayan balsam infestation;

- Specific control plan to be put in place;
- Site hygiene protocols;
- Responsible individuals;
- Follow up requirements; and
- Any other relevant information.

During the site visit in July 2023, the two sites were found to contain an infestation of Japanese knotweed and Himalayan balsam directly (Figure 2-1). These plants were located at specific locations within the site with Japanese knotweed located along the proposed development boundary line at both sites.

Appropriate site management during the treatment stages must be carried out to ensure all necessary measures are taken to prevent the spread of Japanese knotweed and Himalayan balsam. Careful preparation of the site and planning of the works is crucial. Nobody will be allowed into the contaminated area once eradication work has begun unless they have been inducted on the biosecurity measures onsite. Should any risk of contaminated material escaping be observed, the management plan for the site must be modified by an appropriately qualified person to mitigate against that risk.

5.1.1.1 Establishing good site hygiene and a Bio-secure zone

- Fencing will be established around each working area hosting the invasive species. In this case, the bio-secure zone will be 7m away from the visible plant parts. This will ensure all areas scheduled to be treated are included in the area fenced off. This will inform personnel that access into and out of the area is restricted. Signage should be erected along the fencing to avoid unnecessary contact with the plant or surrounding contaminated soils;
- A RAMS must be provided by the contractor prior to commencement of any works;
- A designated wash-down area is to be created, where material from a power-washed vehicle can be effectively contained, collected and buried/removed off-site along with other contaminated material. The area must have a washable membrane or hard surface;
- Stockpile areas shall be chosen to minimise movement of contaminated soil;
- Any stockpiles must be marked and isolated;
- Using tracked machines within the contaminated area is likely to contribute to the spread of seeds and should be avoided;
- The onsite clerk of works will monitor and oversee implementation for the plan; and
- In the event of there being difficulty in sealing the area adequately, the contractor shall not move any contaminated soil from the excavation site, but shall refer back to the ECoW or Ecologist, who will consult with an appropriately qualified person to design alternative measures.

5.1.1.2 Decontamination of vehicles

- Decontaminating may only take place within a designated wash-down area;
- Prior to arrival on site and on departure, the contractor's vehicles and equipment must be thoroughly cleaned. High-pressure steam cleaning, with water > 60°C, is recommended for vehicles and equipment where reasonably feasible. If it is not possible to steam clean the equipment, a normal power hose must be used. After cleaning,

equipment will be visually inspected to ensure that all adherent material and debris has been removed;

- Vehicles and machinery must be cleaned using stiff-haired brush and pressure washer, paying special attention to any areas that might retain seeds such as wheel tyre threads and wheel arches;
- All vehicles and machinery should be cleaned before and after using them to excavate Japanese knotweed and Himalayan balsam contaminated material;
- All equipment (including footwear) that has come into contact with water or soils will be visually inspected for evidence of attached plant or animal material, or adherent mud or debris. This should be done before entering and leaving the site. Any attached or adherent material will be removed before entering or leaving the site;
- Run-off from wash-down area must be isolated and treated as contaminated material;
- All contractors will be required to sign a prepared form detailing the nature of the cleaning process carried out and the date on which this was conducted; and
- No vehicles are to enter watercourses during the construction or operation of the proposed development.

5.1.1.3 Transporting Contaminated Material

This is only to be carried out if all other options are not viable.

- Stockpile areas shall be chosen to minimise the movement of contaminated soil. Any stockpiles must be clearly marked and isolated;
- A licence from the NPWS must be obtained for the transportation of contaminated material;
- Additional to this, if the material has been treated through chemical means it may need to be classified as hazardous waste;
- Vehicles used to transport materials must be lined and covered and shall be decontaminated before they leave the work zone;
- Do not fill the truck to the very top (min 20cm) and seal securely with a suitable membrane for transportation to ensure no material can escape; and
- Biosecurity measures as outlined above shall be implemented for de-contamination.

5.1.1.4 Prevent further spread and introduction of invasive species

The priority of these works is to contain the Japanese knotweed and Himalayan balsam infestation and prevent further spread to areas which are not currently contaminated. The surrounding area will be isolated by closing the works area to all pedestrian and vehicular traffic during excavation and construction, until such time as the site has been reinstated. Biosecurity measures shall be put in place to avoid the accidental transport of material. Biosecurity measures will consist of closing off the area to traffic and providing a wash-down and de-contamination area for all vehicles and equipment operating on site.

- On completion of works and decontamination of the site, biosecurity measures shall be removed under the supervision of the ECoW;
- No material will be removed off-site without prior consultation and consent from the ECoW. This Management Plan does not include for the transport and disposal of materials off-site; and

- All materials entering site must be checked to ensure their sources are free of invasive species, particularly soil and plant material. All machinery entering site must be cleaned and checked for invasive species prior to arrival onsite.

5.1.2 Pre-construction Survey

Since invasive species spread quickly, prior to the commencement of treatment, a pre-construction survey will be undertaken to identify the extent of invasive species at that time. The survey will be undertaken by a suitably qualified ecologist. This information will be utilised to update the ISMP.

6. JAPANESE KNOTWEED STRATEGY TREATMENT FOR THE PROPOSED DEVELOPMENT

6.1 ASSESMENT OF TREATMENT OPTIONS

Below in Table 6-1 is an assessment of Japanese Knotweed treatment options. The assessment aimed to outline all pros and cons of each treatment option to discover the most viable. A ranking system (1-7) has been used to assess which treatment option is recommended, as the more preferable treatment of Japanese knotweed on this site. The ranking systems runs from 1 to 7 with one "1" being the most preferred/viable option and "7" being the least viable option.

Table 6-1: Assessment of Japanese Knotweed Treatment Options

Treatment Options	Advantages	Disadvantages	Site Constraints	Ranking
Option 1 – Herbicide Treatment	• Cost effective. • Less risk of spreading offsite. • Easy to administer. • Treatment can be carried out in situ without risk of spreading.	• Can take many years and may not eradicate rhizomes completely. • Two years of monitoring required after treatment. • Some herbicides are persistent in soil and risk being disturbed if construction works are planned. • Regrowth can occur if soil is disturbed. • Can induce dormancy.	Infested areas can be treated in situ without needing additional space for treatment. Constraints when spraying near water.	3
Option 2 – Combined Treatment	• Increases effectiveness of herbicide treatment. • Less chance of rhizome dormancy. • Crown removal removes large amounts of surface and underground biomass. • Cost effective.	• Crown removal can be time consuming. • If mechanical disturbance is not done correctly, it can cause rhizome dormancy. • Crowns and dead stalks will still need to be disposed of offsite. • Some herbicides are persistent in soil.	Infested areas can be treated in situ without needing additional space for treatment. Constraints when spraying near water.	3
Option 3 – Bund Method	• Treatment may be less than 2 years. • Treatment can be carried out in situ without the risk of spreading.	• Will require a designated area onsite for treatment where it will not be disturbed. • Requires excavation the infested area and moving to a fully secure area, increasing the risk of spreading.	This would involve excavating and moving contaminated materials to an uncontaminated area of the site for treatment. There is no available space onsite at Site 2 as this site is fully utilized for the development and the	5

Treatment Options	Advantages	Disadvantages	Site Constraints	Ranking
		• Must be bunded in an area not more than 1m deep.	infestation is located along a riverbank and within a mature woodland. It would also a risk of spreading it through the site during transport.	
Option 4 – Deep Burial Method	• Allows controlled destruction of the plant and its root material. • Works can continue immediately after burial. • Quickly removes Japanese knotweed from an undesirable area.	• Cannot be buried while herbicides are active. • Risk of future reactivation if not marked clearly. • Must be kept separate from any other rubble or waste. • Only good where soil is not already contaminated. • The use of the area above burial site is limited. • Requires a large hole to take material, if the soil is shallow or the water table this method may not be feasible. • Requires excavation the infested area and moving to a fully secure area, increasing the risk of spreading.	There is no available space at Site 2 as this site is fully utilized for the development and the infestation is located within a mature woodland. It would also a risk of spreading it through the site during transport.	5
Option 5 – Root Barrier Membrane Method	• Prevents the horizontal spread of rhizomes. • Works can continue immediately after installation.	• Can tear easily if not installed correctly or if the ground or excavated material contains rock or rubble. • Tears in sheets can be exploited by growing rhizomes.	There is no available space at Site 2 as this sites is fully utilized for the development and the infestation is located along a riverbank and within a mature woodland. It would also a risk of spreading it through the site during transport.	5

Treatment Options	Advantages	Disadvantages	Site Constraints	Ranking
		• Can only be installed in favourable weather conditions. • Surface water drainage and water table can affect installation and ponding can occur.		
Option 6 – Off-site Disposal	• Time effective – quickly removed Japanese knotweed from site. • No restrictions will be left onsite. • Work can continue immediately after removal. • Fast and efficient.	• Relatively expensive. • If area is contaminated with other materials soil screening may be required to take place. • Will require a licence for transfer. • Must be disposed to a licenced facility. • Increases risk of spreading by moving materials offsite. • Should be considered a last resort.	All contaminated materials within the footprint of the Japanese knotweed is required to be removed offsite. to allow the foundations of the flood defence walls.	1
Option 7 – Soil Screening	• Segregates the infected materials from inert materials. • Increases effectiveness of herbicide treatment. • Lesser chance of re-growth. • Cane, crown removal and rhizome removes large amounts of surface and underground biomass.	• Crown removal and screening/sieving can be time consuming. • Canes, crowns and rhizomes will still need to be disposed of offsite under licence or incinerated. • Some herbicides are persistent in soil.	Infested area can be treated in situ without needing additional space for treatment. There is no available space onsite as the sites are fully utilized for the development and the infestations are located along the Bonet riverbank and also within a mature woodland.	5

Treatment Options	Advantages	Disadvantages	Site Constraints	Ranking
	• Less chance of rhizome dormancy if the majority of rhizomes are removed. • Cost effective.			

By comparing every aspect of the treatment options and taking the nature and scale of the proposed site boundary into account for both Site 2, Option 6 – offsite disposal is considered the most viable with regards the Japanese knotweed located within both sites this IAPS is located along the boundary line of both sites and exactly where the defence walls will be placed. This contaminated waste will need to be removed from site before the defence wall foundations can be placed. Transport of the material off site can be along the main entrance into the site that goes directly to the infestation site. This option eliminates spraying the knotweed near the river. This option also guarantees fast removal so construction works can be completed in a timely manner however it is considered relatively expensive. Option 1 and Option 2 is also a second desirable option to treat the knotweed although this treatment takes over three years to carry out and it does not guarantee complete eradication and includes constraints due to the plant been so close to the Bonet River.

As these sites will be fully utilized for the development and the ground of Site 2 is of river sediment and sand, this creates difficult ground condition and risk of contaminating the water with plant fragments and increases the risk of spread during transport within the river, treatment. Options 3, 4, 5 and 7 are not considered viable for both sites as there is no space to bury the plant.

As discussed, it is proposed to carry out construction works in phases, whilst the infested area is being treated the remaining un-effected area of the site can be developed on, however, it must be noted that this must be carried out while adhering to all biosecurity recommendations outlined in this report and from ecological professionals.

6.2 Management Plan and Monitoring

As shown in Figure 2-1, Japanese knotweed is present directly along the boundary of the sites and also within very close proximity to the Bonet River. These contaminated areas have constraints.

There are a number of suitable management options to control and prevent the spread of Japanese knotweed. The methodology outlined in this document will be updated, if required, based on an up to date survey of the contaminated area. The proposed management plan will be agreed with Leitrim County Council prior to the works being carried out.

Having assessed the available management options and constraints associated with this particular site, it has been concluded that offsite disposal (see Table 6-1, Option 6) is considered the most viable prior to construction, careful management of the works and followed up with continued in-situ chemical treatment post removal and construction.

6.2.1 Exclusion Zones

Prior to the commencement of site works, the extent of contamination will be determined by site investigations including trial pits. This information will be used to determine the area of contamination. If it is determined by visual inspections/trial hole investigation that viable plants remain within the works area the spreading of this viable knotweed plant material outside the current area of contamination is not permitted.

Japanese knotweed rhizomes can extend up to 7m from the nearest visible growth above the ground (EA, 2013[12]). For this reason, Exclusion Zones must be marked out a minimum of 7m away from the nearest knotweed to prevent machinery/personnel from potentially disturbing

the stand leading to spread. It is important that machinery or personnel are aware of the purpose of the exclusion zones and that they do not enter without authorisation, and that they take all appropriate biosecurity precautions as detailed in Section 5. No plant or equipment can exit an exclusion zone without having been thoroughly washed down and certified as clean. A fully equipped wash down area for plant and personnel (incl. boot wash) must be set up before works commence.

All works within an exclusion zone must be supervised by an appropriately qualified Invasive Species Specialist acting as Ecological Clerk of Works (IAS ECoW). The contractor must ensure that the weed is not disturbed or interfered with until a definite biosecurity and control plan is instituted.

6.2.2 Excavation of Japanese Knotweed

Any knotweed vegetation or any soil that may contain knotweed material that is excavated can only be removed off-site under licence from the National Parks and Wildlife Service (see Section 4.2.3.2). It is not possible for contaminated areas to be dug up and then reinstated with the same contaminated material, as this may lead to loosened knotweed material being will stimulate growth. Therefore, this material must be removed off-site to an appropriately licenced waste facility.

1. Where any infested material (soil containing Japanese knotweed) is to be taken off site, a licence to transport the material will be required from National Parks and Wildlife Service (NPWS). A landfill, which is licensed to accept such material, will be identified to dispose of the excavated material in accordance with the terms of a NPWS transport licence. The landfill site operator will be informed of what the material contains. Where digging or working within 7m of Japanese knotweed is necessary due to the proposed works, strict biosecurity protocols must be adhered to (Section 5). Haulage routes must be clearly defined and lined appropriately to avoid ground contamination; and wash-down areas and procedures must be in place.
2. Any excavations that are carried out as part of the project, must be contained within this area and the spread of any fragments of viable plant material or contaminated soil outside of this area must be effectively prevented. Works will be carried out under the supervision of a qualified ecologist who will ensure that the correct methodology are utilised. Any clean material that is removed from the exclusion zone must either be certified as clean by the IAS ECoW.
3. **All plant and equipment including PPE must undergo a full wash-down before they leave the works area to avoid contamination of other sites.**

7. HIMALAYAN BALSAM MANAGEMENT STRATEGY TREATMENT FOR THE PROPOSED DEVELOPMENT

As discussed in Section 5.1.1 above, prior to any works commencing onsite, the Himalayan balsam invasive species may be treated onsite, removed and eradicated completely from the site or excluded from the works area.

7.1 ASSESSMENT OF TREATMENT OPTIONS

There is a number of suitable management options to control and prevent the spread of Himalayan balsam. The methodology outlined in this document will be updated, if required, based on an up to date survey of the contaminated area. The proposed management plan will be agreed with Leitrim County Council prior to the works being carried out.

As shown in Figure 2-1, Himalayan balsam is present directly along the northern western site boundary of the site and also within dense woodland adjacent to the Bonet River.

Having evaluated the four management options available for this invasive species, and given its location being alongside the Bonet River and within close proximity to the proposed works, the preferred management option would be excavation and offsite disposal prior to construction, careful management of the works and followed up with continued hand pulling post initial removal and construction works. This type of treatment, beyond limiting the exposure to chemicals potentially reaching sensitive habitats such as the Bonet River which is part of the Lough Gill SAC (001976), it is likely to reduce the propagation potential onto the surrounding environment, while facilitating the reestablishment of native vegetation. This treatment is also same management option as Japanese knotweed considering the two species are located together onsite.

7.2 MANAGEMENT PLAN AND MONITORING

7.2.1 Exclusion Zones

Prior to the commencement of site works, the extent of contamination will be determined by site investigations to determine the area of contamination. If it is determined by visual inspections that viable plants remain within the works area, the spreading of this viable plant material outside the current area of contamination is not permitted.

7.2.2 Working with the Exclusion Zones

Any Himalayan balsam vegetation or any soil that may contain Himalayan balsam material that is excavated can only be removed off-site under licence from the National Parks and Wildlife Service (as mentioned in Section 4.2.3.2). It is not possible for contaminated areas to be dug up and then reinstated with the same contaminated material, as this may lead to loosened material or seeds being stimulated to grow. Therefore, this material must be removed off-site to an appropriately licenced waste facility.

1. Where any infested material (soil containing Himalayan balsam) is to be taken off site, a licence to transport the material will be required from National Parks and Wildlife Service (NPWS). A landfill, which is licensed to accept such material, will be identified to dispose of the excavated material in accordance with the terms of a NPWS transport

licence. The landfill site operator will be informed of what the material contains. Where digging or working within 7m of Himalayan balsam is necessary due to the proposed works, strict biosecurity protocols must be adhered to (Section 5). Haulage routes must be clearly defined and lined appropriately to avoid ground contamination; and wash-down areas and procedures must be in place.

2. Any excavations that are carried out as part of the project, must be contained within this area and the spread of any fragments of viable plant material or contaminated soil outside of this area must be effectively prevented. Works will be carried out under the supervision of a qualified ecologist who will ensure that the correct methodology are utilised. Any clean material that is removed from the exclusion zone must either be certified as clean by the IAS ECoW.
3. Any contaminated material including material from the wash down area must be contained within the identified and fenced contaminated area or removed to a suitably licenced facility offsite in line with standard hygiene measures.
4. All hygiene protocols as listed in this ISMP must be effectively implemented. All treatment works carried out will be in line with TII Guidelines for invasive species and Invasive Species Ireland Best Guidance on the Management of Himalayan balsam. For all management plans, site hygiene protocols will be implemented. These protocols will apply to sites which are infested with Himalayan balsam and those where balsam is not growing to prevent contaminated material being brought to site. Site hygiene protocols are outlined in Section 5.4 above.

7.2.3 Seed Bank

Given the presence of Himalayan balsam in the area of the works, it can be assumed that there is a seed bank within 7m of the plant. This seed bank will be contained within the top 0.1m of soil. Therefore, any machinery and personnel operating within this area will come into contact with Himalayan balsam seeds. All treatment works carried out will be in line with TII Guidelines for invasive species and Invasive Species Ireland Best Guidance on the Management of Himalayan Balsam.

All plant and equipment including PPE must undergo a full wash-down before they leave the works area to avoid contamination of other sites.

7.2.4 Soil Removal or Excavation

As mentioned above, Himalayan balsam within the works should be excavated and removed under a licence obtained from National Parks and Wildlife Service (NPWS) for the transportation of contaminated material. This should be carried out before flowering in June. when plants have reached 50cm but have not yet developed seedpods. Control measures for Himalayan balsam should aim to prevent flowering and are therefore essentially undertaken before the commencement of flowering in June.

All machinery (digger, lorry etc.) leaving the site will be washed down in a designated wash down area in proximity to the site exit to prevent seeds from being spread outside the site boundary.

The eradication of Himalayan balsam from this site shall be carried out by a licenced professional and this is required over the course of two years. To prevent Himalayan balsam from spreading around the proposed development site contaminating unaffected areas, all

relevant staff must be briefed and made aware of Himalayan balsam issues and follow the recommended management plan and their responsibilities.

7.2.5 Legislative Framework

Invasive Species material can only be removed off-site by a licenced waste haulier and brought to a licenced waste facility. Under Statutory Instrument 477/2011 it is an offence to transport Invasive Species (as listed in the Third Schedule), their propagules or a vector material without first obtaining a licence from National Parks and Wildlife.

Licence from National Parks and Wildlife Service

A licence application must include:

- As much information as possible on the removal, transportation and treatment of the species in question;
- A detailed description of the biosecurity measures that will be in place;
- A copy of the Himalayan balsam Management plan; and
- Details of the timeframe for carrying out the work.

Waste Acceptance Criteria Analysis

Excavated material will require a Waste Acceptance Criteria analysis to be carried out in advance of transport. The soil can only be transported to a licenced waste facility that has been notified in advance of the nature of the waste and has agreed to accept the waste material.

Biosecurity measures shall be put in place on site, appropriate to containing and safely removing all vegetative material and contaminated soil. Monitoring and treatment shall be ongoing until all ground works are complete. The steps described under Section 5.1.1 must be strictly adhered to by the Contractor.

7.3 RE-SURVEYING

Himalayan balsam seeds are not particularly robust but may survive for up to 18 months. Therefore, a two-year programme of control, which will extend beyond the construction period, will be required.

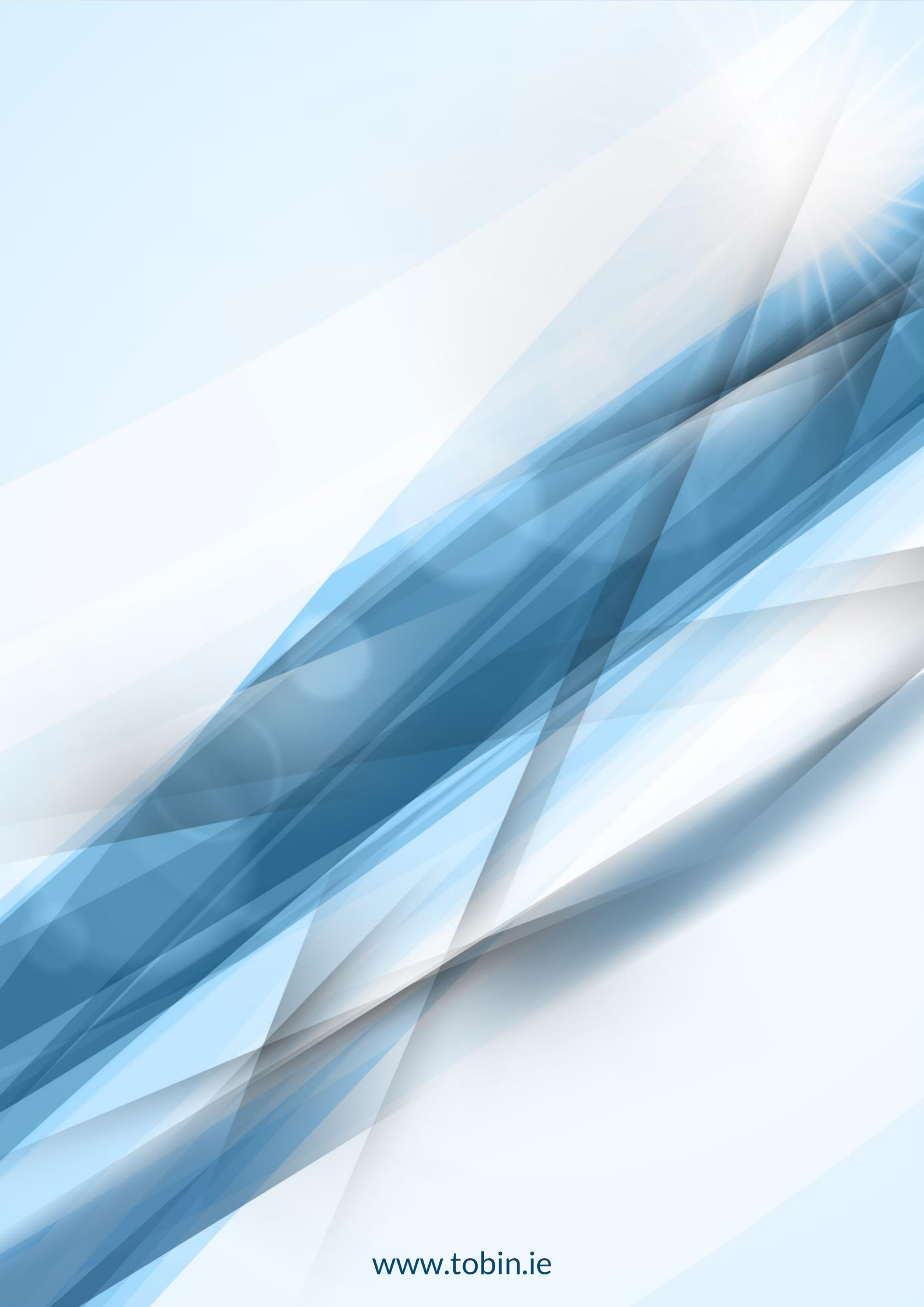
Every plant should be hand-pulled. This should be carried out before flowering in June, bagged and then placed in a designated area of the site to decay. Hand pulling will require a follow up pull in August due to new seeds sprouting.

If and where contaminated soil or heaps of high-risk invasive species (i.e. Himalayan balsam) are to be stockpiled, the area will be clearly marked out on site. These areas will preferably not be within 20m of any watercourse or flood zone. Vegetative material can be disposed of by composting unless seeds are present, in which case the material should be disposed of to a licensed landfill as described above in Section 7.2.2 or burnt.

8. CONCLUSION

This ISMP has presented the locations and abundance of high-risk Japanese knotweed and Himalayan Balsam recorded within the survey area at two of the three proposed development sites for the construction of flood protection and embankments proposed in Dromahair, County Leitrim and discussed the background and identification of these plants. A detailed account of all possible treatment options for Japanese knotweed and Himalayan balsam was subsequently presented in Section 6 and 7, with the preferred recommended management options for Japanese knotweed listed and ranked from 1-7 presented in Section 6.1 as this species is listed in Part 1 of the Third Schedule of S.I No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations 2011 and the IAS Regulations and there is a legal obligation to remove them from the site.

Detailed hygiene protocols following the recommendations outlined in Section 5.1, will ensure that viable plant material will not be spread outside of its current distribution area. Removal of these IAPS will also need to be carried out within the recommended timeline under the supervision of a qualified ecologist/Invasive Plant Specialist. Monitoring and follow-up treatment protocols must be implemented to ensure any potential regrowth is effectively treated. The steps outlined in Section 5.1 must be adhered to by the contractor while the ECoW will monitor establishment of a bio-secure zone and clean-down area.



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