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5 Year Biosecurity Plan for the Kirkcudbrightshire Dee Catchment 2020-2024

Supported by

Galloway Glens Landscape Partnership

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1 INTRODUCTION

Non-native species are any animal or plant that has been introduced by human activity to an area in which they do not naturally occur. Only a small proportion of non-native species have the ability to spread rapidly and cause significant problems to the environment, economy or human health. These are called invasive non-native species (INNS), and are recognised as one of the greatest threats to biodiversity globally. INNS can prey on, out-compete and displace native species and also spread disease. They can be damaging to recreational activities such as angling and boating through the clogging up of waterways.

Once INNS are established, for many species there are no effective techniques available to eradicate them, so preventing introduction and spread is the most effective way to protect the environment. Prevention minimises the impacts and costs of tackling established populations.

It is therefore vital that biosecurity is brought to the frontline and implemented across the Kirkcudbrightshire Dee area. Biosecurity is about reducing the risk of introducing or spreading INNS in the countryside (SISI, 2019).

This biosecurity plan is intended to be accessible by all, acting as a guidance document for all those who take part in activities across the catchment and its watercourses. The actions suggested within this plan are dependent on sufficient funding, and if adequate funding is not available (particularly for third sector organisations) work will need to be prioritised.

This plan is phase two of a three phase project driven by the Galloway Glens Landscape Partnership (GGLP). Phase one assessed the current distribution of INNS within the River Dee catchment. Building on this knowledge, the purpose of this plan is to focus efforts at a catchment scale, assessing the risks and detailing what needs to be done to support and promote biosecurity.

This plan contains:

- An overview of the catchment alongside an overview of current INNS that pose a threat to the region.
- Considerations of the potential pathways of INNS into and out of the catchment.
- An overview of past and current INNS management.
- A five year biosecurity management plan (2020-2024).

2 OBJECTIVES

This plan describes the INNS issues within the River Dee catchment and presents actions for the prevention, early detection, control and mitigation of the introduction and spread of selected INNS. The vision of this plan is:

'To encourage a sustainable framework to prevent, detect, control and eradicate invasive non-native species within the Kirkcudbrightshire Dee through the coordination of data collection, management, liaison, and education'

The ultimate key to the effectiveness of this plan is the building of local awareness, capacity and partnerships to ensure the success and long-term sustainability of the actions presented throughout this plan.

This plan focusses on six key species which are present within the River Dee catchment. These are North American signal crayfish, American mink, American skunk cabbage, Japanese knotweed, Himalayan balsam and Giant hogweed.

The implementation of this biosecurity plan will bring socio-economic and environmental benefits such as those described below;

- Protection of native ecology from American mink.
- Prevention of the spread of North American signal crayfish.
- Improved stability of riverbanks through the removal of annual, non-native plant species.
- Maintenance of access to riverbanks for recreation and angling through the removal and control of invasive plant species such as Japanese knotweed, Giant hogweed, Himalayan balsam and American skunk cabbage.
- Prevention of economic losses that INNS could cause.
- Conservation and increased amenity value of local landscapes.

There are three main objectives that this plan will focus on;

Objective 1: Prevent the introduction and spread of INNS within the Dee catchment.

Output 1.1 – Raising awareness of:

- The ecological and economic impacts of INNS.
- The potential pathways for introduction and spread of INNS.
- Management best practices to prevent introduction and spread of INNS.

Objective 2: Establish a framework for the detection and surveillance of INNS, linked to a protocol to ensure a rapid management response.

Output 2.1 – 'Reporting system' established for INNS within the River Dee catchment.

Output 2.2 – Develop strategic monitoring of INNS within the River Dee catchment.

Objective 3: Develop coordinated control and eradication programme for INNS.

Output 3.1 – Rapid response mechanism established for new INNS which pose significant threats to local biodiversity and economy.

Output 3.2 – Coordinated control, eradication and habitat restoration programme established.

3 THE CONTEXT

3.1 Invasive non-native species: The nature of the problem

INNS issues are of increasing economic and ecological significance. Globalisation has expanded the extent and complexity of world trade and the growth of the tourism market has expanded the number of destinations for activity holidays and travellers. These trends have led to the increased probability of the unintentional as well as intentional introduction, establishment and spread of INNS, parasites and diseases in Scotland and the UK.

According to CBD (2006)[1], **I**NNS are the second greatest threat to biodiversity, being capable of rapidly colonising a wide range of habitats and excluding the native flora and fauna. Furthermore, over the last 400 years INNS have contributed to 40% of the animal extinctions where the cause of extinction is known. As water is an excellent transport medium for the dispersal of many of these species, rivers and lochs and their banks and shorelines are amongst the most vulnerable areas to the introduction, spread and impact of these species. The ecological changes wrought by INNS can further threaten already endangered native species and reduce the natural productivity and amenity value of riverbanks, shorelines and their waterbodies (CBD, 2015a).

The threat from INNS is growing at an increasing rate assisted by climate change, pollution and habitat disturbance with a correspondingly greater socio-economic, health and ecological cost. Many countries including Scotland are now facing complex and costly problems associated with invasive species.

According to a study carried out by Roy *et al* (2014), more than 2,000 non-native species are recorded in Great Britain; of which 237 established species have a negative impact on biodiversity. Among the 1,161 non-native species established in Scotland, 183 (16%) have negative ecological impacts.

Environmental impacts include disrupting habitats and ecosystems, outcompeting native species for space and food, spreading disease and interfering with the genetic integrity of native species. All these impacts lead to a reduction in biodiversity (CBD, 2015a).

The total annual cost of INNS to the British economy is estimated at approximately £1.7 billion. This is said to be a conservative figure and does not include indirect costs which could be substantially higher. Estimated total annual costs of invasive non-native species to Scotland is £244,736, 000 (Williams *et al*, 2010). Japanese knotweed alone is estimated to cost the British economy around £166 million per year (NNSS, 2015). Zebra mussels blocks water pipes and outlet pipes from power stations; in England the estimated cost to the water industry is more than £0.5 million a year for control of this species alone.

Invasive species have already changed the character of iconic landscapes and waterbodies in Scotland reducing the amenity value of those areas.

Some species also have a social impact, whether it is risk to human health (e.g. the harmful sap from Giant hogweed) or those which are considered a nuisance to landowners or recreational users (e.g. Japanese knotweed preventing access to watercourses, or floating pennywort clogging watercourses and preventing angling or boat navigation).

The Convention on Biological Diversity (CBD) focusses on protecting biodiversity through a ten-year framework for action by all countries. The plan provides a set of twenty targets, a collectively known as the Aichi Targets (CBD, 2015b). Aichi target 9 is focused on Invasive Non-Native Species and this target sets out action to control the most problematic non-native invasive species (SNH, 2016).

[1] http://www.cbd.int/gbo2

Without a coordinated and systematic approach to the prevention of introduction and control of the spread of INNS, it is likely that the ecological, social and economic impacts and the costs for mitigation, control and eradication of these species and diseases will continue to increase. This plan is the first step to set out and implement such an approach at a local level for selected species that significantly impact the environment. This local plan will provide a structure for future projects in the catchment, helping them to demonstrate strategic planning to support future funding applications.

Given the high costs for the mitigation, control and eradication of INNS once they are established this plan emphasises the need for prevention and rapid response to the introduction of INNS before they become established. Furthermore, the host of pathways for entry and spread as well as the persistence of many of these species means that a partnership approach to prevent introductions and involving diverse stakeholders is essential. The partnership approach encapsulated in this plan is a key requirement for increased public awareness and engagement, optimisation of the use of resources and the provision of clear guidance for inter-agency working necessary to address the biosecurity issues of the Kirkcudbrightshire Dee region. These approaches are consistent with, and support, the GB Invasive Non Native Species Framework Strategy and the Species Action Framework both of which have been approved by the Scottish Government.

"Addressing the direct and underlying drivers of biodiversity loss will ultimately require behavioural change by individuals, organisations and governments. Understanding, awareness and appreciation of the diverse values of biodiversity, underpin the willingness of individuals to make the necessary changes and actions and to create the "political will" for governments to act" (CBD, 2013).

3.2 Policy and legislation

The actions presented in this plan will conform to, and be supported by, UK and Scottish Government legislation associated with the prevention, management and treatment of invasive non-native species:

- Section 14 of The Wildlife and Countryside Act (1981)[2] (as amended in Scotland by the Wildlife and Natural Environment (Scotland) Act[3] 2011) makes it an offence to release an animal, allow an animal to escape from captivity or otherwise cause an animal not in the control of any person to be at a location outside its native range, or to plant or otherwise cause to grow a plant in the wild at a location outside its native range.
- Code of Practice on Non-Native Species[4] was issued in 2012 by the Scottish Government. The Code sets out guidance on how you should act responsibly within the law to ensure that non-native species under your ownership, care and management do not cause harm to our environment.
- Section 179 of the Town and Country Planning (Scotland) Act 1997[5] empowers local authorities to serve notice requiring an occupier to deal with any land whose condition is adversely affecting the amenity of the other land in their area.
- The Possession of Pesticides (Scotland) Order 2005[6] regulates the use of pesticides and herbicides for the control and eradication of INNS.
- Environmental Protection Act 1990[7] contains a number of legal provisions concerning "controlled waste", which are set out in Part II. Any Japanese knotweed or Giant hogweed contaminated soil or plant material discarded is likely to be classified as controlled waste.

[2] www.opsi.gov.uk/RevisedStatutes/Acts/ukpga/1981/cukpga_19810069_en_1

[3] http://www.legislation.gov.uk/asp/2011/6/part/2/crossheading/nonnative-species-etc/enacted
[4] https://www2.gov.scot/Resource/0039/00398608.pdf
[5] www.opsi.gov.uk/acts/acts1997/ukpga_19970008_en_1
[6] www.opsi.gov.uk/legislation/scotland/ssi2005/20050066.htm
[7] www.opsi.gov.uk/acts/acts1990/ukpga_19900043_en_1

This means that offences exist with the deposit, treating, keeping or disposing of controlled waste without a licence.

- The Waste Management Licensing Regulations 1994[8] define the licensing requirements which include "waste relevant objectives". These require that waste is recovered or disposed of "without endangering human health and without using processes or methods which could harm the environment".
- Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations 1991[9] and the Environmental Protection (Duty of Care) Regulations 1991[10] provide guidance for the handling and transfer of controlled waste.

[8] http://www.opsi.gov.uk/si/si1994/uksi_19941056_en_1.htm
[9] www.opsi.gov.uk/si/si1991/Uksi_19911624_en_1.htm
[10] www.opsi.gov.uk/si/si1991/uksi_19912839_en_1.htm

4 CATCHMENT OVERVIEW

4.1 Geography and land use

Overall the River Dee catchment covers approximately 1,020 km^2 and the river itself runs for 78.5 km.

The geology and landscape of the River Dee catchment is typical of other river catchments in the south west of Scotland. The catchment rivers flow over a mix of rock types, dominated by sedimentary rock in the lowland areas. The catchment lies in a part of the country which supports moorland, commercial forestry plantations, hill farming and arable farming.

The land on the west side of the catchment is dominated by the Glenkens, a range of hills including the Merrick and Corserine, rising to over 800 m above sea level. Cairnsmore of Carsphairn on the east side of the catchment is almost as high (797 m) but in general this side is not as high or as steep as the west. Downstream of Dalry the countryside is flatter being a wide glaciated valley.

In the north and west of the catchment the land is predominantly used for commercial conifer forestry with rough grazing occupying the highest parts. The middle areas of the catchment are used as pastures supporting sheep and beef cattle with some dairy farming and forestry. Below Loch Ken there is also some ground which is cultivated and cropped.

4.2 Galloway Hydro Scheme

The Galloway Hydro Scheme was the first integrated scheme developed in the UK; its viability arose following the 1926 Electricity (Supply) Act which led to the creation of the National Grid. *Figure 1* shows the layout of the Galloway Hydro's Scheme.

It encompasses two major storage reservoirs – Loch Doon which diverts water from the River Doon into the Dee catchment and Clatteringshaws which diverts water from the Black Water of Dee to the Ken at Glenlee.

There are three reservoirs in the Ken valley, Kendoon, Carsfad and Earlstoun, a control weir at Glenlochar (Glenlochar Barrage) creating storage in Loch Ken, and a reservoir at Tongland. There are power stations at Drumjohn, Kendoon, Carsfad, Earlstoun, Glenlee and Tongland.

The power station at Drumjohn was commissioned in 1984 but all of the other installations date from the period between 1931 and 1935 when the scheme was built and they remain largely in the form of their original construction.

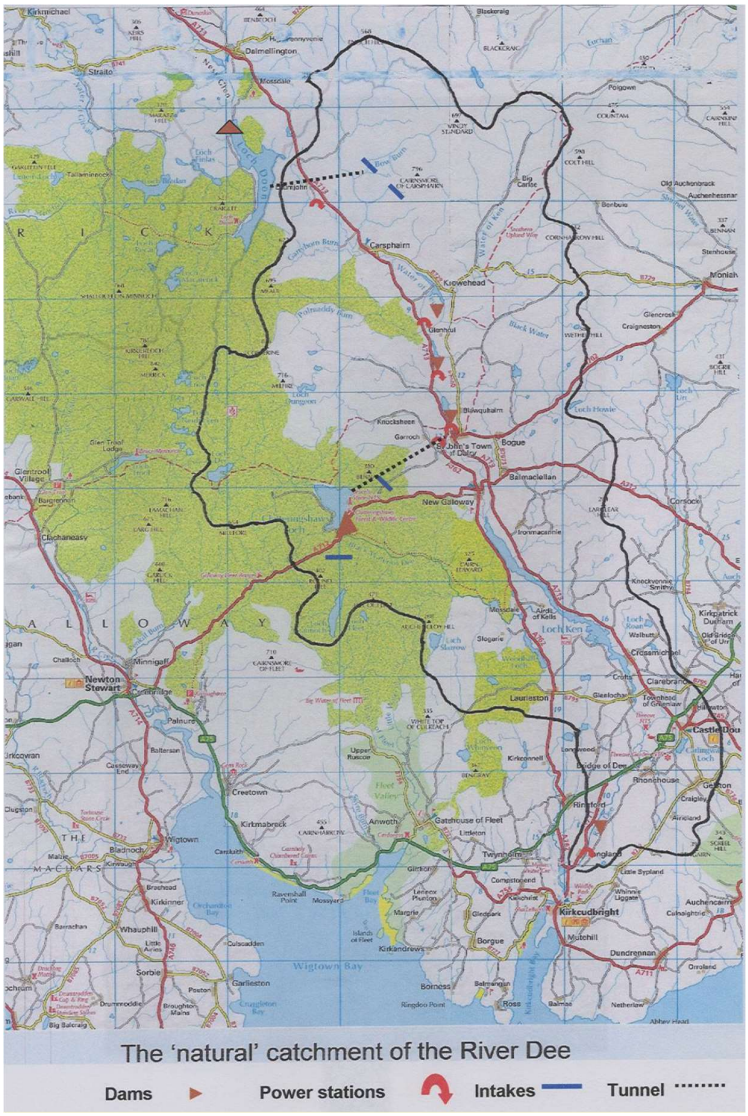

Figure 1: Map of the Dee catchment showing dams and intakes of the Galloway Hydro Scheme

4.3 Recreation

Angling is potentially the most common recreational activity seen around the River Dee Catchment. Loch Ken is hugely popular for coarse fish anglers and matches are held on a regular basis. People come from far and wide to fish the waters of the River Dee.

Much of the non-angling recreation which takes place on the River Dee catchment is focused around Loch Ken. Water sport activities such as boating and sailing, canoeing, wind surfing and water skiing all take place on the loch with the main period of activity between Easter and October. Water sport activities are centred around the Galloway Activity Centre, Crossmichael Marina, Loch Ken Marina and Loch Ken Holiday Park.

The Dee catchment, especially around Loch Ken is a focus for bird watchers. The Royal Society for the Protection of Birds (RSPB) run the popular Dee-Ken Marshes bird reserve on the south west bank of Loch Ken.

Although walking is not common around the perimeter of Loch Ken itself, there are many walks in the surrounding area including the Southern Upland Way, which runs through Dalry.

5 CURRENT INVASIVE NON-NATIVE SPECIES ISSUES

A number of invasive non-native species are established in River Dee catchment. Their known distribution, impacts and potential means of spread are discussed below. Distributions are based on the best information available, but since few systematic studies have been undertaken, it is likely many species are more widespread than is indicated.

Japanese knotweed (*Fallopia japonica*)

This species is present widely across the catchment. The discontinuous nature of this species' distribution likely results from numerous separate introductions. Knotweed spreads quickly through the vegetative reproduction of cut plants and disturbed rhizomes. In earlier years at the beginning of GFTs' work with INNS there were surveys conducted and exact locations were mapped. As a result of reduced funding in recent years surveying has stopped, and efforts have been directly allocated to treatment in priority areas. There have been successful treatment efforts within the catchment however it is highly likely that there are infestations in areas not known to GFT.

Dense stands of knotweed suppress riparian woodland regeneration and outcompete native vegetation, resulting in vulnerable bare banks when the plants die back in winter. The banks of some local rivers and tributaries are largely composed of soft sediment and prone to erosion in flood events. The presence of Japanese knotweed will exacerbate these problems. Knotweed also restricts access to the river for anglers. In other areas knotweed is currently not as widespread and its present impact is more limited.

Awareness of the damage that knotweed can cause has increased dramatically in recent years. That coupled with the legislation governing the species greatly reduces the risk of deliberate planting in the future. The main risk is from the spread of existing stands. Floods, trampling and wind damage could all break stems of the plant and allow it to spread naturally. Inappropriate cutting and dumping speeds the colonisation of new areas. Cut fragments of plants along riverbanks are transported downstream by the river.

Himalayan balsam *(Impatiens glandulifera)*

Records of this plant in the River Dee catchment have been limited to date. A clump of Himalayan balsam is present below Glenlochar barrage however the source of these plants has not been identified. SEPA also recorded a population on Kirkgunzeon Lane (a tributary of the River Urr). The rivers to the east – River Nith and Annan – are plagued by extensive balsam stands and in 2019 GFT discovered a few strands on the River Urr however not in dense populations. The Water of Fleet also has a known population and this is being treated on an annual basis.

Himalayan balsam grows quickly and excludes native plants. It is an annual and dies back in winter leaving bare banks vulnerable to erosion. The present population on the River Dee is currently causing little impact due to its small size. However, the extensive areas of bare soil exposed on the Nith and Annan demonstrate the problems this species could cause if left to spread unchecked across local waters.

The seeds of Himalayan balsam remain viable in the banks for approximately two years. This species has a very efficient mode of seed dispersal, with exploding seed pods sending seeds up to 7 m away from the plant. The presence of balsam (albeit in small clumps at present) in the catchment and in similar densities in two neighbouring mean there is the potential for this species to become a region-wide problem if left unchecked.

Giant hogweed (*Heracleum mantegazzianum*)

Giant hogweed has recently been reported in the River Dee catchment, along the coastline of St Marys Isle. This is the first known population and appears relatively contained and has been treated by the land owner. Giant hogweed also spreads through seed dispersal and the movement of soil contaminated by its seeds. Giant hogweed out competes native vegetation for space and resources shading out desirable vegetation which can result in a loss of plant and invertebrate diversity. Winter dieback increases exposed bare soil to direct rainfall and floods. The death of the plant stems loosen the surrounding soil that can result in whole sections of riverbank being eroded and washed out.

It is well documented that Giant hogweed is a public health risk. The sap of Giant hogweed is phototoxic and causes phytophotodermatitis in humans and animals, resulting in blisters and scars. Considering this current population resides along a public footbath and in a residential area, there is cause for concern and needs to be monitored. It is likely that this is an isolated population, introduced via seed dispersal from the sea or as a result of the area previously being an ornamental garden.

American Skunk cabbage *(Lysichiton americanus)*

There is currently a population of American skunk cabbage within the Aquavitae Burn, which has accumulated at the outflow just downstream of Loch Ken. This population was introduced upstream decades ago, before its invasive status was known.

This species has been introduced to the wild by gardeners and although it can be invasive, it remained popular and sold locally until recently. It is found in pond margins, riparian and boggy areas and can grow to over 1 m in height (Sanderson, 2013). Due to the waxy nature of its leaves, the effectiveness of foliar spray is questionable. GFT are currently trialling various methods to determine the most effective treatment.

North American Signal crayfish (*Pacifastacus leniusculus)*

The River Dee catchment is home to the largest known population of North American Signal crayfish in Scotland – Loch Ken. This population is believed to originate from deliberate introductions to two separate ponds which have outflow tributaries which connect ultimately to the River Dee catchment. Since the introduction, believed to be in the late 1980s, the crayfish population has hugely expanded to inhabit all of Loch Ken and numerous surrounding tributaries. Crayfish have spread throughout the lower catchment easily and are now present as far down as Tongland Power Station.

North American Signal crayfish can feed vigorously on aquatic vegetation, invertebrates, juvenile fish and eggs, de-stabilise river banks by burrowing and exclude salmonids from their preferred habitats. They are a fecund species with the ability to make use of many different habitats.

Efforts have been made in the past to manage this species which will be discussed in section 6.3. Since this time, it has been questioned as to whether trapping is an effective method of reducing the population due to trapping targeting primarily larger crayfish. Crayfish are notoriously cannibalistic and older crayfish will prey on smaller crayfish which provides a level of internal population management. If large scale trapping events occur, this may remove this predatory effect and allow the population density to increase further.

The presence and availability of crayfish in the catchment is also encouraging another invasive species, American mink, to utilise the area. With such an abundant food source, mink are now a common sight along the riverbanks.

American Mink *(Mustela vison)*

Mink are present throughout the whole length of the River Dee catchment. Mink are opportunistic predators and they will kill spawning salmon and trout on spawning beds. Research from the Western Isles also showed that mink can significantly reduce salmon and trout parr numbers. They can depress fish stocks and are capable of decimating water vole and ground-nesting bird populations. The original mink populations were the result of deliberate and accidental escapes from farms. Extensive trapping was undertaken in the past however is limited at the time of writing this plan.

Sitka spruce *(Picea sitchensis)*

Sitka spruce and other non-native conifers have been planted for commercial forestry or shelter belts. In most cases the conifers are restricted to areas where they have been planted and ground conditions and grazing levels are limited to promote growth. However, Sitka spruce is able to seed out of plantations and establish in riparian areas, particularly onto bare banks following the clear felling of conifers during the restructuring process. Most self-seeded Sitka is close to forestry plantations, although records of the species in river headwater areas away from plantations indicate its ability to spread greater distances. There are some impacted watercourses within forestry plantations affecting the Dee catchment.

Sitka are fast growing, resistant to browsing and capable of outcompeting natural vegetation. They are capable of shading watercourses and preventing access to banks. Forestry guidance advise up to a 20 m buffer zone free of conifers along larger watercourses. The ability of Sitka to naturally seed into such a buffer zone reduces the effectiveness of these guidelines to protect watercourses from over shading problems.

Forestry plantations will remain the most likely seed source of invasive Sitka. The edges of forestry tracks seem to provide ideal conditions for seedlings and it is likely Sitka will spread along these corridors. The presence of isolated Sitka trees in remote places suggest seeds can be dispersed for many miles so there is some potential for Sitka to spread over greater distances. Grazing and browsing by livestock and deer will prevent Sitka seedlings establishing and fenced areas close to existing plantations will be the most vulnerable to invasion.

Rhododendron (*Rhododendron ponticum)*

Popular in the gardens of large Victorian houses and soon spread beyond the garden wall. The west coast of Scotland seems to provide ideal growth conditions and various woodlands in Galloway have abundant rhododendron stands. While a major problem in many areas of Scotland, rhododendron problems for water habitats in Galloway is limited.

The plant regenerates from seed and the widespread presence of small plants in some areas indicates that natural regeneration is occurring readily. Rhododendron forms a closed canopy and acidifies the surrounding soil preventing other plants establishing. Its presence will destroy the native ground flora of woodlands and prevent tree regeneration. The rapid growth of rhododendron along watercourses can lead to shading and reduced nutrient input.

Rhododendron continues to be sold and planted as an ornamental garden plant. However, the present wide distribution and abundance of rhododendron ensures that there is already sufficient seed and plant material to allow its potential further natural spread into suitable habitats across the River Dee catchment.

Canadian pondweed *(Elodea canadensis)*

Canadian pondweed was recorded by SEPA at a number of locations throughout the River Dee. The NBN Gateway website also suggests the plant to be present in Woodhall Loch & Carlingwark Loch. *Elodea* can grow very quickly and totally dominate native macrophyte communities which may lead to local extinctions and can make angling impossible. The plant

is spread easily via plant fragments and has found its way into watercourses and stillwaters via ponds and anthropogenic disposal. Impacts on invertebrates have also been recorded and *Elodea* is known to absorb metals from sediments and transfer them into their water environment (CEH, 2004a).

Nuttalls pondweed (*Elodea nuttallii*)

Nuttalls pondweed has been recorded by SEPA to be present within the Dee catchment, found at Loch Ken outlet to Tongland. This waterweed threatens local biodiversity through shading and outcompeting local plants as well as potentially changing its surroundings nutrient cycle and water quality.

Curly waterweed *(Lagarosiphon major)*

Has been identified in the Stewartry area so risk of translocation to other catchments. Sold for the aquaria trade so could become established through intentional/unintentional introductions. Can also be spread by fragmentation via wind dispersal, boat movement, angling equipment and, possibly waterfowl. Capable of forming very dense infestations in suitable habitats and occupying the full water column in waters up to 6 m deep with significant impacts on native plants, insects and fish (CEH, 2004b).

Rainbow trout *(Onchorhynchus mykiss)*

There is one operational rainbow trout farm on Kendoon Loch, which uses floating cages on the loch. Mostly stocked fisheries are well screened or isolated to ensure that no stocked trout can escape into the wider aquatic environment. Anglers used to report regular catches of rainbow trout of various sizes. Rainbow trout may predate young fish and smolts and can also compete with native salmonids for food and shelter. Escapees from this farm may have been the original source of the rainbow trout in this catchment. Only a few of the many rainbow trout escapees in Britain have ever resulted in self-sustaining breeding populations, and no evidence of spawning has been recorded in the River Dee.

Non-native fish (various species)

Present in many still and running waters in the River Dee catchment. Some of these have been deliberately introduced; others have been introduced when discarded after using as bait by anglers. Until recently the stocking of coarse fish was unregulated and, due to the high number of stillwaters across the region, this has resulted in species such as tench, rudd, roach and bream becoming established in some Galloway waters. Some of these species are native to the UK but have been translocated to Galloway which is outside their natural range. Many non-native fish species have become established in Loch Ken. Loch Ken is frequented by many coarse fish enthusiasts and over the years has become popular due to the many non-native species available for angling. These fish can have ecological impacts on various native species through predation, competition for resources or habitat change.

Giant rhubarb (*Gunnera tinctoria)*

Giant rhubarb, a large leaved plant from Chile growing up to 2 m in height, became a very popular ornamental species in gardens and parks in temperate areas from the middle of the nineteenth century (NNSS, 2011b). The species can spread from rhizomes discarded from gardens and from seed disseminated by birds and is a threat to native vegetation. It is mostly present in large gardens and estates and its presence along river banks and waterways is currently unknown in the Dee catchment however isolated populations have been recorded in estates and gardens within the overall catchment.

6 CURRENT AND PAST INNS MANAGEMENT

6.1 Invasive plant species

GFT have been working to manage and control INNS of plants since 2008. A four and a half year project titled 'Controlling priority invasive non-native riparian plants and restoring native biodiversity' was completed in 2012. The GFT was one of five Scottish partners (GFT, Rivers and Fisheries Trusts of Scotland (RAFTS), Ayrshire Rivers Trust, Argyll Fisheries Trust and the Tweed Forum) that secured EU Interreg support to control Japanese knotweed on a catchment scale. In Galloway, the GFT was focused on eradicating Japanese knotweed from across six catchments; Water of App, Water of Fleet, River Luce, River Bladnoch, Urr and the Kirkcudbrightshire Dee.

Though this project, the River Dee was surveyed and controlled for Japanese knotweed. Since this project, funding has been significantly reduced and as a result treatment has been prioritised and limited. No catchment wide surveys have been carried out since, other than at the beginning of this biosecurity project where specific sites were surveyed to confirm presence or absence following reports.

Through funding previously provided by SEPA and then in recent years the Stewartry Area Committee, GFT continued to treat a prioritised section of the River Dee for Japanese knotweed and also American skunk cabbage on the Aquavitae Burn. However, 2019 has seen the complete loss of funding limiting treatment to private contracts. This work has no catchment wide effect and only covers very small areas.

6.2 American mink

A trapping project of American mink began in early 2009 across the catchments of the River Dee and Water of Fleet, coordinated by GFT. The project involved training, coordinating and providing trapping equipment to volunteers across both catchments, where mink predation is believed to be an issue. Mink rafts and traps (designed by the Game and Wildlife Conservation Trust) were given to volunteers which use a clay tray to record tracks of mink prior to the setting of a cage trap. GFT and GWCT held a training day for all participating in the project.
In recent years the only trapping of Mink carried out within the Dee catchment has been done by keen individuals.

6.3 North American Signal crayfish

The exact distribution of the two Galloway crayfish populations (Dee and Skyre Burn catchments) were mapped in 2009 by GFT as part of a Scotland wide RAFTS / SNH survey using agreed protocols.

In 2009 Marine Scotland funded a five month research study to look at the crayfish population in Loch Ken and investigated the possibility of large scale (using ~ 600 traps) trapping to control their numbers and spread. The study recommended a further three year trapping study on the loch.

A Loch Ken Council Ranger has been undertaking limited trapping (when he had time available) for crayfish on various tributaries around Loch Ken in 2009 / 2010. The aim of the trapping was to reduce the densities of crayfish in important salmonid spawning and nursery burns.

Since this trapping program it has been widely accepted that the problem is far worse than can be managed. Focus has been directed onto reducing the spread as opposed to active trapping programs. A recent discovery of crayfish in Tongland fish pass has highlighted that the population has spread further than previously thought.

7 RISKS WITHIN THE CATCHMENT

There are two directions of risk within the River Dee catchment, introduction of new INNS species from other areas, and the spread from the catchment to other catchments. Whether the risk is spreading from or introducing to the catchment, the problem remains the same. It is an important aspect of a management plan to consider potential pathways in and out of the catchment which pose a risk and determine which biosecurity actions could be introduced to reduce the risk. It is also key to consider species which pose a risk to the region.

7.1 Potential biosecurity issues

The INNS listed below in *Table 1* are believed not to be currently present within the River Dee catchment. They have been classified as High or Medium level threats depending on their likely impact on the local economy and biodiversity in combination with the likelihood of their introduction. The level of risk of introduction was based on the pathways for the introduction of INNS, their current geographic proximity and land use within the catchment.

High Threat: Species with **Severe** consequences for local biodiversity and economy and a **High** to **Medium** risk of introduction

Medium Threat: Species with **Moderate** consequences for local biodiversity and economy with a **Low** to **High** risk of introduction

Table 1: The risk of introduction of threat species

SPECIES	RISK OF INTRODUCTION	IMPACTS
Gyrodactylus salaris (Freshwater external parasite of salmon)	**High** – Through unintentional introduction from anglers and water sport enthusiasts through: ▪ Contaminated fish ▪ Clothing/equipment which has been in contact with infected water including canoesBallast water	Predicted catastrophic impact on salmon *(Salmo salar)* populations throughout Scotland (it has largely exterminated *S. salar* in 41 Norwegian rivers).
Killer Shrimp (*Dikerogammarus villosus)*	**High** – Species was first confirmed in 2010 in England (Cambridgeshire) and Wales (Cardiff Bay and Port Talbot). Unintentional introduction can be from anglers, water sport users, ballast water and through contaminated equipment.	The killer shrimp is an omnivorous predator native to the Steppe region near the Black and Caspian Seas. It can feed on a variety of macroinvertebrates, including other gammarid species, and exhibits an important biotic potential and ecological plasticity. It has had major impacts in lowland Europe, particularly Holland where it has destroyed local ecology by wiping out native shrimps and small fish species.
Zebra mussel (*Dreissena polymorpha)*	**Medium -** through unintentional introduction from contaminated boat/canoe hulls and engines and bilge water.	Major economic impact on all subsurface water structures e.g. blocking pipes and impacting upon hydro-electric schemes. Varied and unpredictable ecological impacts including changes to freshwater nutrient cycles, extinction of local mussels and changes to stream substrate affecting spawning areas (NNSS, 2011).
Chinese mitten crab *(Eriocher sinensis)* Resides in freshwater but migrates to the sea for breeding	**Medium -** through unintentional introduction from boat hulls and live food trade.	Burrowing in high density populations damages river banks Concern over impacts on local species Intermediate host for the mammalian lung fluke *Paragonimus ringer,* known to infect humans.
Parrot's feather (*Myriophyllum aquaticum*)	**Medium** – A population has been recorded in the Nithsdale/Annandale area. The plant can spread by asexual means. Stems are brittle and it can also spread via fragments of plants.	Can shade out native flora. In coastal or brackish water it has been observed to displace native species. In Guernsey, a reduction in native biodiversity has occurred; it is a major problem and has eliminated many native species and impacted fisheries in South Africa. Has caused major problems for hydroelectric power production in Argentina. Can quickly dominate and block watercourses (NNSS, 2011a).

Slipper limpet (*Crepidula fornicata*)	**Low** – A marine INN species which has been recorded as present in coastal waters off the central belt in Scotland. Can be introduced on ship hulls.	Can occur in high densities (1000s per m^2) in marine and estuarine waters.
Floating pennywort (*Hydrocotyle ranunculoides*)	**Low** – Not known to be present in Scotland and has mostly been recorded in south east England. Has become established through the trade/disposal of garden pond plants. Dispersed by water flow and flood events. Care should be taken to remove all cut plant material from the waterbody as rapid re-growth can occur from a single node.	Can form dense rafts and outcompetes native plant species. Reduced light levels below the rafts can cause die off of waterweeds and algae and reduce water oxygenation levels. This can kill fish and other fauna.
Fanwort (*Cabomba caroliniana*)	**Low** – Known to be present in Dumbartonshire. Popular as an aquarium plant and introductions may occur through inappropriate disposal of the plant. Spreads primarily by stem fragments by also by seed dispersal.	Originally found in South America. Forms dense stands that exclude native flora and clog watercourses.

7.2 Pathways of introduction

- Intentional introduction or planting
- Fouling and ballast water of marine vessels
- Fouling and ballast water of freshwater vessels
- Escapes from garden ponds
- Contaminated water sports equipment (e.g. from anglers, canoeists)
- Movement of contaminated soils or vehicles
- Improper control and disposal measures e.g. cutting and dumping without treatment
- Natural dispersal by seeds, vegetative spread or migration

7.2.1 Intentional introduction

Unfortunately, it is believed that people are still intentionally planting invasive species in their gardens, knowingly letting them spread and actively moving species between catchments.

7.2.2 Gardens and garden centres

It is estimated that nationally, 60% of invasive plants have been introduced through horticultural use (Plantlife/Royal Horticultural Society, 2010). In 2014, five non- native invasive aquatic species were banned from sale in the UK (Brockman and Holden, 2015). The spread of invasives from private gardens can be a result of direct or indirect dispersal. It is common for gardeners to dump cuttings, and often this occurs along riverbanks, aiding the transport of these cuttings downstream.

7.2.3 Tourism/leisure

The River Dee catchment, primarily Loch Ken, is a hub of activity during summer months as a result of its recreational attractions. Invasive species can be inadvertently spread by people using the catchment for general leisure and tourism purposes, including activities such and walking and cycling (Brockman and Holden, 2015). By highlighting attractions and locations which may pose a risk of spreading INNS, it allows for considerations to be made regarding potential biosecurity procedures which could be adhered to, to reduce the risk.

National Trust for Scotland is a key partner in this task considering the wide range of sites they cover in the region. Visitors are known to visit several sites across Galloway in one trip which could transfer seeds or vegetation on shoes and clothes between sites. Hosting beautiful scenery and water sport activity opportunities, many people visit on an annual basis.

Water sports are a popular activity within the River Dee catchment and it is important that users of the water are aware of the risks associated with INNS and know how to reduce the risk of spread.

7.2.4 Angling

Angling is a potential route of introduction as a result of anglers traveling from catchment to catchment and reusing equipment that may not have been cleaned properly. Nets are an easy place for young crayfish to catch onto and hide. Angling also occurs regularly in areas where there are INNS of plants present, potentially transporting seeds and plant matter across catchments.

7.2.5 Kirkcudbright Marina

Harbours, marinas and ports are high risk areas for introducing new INNS to the catchment. The risk is dependent on where the boat traffic is from and also the location of the harbour.

Kirkcudbright marina on the River Dee is the main base for scallop fishers in south Scotland. Recreational boat users also pose a risk with activities such as sea angling, scuba diving, sea kayaking, jet skiing, wind and kite surfing popular in the area. These factors mean that there is an increasing probability that certain INNS are likely to arrive in the Solway (SFP, 2017).

Discussions with the Harbour Master confirmed there are no biosecurity measures currently in place to tackle the risk of INNS being transported into the catchment from other areas. However, it was also discussed that the risk is very low in comparison to larger, more commercial ports due to the limited area where boats are moving to and from. Discussions are in place further considering risk at this location and potential biosecurity measures that could be implemented if required.

8 STAKEHOLDERS

There are a number of organisations and individuals with an interest in INNS in the River Dee catchment. The engagement of key stakeholders is imperative for the success of this plan. Regulatory agencies and other bodies with an interest in INNS can be found in *Table 2.*

Table 2: Regulatory agencies and other bodies with an interest in INNS

Policy and Legislation	Land Resources	Water Resources
• Scottish Government • SNH • SEPA • Marine Scotland • Fisheries Management Scotland	• Forest and Land Scotland • D & G Council • Landowners Association • NFU	• Scottish Water • Drax
Fisheries Management	**Recreation**	**Conservation and Biodiversity**
• Dee District Salmon Fishery Board • Galloway Fisheries Trust • Commercial Fisheries Industry	• Ramblers Association • Local Angling Associations • Activity centres	• NTS • Scottish Wildlife Trust • RSPB • Solway Firth Partnership • Plant Life • Dumfries & Galloway Environmental Resources Centre

The plan also seeks to engage with all members of the community who have an interest and/or a role to play in preventing the introduction or spread of INNS. These include: local garden centres; landowners, local water sport organisations; local angling clubs; local quarries; farmers and members of the public.

Stakeholders have been identified from an analysis of possible routes of introduction, spread or control of non-natives presented in *Table 3*.

Table 3: Pathways and stakeholder groups

Pathway	Groups or Stakeholders at Risk
Intentional introduction or planting	Plantlife, riparian landowners, public, local councils, planning department, anglers
Fouling and ballast water of marine vessels	Local harbour authorities, Marine Scotland
Fouling and ballast water of freshwater vessels	Port Authority, SEPA, UK Government; local canoe and water sports organisations
Escapes from garden ponds, gardens	Horticultural Trade Association, SNH, SEPA, Plantlife, public, planning authorities, riparian owners
Contaminated water sports equipment (e.g. from anglers, canoeists	DSFB's, local canoe/water sports organisations, anglers, angling clubs
Movement of contaminated soils or vehicles	D & G Council, SEPA, quarries, building contractors, landscape contractors, Drax
Improper control and disposal measures e.g. cutting and dumping without treatment	Local councils, SEPA, environmental health, Plantlife, riparian owners/members of the public

This plan identifies key actions required to change the behaviour and practices of the above groups so as to reduce the opportunities for the introduction and spread of INNS. Key stakeholders have been contacted regarding this plan to discuss potential action points and to identify gaps in biosecurity protocol within the region.

It should be noted that discussions with local stakeholders and groups were very positive and it was pressed that any action points that are put forward need to be realistic and applicable catchment wide. This plan needs to be accessible and available to relevant organisations and needs to take into consideration individual circumstances. It is key that the plan is commented on and can be altered following the circulation of the draft version.

9 STAKEHOLDER DISCUSSIONS

9.1 SNH

SNH are the lead body for INNS on land in Scotland. They are currently embarking on a four-year Scottish Invasive Species Initiative in the north of Scotland, tackling INNS on a large scale. Within the River Dee catchment there is currently no INNS management being carried out, however SNH are willing to support GFT's actions and comment on potential biosecurity procedures that could be implemented in the region.

9.2 SEPA

SEPA are the lead body for INNS in standing and running freshwater habitats in Scotland. SEPA regulates activities affecting the water environment, and are incorporating biosecurity requirements into General Binding Rules and license conditions where possible.

9.3 National Trust Scotland

NTS have numerous sites across Galloway. By identifying risks and potential pathways of invasion and spread, we can consider actions to be put forward to tighten up biosecurity in the region. NTS are now working on protocol and procedures to be put in place at Threave Castle to ensure boats leaving site have been checked, cleaned and dried and it will be mandatory for the presented method statement to be followed by all staff. Signs are going to be erected throughout the region, including sites out with the Dee catchment. Fishing permits will highlight biosecurity procedures to be followed within the NTS' land. GFT and NTS have formed a partnership and will continue to work together.

9.4 Forest and Land Scotland

FLS are committed to completing INNS work to ensure they comply with their UKWAS accreditation. Individual foresters are encouraged to be vigilant for any INNS within their beats. There is an internal system in place used to map work due within their land and this continues to be a useful tool for managing INNS control. From this, specific INNS work is prioritised so that even with budget cuts, key invasive control work is still completed.

9.5 Solway Firth Partnership

GFT work closely with Solway Firth Partnership (SFP), and both organisations have a key interest in INNS within the region. SFP were contacted in relation to the risk of INNS introduction through the Kirkcudbright Marina.

A recent study 'Marine Invasive Non-Native Species in the Solway Firth[11] ' was carried out by SFP using settlement panels concluded that due to location of the marina being tidal but primarily freshwater, it was unlikely that many marine INNS would pose a risk of introduction from this pathway.

9.6 Drax

Drax recently bought over Scottish Powers' Gas and Hydro stations. The Dee catchment as detailed in section 4.2 is host to a series of hydro's which link different catchments. The importance of biosecurity in this instance is clear and Drax have a stringent biosecurity risk

[11] https://solwayfirthpartnership.co.uk/wp-content/uploads/2018/09/Marine-INNS-in-Solway-2018-2021.pdf

assessment in place. All staff are trained in biosecurity before being allowed on site and know the procedures to follow if invasive species are present.

10 FIVE YEAR MANAGEMENT PLAN

10.1 Objectives and outputs of the Kirkcudbrightshire Dee biosecurity plan

The objectives of this plan are based on three elements:

- Prevention
- Early detection, surveillance, monitoring and rapid response
- Mitigation, control and eradication

The involvement and participation of stakeholders will be essential to achieve the objectives of this plan.

This section describes the expected outputs from implementation of the three plan objectives and the actions required for their realisation. Agreed actions for prevention are focussed on the disruption of the pathways for the introduction and spread of INNS, translocated species and fish diseases and include a mixture of awareness raising and practical measures. Awareness activities take note of the GB Awareness and Communication Strategy. Increased probability of early detection of the introduction or spread of INNS is realised through surveys to establish the location of existing populations, establishment of a coordinated local surveillance and reporting system supported by routine monitoring of established populations or sites vulnerable to the introduction and spread of these species. Control activities will be undertaken in a coordinated and systematic manner to eradicate identified INNS where feasible.

Objective 1: Prevent the introduction and spread of INNS within the River Dee catchment.

Key Actions
A. Establish programme to raise awareness with stakeholders
B. Encourage use of good practice within key stakeholder groups
C. Establish and extend disinfection programme to cover likely pathways of entry

The River Dee catchment contains various INNS and stopping the further spread of these species and preventing the colonisation of new INNS offers the most efficient and effective means of control. Awareness-raising activities will be focussed on addressing local priorities as well as supporting the GB Awareness and Communication strategy and its key messages to the general public. The key stakeholders, the identified areas of priority and the proposed mechanisms for delivery are presented in *Table 4*. The roles and actions of key government agencies and non-government bodies in promoting awareness of INNS issues is presented in *Table 5*.

Table 4: Priority areas for awareness and delivery mechanisms according to stakeholder group

Stakeholders	Priority Areas	Mechanism of Delivery
Local fish farm	- Inform fish farms of the impact of INNS and how they spread - Dangers of importing from contaminated areas - Use of proper screens and other biosecurity measures - Need for controls on movement of stock and water	- GFT to liaise with local industry and trade associations to advise members regularly of best practice in respect of INNS - Invasive Species Scotland website - Marine Scotland Fish Health Inspectors to discuss with fish farms during audits
Local garden centres	- Educate trade buyers to avoid stocking invasive species - Promotion of existing codes of practice covering the security and disposal of INNS to all garden centres - Target gardeners to dispose plant material and/or soils in a responsible manner	- GFT to work with garden centres to encourage distribution of codes and posters (available from Plantlife) and to advise the general public of INNS issues
Local Aquarium and pond stockists	- Promote code of practice to all pet shops and suppliers of ornamental fish - Target aquarists and pond keepers to dispose of unwanted animals or plants in a responsible manner	- GFT to work with retailers to encourage distribution of codes and posters (available from Plantlife)
Water user associations (canoeists, sailing clubs)	- Promote awareness to clubs and participants of the dangers arising from INNS - Identification of suitable people to act as monitors for GFT to watch for any INNS species in their activity area	- GFT to work with associations to promote check clean dry for equipment.
Riparian landowners	- Promote knowledge of biosecurity issues amongst all tenants and resource users - Identification of suitable persons to act as monitors for GFT	- DSFB's and Improvement Associations to work with GFT to ensure dissemination of best practices and appropriate signage to reduce threats from INNS - GFT to offer training for monitors

Stakeholders	Priority Areas	Mechanism of Delivery
Angling clubs	- Promote knowledge of biosecurity issues amongst all members and visiting anglers - Ensure the distribution of information and erection of signage in fishing huts and recognised car parks - Recommend suitable members to act as monitors	- Local AC's work with GFT to ensure dissemination of best practices and appropriate signage to reduce threats from INNS - GFT to work with clubs to promote check clean dry for equipment - GFT to offer training for monitors
General public	- General awareness of impacts and measures to prevent/control INNS	- Local Media Campaigns - Use of social media - GFT to develop a leaflet to promote the biosecurity plan, the dangers arising from INNS and the reporting system - Promote the biosecurity plan to all retail outlets who deal with NNS e.g. pet shops, garden centres
Contractors / Ground maintenance workers	- General awareness of impacts and measures to prevent/control INNS	- GFT to work with industry bodies to ensure dissemination of best practices - GFT to offer training for monitors through industry bodies
Schools	- General awareness of impacts and measures to prevent/control INNS	- School visits focusing on key species and explaining the problems associated and what they can do to help

Table 5: Roles and/or actions of key government and non-government agencies in promoting awareness of INNS issues

Organisation	Role and/or action	Delivery Mechanisms
GFT	- Promote awareness to general water users promoting the biosecurity plan and highlighting the dangers from INNS	- Promote and launch of biosecurity plan -Distribute information leaflets to stakeholders and members of the public -Promote reporting system
DSFBs	- Continue to promote awareness to anglers and angling clubs of the dangers arising from INNS	- Highlight potential risks of fish movements between catchments - continue to promote check clean dry for equipment
D & G Council	- Promote use of codes of best practice for construction, haulage, horticulture, aquaculture amongst local business and relevant departments particularly construction, garden and pet trade - Encourage responsibility within Local Authorities for the control of all INNS on public land	- Councils to promote codes of best practice at every opportunity e.g. including INNS guidance with planning applications and building warrants - Holding of awareness event/open days to promote biosecurity issues - Issue INNS ID and guidance cards to appropriate council staff - Display posters (Check, Clean, Dry) in council offices, libraries and other public places
SEPA	- Clarify SEPA responsibilities for INNS to both staff and customers - Incorporate INNS issues into relevant authorisation and guidance documents (as they are developed or updated)	- maintain page on website with links to relevant SEPA information and other sites e.g. Non-Native Species Secretariat - Ensure relevant documents available for download on SEPA website
SNH	- Promotion of good practice in the prevention, control and eradication of INNS - Provision of funding for local INNS initiatives	- Holding of SNH Sharing Good Practice events. - Grant funding may be available for some projects
NTS	- Promotion of good practice in the prevention, control and eradication of INNS	-Producing method statement for removal of boats and engines from the water surrounding Threave Castle -Erecting signs around NTS visitor attractions -Fishing permits will promote biosecurity -Partnering with GFT to carry out school projects and information events.

Objective 2: Develop systems to ensure the detection and surveillance of INNS and rapid response to the threat.

Key Actions
A. Establish an 'early warning system' for detecting new threats
B. Develop strategic monitoring of INNS in Galloway
C. Develop rapid response protocols for new significant threats to local biodiversity and economy

Early Warning System

The monitors of the early warning system will be trained members of the public, anglers, bailiffs, ghillies, canoeists and walkers, with reported sightings verified by trained GFT personnel. A sighting of a GB or local high priority species (*Table 6)* will be verified if possible by appropriate personnel. If confirmed, it will initiate the appropriate GB or local high priority response. Reports of priority species will be verified as time permits. All verified sightings will also be entered onto the GFT Geographic Information System (GIS) database to monitor INNS distributions within the region.

Establish rapid response mechanism for new high-risk INNS

The type of response will depend on the severity of the species detected (*Table 6*) and is proportionate to the threat posed. There are three levels of response:

- a GB level response that will be undertaken by national governmental institutions as part of the GB INNS strategy
- a high priority local rapid response
- a priority local rapid response

Table 6: Response level for the invasive non-native species

GB Response	High Priority Local Response	Priority Local Response
Gyrodactylus salaris Asian top mouth gudgeon Water primrose Wireweed	Killer shrimp North American signal crayfish Chinese mitten crab Zebra mussel	American Mink Parrot feather Canadian pond weed Japanese knotweed Water primrose Himalayan balsam Water fern Large flowered waterweed Rhododendron *Anasakis sp* Australian swamp stonecrop Slipper limpet Common cord grass Fanwort Curly waterweed Floating pennywort Escaped farm salmon Sitka spruce regen Giant hogweed American skunk cabbage

A confirmed sighting of a GB priority species will trigger the GB contingency plan for that species e.g. *Gyrodactylus salaris*. However, there is still a need for local level protocols to link with the GB response as well as for local level contingency plans for local priority species. The elements to be included in the response to detection of a GB priority species or the contingency plans for local priority species are outlined in *Table 7*.

Table 7: Elements of contingency plans or protocols for response to GB priority, local high priority and priority species

GB Response	Local High Priority Response	Local Priority Response
Report to local and GB institutions - Determine the extent of infestation - Isolation of area where practicable	Report to local and GB institutions - Determine the extent of infestation - Isolation of area where practicable - Establish source and check related sites - Closure of all pathways - Decision on appropriate action eradication/containment. - Approved eradication methodology - Monitor	Report to local and GB institutions - Determination of the extent of infestation - Surveys in course of normal work to establish and map distribution - Inclusion of new areas in existing eradication/control programmes - Identification and closure all pathways - Monitor as part of planned catchment monitoring programme

Objective 3: Develop effective control and eradication programmes for INNS present in the River Dee catchment.

Key Actions
A. Collect data on distribution and abundance of existing threats
B. Develop and initiate control and eradication programmes to tackle threats
C. Coordinate partnerships with other organisations to source future funding and develop projects to ensure long-term control and eradication

A. Collect data on distribution and abundance

For effective INNS control and eradication programmes, it is essential that the current distribution and abundance of INNS is known. To collect accurate and up-to-date on INNS distribution, the following actions are required:

- Continue and expand specific surveys for INNS to address the question of INNS within the River Dee catchment
- Liaison with SNH, D & G Council, SEPA and other groups to standardise survey methods and combine current knowledge of distribution and abundance of existing INNS in the area
- Work with South West Scotland Environmental Information Centre to collect reports and survey data

B. Develop and initiate control and eradication programmes

As surveys continue to reveal the distribution and extent of INNS in Galloway, control and eradication programmes will be considered in conjunction with key stakeholders using up-to-date NNSS advice on good practice for each INNS present. The GFT will liaise with the NNSS for current good practice and with other specialists on their practical experiences with control and eradication programmes. Control and eradication programmes will depend upon the nature of the INNS threat and different stakeholders will be involved in and lead different programmes depending on the threat. A combination of specialist contractors, volunteers, river managers, local estate staff and GFT staff forum will be used depending on the management requirements of the area involved.

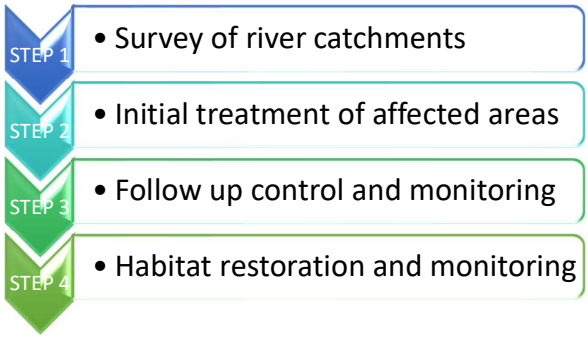

Figure 2: Flow chart detailing program structure

Envisaged mitigation, eradication and control measures for the some of the INNS present in the River Dee catchment are presented in *Table 8*.

Table 8: Invasive Non-Native Species control and Eradication in the Kirkcudbrightshire Dee catchment

Species	Action	Treatment/post treatment
Japanese knotweed / Himalayan knotweed	Control/eradication Identify and close pathways	Undertake control (through glyphosate spraying and injecting) on riparian areas across all main river systems and their tributaries. Map, quantify and control knotweed on coastal burns
Rhododendron	At key riparian locations control / eradicate Survey for problem areas	Undertake control (through cutting followed by herbicide treatment) in identified riparian areas
Himalayan balsam	Control/eradication Identify and close pathways	Undertake control (by glyphosate spraying, strimming or hand pulling) in all areas where Balsam identified
Sitka spruce regeneration	Remove naturally seeded conifers in riparian buffer zones (as defined in Forest and Water Guidelines)	Control regeneration Sitka spruce trees by strimming, hand cutting or chain sawing – depending on size – within 20 m of all burns over 1 m width, on a 10 year rotation
American mink	Control	Continue and expand catchment co-ordinated trapping programmes
Rainbow trout	Monitor angler catches	Encourage anglers to kill all rod- caught rainbow trout present in running waters
Giant Hogweed	Control/eradication Identify and close pathway	Spray with glyphosate up to three times a year
North American signal crayfish	Monitor distribution and consider risk of spread to other catchments	
Canadian Pondweed	Eradication and monitor distribution	Trial eradication methods at two important fishery waters (Ornockenoch Loch and Black Loch). If successful roll out into other affected waters
American Skunk cabbage	Eradication, identify and close pathways	Appears to be in low numbers so control with glyphosate
Giant rhubarb	Monitor distribution	
Curly water weed	Monitor distribution	
Escaped salmon	Eradicate	Circulate advice on recognising fish farm escaped salmon. Ensure all anglers kill any rod caught escape salmon

C. Coordinate partnerships to source future funding and develop projects

Any progress made in the control of INNS can be quickly undermined and resources wasted if continued, long-term commitment is not present. There are many organisations with a remit and desire to control INNS. The GFT will seek to form and coordinate partnerships with these organisations and neighbouring fisheries trusts to identify funding sources and potential projects that ensure sustainable control of INNS in Galloway. Such partnership working will be essential to bring about large-scale resource-intensive projects.

10.2 Actions and timeframes

The table below presents the actions required to realise the objectives and outputs described in Section 10.1 along with the lead agency, key partners and timeframe required for their implementation.

Key: ——— Solid line indicates continuous action ····· Dotted line indicates ongoing / wide timescale effort

Action	Lead	Partners	TIMEFRAME 2020	2021	2022	2023	2024
Objective 1: Prevent the introduction and spread of INN species							
Launch of Galloway biosecurity plan through national and local press release	GFT	GGLP, SEPA, NTS, SNH	———				
Produce leaflet on legislation including waste management & planning regulations	D & G Council	SNH	———	———			
Produce leaflet(s) on biosecurity issues and the reporting system	GFT	SNH	———				
Produce posters on biosecurity issues and distribute to the general public	GFT	NTS SEPA	·····	·····	·····	·····	·····
Develop good practice protocol with Harbour Authority	GFT	Port Authorities		———	———		
Distribute Codes and posters to relevant retail outlets and clubs at open days and events such as agricultural shows	GFT	SEPA, GFT, SNH	·····	·····	·····	·····	·····
Engage with Landowners and angling clubs to promote awareness of measures to tenants, resource users, members and visitors	GFT DSFB's	SEPA, SNH,NTS	———	———			
Work with environmental groups and local schools to enhance awareness of INNS	GFT	SNH, NTS, SEPA	·····	·····	·····	·····	·····
Objective 2: Establish framework for the detection and surveillance of INN species, linked to a protocol to ensure a rapid management response.							
Output 2.1 - 'Reporting system' established for INN species in Galloway.							
Train GFT personnel in the identification of INNS	GFT	SNH	———				
Work with user and interest groups to identify monitors	GFT	NTS, SEPA, GGLP	———	———			

Action	Lead	Partners	TIMEFRAME 2020	2021	2022	2023	2024
Training of monitors	GFT	SNH SEPA FLS NTS HES					
Establish, test and refine communication mechanisms within surveillance system	GFT	SEPA SWSEIC NTS					
Monitor and periodically evaluate efficacy of surveillance system	GFT & other partners	RAFTS					
Output 2.2 – Develop strategic monitoring of INN species in district.							
Training of Trust and other agency staff in monitoring methods	GFT	SFCC SEPA D & G Council					
Develop monitoring manual	SFCC	SEPA (National)					
Output 2.3 – Rapid response mechanism established for new INN species which pose significant threats to local biodiversity and economy.							
Formulate contingency plans for key species	GFT	D & G Council, SEPA, SNH, NTS					
Identification of personnel for response teams	GFT and SNH	D & G Council, SEPA					
Training of personnel to execute contingency plans	GFT and SNH	D & G Council, SEPA					
Refresher training	GFT						
Monitor populations/treated areas	GFT	SNH, SEPA, D & G Council, NTS					
Objective 3: Develop coordinated control and eradication programmes for INNS							
Output 3.1- Collect data on the distribution and abundance of existing threats							
Complete catchment wide surveys by trained personnel	GFT and other partners						
Objective 3.2 – Develop and initiate control and eradication programmes							
Implementation of control/ eradication programme for riparian INNS plants (Knotweed, rhododendron, skunk cabbage, balsam, giant hogweed, Sitka spruce regeneration)	GFT	Local volunteers, DSFB's, SNH, SEPA, FLS, RSPB, NTS					
Implementation of mink trapping programme	GFT/DSFB/NTS	Volunteers, SNH					
Survey of screening facilities on stillwaters containing non-native fish	GFT	DSFB's, MS					
Monitor distribution of curly waterweed, common cord grass and wireweed	DGERC	SNH, Solway Partnership					
Monitor the effectiveness of control programmes	GFT Various						
Objective 3.3 – Coordinate partnerships to source future funding and develop projects							

Action	Lead	Partners	TIMEFRAME				
			2020	2021	2022	2023	2024
Complete draft biosecurity plan	GFT	SEPA, SNH	—				
Consultation with all stakeholders to agree biosecurity plan	GFT		—				
Identify and develop opportunities for future funding of eradication projects	GFT	SEPA, SNH,NTS	—	—	—	—	—

11 MONITORING

To ensure the effective implementation of this plan, it is vital that the outcomes and impacts of the actions are monitored and reviewed to ensure that the objectives are being met. Thus a fully coordinated monitoring programme must be established to ensure efficacy and sustainable treatment initiatives and include:

- Assessment of efficacy of surveillance and rapid response systems
- Occurrence and distribution of the selected INNS within the district
- Effectiveness of control/eradication programme
- Assessment of the ability to close established pathways of transmission
- Monitoring the effectiveness of all legislation and codes of practice especially those which are aimed at restricting/closing pathways
- Monitoring general activities within the district and assessing them in terms of risk for the introduction of INNS

A monitoring programme will be developed based on the agreed objectives and outputs of this plan. Monitoring activities will be undertaken by GFT staff in conjunction with stakeholder representatives who by virtue of their work are out in the catchment on a regular basis e.g. roads department and access officers employed by local councils.

12 REFERENCES AND ABBREVIATIONS

Abbreviation	Organisation
GGLP	Galloway Glens Landscape Partnership
NTS	National Trust of Scotland
DSFBs	District Salmon Fisheries Boards
FLS	Forestry and Land Scotland
DGERC	Dumfries and Galloway Environmental Resources Centre
GFT	Galloway Fisheries Trust
MS	Marine Scotland
NNSS	Non Native Species Secretariat
SEPA	Scottish Environment Protection Agency
SFCC	Scottish Fisheries Co-ordination Centre
SNH	Scottish Natural Heritage

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