CL:AIRE guidance bulletin

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CL:AIRE guidance bulletins describe good practice as it applies to the characterisation, monitoring or remediation of contaminated soil or groundwater. This guidance bulletin provides a summary of the Environment Agency's "Knotweed Code of Practice" which was published in 2006.

Managing Japanese Knotweed on Development Sites: Code of Practice

PURPOSE OF THIS BULLETIN

CL:AIRE encourages readers to obtain a copy of the Environment Agency's "The Knotweed Code of Practice"; this bulletin has been produced as a summary of the document.

This bulletin summarises the main sections of the Code of Practice – ecological information, prevention of spreading, management, root barriers, on-site treatment/disposal, movement of soils, affect on site use. The Environment Agency developed the Knotweed Code of Practice to allow their staff to have a consistent approach and it is also relevant to anyone working in the brownfield development or soil haulage sectors.

1. INTRODUCTION

1.1 Background

The Victorians first introduced Japanese knotweed (*Fallopia japonica*) to the UK in the mid-19th century as an ornamental garden plant, however, once fashions changed it was commonly dug up and dumped. The persistent and robust nature of knotweed means it survived this disturbance and spread rapidly, especially along watercourses.

Japanese knotweed in the UK is not exposed to the pests and diseases of its natural range which would normally hold its development in check, in these conditions it flourishes and out-competes native flora and fauna. Fly tipping of knotweed infested soil is perhaps the most common method of its dispersal especially along road verges, lay-bys and waste grounds. Once it has taken hold, knotweed frequently damages buildings and tarmac as well as flood defence structures along watercourses.

On brownfield development sites, the presence of Japanese knotweed is of concern as it has the potential to significantly raise the cost of the project earthworks. Troublingly, it only takes a very small fragment of the plant to regenerate and begin an infestation (as little as 0.7 g of Japanese knotweed rhizome may grow into a new plant).

The fact that Japanese knotweed can grow in poor soils, including those impacted by contaminants commonly associated with brownfield sites means no sites are off limit to infestation. The key therefore is to fully understand the nature in which the weed is spreading if control is to be achieved.

1.2 Relevant Legislation

The Environment Agency's Code of Practice should provide the reader with some assistance on the legal management of Japanese knotweed and some of the treatment options available. It should not be seen as a form of legal advice; relevant legislation is outlined but not covered exhaustively. The aim of the guidance is to promote best practice with the onus remaining on the site owner to ensure compliance with the law.

As an example, the management of Japanese knotweed is covered by the following pieces of legislation, although this list is not exhaustive:

- The Control of Pesticides Regulations 1986
- Wildlife & Countryside Act 1981
- Environmental Protection Act 1990

Figure 1. Flowering Japanese knotweed plants.

- Hazardous Waste Regulations 2005 - for treated knotweed containing material
- Waste Management Licensing Regulations 1994

The list shows that there are lots of varied forms of legislation covering the management of Japanese knotweed, which means that managing it properly is often an extensive task and essential.

Strictly speaking, the Environment Agency would normally require anyone dealing with Japanese knotweed on their site to hold a waste management licence or a pollution prevention and control permit, however if the Code of Practice is followed this is unlikely to be enforced.

2. ECOLOGICAL INFORMATION ON JAPANESE KNOTWEED

The Code of Practice presents the key characteristics of Japanese knotweed, which have been summarised in Table 1. Figures 1 and 2 will aid in the visual identification of Japanese knotweed plants.

3. PREVENTING THE SPREAD OF JAPANESE KNOTWEED

There are considered to be three main steps in preventing the spread of Japanese knotweed. Firstly a comprehensive knotweed management plan should be implemented; examples of such a plan are contained in the appendices of the Environment Agency document. The other two steps are to educate the site workforce and to delegate someone with experience to be responsible for its management.

One of the first stages of knotweed management must be to fully delineate its presence on the site in question; further, once this has been done the site workforce must be aware of this information in order to consider the presence of Japanese knotweed in every task they perform. Areas of infestation should be fenced off and clearly marked out.

Table 1. Key characteristics of Japanese knotweed.

Key descriptions	Japanese knotweed (*Fallopia japonica)*
Appearance	• Rhizomatous - underground stem system. • Bamboo like stems with purple speckles. • 2-3 m high. • Zig-zag, pointed leaf pattern. • Small white flowers in clusters. • Rhizomes - thick and woody with a bright orange centre. • During winter orange/brown woody stems remain. New shoots appear in March and April which are red/purple in colour.
Rhizome system	• Up to 2 m deep and 7 m laterally from the parent plant.
Flowering	• August to October
Growth rate	• Up to 40 mm per day
Regeneration	• Only female plants have been recorded in the UK and these result in hybrid seed productions which rarely survive. • In the UK the plant is mainly spread through rhizome fragments or cut stems.
Related species	• Giant knotweed (*Fallopia sachalinensis*) and a hybrid version (*Fallopia x bohemica*) are also found within the UK. • Management for all should follow the Code of Practice.
Dispersal	• Cut fragments of stem or rhizome can easily enter watercourses and spread rapidly. • Fly tipping of infested garden material. • Transport of rhizome fragments on machinery.
Range of the problem	• UK, Continental Europe & Western United States seaboard.

Good site hygiene should be maintained at all times. As explained in Table 1, the area of infestation is likely to be up to 7 m laterally from any one plant, therefore it is necessary to map out all zones of infestation by digging test pits to identify the presence of rhizomes. These areas can then be fenced off and signposted as mentioned previously, and stockpiles of soils impacted with knotweed should also be appropriately signposted and isolated.

4. MANAGEMENT OF JAPANESE KNOTWEED

Implementing a Japanese knotweed plan should be the first response to identifying it on a site; this should include the delegation of a clerk of works and regular briefings for all site users.

If possible Japanese knotweed should be dealt with *in situ* using chemical herbicide treatment, however, this is not always practicable due to the treatment period required. Minimising the disturbance of the Japanese knotweed is crucial combined with diligent separation of infested material from clean usable soils. Typical herbicides used for treating Japanese knotweed are shown in Table 2.

Table 2. Herbicides for Japanese knotweed treatment.

Herbicide	Affects grasses?	Time of application	Approved for use in or near water?	Persistency
Glyphosate	Yes	May - October (late season preferable)	Yes (certain formulations)	Non-persistent
2,4-D Amine	No	May - October (early season preferable)	Yes (certain formulations)	Up to 1 month
Triclopyr	No	Mar - October (early season preferable)	No	up to 6 weeks
Picloram	No	All year (soil treatment in winter)	No	Up to 2 years

The Environment Agency recommends that herbicide and pesticide contractors should have National Proficiency Test Council (NPTC) certification as well as being a BASIS registered advisor (An Independent Registration, Standards and Certification Scheme Serving Pesticide, Fertiliser and Allied Organisations and Interests), this is in reflection

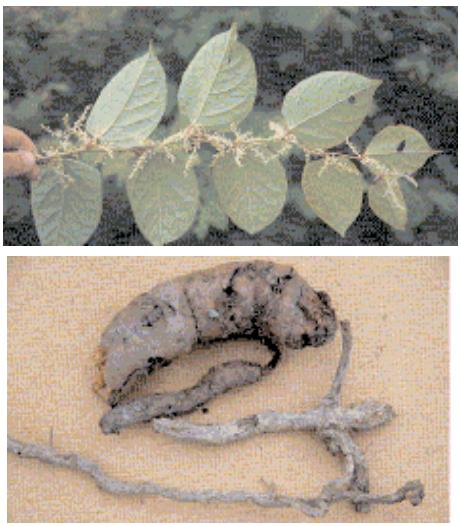

Figure 2. Japanese knotweed leaves (top) and rhizome (bottom).

of the potential to further impact the environment with these chemicals, especially watercourses. The Environment Agency should always be notified beforehand if there is a suspicion that a watercourse could be impacted. The Environment Agency will also verify that an appropriate selection of herbicide has been made, for use near a watercourse and considering surrounding flora.

Herbicide treatment can take up to 3 years before re-growth no longer occurs, even then this should not be used as an indicator that the plant has been killed off due to the persistence of the rhizome. Autumn is the most effective period for herbicide treatment.

If there is a need to bury or reuse soils immediately after treatment then use of non-residual herbicides should be made. More persistent herbicide options can be selected if the soil will not be reused whilst the herbicide is still active. In all cases, reuse of treated soils should be localised and away from any watercourses.

In line with the decision above on persistent chemicals, care must be taken not to bury soils with residual herbicides which could impact groundwater. In fact the use of persistent herbicides removes the option to bury impacted soils completely. In such a case off-site disposal may be the only remaining option; however, the classification of the waste must be carefully assessed, as some pesticides at elevated concentrations are classified as hazardous. Full adherence to all relevant waste regulations is required in such scenarios.

Soil treatments or root barrier systems should be considered if an infested area is highlighted for covering with tarmac or an engineered surface which could be seriously damaged by Japanese knotweed. These are outlined in the next section.

5. USE OF ROOT BARRIER MEMBRANES

5.1 Introduction

With careful expert supervision root barrier systems can be used to stop knotweed developing and / or spreading. Table 3 describes design criteria for the use of root barrier membranes.

Table 3. Membrane design criteria.

Membranes are designed to protect structures or clean soils. It should be made of a material that can:-
a) be used without damage;
b) be provided in large sizes, to minimise the need for seals;
c) be sealed securely;
d) remain intact for at least 50 years;
e) resist UV damage if it is exposed to sunlight.

Expert supervision is required as the membranes can only be as effective as the quality of their installation. For example, seams or joints in a membrane will be exploited by Japanese knotweed therefore one large well fitted sheet is the most effective option.

An expert in barrier membranes will also know the construction material of the product and its expected behaviour in the subsurface. During installation it must be ensured that the root barrier membranes containing leachable chemicals do not pollute streams and groundwater.

Membrane guarantees must exceed the expected lifespan of Japanese knotweed (20 yrs), and they should be buried at a depth of 2 m or deeper. This is recommended in order to protect from burrowing animals, bearing in mind especially the legislation governing the disturbance of badgers and their setts.

Current uses of barrier membranes are outlined in sections 5.2-5.6 below.

5.2 Cell formation

Burial of treated Japanese knotweed infested material would require a depth of 5 m; should this be unachievable a second option is to completely encase the material in barrier membrane, over-laying it with a capping layer at 2 m. Burial locations of the cells should be selected on a low chance of disturbance; the selected locations should then be accurately recorded and included in the property deeds.

5.3 Protecting structures and hard surfaces

If there is a potential for Japanese knotweed to remain in the soils earmarked to fall within a building footprint, barrier membranes can be used to horizontally enclose the entire area (Fig.3). Consideration of this should be given in the build plan as the inclusion of a membrane could change the ground conditions. Alternatively barrier membranes can be included directly within the floor structures of buildings, roads or car parks. These should be designed to contain a flexible layer within the backfill to prevent heave damage from Japanese knotweed growth underneath the membrane.

Figure 3. Installation of a horizontal root barrier membrane.

5.4 Preventing horizontal spread

An option for protecting a site against a neighbouring infestation is to install a vertical membrane barrier usually supported with plywood to a standard depth of 3 m.

5.5 Protecting services, etc.

If new services are to be installed in areas of infestation, often the cheapest and quickest option is to encase them in a membrane. Backfilled soils between the services and the membrane should be verified as being completely free from Japanese knotweed.

6. TREATMENT OR DISPOSAL OF JAPANESE KNOTWEED ON SITE

Wherever possible, the excavation of Japanese knotweed impacted soils should be kept to a minimum and the focus should be on treating it in its original location and taking measures to protect engineered surfaces and structures.

6.1 Cutting Back

Cutting back of Japanese knotweed canes should be managed with care as they contain 'crowns' which are highly invasive, a clean cut should always be achieved. The stems can be effectively dried out on an appropriate surface such as a membrane but care must be taken to ensure they are not blown away or near a watercourse. The stems are dead once a brown colour is achieved but this is not the case for the crown or rhizome.

6.2 Burning

Burning can be used as a form of management and significantly minimises the volumes of material on site. Japanese knotweed has a tolerance to heat so burning must not be relied upon as a complete treatment.

Burning of waste materials is covered by Waste Management Licensing Regulations 1994 and the local Environment Agency must be notified one week before burning. Consideration of local by-laws and neighbours should always be given.

6.3 Excavation

Excavation should be considered a last resort as a management option. If disposal is the reason for excavation, care must be taken not to contaminate surplus material and, as much as possible, volumes should be minimised.

Having an experienced individual supervising excavation is strongly recommended as it is vital to remove all traces of rhizome from the dig, therefore the ability to identify the material is required. The Code of Practice contains a rhizome identification guide. It is unlikely that any rhizome will be found below 3 m unless it has been previously backfilled.

Any compaction likely to be caused by the tracking of heavy plant across treatment areas should be kept to an absolute minimum as it can increase surface run off by preventing subsurface draining and therefore increase the spread of Japanese knotweed by physically moving it.

6.4 The Burial Method

Burnt remains or soils containing Japanese knotweed can be buried on the site of origin; treatment using a non-persistent herbicide is recommended. Burial must not commence while any chemicals remain active in order to protect groundwater.

A burial depth of 5 m should be achieved and a membrane barrier should be used to cover the excavation. If such a depth cannot be reached the membrane cell option is the recommended alternative. All burials should be in areas of the site that will not be disturbed in the future; locations should be accurately recorded and explained to future owners or workers of the site. The Environment Agency must be notified one week before burial, they will then verify the material is acceptable for this option; soils impacted with other contaminants are unlikely to fall into this category.

6.5 Stockpiling Japanese knotweed infested soil prior to burying

Areas of low disturbance on site should be used for stockpiling and the underlying soils should be protected using a barrier membrane. These sites should be away from watercourses or disturbance. Any re-growth in the soils should be treated straightaway with herbicides and the area and pile should be clearly signposted.

6.6 The Bund Method

Bunding can sometimes be used where burial is not appropriate, this can either be raised above the ground surface or within a shallow excavation. The aim of bunding is to gain time for the adequate treatment of the knotweed by moving material to an area of the site which is not involved in the development programme. Keeping the bund shallow means the knotweed is less likely to become dormant. It can therefore be treated frequently and with maximum effectiveness with a herbicide. Some requirements for using a bund are given in Table 4.

Table 4. Bund requirements.

Bunds are most effective when planned at an early stage, the following should be considered necessary:–
a) an area set aside for at least 18 months - 2 years. Deeper bunds may need longer.
b) local planning authority approval, if necessary, before creating a bund. It is advisable to emphasise the purpose of the bund, and how long it is expected to take to build when discussing the proposal.
c) an area within the perimeter of the original site.
d) positioned away from watercourses (at least 50 m) and trees.
e) temporary bunds should have a root barrier membrane layer to protect the underlying site from Japanese knotweed infestation. Permanent bunds on previously Japanese knotweed-free areas should also use a root barrier membrane layer to contain the material. If the site was previously contaminated with Japanese knotweed, there is no need for the root barrier membrane layer.
f) not more than 1 m deep, and preferably no deeper than 0.5 m. Clearly a large area may be needed to provide enough space for a bund, especially if infestations are scattered around the site or dominate a large part of it.

Prior to excavation the knotweed should be treated with a carefully selected and appropriately persistent herbicide, particular consideration for how long the bund will be in existence should be given. Raking the material can effectively bring the crowns or rhizomes to the surface, burning these and concentrating them near the surface of the bund is the most effective approach. Soil near the base of the bund should contain the lowest amount of rhizomes in order to promote re-growth; treatment with herbicides is most effective when plenty of foliage is present. Two treatments with herbicides will normally be enough to prevent further re-growth but the material should be raked over again in order to prove the treatment has been successful.

Future use of the bunded material should be the dominant deciding factor in selecting a herbicide for the treatment.

7. DISPOSAL OF JAPANESE KNOTWEED OFF-SITE

Japanese knotweed containing material would normally be considered a controlled waste, therefore its presence must be communicated to the landfill operator as not all landfills can accept knotweed. If the material has been treated with herbicides there is potential for it to be classed as hazardous if the concentrations are significantly high.

Off-site disposal should be considered a last resort and can only be done at a suitably licensed landfill site which has been properly notified that living knotweed is present in the waste. There are many requirements on landfill operators who can accept Japanese knotweed material, it is therefore advisable to inform them of the intention to dispose a week or so in advance (see Table 5).

Table 5. Landfill requirements.

Landfill operators dealing with material contaminated with Japanese knotweed must make sure that:
a) they are licensed/permitted to receive it;
b) they have enough capacity to make sure they can deal with the material according to the following:
Material, including contaminated soils, rhizome and the crown at the base of the stem, must be buried:
• at least 5 m deep, (immediately covered to 1–2 m, final depth after 2–4 weeks.
• at least 7 m from the margins of the site or any engineering features, for example drains or bund, of the site.
• at least 3 m above the base / liner of the landfill.

At least 2 weeks prior to excavation the Environment Agency recommend treating the knotweed with a non-persistent herbicide, this should mean that any missed or dropped sections of rhizome have less chance of regenerating.

Care during transport to prevent any escape of material is very important, small loads should consider double bagging while skips and wagons should be sealed using membranes.

Hauliers should always inspect material prior to accepting it for transportation and must ensure it is only taken to facilities which have the required licence and permits to accept it. Knowledge of bad practice within the industry should always be reported to the Environment Agency as soon as possible.

It is important that vehicles moving on and off-site are regularly checked and cleaned of any possibly infested material, it is recommended they are washed down with high pressure hoses and swept out with brushes. During transport no material must be allowed to escape, wagons should therefore be sealed with membranes across the top and material kept to a minimum of 20 cm from the top of the skip or truck.

8. MOVING SOIL CONTAINING JAPANESE KNOTWEED

Any attempt to move infested material around a site should be carefully planned. Routes should be designed especially to reduce the risk of spreading the knotweed to previously unaffected areas. Transport routes, once planned out, should have a membrane laid on them to protect the underlying soils, this in itself should then be protected by a layer of sand.

All vehicles leaving infested areas should be thoroughly washed down, particular attention should be given to the tyres of vehicles where fragments of rhizome can easily accrue. Washing procedures should be carried out in an area where no impact to the underlying ground can be caused such as one lined with a membrane. Any waste collected from the washing process should be dealt with in the same manner as the rest of the material containing Japanese knotweed.

As mentioned in the section 7, moving material must be done with extreme caution, as Japanese knotweed is currently thriving in particular along lines of transportation in the UK.

9. THE LONG TERM EFFECTS OF JAPANESE KNOTWEED ON A SITE

If a site infested with Japanese knotweed has been treated in a diligent manner following the procedures laid out in the Code of Practice, re-growth of the rhizome is unlikely, however due to the potential life span of 20 years a management plan should be robust enough to consider the situation in the future. A vital part of this is the accurate recording of all locations and treatments carried out such that future site owners can minimise any future disturbance.

Re-growth on site from material which has previously been treated will usually respond well to further treatment by herbicides. Any re-growth from material which was completely missed in the first phase of management will require more extensive works in line with that done previously.

The Japanese knotweed management plan containing full details of all mitigation measures taken on site should always be included with the vendors statement in the instance that the site is sold on in the future.

If Japanese knotweed re-occurs and breaks through tarmac or hard standing areas there are only limited options available for treatment. There are some herbicides available for use on hard standing surfaces in which case allowing the plant to grow first is advisable in order for the chemical to act most effectively. Removal of the hard standing and full treatment before re-laying the surface is the recommended method if at all practical.

Any areas of infestation on or near a site boundary should be given particular attention as early as possible and effective communication between both site owners is vital in order to agree on an amicable solution. Root barrier systems as described in section 5 of this bulletin are one of the most effective solutions to preventing Japanese knotweed spreading from an infested site.

10. ADDITIONAL INFORMATION

As part of the Code of Practice, there are several useful appendices to help in the management of Japanese knotweed. One of these is an accompanying guide to Japanese knotweed rhizome identification and excavation, which has been produced as a separate guide to facilitate use during excavations. The other appendices include a root/rhizome identification chart and a template Japanese knotweed management plan, with a worked example.

Obtaining your copy

The Code of Practice and other relevant documents are available as free pdf downloads from the Environment Agency's publications catalogue: http://www.environment-agency.gov.uk/subjects/conservation/840870/840941/?version=1&lang=_e

Alternatively, contact the Environment Agency's National Customer Contact Centre by emailing enquiries@environment-agency.gov.uk or by telephoning 08708 506506.

Acknowledgements

This guidance bulletin was prepared by CL:AIRE staff from information contained in the Environment Agency's Knotweed Code of Practice.

Please note that references in the Code of Practice to Waste Management Licensing Regulations 1994, waste management licences and pollution prevention and control permits may now be covered by the Environmental Permitting Regulations 2007 and environmental permits, which came into force in April 2008.