

Parrots Feather (*Myriophyllum aquaticum*) Invasive Species Action Plan

1. Introduction

The risk assessment undertaken as part of the Invasive Species Ireland project prioritised *Myriophyllum aquaticum* for preparation of an Invasive Species Action Plan. *M. aquaticum* has negative impacts on the environment, biodiversity, native flora and fauna, tourism and transport (EPPO, 2004). This species acquired a score of 19 out of a possible 25 from stage 1 of the risk assessment process owing, in part, to its potential impact on protected habitats and species leading to non-compliance with EU legislative obligations under the Water Framework and Habitats Directives.

2. Aim of plan

The aim of this Invasive Species Action Plan is to prevent further spread of *M. aquaticum* in Ireland and put in place mechanisms to prevent new introductions to the island. This plan sets out actions required for successful implementation and guidance on methods for eradication/control of *M. aquaticum* populations in Ireland. This can be achieved through the implementation of control options, raising awareness of this species, developing policy and identifying actions needed to deal with further spread.

3. Key priorities

3.1. Prevention of further spread

- Restrict the sale of *M. aquaticum* through garden centres, supermarkets, aquarists and other retail outlets.
- Raise public awareness of the economic and environmental impacts *M. aquaticum* could have in Ireland in combination with education efforts targeted at key stakeholder groups linked to the import and spread of this and other aquatic plant species.
- Encourage the removal and proper disposal of domestic plantings in ponds and aquaria and promote the use of native species.
- To inform management by recommending methods to gather accurate baseline distribution of this species. This can be achieved by encouraging recording of the plant by the general public, gardeners, naturalists and water course users such as agriculturalists, anglers and canoeists.

3.2. Eradication

- Guide the eradication of the plant at its known wild populations.
- Engage with stakeholders to provide advice and help, where appropriate, to eradicate populations in private gardens.

4. Invasion history

M. aquaticum is a native of the Amazon River in South America, but it has naturalized worldwide, especially in warmer climates (Department of Ecology, State of Washington, 2009). It was first found in Britain in 1960 and is now found in about 300 sites in the UK (Centre for Ecology and Hydrology, 2004). The species is known from a number of sites around Ireland but so far we have not seen the same proliferation as in Britain. It is found mostly in ponds, but has also been found in reservoirs, gravel pits, streams, canals and ditches. It is most often found in eutrophic water bodies. In contrast to other members of the genus, which are native to the UK, it is able to grow as a terrestrial plant when ponds dry out and has even been found growing on the dry bank of a council tip in Cornwall (Centre for Ecology and Hydrology, 2004).

5. Nomenclature

Common name: Parrot's Feather

Also known as: Brazilian watermilfoil

Synonyms: *Enydria aquatica*, *M. brasiliense*, *M. proserpinacoides*

6. Identification

M. aquaticum gets its common name, Parrots Feather, from its feather-like leaves (Figure 1A) which are arranged around the stem in whorls of four to six (Figure 1B). *M. aquaticum* has both submerged and emergent leaves (Figure 1C). The submerged leaves are 1.5 to 3.5 centimetres long and have 20 to 30 divisions per leaf. The emergent leaves are 2 to 5 centimetres long and have 6 to 18 divisions per leaf. The bright green emergent leaves are stiffer and a darker green than the submerged leaves. The emergent stems and leaves are the most distinctive trait of *M. aquaticum*, as they can grow up to a 12 cm above the water surface and look almost like small fir trees (GISD, 2009).



Figure 1: **A.** Feather like leaves; **B.** Leaves arranged in whorls; **C.** *M. aquaticum* growing along a bank. Photos A and B courtesy of the GB Non-native Species Secretariat. Photo C courtesy Joe Caffrey.

7. Impacts

M. aquaticum is a very aggressive plant that is capable of rapid growth and spread which can displace native species, reduce biodiversity, limit recreation, diminish aesthetic value, and decrease water quality and flow. Presently, it is locally established in lakes and ponds in Ireland where it thrives in shallow (<1.5m deep) and nutrient rich waterbodies. Impacts include (Department of Conservation and Recreation, 2004):

- Dense floating mats of *M. aquaticum* can form on the water's surface, restricting light, excluding native plants.
- Decreasing the air exchange between the water's surface and the atmosphere.
- Thick mats can prevent fishing, boating, swimming and other activities in a ponds and lakes.
- The loss of recreational and aesthetic value can cause a decline in surrounding lake property value.
- Shading can result in a decline in algae, part of the base food chain, disrupting the entire food web in a waterbody.
- *M. aquaticum* may form dense single species stands that often do not provide ideal habitat or food for native wildlife and may limit access to the water for some species. These native wildlife populations may be forced to relocate or perish, ultimately resulting in a loss of biodiversity and a disruption in the balance of the ecosystem.
- Sediment levels increase with increasing *M. aquaticum* abundance.

M. aquaticum can have an economic impact. Some specific problems reported for *M. aquaticum* include interference with fisheries, major problems for hydroelectric power production and forestry development in Argentina and increased incidence of mosquitoes (EPPO, 2004).

While *M. aquaticum* may provide cover for some aquatic organisms, it can seriously change physical and chemical characteristics of water bodies, and infestations alter aquatic ecosystems by shading out algae that serve as the basis of the aquatic food chain. In eutrophic coastal or brackish waters conditions it has been observed to displace native species (EPPO, 2004). These effects would impact on Ireland's ability to maintain or attain favourable conservation status of designated waterbodies.

8. Known distribution and spread potential

M. aquaticum is known to be dispersed by or through natural and human mediated vectors such as gardening, the horticulture trade, recreational and industrial boats, clothing and equipment, animals and water currents. Single fragments of this plant are capable of colonising an entire water body within a few years. The known distribution of *M. aquaticum* in Ireland is shown in Figure 2.

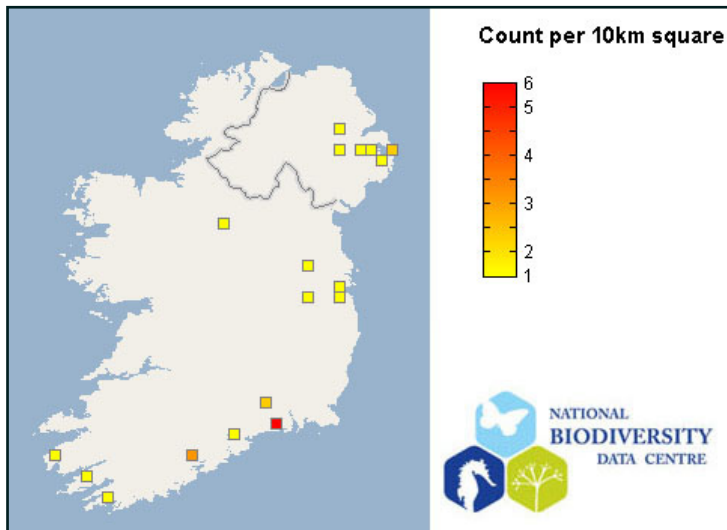


Figure 2: June 2009 known distribution of *M. aquaticum*. For up-to-date maps, please refer to the National Biodiversity Data Centre

www.biodiversityireland.ie.

M. aquaticum is known to colonise freshwater lakes, ponds, streams, and canals and appears to be adapted to high nutrient, slow flow or still water environments. While it grows best when rooted in shallow water, it has been known to occur as a floating plant in the deep water of nutrient-enriched lakes. In light of the preferred habitat of this species, *M. aquaticum* has a widespread distribution potential and could be expected to colonise isolated ponds and slow moving connected waterways such as the canal network where it would impact on boating and recreational water users. Available habitat is widespread in Ireland with island wide distribution potential.

Predictions based on our current knowledge of the habitats most susceptible to invasion will allow us to identify priority areas for control and prevention. Proximity to known populations of *M. aquaticum* should be used to prioritise local preventative measures but on a national scale, remote and isolated populations are likely to occur at geographically distant sites due to the vectors and pathways associated with this species.

If eradication is the ultimate goal all locations must be known. Plants left untreated/removed will facilitate reintroduction. If a site is chosen for *M. aquaticum* eradication or management other invasive species should be included in the plan.

Action 1. Establish accurate baseline distribution

In order to progress action on the ground, it is essential to have information on its distribution easily available. Recording programmes for invasive species should be encouraged on an annual basis and records should be submitted to the National Invasive Species Database and made readily available through the two biodiversity record centres on the island of Ireland. The biodiversity record centres should be resourced to gather information on invasive species and disseminate this information on request and/or online methods to key stakeholders for example, Local Biodiversity Officers and site managers.

9. Prevention of new introductions and further spread

Action 2. Enforcement and raise awareness of legislative powers

Legislation is already in place to prevent the release of invasive species in both Northern Ireland and the Republic of Ireland:

Northern Ireland - under Article 15 (2) of The Wildlife (Northern Ireland) Order 1985 (under review) if any person plants or otherwise causes to grow in the wild any plant which is included in Part II of Schedule 9, he shall be guilty of an offence.

Republic of Ireland - under Section 52 (7) of The Wildlife (Amendment) Act 2000 any person who plants or otherwise cause 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 except under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.

Action 3. Amend existing legislation

Legislation should be strengthened to ensure a total ban on import and possession of *M. aquaticum*. To this end:

- *M. aquaticum* should be added to Schedule 9 Part II of the Wildlife (Northern Ireland) Order 1985.
- The Minister of the Environment in the Republic of Ireland has power to prohibit the possession or introduction of any species that may be detrimental to native species. *M. aquaticum* should be brought to the attention of the Minister and the required prohibition enacted.

Action 4. Highlight, support and promote Invasive Species Codes of Practice

A priority action to prevent the spread and release of invasive species is to promote the uptake of the Invasive Species Codes of Practice and support these with literature and information leaflets for both industry and the general public.

Action 5. Public sector bodies adopt Invasive Species Codes of Practice

All public sector organisations should lead by example and adopting Invasive Species Codes of Practice in their relevant work areas. This is a key priority to the success of each of the codes. Government agencies should also incorporate the sentiment of the codes into tenders and procurement procedures and ensure that suppliers are abiding by the codes, where possible.

10. Eradication and management

Action 6. Prioritise sites for eradication across the island of Ireland and initiate programme of measures

M. aquaticum has a relatively restricted distribution across the island of Ireland (Figure 2). We are still at an early stage of colonisation and action is needed sooner rather than later to prevent widespread economic impacts, loss of biodiversity and a need for large scale and expensive programmes in the future. State agencies and local authorities, such as councils, should prioritise sites for eradication based on a transparent framework to guide a co-ordinated eradication programme. It would be cost effective to undertake this for all the high risk invasive aquatic plant species identified in the Invasive Species Ireland risk assessment.

10.1 Best practice management guidance

A combination of the following physical, chemical and environmental control options is recommended. In general, programmes should manually remove growth, spraying regrowth with glyphosate. The intention here is to reduce the risk of non-target spray of herbicide onto native flora and into water bodies. Repeat applications and a follow up program will be required to remove regrowth/recolonisation.

Note: Care should be taken not to inadvertently spread fragments attached to clothing or equipment. Strict cleaning protocols should be adapted and adhered to. Correct disposal of plant material is also essential.

10.2 Physical control

M. aquaticum regrows rapidly from shoot fragments and as such mechanical cutting alone is rarely effective. However, more effective harvesting systems that remove the biomass and accumulated nutrient reserves may offer control possibilities (EPPO, 2004). Mechanical control is effective for removing large infestations of this plant in areas where access is available for weed cutting buckets or boats. Care should be taken to restrict the downstream movement of stem fragments which will result from cutting operations as regrowth is rapid from this type of propagule. The stems of this species are especially brittle and fragmentation occurs readily when the plant is cut. Chemical control of remaining plants should be undertaken (CEH, 2004).

10.3 Chemical control*

Although *M. aquaticum* is considered by some to be susceptible to herbicides, it is difficult to achieve complete control. The emergent stems and leaves have a thick waxy cuticle and it requires a wetting agent to penetrate this cuticle. Often the weight of the spray will cause the emergent vegetation to collapse into the water where the herbicide is washed off before it can be translocated throughout the plant (Department of Ecology, State of Washington, 2009).

Glyphosate can be used later in the season, and also to some extent from April onwards (CEH, 2004) but glyphosate has been found to be inefficient at killing *M. aquaticum* (Negrisoli, 2003). Chemical control may lead to a short-term eradication of this species, as recolonisation from original sources will often occur. It is important to establish where the infestation has come from and take action to eliminate the source of material (CEH, 2004).

Other studies have shown the plant can be controlled by applications of dichlobenil in April and herbicides containing 2,4-D amine as the active ingredient in early April. Dichlobenil, however, will no longer be approved for aquatic use after 18th March 2010. Any such usage would require the user to obtain a Specific Off License Approval (SOLA) from the Pesticide Safety Directorate (PSD) for the UK or the Department of Agriculture and Food for ROI.

Note: Prior to undertaking any spraying it is essential that the user is fully trained to the required pesticide spraying level (e.g. PA1, PA6 aw). The user must fully comply with the Pesticide Product Label. In the UK the use of Pesticides is regulated by the Pesticide Safety Directorate (PSD). The Pesticide Control Service (PCS) of the Department of Agriculture and Food is responsible in Ireland. Historically several pesticides have been available for aquatic use in the UK and Ireland. It is expected that certain chemicals will be subject to restrictions in the near future. Please refer to PSD website (<https://secure.pesticides.gov.uk/pestreg/ProdSearch.asp>), the PCS website (<http://www.pcs.agriculture.gov.ie/pest.asp?searchType=functCrop>) or contact the relevant organisation directly for the most up-to-date list of herbicides approved for aquatic use.

* When considering chemical control options always refer to the Invasive Species Ireland policy on this management procedure. A brief statement on this policy can be found in Section 11. For a more detailed outline of the policy please refer to the Invasive Species Ireland website.

10.4 Environmental control

This species is not tolerant of fast flow and does not appear to grow in rivers or fast flowing streams. Increasing flow by narrowing slow flowing channels may be a way of controlling the growth of this species. This effect is achieved when the plant itself grows in slow flowing systems and may result in self-limitation in this type of channel (CEH, 2004).

Most emergent species are controlled by increasing shade. This can be achieved by using light barriers such as UV sheeting weighted down (Figure 3). The planting of trees along the south side of water bodies or by placing a floating opaque material over the water surface in early spring has also been suggested. Shade needs to be maintained for at least twelve months to give good control. Because of the association with eutrophic waters a reduction in the nutrient loading to the water may help reduce the competitive ability of this species and lead to a re-establishment of the native species. This can be achieved by buffer strips if non-point nutrient sources can be identified and by a reduction in phosphate loading from other point sources such as sewage works and farm effluents (CEH, 2004).

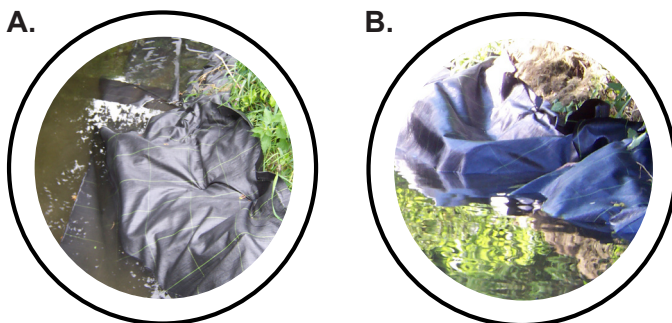


Figure 3: A and B. UV barrier in use to control aquatic invasive plant in Northern Ireland. Photos courtesy of John Early.

11. Invasive Species Ireland: Policy statement on chemical control

1. The Invasive Species Ireland Steering Group do not support unjustified general, non-specific chemical control of aquatic invasive species due to potential impacts on non-target species; residual impact and persistence in the environment; the lack of associated rigorous monitoring to appraise effectiveness of control methods; and the potential noncompliance with the Water Framework Directive.
2. Targeted and appraised chemical control does have a role to play in management of aquatic invasive species, but should be seen as a last resort; after all other alternative control options have been thoroughly considered and assessed.
3. Before undertaking a chemical control programme, a transparent cost/benefit analysis identifying the risks associated with intervention options and risks of non intervention must be carried out.
4. A transparent cost/benefit analysis of management options should include the following:
 - Knowledge of the invasive species occurrence/distribution at and around the location.
 - Thorough knowledge of the invasion ecology and life history of the species.
 - An assessment of the potential impacts based on invasive history elsewhere and similarity of Irish habitats. This should include the identification of:
 - The sensitivity of native species, habitats and ecosystems present in respect to international, European and domestic legislative obligations and concerns.
 - Impacts on economic and amenity values
 - Potential impact of both the invasive alien species and the proposed control methodology.

- Other human, animal and plant health issues.
- The need for appropriate assessments.
- Efficacy of control and eradication methods available based on assessment of experience elsewhere and on site, if applicable.
- Assessment of known impacts of potential control methods on non-target species and residual impacts in the environment.
- Due consideration of the legal status of the options considered.
- A planned schedule of works with disposal procedures for waste predetermined.
- The identification of competent authority with the capacity and budget to complete the programme.

5. If the analysis concludes that other control options are not sufficient the Invasive Species Ireland Steering Group recognise that in these circumstances, chemical control has a role in the management of the aquatic invasive species.

12. Resourcing the plan

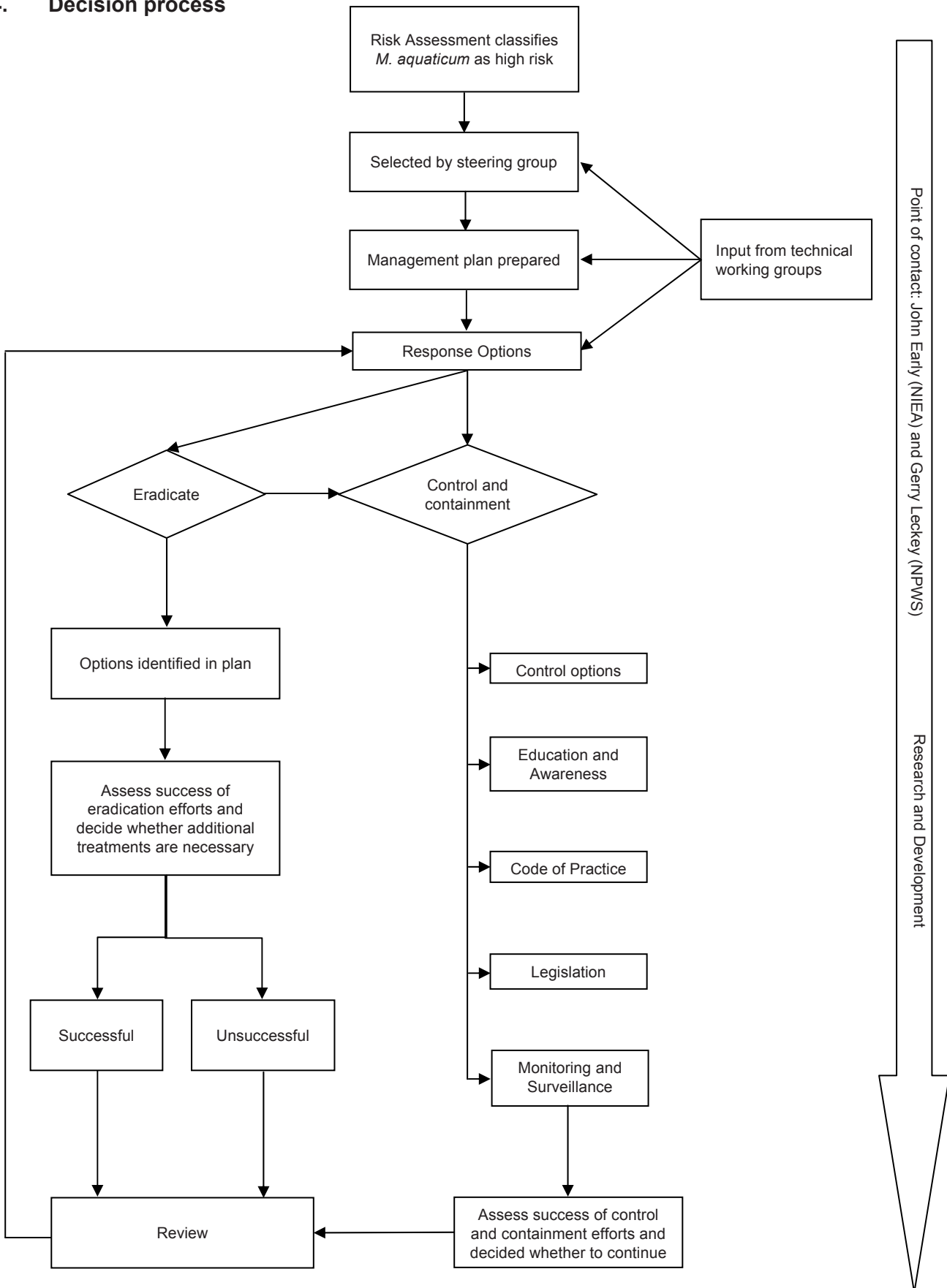
Action 7. Ensure adequate resources are in place to facilitate implementation of this plan

Small scale control programmes for this species i.e. garden ponds are estimated to cost less than £500. Larger ponds or river systems will required additional funding on a continuous basis until eradication is achieved. This is estimated to cost up to £5,000 annually. Should a lake, canal, or river system become colonised, costs associated will increase and are estimated to fall between the £50,000 - 100,000 in the first year. If funds are dedicated early in the invasion of a system this will reduce the overall cost of the programme and provide the greatest value for money in terms of commitment of resources and preventing economic impact in Ireland.

13. Recommended actions and timetables

No.	Action	Responsibility	Timescale
1	Establish accurate baseline distribution	Government Agencies in partnership with the National Biodiversity Data Centre, Cedar and other stakeholders engaged in the collection of biodiversity data	Annual programme required. Programmes should aim to build on that of the 2009 Invasive Species Survey co-ordinated by the National Biodiversity Data Centre
2	Enforcement and raise awareness of legislative powers	State agencies in partnership with relevant stakeholders	Initiate in 2009
3	Amend existing legislation	State agencies	2009 - 2010
4	Highlight, support and promote Invasive Species Codes of Practice	State agencies, Invasive Species Ireland, relevant stakeholders	Initiate in 2009
5	Public sector bodies adopt Invasive Species Codes of Practice	All public bodies	2009
6	Prioritise sites for eradication across the island of Ireland and initiate programme of measures	NPWS, NIEA, local authorities and other relevant stakeholders	2009/2010
7	Ensure adequate resources are in place to facilitate implementation of this plan	NPWS, NIEA, local authorities and relevant stakeholders	Immediately after successful completion of Action 6

14. Decision process



15. Template management plan

Use this template to help formulate a management plan outlining how you are going to proceed and what you will need.

Site Manager(s)/Owner(s): _____

Site Name(s): _____

Central grid reference: _____

License to proceed with plan acquired? Yes No

Site details

Address:	
Telephone:	
Email:	
Agencies/persons involved:	
Date:	
Species of concern:	

Invasion history

Date of introduction:	
Original location of introduction:	
Date of first report to competent authority:	
Method of introduction:	
Additional information on introduction event:	

Site information

Total site area:	
Total area colonised:	
Total area of relevant habitats:	

Designation	On site	Near site	None present
Details: Establish if there is a requirement to apply for a license/notify before proceeding with plan.			

Rare and threatened species	On site	Near site	None present
Red Data Book or BAP species:			
Other rare or threatened species:			

Current identified impacts

Impacts	Minimal	Moderate	Severe

Human sensitivities/vested interests at site

Issue	Human receptor

Identify requirements and best practice for collaboration with stakeholders

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Actions and resources

Management options	Responsibility	Date to undertake

Resources needed	Responsibility	Date to undertake

Monitoring and evaluation

Name of person/s	Date to undertake	Report to	Additional treatments date (if required)

16. Summary of actions needed for effective management

1. Confirm identification of species. Refer to recognised experts to confirm identification, if required.
2. Develop and produce a site specific management plan. Use the template provided in this document to guide you. A key part of this will involve surveying and producing a distribution map indicating the species distribution on the site.
3. Consider all designated sites on or nearby the management area. You may need to apply for a license under nature conservation legislation to proceed and/or undertake an Appropriate Assessment under the terms of Article 6 of the Habitats Directive. Remember that actions taken outside a designated site may have an impact on a nearby designated site and are thus subject to the same considerations.
4. Consider surrounding properties and households. Talk to adjacent land owners and make them aware of the issues and what you plan to do. It may not be possible but always attempt to get their support. Control programmes will have a higher chance of success with support from the local community. Raise awareness of the issues and ensure alerts are placed in appropriate media e.g. the Invasive Species Ireland website.
5. Consider if you can successfully and safely carry out the work or if professional practitioners, with relevant training and certificates should undertake the work. Also consider if the programme can be co-ordinated with voluntary clubs and local societies and ensure their support and understanding of the issues.
6. Ensure safe disposal of plant material, including the cleaning of any machinery or equipment that may be contaminated.
7. Remember relevant health and safety legislation and procedures.
8. Identify if sufficient resources are/will be available to complete the work within the planned timescale. If work will take more than 1 year to complete, ensure you have sufficient funds to complete the work.
9. Monitor for missed plants/reintroduction during site visits. If applicable, ensure new members of staff are aware of the action plan and report sightings.

17. References

- CEH (Centre for Ecology and Hydrology), 2004. Information Sheet *Myriophyllum aquaticum* Parrot's Feather. [online] Available from <http://www.nerc-wallingford.ac.uk/research/capm/pdf%20files/24%20Myriophyllum%20aquaticum.pdf>. [accessed 12 June 2009].
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The Invasive Species Ireland Project is undertaken, in partnership, by
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www.envirocentre.co.uk



www.quercus.ac.uk

and is funded by the National Parks and Wildlife Service and the Northern
Ireland Environment Agency.



www.ni-environment.gov.uk



www.npws.ie

For more information on the Invasive Species Ireland Project please see the
website at www.invasivespeciesireland.com