The Control of Japanese Knotweed *(Fallopia japonica)* in Construction and Landscape Contracts

Model Specification and Guide to Procurement

Llywodraeth Cymru
Welsh Government

www.cymru.gov.uk

(Alternative scientific names: *Polygonum cuspidatum, Reynoutria japonica*)

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This document set replaces the former Welsh Development Agency's publications 'The Control of Japanese Knotweed in Construction and Landscape Contracts – Model Specification' and 'The Eradication of Japanese Knotweed – Model Tender Document' first published in 1994 and reprinted in 1998. Part A 'Guidance Notes' and Part B 'Model Specification' replace the former Model Specification document. Part C replaces the former Model Tender document.

Related documents

Readers new to Japanese Knotweed should consult the Environment Agency's Knotweed Code of Practice for:

- an introduction to the plant,
- what to do if it is found on site,
- guidance on the legal obligations of landowners and those carrying out knotweed control work,
- methods of good practice to minimise the risk of spread,
- an introduction to the options available for knotweed treatment and control,
- detailed procedures for the management of knotweed and infested soil as waste, including deep burial on development sites and transporting to licensed landfills.

These Welsh Government Knotweed guidelines are designed to work alongside the EA Code of Practice, for readers who already have some knowledge of Japanese Knotweed and now need to arrange the eradication of knotweed on one or more sites. They provide local authority and other technical or professional personnel with:

- guidance on preparing a programme for knotweed control,
- guidance on the selection of a control strategy (chemical or mechanical),
- more detailed and specific advice on knotweed control methods, set out as control strategies,
- a model specification for use in contract works such as landscape or civil engineering projects, where Japanese Knotweed may be present,
- specific advice on the procurement of control work on land infested with Japanese Knotweed, by means of a specialist contractor and a guide to the use of an 'industry-standard' form of contract for this purpose.

Japanese knotweed – *Fallopia japonica* (alternative scientific names: *Polygonum cuspidatum, Reynoutria japonica*)

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A Part A – Guidance Notes

These notes provide guidance on the selection and development of a strategy for the control of Japanese Knotweed, from which a Specification can be developed. Part B of this document contains a Model Specification which can be modified if necessary by following this guidance.

A1.0 Introduction

A1.1 Japanese Knotweed is a vigorously growing perennial plant which overruns other vegetation, forming dense tall stands which can harbour vermin, collect litter, obstruct drainage channels or sight lines, and dies back to an unsightly mass of dead stems in winter. Invading shoots displace channel protection systems and erosion control materials. They can penetrate footpaths and paved surfaces.

Japanese Knotweed spreads locally by underground growth, but the main method of distribution has been the movement of infested soil and fill materials for earthworks. Excavated material containing Japanese Knotweed must be treated as a waste under the Waste Management Regulations which control its transport from site and subsequent disposal. It is an offence under the Wildlife and Countryside Act 1981 knowingly to introduce Japanese Knotweed into the wild. Japanese Knotweed is already a major nuisance and an expensive maintenance problem. All organisations are urged to avoid introducing this problem to new sites or spreading it, by vigilance and implementing the control measures contained in this specification.

It is not mandatory for any landowner, public or private, to control the knotweed on their land, but under the Wildlife and Countryside Act 1981 anyone who "plants or otherwise causes to grow in the wild any plant which is included in Part II of Schedule 9" shall be guilty of an offence. This applies to Japanese Knotweed. However, this law does not place any onus on landowners to treat established stands of knotweed. Therefore, knotweed control work undertaken on public or privately-owned land is at the discretion of the owner and subject to their competing priorities.

Management of Invasive Species

Thousands of species of plants and animals have been introduced to the UK and many now form part of ecosystems without causing significant harm. 'Invasive' species are those which are well-suited to conditions in the UK and, having few or no control mechanisms, spread rapidly and cause economic, social or ecological problems in many locations.

The Invasive Non-Native Species Framework Strategy for Great Britain

In 2001 Defra initiated a fundamental review of policy for non-native species, the report of which was published in 2003. In 2005, fulfilling

one of the key recommendations of this report, the Great Britain Non-Native Species (NNS) Programme Board was set up as a partnership of government organisations including the Welsh Government. The Board commissioned a Strategy with the aim of addressing the key weaknesses in our capacity to respond to the threats to biodiversity posed by non-native species.

The GB Strategy provides a framework for a more co-ordinated and structured approach to dealing with non-native species and their potential threats. It includes better co-ordinated and strategic prevention measures aimed at reducing the rate of introduction of damaging non-native species into Great Britain. Its implementation will enable more rapid detection of potentially invasive non-native species through improved and better-targeted monitoring and surveillance. Its implementation will also produce more rapid responses to remove newly-arrived high risk species, and more strategic and joined-up control of existing problem species.

A1.2 Research into biological control programmes to stop the spread of Japanese Knotweed has been carried out with funding from a consortium of sponsors. They are British Waterways, Cornwall County Council, Defra, the Environment Agency, Network Rail, South West Regional Development Agency and the Welsh Government.

Purpose of biological control

Successful biological control will not eradicate Japanese Knotweed but it should bring the population to a more acceptable level, where it will become more susceptible to traditional control methods. Natural enemies have the potential to reduce the vigour of Japanese Knotweed, and so reduce the damage it causes to natural habitats and other desirable vegetation.

The two agents identified from a series of stringent tests are a *Mycosphaerella* leafspot fungus and a sap-sucking psyllid, *Aphalara itadori*. Licenses for the release of *Aphalara itadori* were granted in 2010, by the UK and Welsh Governments. If the release (which is subject to stringent conditions) is successful, the organisms will establish and spread to co-exist in a new balance with the Japanese Knotweed.

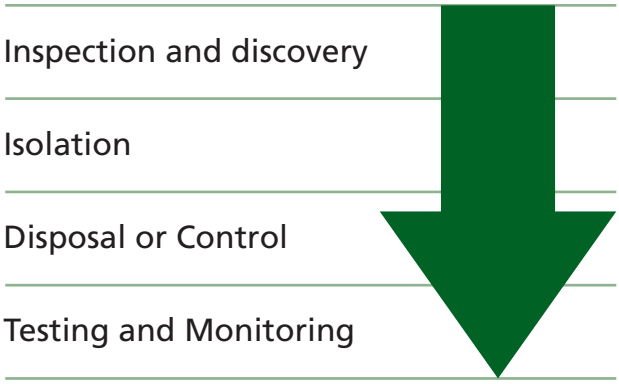
The biological control programme will not eradicate Japanese Knotweed from the UK, nor will it provide a solution to individual infested sites requiring the eradication of knotweed. Techniques based on the use of herbicides, barriers, excavation and processing or, as a last resort, removal to landfill will still be required for these sites.

A1.3 This specification aims to control Japanese Knotweed in two ways:

a. locating existing stands and preventing the movement of soil or plant fragments from these areas,

b. controlling existing and new stands by herbicide or mechanical control strategies.

The approach may be summarised as:



Some methods of knotweed eradication take a number of years to achieve success. Where this could add to the planned contract period for works, it may be better to isolate the knotweed from disturbance under the works contract, and then let a separate contract specifically to eradicate it. A guide to procuring knotweed eradication by contract has been prepared in part C of this document.

A1.4 The specification places responsibilities on the Employer/Project Manager and his site supervisory staff, as well as the contractor. Only if all parties undertake these responsibilities will control be ensured.

Employer/scheme designer:	• Identification of existing Japanese Knotweed.
	• Confirm priority for selection of sites to treat, eg: sites with a defined future use, sites which can be planted to establish dense vegetation and sites which can readily be added to maintenance programmes.
	• Selection of control strategies and inclusion in tender documents.
	• Arrange long-term management of treated sites.
Project Manager:	• Contractual aspects.
Site supervisory staff:	• Site inspection and designation of areas.
	• Designation of control areas.
	• Monitoring control and confirming clearance.
	• Inspections of imported and exported material.
	• Planning for unexpected outbreaks.

Full implementation of these responsibilities will require the use of additional staff time and resources. Failure to provide these resources within financial agreements and contracts will lead to the wider spread of Japanese Knotweed and much greater eradication and repair costs.

A1.5 The term 'Project Manager' is used throughout the specification, as the Engineering and Construction Contract (ECC) would typically be written. Where other forms of contract are used the following terms should be substituted as appropriate.

Form of Contract	Equivalent term
JCLI Agreement for Landscape Works	'Landscape Architect' or 'Supervising Officer'
JCT 80 Agreements	'Architect' or 'Supervising Officer'
ICE	'Engineer'

A1.6 This specification should normally be used in its entirety but, where a specific control strategy has been selected in advance, the remaining strategies may be omitted. If it is decided to let a separate contract for herbicidal control of Japanese Knotweed, then sections 3-5 need not be included in the main contract specification.

A1.7 The project manager and site supervisory staff should be aware of the legal restrictions on the use of pesticides, which are summarised in clauses B1 and B3 of this document. The Environmental Protection (Duty of Care) Regulations 1991 apply to knotweed-contaminated material disposed of off-site as waste. Senior site supervisory staff should be aware of the requirements placed on producers, carriers and disposers of waste. The Environment Agency's Knotweed Code of Practice provides 'plain English' guidance on the legal obligations of landowners and the management of waste.

A2.0 Selection of a control strategy

A2.1 Introduction

- Control may be either by treatment with herbicides, or by mechanical control, or by a combination of the two.
- Acknowledging the often tight timescale between entry to the site and commencement of development, methods which enable development to proceed unimpeded are included (paras A2.10, A2.11).
- Inspection of the site for Japanese Knotweed in the early stages of the development proposal will facilitate the preparation of the control strategy (para A2.5).
- Soil and material infested with Japanese Knotweed must be treated as 'waste' if taken off site. All other on-site control strategies should be exhausted before consideration is given to removal of material off site.

A2.2 Before selecting a method of knotweed treatment, decide:

What is the purpose of the proposed treatment?

- 'Eradication' – the complete removal of Japanese Knotweed from an area, to meet a deadline or without time limit.
- 'Control' – reduction of an infestation to prevent invasion or spread.
- 'Management' – reduction of an infestation to a point where it becomes easily managed over the long term.

The type of treatment, and its cost, depend greatly on the timescale and the purpose.

What happens after the treatment?

- Site to be used for construction or landscape scheme.
- Site to be restored to natural habitat.
- Site to be managed to achieve other objective(s).

Treated knotweed looks unsightly, and unless the land is used or managed after eradication it will degenerate or be at risk of erosion.

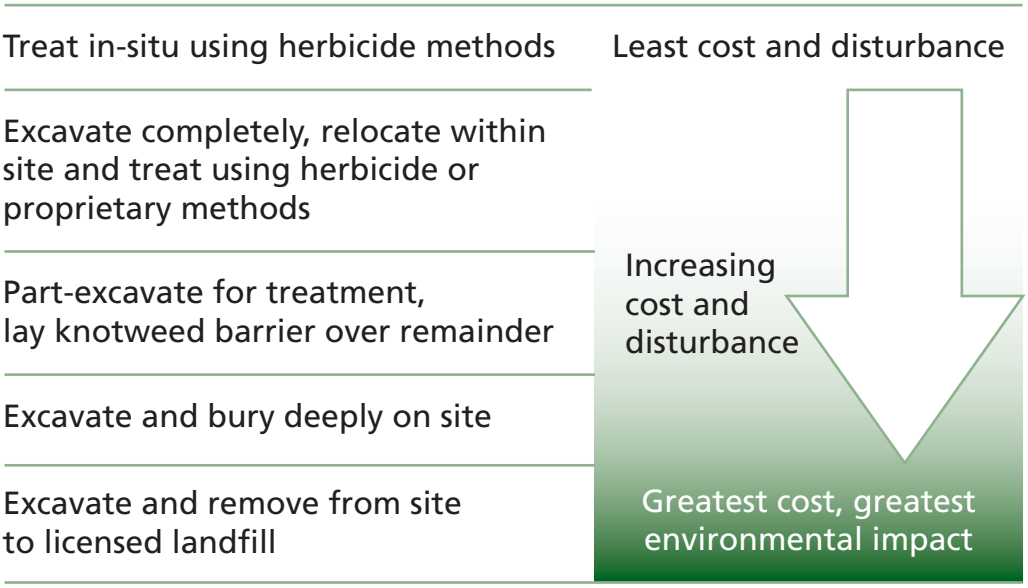
What are the environmental consequences of each treatment option?

- Carbon footprint of the treatment.
- Use of persistent herbicides.
- Transport and other disturbance of nearby residents.

Further information on the environmental impacts of various treatments is given in Table A1 and Figure A1.

A2.3 Consideration of the relative sustainability and environmental impact of the treatment options available leads to the following hierarchy of treatments, where technical and time factors allow a choice:

Treatment Hierarchy



A2.4 It is not possible to eradicate an established stand of Japanese Knotweed with a single herbicide application, and so scheme designers should allow for the inclusion of repeated control measures over more than one growing season. The presence of Japanese Knotweed has significant implications for the contract working method, and so control must be considered and specified within the tender document. If development is to take place in infested areas then control by deep burial on site, movement to a treatment area on site, or a proprietary eradication method can be specified. Appendix A gives examples of the programme for herbicide treatment regimes according to the time of year that the contract is let.

A2.5 The site should be thoroughly inspected for signs of Japanese Knotweed during the initial design stages (preferably between May and November when the weed is most evident), and the extent of infestation recorded. It may be appropriate to include Japanese Knotweed in the topographical survey of the site in order to obtain an accurate plan of the location and area involved.

A2.6 The selection of a control strategy should be based on the following factors.

1. Whether Japanese Knotweed is well established or recently arrived.
2. Whether earthworks and construction are planned for land containing Japanese Knotweed; and whether the timescale for development precludes the treatment of the Japanese Knotweed in situ.
3. Whether the Japanese Knotweed is near a watercourse or in other vegetation which must be retained or is of any value.
4. Whether it is intended to establish grass, trees or shrubs in areas after Japanese Knotweed is eradicated.

A2.7 It is necessary to consult all parties with an interest in the site before selecting a control strategy. Sites should be appraised for the potential to support wildlife, including legally-protected species. For example, otters are known to use the dense cover provided by Japanese Knotweed along river corridors. The landowner, land user and any other organisation responsible for managing the land may have requirements which restrict the control strategies available. These requirements include:

- Farmland: protection of crops and livestock.
- Amenity land: protection of desirable vegetation, protection of the public, establishment of attractive replacement vegetation cover.
- Land near watercourses: protection of surface water and groundwater quality, prevention of erosion following knotweed treatment.
- Land of wildlife value: protection of plants and animals, and their habitats.
- Development sites: compliance with tight timescales for development.

The following organisations or individuals should therefore be consulted where relevant:

- Owners, tenants and managers of land, including adjoining land.
- Environment Agency/Environment Agency Wales/Scottish Environment Protection Agency.
- Natural England/Countryside Council for Wales/Scottish Natural Heritage.

A2.8 A simple key to the selection of an appropriate control strategy is presented on page 20. The control strategies are set out in the specification which forms Part B of this document.

A2.9 All vegetation control by means of **herbicides** requires careful consideration of operator safety, the protection of the public and of the wider environment. The main source of information on the use of pesticides is the approved product label. A summary of the relevant pesticide legislation is given in Chapter 6 of these guidance notes, but it is the responsibility of the project manager to ensure that the current legislation and guidance is followed. The model specification places the onus on the Contractor to follow the relevant regulations and Codes of Practice and, in particular, to ensure that herbicides are only handled and applied by persons holding a valid Certificate of Competence issued under the Control of Pesticides Regulations (as amended) 1986. The specification requires that herbicides shall be applied at the rates and by the methods stated by the manufacturers.

A2.10 **Deep burial of excavated material on site** as part of construction works, at least 2m deep. Where the proposed earthworks permit, this is an economical and non-polluting option provided that complete excavation of the knotweed has been achieved. Root fragments as small as 0.7g have been shown to regenerate new plants. The excavation of disposal cells designed specifically for knotweed burial is costly and can lead to drainage problems as root barriers are required. However, Clause 2.6 of the specification provides that where earthworks give the opportunity for deep burial, the Project Manager may direct this means of disposal in accordance with the Environment Agency Code of Practice. It is not intended that cover material is imported purely to bury knotweed. This method enables early development of the infested area to proceed.

A2.11 **Excavation and removal to a control area on site** may be desirable to permit earthworks to proceed. This should only be undertaken if in-situ control is not practical and if thorough excavation can be ensured. This method enables early development of the infested area, but requires the designation of a control area within the site and outside the development footprint, where herbicidal control can be used. Control areas should be large enough to accommodate all the infested material in a layer less than 1m thick so that rhizomes will regenerate for treatment. If buried deeply, rhizomes can become dormant and persist for very long periods, presenting a risk if disturbed in the future.

To avoid the risk of flooding/erosion and to allow the use of herbicides, control areas should not be steeply sloping, and should be well away from watercourses.

A2.12 **Removal of contaminated material to a licensed tip** should only be considered if the above options are not practical. Soil contaminated with Japanese Knotweed, including living stems and rhizomes, should be treated as controlled waste. Such waste is subject to various legal controls with regard to transportation and disposal off site. For example, the Environment Agency requires this waste to be disposed of at licensed landfill sites which have a lined contained system. Contact the local area office of the Environment Agency, and their website, for further information to ensure compliance with current guidance and legislation.

Table A1 Main environmental impacts associated with treatments for Japanese Knotweed

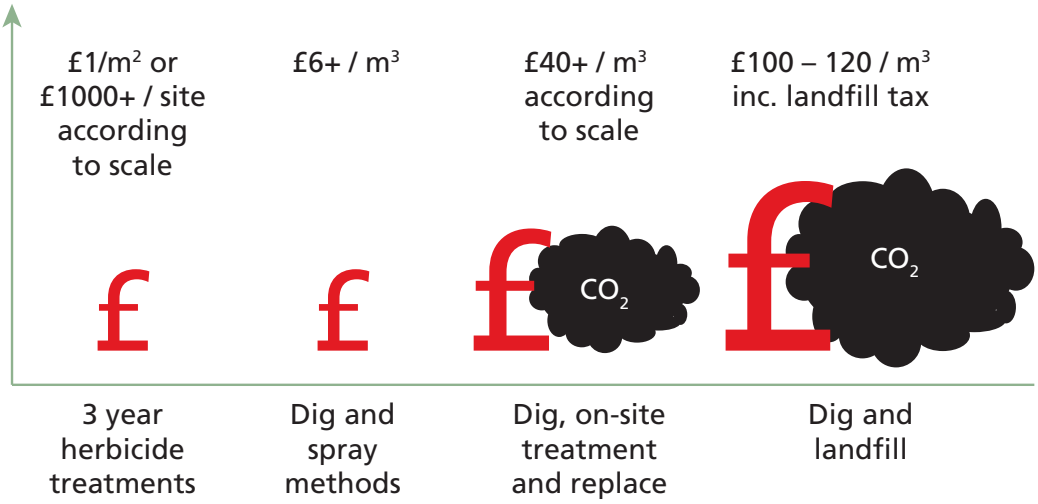
Method	On-Site Impacts	Off-Site Impacts
In-situ herbicide programme – spray application.	Use of herbicide (translocated or residual) in accordance with manufacturer's instructions and current regulations.	
In-situ herbicide programme – stem injection.	Precision application limits spread of herbicide.	
Excavation and on-site herbicide programme.	Fuel for earthworks plant in excavation and placing material. Herbicide as above. Excavation damage to tree roots and other desirable vegetation. Noise and dust during site operations.	Transport of earthworks plant (unless already on site).
Excavation and screening/ hand-removal, or other proprietary treatments.	Fuel for earthworks plant in excavation, loading and replacing material. Excavation damage to tree roots and other desirable vegetation. Noise and dust during site operations.	Transport of earthworks plant (unless already on site).

Method	On-Site Impacts	Off-Site Impacts
Excavation and containment in burial cell.	Fuel for earthworks plant in excavation of cell, excavation, moving and depositing material, and placing cover material. Cell lining material (oil-derived plastics). Excavation damage to tree roots and other desirable vegetation. Noise and dust during site operations.	Transport of earthworks plant (unless already on site).
Excavation and disposal to landfill.	Fuel for earthworks plant in excavation and loading material. Fuel for road transport. Excavation damage to tree roots and other desirable vegetation. Noise and dust during site operations.	Transport of earthworks plant (unless already on site). Use of scarce landfill space. Quarried material as backfill for the excavation. Traffic noise, emissions and congestion.

Figure A1 illustrates the comparative cost and carbon footprint of four different methods of knotweed treatment. The actual cost of any treatment can vary greatly depending on site-specific conditions. Landfill tax will rise annually from 2008, adding significantly to the cost shown here. Note, when comparing costs, that herbicide treatment is costed according to the **area** of knotweed to be sprayed while other methods are costed on the **volume of infested soils** to be dug and treated.

The 'clouds' are representative of the carbon dioxide produced per tonne of infested soil treated on site or removed and transported to landfill. Again, the actual CO_2 produced will vary depending on site-specific conditions and the distance to landfill, but landfill options will typically generate 3 – 4x the CO_2 of on-site processing.

Figure A1: Relative costs and CO_2 footprint of various knotweed treatments



A3.0 Planning of Clearance and Spraying

A3.1 Experience suggests that translocated herbicides are most effective when applied after the knotweed has reached its maximum height, from mid-summer onwards, but before die-back at the first frosts. Although tall established stands of Japanese Knotweed are difficult to spray effectively by conventional means, extended lances, mobile elevated work platforms, stem injection and the cutting of paths for access have all been used to achieve treatment of large or inaccessible stands. Tall stands should be sprayed as far as is practicable, while the stems and leaves are still green, and subsequently all dead stems cleared in the late winter, to maximise access to the stand in the following year. The treatment period may need to be extended to allow for any period of incomplete spraying due to weather conditions or other unforeseen limitations to the spray programme.

Timing Glyphosate application for greatest effect

Observations show that applying glyphosate in the autumn, after the main period of growth but before the first frost, is significantly more effective than application earlier in the season. The following explanation is proposed, but specific research is required to provide evidence that would support or disprove the theory.

Japanese Knotweed is a herbaceous perennial plant. In the spring the over-wintering buds develop as fast-growing shoots which extend to 2m or more in height. Much of this growth occurs before the leaf canopy develops fully, and so the plant uses energy stored within the rhizome. Within the plant stems, sugars and minerals are translocated upwards and outwards to supply the developing shoots and new leaves. It is likely that translocated herbicides such as glyphosate will also be carried upwards and outwards, acting on the shoots and leaves but having little or no effect on the rhizomes.

Once the leaf canopy has developed and shoot extension slows down, the products of photosynthesis are directed to replenish the reserves stored in the rhizomes. As the plant dies back after the first frost, sugars and other resources are withdrawn from the foliage and stems and stored in the rhizomes. It is likely that translocated herbicides such as glyphosate will be carried into the rhizome where they have an effect on dormant and developing buds.

A3.2 Dense stands can obscure uneven ground, dumped scrap and similar hazards to operators. Where the contract timing or staff resources permit, it is advisable to clear the dead vegetation in November – March, so that new growth may safely be sprayed during the growing season.

A3.3 Mechanical disturbance of established rhizomes can stimulate dormant buds into growth, so that further herbicide applications can be made. Some publications advise that mature crowns are excavated to 0.5m depth, broken up and left at the ground surface to regenerate before spraying, as a means to accelerate control.

Table A2 summarises the planning of clearance and spraying.

Table A2 Planning the clearance of Japanese Knotweed by herbicide

Situation	Height	Dig or excavate	Spray	Stem inject or spray*
Established stand or new growth in undisturbed ground.	Up to 1.5m		✓	
	Over 1.5m, full access		✓	✓
	Over 1.5m, part access			✓
New growth in disturbed ground or imported soil.	Up to 0.3m	✓	✓	
	0.3m – 1.5m		✓	
	Over 1.5m, full access		✓	✓
	Over 1.5m, part access			✓
Dense dead stems in winter.	Any	Cut down and apply soil-acting residual herbicide.		Cut down and apply herbicide to new growth as above.
		✓		✓

* if treatment is incomplete, allow additional treatment year in programme. See Appendix A for examples of programmes.

Viability testing

A3.4 It is difficult to demonstrate conclusively that herbicide-treated knotweed stands are completely dead. The stand can be left undisturbed and simply monitored for a full growing season to record whether any new growth appears, but this is time-consuming and the lack of growth may be due to residual effects of herbicide.

A two-month test based on the 'incubation' and observation of excavated rhizome fragments is presented in Part B. Rapid viability tests based on the use of vital stains became commercially available through specialist contractors in 2008. Vital stains change colour through the action of living cells, and this can be detected under suitable microscopes within a few hours.

A4.0 Contract arrangements

A4.1 The thorough eradication of Japanese Knotweed almost always takes considerably longer than one growing season. Follow up control of regrowth may be required beyond the usual 12-month defects liability/ maintenance period of most contracts. The designers of schemes for sites where Japanese Knotweed exists must therefore make appropriate contract arrangements to suit the control strategies adopted. Options for consideration include:

Option 1	Identifying follow-up control of Japanese Knotweed as a separate section under the construction contract, with separate retention and completion date. The 'main' works can be completed and the relevant retention released, leaving the control of Japanese Knotweed to be completed by the Contractor while the Final Account is settled.
Option 2	Including a period of follow-up control equivalent to the contract maintenance period, and passing responsibility for completing the control of Japanese Knotweed to the Employer or landowner (or to a further specialist contractor).
Option 3	Nominating a specialist sub-contractor to carry out all the control measures, and novating this work into a further contract once the main contract is completed.
Option 4	Excavating all Japanese Knotweed – infested soil to a control area on site, and letting a separate long-term contract for the control works, allowing the main works to proceed unhindered.
Option 5	Using a form of contract such as JCLI, modified to allow an extended period of maintenance works including Japanese Knotweed control. Such contracts are commonly used to ensure the establishment of trees and shrubs. The JCLI 2008 contract has the provision for transferring landscape maintenance works into a separate contract on completion of the main or works contract. This method could be used for the follow-up control of Japanese Knotweed.

Options 1 and 5 have the advantage that all responsibilities remain with the same contractor. Options 2, 3 and 4 are contractually simpler but rely on the parties involved undertaking their responsibilities thoroughly.

A5.0 Contract Quantities

A5.1 None of the standard methods of measurement make specific provision for Japanese Knotweed control, but since tenderers will need to price this work it is important that contract bills make the extent of the work clear without conflicting with other bill items.

A5.2 Where the Method of Measurement for Highway Works is to be used, additional items should be entered in Section 2: Site clearance, and Section 6: Earthworks.

A5.3 Where Civil Engineering Standard Method of Measurement (CESMM) is used, specific items should be entered in class D: Demolition and Site Clearance, and Class E: Earthworks.

A5.4 The indiscriminate clearance of the existing Japanese Knotweed will spread the problem over the site and so clear instruction should be given either on the drawings or before any clearance commences, that Japanese Knotweed areas are to be excluded from the general site clearance and treated separately.

A5.5 It is recommended that the following units of measurement are used for the control items:

1	Initial site inspection.	Lump Sum
2	Marking of designated Japanese Knotweed areas.	lin.m
3	Herbicide treatment.	m^2
4	Mechanical treatments ie cutting.	m^2
5	Monitoring inspections and reports.	per report
6	Excavation and filling.	m^3

A6.0 Pesticide Legislation

A6.1 The contract specification must contain clear guidelines describing the appropriate control methods for the different situations in which knotweed might be found. Control has to be carried out in a way which ensures environmental and personal safety and which satisfies the various regulations governing pesticides use. There is a substantial amount of legislation which is concerned with the use of pesticides in the U.K. The legislation includes:

- The Food and Environment Protection Act (FEPA) 1985
- Control of Pesticides Regulations 1986 (as amended)
- The Control of Substances Hazardous to Health Regulations (COSHH) 2002.

A6.2 The Control of Pesticides Regulations fall under the Food and Environment Protection Act (FEPA) and cover the use of particular pesticides. The regulations are outlined in the 'UK Pesticide Guide' (C.A.B. International British Crop Protection Council, published annually) and can be obtained in full from TSO. Approval for the use of specific pesticides is now a legal requirement and it is an offence to use non-approved products in a manner which does not comply with the specific conditions of approval. Only those adjuvants listed by DEFRA and those tank mixes approved by DEFRA are allowed. The main source of information on the use of pesticides is the approved product label.

A6.3 Particular note should be taken of those herbicides which can be used next to watercourses, since many stands of knotweed are situated along riverbanks. The regulations under FEPA concerning pesticide use near water, cover those for use near watercourses. The regulations also cover those pesticides approved for use in forestry, for aerial application and for ultra-low volume applicators, for example using mist blowers, aerosol projectors, controlled droplet application sprayers and fogging machines.

A6.4 Under the regulations the application of any pesticide should be by contractors with a recognised Certificate of Competence. Users of pesticides must comply with the conditions of approval relating to use. These will be on the product label and/or attached leaflet and may cover:

- field of use,
- situations where treatment may be applied,
- need for protective clothing. Engineering control of operator exposure must be used where reasonably practical in addition to the following personal protective equipment: a basic minimum of face shields, coveralls and protective gloves should be worn when handling any concentrated pesticide and additional items may be specified by the manufacturer. However, engineering controls may replace personal protective equipment if a COSHH assessment shows they provide an equal or higher standard of protection,
- doses to be applied, volume rates and spray quality,
- number of treatments,
- techniques for mixing up sprays and the need for agitation in spray tanks,
- permitted tank mixes and compatibility with fertilisers,
- need to avoid drift onto sensitive crops, gardens, etc and to avoid contamination of water,
- measures required for the protection of spray operators and the avoidance of hazards to the public, to livestock and to non-target organisms. For example, bees are particularly vulnerable when crops are in full or partial flower. It is a good policy to inform all beekeepers in an area in good time of any planned spraying and spraying should avoid the times when bees are most active. However, none of the pesticides covered in the guidelines are harmful to bees,

- need to avoid spillages and designation of means for disposal of surplus spray liquid and empty containers,
- need to wash out spray tanks carefully after spraying so as to avoid injury to sensitive crops sprayed later,
- need to provide for the safe storage of pesticides,
- need to keep humans and animals out of treated areas.

A7.0 References and Further Information

The UK Pesticide Guide published annually by British Crop Protection Council. publications@bcpc.org

Environment Agency 'Managing Japanese Knotweed on development sites – the knotweed code of practice' available at www.environment-agency.gov.uk

Environment Agency, 1996. Guidance for the Contol of Invasive Plants Near Watercourses.

(Bilingual leaflet available from local Environment Agency office).

Further information

Herbicide Manufacturers. Addresses are given in The UK Pesticide Guide.

Richards, Moorehead & Laing Ltd, 1990. Japanese Knotweed (*Reynoutria japonica*) in Wales.

Appendix A – Identification table for Japanese Knotweed rhizomes (underground stems)

A. General characteristics	Yes	No
Twig-like appearance		
Fleshy with hardness like carrot		
Brittle when fresh, break easily like carrot		
Young rhizomes are white and very soft		

B. Exterior of rhizome	Yes	No
Colour dark brown, like coffee granules		
Outer bark has leathery texture		
Tissue beneath bark is pale orange / yellow		
Nodes at 1 – 2 cm spacing		
Nodes slightly enlarged and 'knotty'		
At nodes, white fibrous roots are common		
If present, fresh buds at nodes are pink in colour		

C. Interior of rhizome	Yes	No
Longitudinal view:		
Colour: pale orange to light yellow (carrot coloured)		
Central core is dark orange / brown, like rust and sometimes hollow		
Cross section:		
Cortex has rays coming from centre in 'star-burst' appearance		
TOTAL		

If the 'Yes' score is greater than the 'No' score then treat rhizomes as Japanese Knotweed.

Key to Control Strategies

(For detail of control strategies, see Specification clauses 3 and 4)

1.	**For newly emerged, shallow rooted knotweed, eg, in newly placed topsoil**	
Q1.1	Can the whole plant (shoot and rhizome) be dug out or excavated?	
Yes	*Hand dig or excavate mechanically.*	*Mechanical Control Strategy 1.*
No	*Q1.2*	
Q1.2	Is the Japanese Knotweed in a grass sward which is to be retained?	
Yes	*Treat with spot application of Glyphosate.*	*Control Strategy 2.*
No	*Treat with Glyphosate.*	*Control Strategy 2.*

2.	**For Japanese Knotweed invading from land outside the control of the specifier**	
Q2.1	Can agreement be reached with the adjoining landowner?	
Yes	*Treat the whole stand as for established knotweed.*	
No	*Q2.2*	
	To prevent invasion (will not eradicate the knotweed)	
Q2.2	Is the Japanese Knotweed invading other vegetation which is to be retained?	
Yes	*Q2.3*	
No	*Treat with Glyphosate as an overall application.*	*Control Strategy 2.*
Q2.3	Is the vegetation to be retained a mown grass sward?	
Yes	*Mow regularly.*	*Mechanical Control Strategy 3.*
No	*Treat with careful spot applications of Glyphosate.*	*Control Strategy 2.*

3.	**For established stands of Japanese Knotweed**
Q3.1	Is Japanese Knotweed in the way of earthworks or construction proceeding?
Yes	*Q3.2*
No	*Q3.4*
Q3.2	Is the infested area to be covered by hard surfacing?
Yes	*Consider shallow excavation and installing a proprietary barrier membrane before constructing hard surface. Treat excavated material as Q3.3.*
No	*Q3.3*

Q3.3	Is deep burial (2m+) available within the works, as works proceed?	
Yes	*Excavate the entire stand and bury on site.*	*Mechanical Control Strategy 2.*
No	*Excavate the entire stand and move to control area on site, but outside the development footprint, where treatment can take place.*	
	Treat as for established stand. Q3.4 or engage specialist contractor with proprietary treatment system.	
	Only if treatment on site is totally impractical, remove material to a licensed tip as a controlled waste – see para 2.12.	
Q3.4	Is the stand within an area of desirable vegetation?	
Yes	*Q3.5*	
No	*Q3.6*	
Q3.5	Is the desirable vegetation a pure grass sward?	
Yes	*Q3.8*	
No	*Dig out entire stands or treat with careful applications of Glyphosate (spot treatment or stem injection).*	*Mechanical Control Strategy 2 or Control Strategy 2.*
Q3.6	Is it practical to disturb the ground to achieve more rapid eradication?	
Yes	*Excavate to 0.5m to break up crowns and large rhizome before treating regrowth.*	*Mechanical Control Strategy 4.*
No	*Q3.7*	
Q3.7	Is it intended to establish broad-leaved plants immediately after controlling Japanese Knotweed?	
Yes	*Treat with Glyphosate.*	*Control Strategy 2.*
No	*Q3.8*	
Q3.8	Is the affected area near a watercourse?	
Yes	*Treat with careful applications of glyphosate (directed spray or stem injection).*	*Control Strategy 2.*
No	*Treat with Picloram.*	*Control Strategy 1.*

B Part B – Model specification for the control of Japanese Knotweed in construction and landscape contracts.

This model specification can be directly inserted into civil engineering or landscape contracts where control of Japanese Knotweed is needed. It can be modified as necessary to reflect site conditions by following the guidance in Part A of this document. Re-number if necessary to fit the sequence of other specification elements.

B1.0 Introduction

B1.1 Legislation

The Contractor is reminded that the following legislation is applicable to his operations.

1. The Wildlife and Countryside Act 1981 (as amended).

   Schedule 9 Section 14 makes it an offence for anyone knowingly to introduce Japanese Knotweed into the wild.
2. The Control Pesticides Regulations 1986 (as amended).

   These regulations require all those who handle or use pesticides (including herbicides) to hold approved Certificates of Competence. Only approved pesticides may be used.
3. The Environmental Protection (Duty of Care) Regulations 1991 (as amended).

These regulations require all producers, carriers and disposers of waste to follow a Code of Practice and keep records. Any material contaminated with Japanese Knotweed is a 'waste', unless treated for re-use, and must be handled responsibly at all stages between its production and final recovery or disposal. Waste must be accompanied by a written Transfer Note describing the waste to enable the receiver to handle it in accordance with his duty of care. This specification also contains clauses which require compliance with this legislation.

B1.2 Identification

Japanese Knotweed is a vigorously growing perennial plant which invades other vegetation and damages riverbank protection works, tarmacadam and paving.

The Contractor shall ensure that his staff, and those of all groundwork subcontractors can identify this plant and are aware of the need to control it. He shall display in his site offices and messrooms the illustrated leaflets provided by the Employer. Identification of root fragments shall be by means of the guide given in this specification.

B1.3 Purpose of Control

Japanese Knotweed is time consuming and expensive to control once

it gains hold. It spreads rapidly beneath the ground surface. Small fragments rapidly regrow into invasive plants. This specification is intended to avoid further spread of Japanese Knotweed, and to eradicate it wherever possible.

B2.0 Site Inspection and Control of Spread

B2.1 Initial inspection

Before the commencement of site clearance or any earthworks, the Contractor's site Foreman shall inspect the site with the Project Manager's representative, to locate any existing Japanese Knotweed. Particular attention shall be paid to watercourses, tipped material, site boundaries and adjoining land. All occurrences of Japanese Knotweed are to be recorded on plans retained by Contractor for reference.

B2.2 Interim inspection

At all stages of the works, any Japanese Knotweed observed by the Contractor shall be notified to the Project Manager, who may then give instructions for its disposal or control.

B2.3 Control of spread

No disturbance of the soil in marked knotweed areas shall be permitted until the written approval of the Project Manager has been given; this will only be:

1. after effective eradication of Japanese Knotweed has been demonstrated, by means of the viability test given in this specification; or
2. where material is to be placed in designated disposal areas; or
3. where material is to be placed in designated control areas; or
4. under other circumstances at the Project Manager's discretion.

The contractor shall not disturb any infested material until he has provided the Project Manager with a written Method Statement showing clearly how he will ensure that no rhizome fragments will be spilled or inadvertently moved by plant, and how all plant in contact with infested soil is to be cleaned after use.

The contractor shall satisfy the Project Manager that all works to excavate knotweed are continuously supervised by personnel with the expertise necessary to identify rhizomes accurately.

B2.4 Imported material

The Contractor shall ensure that no Japanese Knotweed contained in imported materials is brought on to the site by his works, or those of any subcontractor. He shall take such steps as he considers necessary, which may include:

1. inspection of any material in-situ, before importation;
2. inspection of each load as delivered.

The identification of root fragments shall be by means of the guide given in this specification.

All materials delivered to site and found to contain Japanese Knotweed shall be removed and returned to the place of origin, at the Contractor's expense. The haulier and the originator of the material shall be notified in writing of the presence of Japanese Knotweed, and this notification copied to the Project Manager.

B2.5 Exported materials

Material in which Japanese Knotweed has been identified or is observed shall, if it is to be exported from the site, be classed as 'controlled waste' and subject to the relevant current regulations. In addition, it shall only be exported from the site with the written approval of the Project Manager who will require to be satisfied as to its destination and treatment. Such material for re-use within the site shall be treated as described in Clause B2.3.

B2.6 Disposal areas

The Project Manager may designate areas of the works for the disposal of Japanese Knotweed or infested fill material in accordance with applicable waste management regulations and guidelines. These shall be located where not less than 2 metres of cover is to be placed and compacted. Material for disposal shall be placed in layers no thicker than 1 metre (or less if so directed in the specification for earthworks), and compacted as specified for the surrounding fill. The containment membranes shown on the drawings shall be installed in accordance with the specification or manufacturer's instructions, which shall include protective sheeting or stone-free blinding material to prevent damage on backfilling.

B2.7 Control areas

The Project Manager may designate areas of the works for the control of Japanese Knotweed and infested material removed from elsewhere within the works. Control areas shall be clearly marked with bunting or temporary fencing. The material shall be placed in a single layer no thicker than 1m, and not compacted.

B2.8 Viability test

Step 1. Rhizome fragments shall be taken from not less than five points in the knotweed area, covering the full extent and depth. Two fragments per point shall be taken, each not less than 150mm long and 10mm in diameter. Each fragment shall be inspected by the Project Manager for signs of root or bud growth, and for the condition or health of the fragment. The findings shall be recorded. If any fragment appears to be alive then the test shall be concluded and the knotweed area shall be treated further.

Step 2 Alternative A. Fragments shall be washed to remove soil, and placed still damp in a clear polythene bag which shall be loosely tied and

labelled with the knotweed area reference and sampling date. The bag shall be kept dark and at between 60°F and 70°F (15-21°C). The Project Manager shall inspect the bag and contents weekly for 8 weeks for signs of root or bud growth. Only if the Project Manager is satisfied that all the fragments are dead will he give approval under Clause B2.3.1 of this specification. All sample material shall be burned at the end of this test.

Step 2 Alternative B. One fragment per sample point shall be sent, in a sealed plastic bag labelled with the knotweed area reference and sampling date, to an approved viability testing laboratory. Only if the testing laboratory certifies that all the fragments are dead will the Project Manager certify completion or give approval under Clause B2.3.1 of this specification.

B3.0 Herbicidal Control

B3.1 Introduction

This section of the specification gives two control strategies using herbicides. The Contractor shall adopt the strategy stated elsewhere in the contract or as directed by the Project Manager.

Details of the herbicide application methods are given.

Experience has shown that treatment for more than 3 years, possibly up to 5 years, is often needed in order to achieve complete eradication of Japanese Knotweed. Residual herbicides can suppress regrowth and so delay subsequent treatments.

Herbicides shall only be handled and applied by persons holding a valid Certificate of Competence issued under the Control of Pesticides Regulations 1986. The Contractor shall provide the Project Manager with copies of the Certificates for each relevant person. Where necessary, the Contractor shall engage a specialist sub contractor to comply with this clause.

The Contractor shall use specialised application methods such as telescopic lances and ULV equipment where necessary to achieve good spray coverage, or stem injection techniques where spray application is not possible.

Japanese Knotweed flowers between August and October when it is attractive to bees. Where spraying of flowering Japanese Knotweed is required, spray in late evening.

'Away from watercourses' in the following clauses means at a distance where no risk of the chemical reaching watercourses exists. The distance will depend on topography, run-off, and the application method used. Guidance should be sought from the Environment Agency.

All storage and application of herbicides shall be carried out in accordance with the Control of Pesticides Regulations 1986 (or later amendments if issued). The approved product label is the principal source of reference for each product. A copy of the product label shall be

supplied to the Project Manager at least 24 hours before any application together with a brief method statement. The Contractor shall be responsible for notifying the Environment Agency and obtaining permits where necessary.

B3.2	Control Strategy 1	Persistent herbicide containing picloram.
	Applicability:	Infested land not intended for broadleaved planting within 2 years, away from drainage channels, rivers and other wetland areas, on bare ground or established grassland of no nature conservation value.
	Timing:	Apply as foliar spray when shoots have fully-open leaves and have reached 1.0m or greater height (May or later according to season). If shoots are obscured by tall dead stems or so tall that thorough application is impossible, trash down the vegetation as specified herein, and apply when regrowth reaches 1.0m tall.
	Alternative timing:	Apply as spray to bare ground in winter, after clearance of dead stem material.
	Application rate and spray method:	As stated by manufacturer for Japanese Knotweed.
	Follow-up:	When vegetation has died back fully, and no later than the first emergence of new shoots, cut and remove all above-ground stems and burn in an area directed by the Project Manager. When new shoots reach 0.5m tall, apply herbicide containing 2,4D amine only, as a foliar spray, at the rate and in the method stated by the manufacturer for perennial weeds.
	Follow-up Option:	Adopt control strategy 2 using glyphosate.

B3.3	Control Strategy 2	Non-persistent herbicide containing Glyphosate only.
	Applicability:	On knotweed in bare ground or vegetation to be killed. As spot treatment within vegetation to be retained. The spray must not be allowed to contact desirable plants. Approved for use as directed near watercourses.

	Timing:	Apply as foliar spray when shoots have fully open leaves and have completed rapid height growth (August onwards according to season), but before frost.
	Application rate and spray method:	As stated by manufacturer for Japanese Knotweed, perennial weeds or woody weeds. A wetting additive approved by the manufacturer (eg "Mixture B") shall be used to improve herbicide uptake. If shoots are obscured by tall dead stems or so tall that thorough application is impossible, consider long lances, elevated platforms, stem injection techniques to achieve maximum possible application. Where application is to be made in the vicinity of vegetation to be retained, the Contractor shall select a method which ensures the protection of desirable plants, eg, weed wiper or stem injection.
	Follow-up:	When vegetation has died back fully, and no later than the first emergence of new shoots, cut and remove all above-ground stems and burn in an area directed by the Project Manager.
	Follow-up Option 1:	Apply glyphosate as foliar spray when shoots have fully open leaves and have completed rapid height growth (August onwards according to season), but before frost.
	Follow-up Option 2:	Where grass or turf has been sown or laid for at least 6 months, follow-up treatment using herbicide containing 2,4D amine only, as a foliar spray, at the rate and in the method stated by the manufacturer for perennial weeds in turf, may be substituted.
	Follow-up Option 3:	Where Japanese Knotweed regrowth is within vegetation to be retained, or where small amounts of regrowth are present, spot application of glyphosate using a suitable method, should be substituted.

B4.0 Mechanical Clearance and Control

B4.1 Trashing and clearance

Where specified before or after spraying, cut Japanese Knotweed cleanly within 50mm – 150mm of ground level using brush-cutters, hand tools or mechanical mowers. To avoid spreading live buds, no stems shall

be broken from the crowns. Remove all cut vegetation to a location directed by the Project Manager and burn. Where necessary, allow the vegetation to dry out to minimise smoke generation. The Contractor shall take all measures necessary to prevent cut material from being washed into watercourses or contaminating adjacent land. Livestock access to herbicide-treated vegetation shall be prevented.

B4.2	Mechanical Control Strategy 1	
	Application:	New growth in disturbed ground or imported soil. Isolated small plants.
	Timing:	At any time of year, before root growth extends to anchor the plant fragment.
	Method:	Dig below the root fragment to remove the entire growth of the plant, and place in a heavy gauge polythene bag for disposal.
	Disposal:	Burn, or bury at least 2m deep in on-site disposal area. If taken off site, dispose of in accordance with regulations for controlled waste.
	Follow-up:	All further growth shall be removed by hand digging before shoots reach 300mm height.

B4.3	Mechanical Control Strategy 2	
	Application:	Isolated established stands.
	Timing:	At any time of year.
	Method:	Mechanically excavate the entire stand and sufficient surrounding soil to ensure that all root fragments are removed (up to 7m laterally and 3m deep).
	Disposal:	Dispose of all excavated material in a designated disposal area on site, or designated control area on site, at the Project Manager's direction. If taken off site, dispose of in accordance with regulations for controlled waste.
	Follow-up:	Record the area of excavation and monitor for any future regrowth of Japanese Knotweed. Apply control measures in control area, as specified.

B4.4	Mechanical Control Strategy 3	
	Application:	To prevent the invasion of Japanese Knotweed into established grassland, where selective herbicides are not desired.
	Timing:	Throughout the growing season (April – October), before Japanese Knotweed shoots reach 300mm tall.
	Method:	Mow grass and invading knotweed at intervals not greater than 14 days, to height of 25mm or as specified elsewhere in the Contract. All mowing equipment shall be correctly maintained and operated to produce an even, clean cut without 'scalping' or missed patches. Where directed, cuttings shall be removed or pulverised to less than 10mm long to prevent risk of regeneration.

B4.5	Mechanical Control Strategy 4	
	Application:	To prepare established stands for herbicide treatment and accelerate control. NOT SUITABLE FOR STEEP SLOPES.
	Timing:	Throughout the dormant season (November – March) after stem die-back.
	Method:	Mechanically excavate upper 0.5m of crowns and larger rhizome around the stand, fragment the knotweed and roughly level the ground.
	Follow up:	Treat regrowth by following Control Strategy 2.

B5.0 Site Monitoring

B5.1 Inspection and report

During the works and the maintenance period, the Contractor shall inspect the whole site in each June and each September, and provide a written report covering:

1. The extent, height and density of Japanese Knotweed in each 'knotweed area' identified during the initial inspection or subsequently.
2. The location, extent, height and density of any new Japanese Knotweed stands not previously recorded.
3. The occurrence of any Japanese Knotweed in designated disposal areas.

4. The condition of Japanese Knotweed in designated control areas, with a summary of control treatments applied, stating Herbicide; Application method; Date.
5. The sample location and date, inspection date and result of any viability tests conducted.

C Part C – Guide to procuring the control of Japanese Knotweed

C1.0 Introduction

C1.1 The purpose of Part C is to assist landowners and land managers to procure the eradication or control of Japanese Knotweed. The document explains a number of options that are available, and provides a guide to the use of an 'industry-standard' form of contract for this particular purpose.

C1.2 A summary of the problems caused by Japanese Knotweed, legal requirements, and technical guidance on the methods of Japanese Knotweed control is given in Parts A and B of this document.

C1.3 Guidance on the legal obligations of landowners, good practice to minimise the risk of spread, the options available for knotweed treatment, and the management of waste is given in the Environment Agency publication 'Managing Japanese Knotweed on development sites', available from the EA website.

C2.0 Selection of a procurement strategy

C2.1 Eradication techniques range from herbicide treatment programmes taking several years to complete, to proprietary systems implemented by specialist contractors over a few weeks or months. In the last resort, excavation and removal to landfill offers a rapid but unsustainable and very expensive option. Appendix A (see Part A of this document) gives some examples of the timescales needed for various herbicide treatment programmes, taking account of the seasonal requirements. A worked example of the contract assessment procedure and payments schedule follows C4.1.

Before commencing a scheme of knotweed treatment, decide:

What is the purpose of the proposed treatment?

- 'Eradication' – the complete removal of Japanese Knotweed from an area, to meet a deadline or without time limit.
- 'Control' – reduction of an infestation to prevent invasion or spread.
- 'Management' – reduction of an infestation to a point where it becomes easily managed over the long-term.

The type of treatment, and its cost, depend greatly on the timescale and the purpose.

What happens after the treatment?

- Site to be used for construction or landscape scheme.
- Site to be restored to natural habitat.
- Site to be managed to achieve other objective(s).

The type of treatment, and its cost, depend greatly on the timescale and the purpose.

Treated knotweed looks unsightly, often exposing fly tipped material in amongst dead stems and unless the land is used or managed after eradication it will degenerate, risking re-infestation with knotweed or erosion.

What are the options for arranging the treatment, as part of a long-term programme or a single site treatment?

- Using the guidance in this Part C, engage a specialist contractor to propose and implement a treatment regime, competitively tendered, to meet site-specific performance objectives and pay when those objectives are achieved (Table C1 Approaches A and B).
- Using the specification guidance in Parts A and B, decide on the treatment regime and engage a contractor to carry it out, paying as the work is done (Table C1 Approaches C and D).
- Recruit a trained person or team to carry out programmes of treatment extending over a period of years (Table C1 Approach E).

Tendering is an expensive process, for contractors and employers. Contract administration can form a large proportion of the cost of smaller treatment programmes, and placing a direct order for treatment works could be less expensive than a full contract based on a performance specification.

Table C1 sets out some of the advantages and disadvantages of various approaches to procurement, and suggests when each might be applicable.

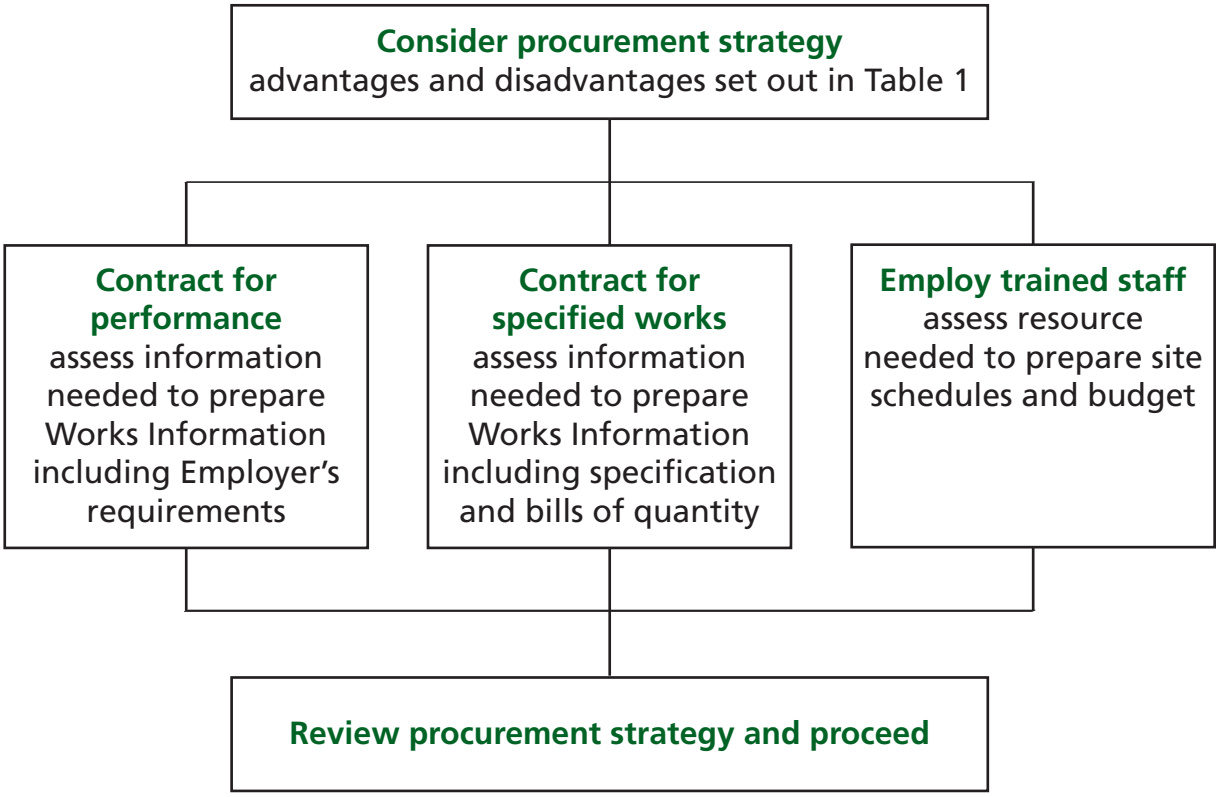
Table C1 Approaches to procuring knotweed treatment

Approach		Advantages	Disadvantages	Application
A	Tender or negotiate contract on performance-specification, with deadline for completion.	Methods chosen to achieve deadline, payment only made if deadline achieved. Risk of performance remains with contractor.	Cost of tender process and contract administration. Contract must set out definition of eradication, and remedy if deadline is not achieved. Contractor will pass cost of risk onto Employer through prices.	Eradication on site of development project with deadline for start of works.

B	Tender or negotiate contract on performance-specification, payment when objective is achieved.	Contractor responsible for selecting method, payment only by results. Risk of performance remains with contractor.	Cost of tender process and contract administration. Contract must set out definition of eradication. Uncertainty of expenditure. Delay in cash flow for contractor is difficult for smaller firms. Contractor will pass cost of risk onto Employer through prices.	Knotweed in location where time taken to achieve eradication is not critical.
C	Tender or negotiate contract on method specification, payment as work is carried out.	Simpler contract administration. Greater certainty of expenditure timing. Small firms able to implement contract procedures with little delay to payment.	No certainty of effectiveness of treatment. Termination of funding risks losing benefit of partially-completed work. Cost of remeasurement of work items.	Control or management works. Projects involving smaller area of knotweed.
D	Place order directly with contractor on method specification, payment as work is carried out.	Simple administration. Flexibility in areas to be treated. Greater certainty of expenditure timing. Employer does not pay higher price covering risk of performance. Small firms able to implement contract procedures with little delay to payment.	No certainty of effectiveness of treatment. Termination of funding risks losing benefit of partially-completed work. Cost of remeasurement of work items.	Control or management works. Projects involving smaller area of knotweed.

E	Employ trained staff (short or long term contract).	No contract administration. Staff can manage the programme directly, giving flexibility in areas to be treated and timing of works. Direct contact between landowners and treatment staff builds local knowledge. Greater certainty of expenditure timing.	On-cost of employing staff. No certainty of effectiveness of treatment. Termination of funding risks losing benefit of partially-completed work.	Eradication where time is not critical. Control or management works. Projects involving many small areas of knotweed and many landowners / neighbours. Long-term programmes where follow-up is critical.

Flowchart for Selecting Procurement Method



C2.2 The former WDA Model Tender Document used the JCLI contract as its basis, although the JCLI contract was written for use where the works were fully designed by the Employer's designer. In many projects intended to eradicate Japanese Knotweed, the contractor is invited to

use his own judgement and expertise to select his chosen method(s) for eradication and so the JCLI contract had to be modified for use with knotweed projects.

C2.3 This document provides a guide to the use of one standard form of contract, the 'NEC3 Engineering and Construction Short Contract', as the basis of a procurement procedure which requires little modification. This form is part of a 'family' of contracts which have wide acceptability amongst contractors and professionals within the construction industry and embrace the principles of collaborative working between the parties. This guidance document assumes that the reader is familiar with the standard form which has its own published Guidance Notes[1].

C2.4 The structure of this contract requires the Employer to set out his requirements in the form of Contract Data, Works Information and Site Information. The Tenderer provides a list of prices against Items which may be lump sums or remeasured quantities. The contract form can therefore be used:

- For implementing works designed by the tenderer or specified by the Employer.
- For works where payment is by results or for the work carried out.
- For projects where there is a time limit or an open-ended commitment to achieve results.
- For large areas of knotweed on one site or for many areas over a number of sites.

C2.5 It is essential that the Employer (or his professional advisor) is able to set out the contract requirements in sufficient detail that tenderers are able to make an accurate assessment of the work involved. Where this is not possible at the outset, the Employer may approach a specialist contractor directly and use the Contract as the basis of a contract agreed between the parties.

Guarantees, warranties and performance bonds

C2.6 Many commercial organisations advertising knotweed eradication services offer **guarantees**, but the detail of what is offered varies greatly between firms. Typically, the guarantee sets out the remedial action (eg further herbicide applications) that the firm will take if knotweed continues to regenerate after the specified programme of treatment. Consequential loss or damage may be excluded. For projects where complete eradication by a particular date is essential, the guarantee may not provide a satisfactory outcome. If the contractor ceases trading or has no resources when a problem occurs, the guarantee may have no value unless backed by a separate insurance system. Professional indemnity insurance does not normally cover contract works.

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1 NEC3 Engineering and Construction Short Contract Guidance Notes and Flow Charts pub. Thomas Telford Ltd

C2.7 A **warranty** is designed to allow the client (or in the case of a 'Collateral Warranty' a third party eg. a project funder) to rely on the contractor achieving the specified performance, and to obtain financial recompense for consequential losses if the performance is not achieved. For example, if the construction of a building is halted because knotweed regenerates, then the cost of delays on site would be recovered. These costs would be much greater than the cost of the knotweed treatment. If the contractor ceases trading or has no resources when a problem occurs, the guarantee may have no value unless backed by a separate insurance system. Professional indemnity insurance does not normally cover contract works.

C2.8 Where the potential consequences of a failure to achieve the specified knotweed eradication performance are considered great enough to justify the legal costs, it is recommended that a bespoke warranty should be prepared by specialists.

C2.9 A **performance bond** is a separate legal document, often to a standard wording, linked to the completion of the works specified in the contract. A reputable bondsman, such as an insurance company, undertakes to pay a stated sum of money to the Employer unless the works specified in the contract are completed. If the contractor fails to complete the works then the money is paid to the Employer even if the contractor has become insolvent or ceased trading. The insurance company charges the contractor for setting up the bond, and the contractor will normally pass on this cost within his tender to the Employer. In most construction contracts the bond is for 10% of the contract amount, and this might meet the administrative costs of engaging another contractor to complete the unfinished work. A 10% bond would not meet the cost of completing the work, the consequential costs of delays to a project or damage to subsequent works.

C2.10 A standard construction industry contract will provide for Liquidated Damages – 'a genuine pre-estimate of loss' that would be suffered by the Employer if the specified works are not completed by the specified date. It will also provide for Retention, so that a percentage of money due for works completed is held back by the Employer for expenditure if the contractor fails to remedy a defect. If some greater protection against failure is required, then consider the following questions:

- What will the financial and time-based losses be?
- Will the contractor be able to carry out corrective works action to remedy the failure?
- Will the contractor be in a position to pay for the losses incurred by the Employer?
- What form of insurance policy would provide financial protection, and what is the least expensive method of securing such a policy?

C3.0 Completing the tender document

C3.1 The following sections provide a guide to completing the standard printed 'NEC3 Engineering and Construction Short Contract' for use in knotweed control or eradication projects.

Contract Data

Item	Recommendation
'The defects date is …weeks after Completion'.	**52 weeks** – to allow full growing season for any residual Japanese Knotweed to become apparent (see Appendix A).
'The defects correction period is …. weeks'.	**26 weeks** – or shorter period if planned construction work dictates the need.
'The delay damages are …. per day'.	**Daily Sum** – a forecast of additional expenditure in supervision of contract, and consequences of delay to following works.
'The assessment day is the …. of each month'.	**As notified by the Employer in accordance with clause 50.1 as amended.**
'The retention is …. %'.	**10%** **The additional retention on eradication is 40%.**

Amendments to the conditions of contract

The conditions of contract are the NEC3 Engineering and Construction Short Contract (June 2005) amended as follows:

Clause No.	Original Clause	Amended Clause
30.2	The *Contractor* submits a forecast of the date of Completion to the *Employer* each week from the *starting date* until Completion.	The *Contractor* submits a forecast of the date of Completion to the *Employer* at the start of each treatment season or as requested by the *Employer* until Completion.

50.1	There is an *assessment day* in each month from the *starting date* until the month after the Defects Certificate has been issued.	There will normally be one *assessment day* each year from the *starting date* until the month after the Defects Certificate has been issued. Each *assessment day* will be notified by the Employer following his assessment of the eradication achieved during that year. Additional *assessment days* may be agreed between the parties.
50.6	An amount is retained from the *Contractor* in the assessment of each amount due until Completion. This amount is the *retention* applied to the Price for Work Done to Date.	An amount is retained from the *Contractor* in the assessment of each amount due until Completion. This amount is calculated separately for each area stated in the Contract as follows.
50.6.2		On the first *assessment day* the amount retained shall be the total of the *additional retention on eradication* and the retention applied to the Price for Work Done to Date for that area. The *additional retention on eradication* shall not apply to any works which are identified in the Schedule of Quantities as 'Non-eradication Works'.
50.6.3		On the second or any subsequent *assessment day* before Completion the amount retained shall be only the *retention* applied to the Price for Work Done to Date for that area provided that there has been no re-growth since the previous *assessment day*.

50.6.4		If, in advance of any *assessment date*, the *Contractor* commissions independent rhizome sampling and viability testing and provides to the *Employer* a certificate addressed jointly to himself and the *Employer* verifying eradication in accordance with the requirements of the Works Information then the amount retained shall be the *retention* applied to the Price for Work Done to Date for that area.
50.6.5		The amount retained is halved in the first assessment made after Completion and remains at this amount until the first *assessment day* after the Defects Certificate is issued. No amount is retained in any assessment made after the Defects Certificate has been issued.
51.1	The *Employer* pays within three weeks after the next *assessment day* which follows receipt of an application for payment by the *Contractor*.	The *Employer* pays within 28 days of the *assessment date*.
51.2	Interest is paid if a payment is late or includes a correction of an earlier payment. Interest is assessed from the date by which the correct payment should have been made until the date when it is paid. Interest is calculated at the rate stated in the Contract Data or, if none is stated, at 0.5% of the delayed amount per complete week of delay.	Interest is paid only if a payment is late. Interest is assessed from the date by which the payment should have been made until the date when it is paid. Interest is calculated at the rate stated in the Contract Data or, if none is stated, at 0.5% of the delayed amount per complete week of delay. Interest will be added to the amount due in the next payment.

60.1(13)	A difference between the final total quantity of work done and the quantity stated for an item in the Price List (is a Compensation Event).	Clause deleted.
61.2 (last para only)	If the *Employer* decides otherwise, he instructs the *Contractor* to submit a quotation for the Event. The *Employer* notifies the decision to the *Contractor* or instructs the *Contractor* to submit a quotation within one week of the *Contractor's* notification to the *Employer* of the event.	If the *Employer* decides otherwise, he instructs the *Contractor* to submit a quotation for the Event. The *Employer* notifies the decision to the *Contractor* or instructs the *Contractor* to submit a quotation. The *Employer's* decision shall be given within one week of the *Contractor's* notification to the *Employer* of the event.

Contract Data Price List

C3.2 The price list should be completed by entering:

- an item for the preliminary works (such as marking out and fencing) on each separately identified knotweed area, paid as a lump sum for that area,
- an item for the eradication of knotweed on each separately identified knotweed area, paid as a lump sum for that area. As a guide the knotweed should be divided into 10 – 25 areas for practical management of the contract and to allow the contractor to receive payment for each area as the specified performance is achieved. For larger contracts spanning a number of sites, a number of knotweed stands on one site should be treated as one area. For smaller contracts, each stand should be treated as a separate area,
- an item for additional knotweed discovered at each location before the first treatment applied in the works, paid per m^2 measured.

For example:

Item number	Description	Unit	Quantity	Rate	Price
1	Mark out all areas as specified	SUM	-	-	
2	Eradicate Japanese Knotweed from knotweed area A	SUM	-	-	
3	PROVISIONAL ITEM Eradicate additional Japanese Knotweed arising in vicinity of area A, if instructed	m^2	20		

4	Eradicate Japanese Knotweed from knotweed area B	SUM	-	-	
5	etc				

Contract Data Works Information

C3.3 The Employer should complete this section in accordance with his requirements. Recommendations for knotweed works are given:

ITEM	RECOMMENDATION
1. Description of the works.	Description must set out • whether the contractor is to achieve eradication or control/management of Japanese Knotweed, • the planned use of the site once eradication or control/management is achieved, • the time limit (if any) by which the site must be free from living Japanese Knotweed, • definition of Completion.
2. Drawings.	Drawings must show clearly: • The location, means of access, boundaries and name of each site within the contract, • The surveyed limits of each separately-identified area of knotweed within the contract, with label given to each, • Constraints within or adjacent to each site that might affect the working method (eg watercourses, steep slopes, sensitive vegetation or land uses).
3. Specifications.	The Employer must provide, and list in this section, all specifications for work items which are not to be designed by the contractor. The Employer must provide, and list in this section, all specifications giving the performance to be achieved by the contractor's works. The Employer should list the work items for which the tenderer is to provide a Method Statement. The test for knotweed viability or eradication performance (Appendix B) shall be listed here.

4. Constraints.	The Employer must set out all constraints which the Contractor is to observe (see also 3.5). Examples include: • Limitations on the selection of knotweed control methods, • Separate time limits applicable to areas within the works, • Areas in which excavation of knotweed is not permissible, • Limitations on site access, or the Employer's requirements for continuing use of parts of the site.
5. Requirements for the programme.	The Employer must set out the form in which the programme is required. A simple chart or list of planned treatments and dates, planned reviews of effectiveness, and the assessment dates set out in the contract, is usually sufficient. Where excavation or other groundworks are planned by the contractor they should be shown separately. The programme should be updated not more than 4 weeks after emergence of untreated knotweed stands in the vicinity, and not more than 4 weeks after the final treatment in each growing season, as a minimum. The Employer is to state here the intended use of each area of the site at Completion.
6. Services and other things provided by the Employer	The Employer is to enter any items that will be provided, or state 'none'.

C3.4 By requiring the tenderer to provide a method statement within his tender, the Employer can establish how each tenderer intends to carry out the works. The method statement of the successful tenderer may then form a contract specification, binding the contractor to the method set out. Method statements will demonstrate that the tenderer fully understands the particular requirements of working with Japanese Knotweed, such as the cleaning of earthworks equipment used in contact with infested soil or the planning and supervision of the transport of infested soil from the stands to a treatment or disposal area. A checklist of items that should be present in method statements for excavation and transporting knotweed, and in method statements for herbicide treatment, is given in Appendix C.

Contract Data Site Information

C3.5 The Employer should complete this section in accordance with his knowledge of the site or sites involved. Information which could affect knotweed works includes:

- The presence, alignment and details of services within the site,
- Information about potential contaminants, made ground and buried foundations or structures within or adjacent to knotweed areas,
- Restrictions on access for vehicles and contractor's plant,
- Wildlife habitats, known presence of protected species or similar ecological constraints (otters are known to use dense knotweed stands along rivers as daytime cover),
- Information and concerns from neighbouring landowners, residents and occupiers (eg school staff, livestock owners, beekeepers and others who should be informed before spraying).

C4.0 Interpretation and administration of the contract

Cl 60 Compensation events

C4.1 If the Employer decides to add further areas of Japanese Knotweed to the contract, whether these are established stands or newly recorded and arising outside the identified areas, he shall give an instruction changing the Works Information and this shall be treated as a Compensation event under clause 60.1 (1). Where the instruction is given before the treatment of the adjacent knotweed areas has commenced then the prices stated in the relevant item of the Price List shall be used to assess the Compensation Event. Where treatment of adjacent areas has begun or the method used for adjacent areas is not suitable for the treatment of the additional area then the contractor shall submit a quotation in accordance with clause 62.

Worked Example Showing Payment and Calculation Of Retention

This example shows a contract consisting of 3 areas where eradication is specified and 3 areas where repeated treatment is specified. Annual assessments of progress and payment due have been made, as shown.

Step	1	2	3	4	5	6

Summary Of Tendered Works		**Tender Price**	
Non-eradication Works			
Temporary Fencing to Site Boundary	SUM	7,500.00	
Clear Fly-Tipped Material from Area D	SUM	950.00	
Eradication of Knotweed by end of Year 3			
Area A	SUM	12,000.00	
Area B	SUM	8,000.00	
Area C	SUM	11,500.00	
Treatment to Keep Area Free of Knotweed for 3 years			
Area D	RATE	850.00	per year
Area E	RATE	950.00	per year
Area F	RATE	1,200.00	per year
Retention Percentages			
Retention (all items)	10%		
Additional Retention on Eradication	40%		
Retention after Completion	partial release as contract		

In this example, Contract Year 1 commences 1st August.

Step	1	2	3	4	5	6

Assessment 1 (July of Year 1)			
EMPLOYER AGREES: Areas A, B and C not yet achieved, payment due for D E and F with retention deducted, contractor instructed to add new Area G to treatment programme			**Notes**
Retention Free Works	SUM	8,450.00	
Treatment of Area D	1 year	850.00	
Treatment of Area E	1 year	950.00	
Treatment of Area F	1 year	1,200.00	
Assessment 1 Sub-Total		**11,450.00**	
Deduct Additional Retention on Eradication	40%	-1,200.00	Works to Areas D, E and F
Deduct Retention	10%	-1,145.00	All Works
Assessment 1 Net Payment		**9,105.00**	

Step	1	2	3	4	5	6

Assessment 2 (July of Year 2)			
EMPLOYER AGREES: Area A completed, Areas B and C not yet achieved, payment due for Areas D and E, treatment of Area F unsatisfactory			**Notes**
Retention Free Works	SUM	8,450.00	
Eradication of Area A	SUM	12,000.00	Eradication proven by testing
Treatment of Area D	2 year	1,700.00	
Treatment of Area E	2 year	1,900.00	
Treatment of Area F	1 year only	1,200.00	Year 2 unsatisfactory
Treatment of Area G	1 year only	900.00	Rate by quotation
Assessment 2 Sub-Total		**26,150.00**	
Deduct Additional Retention on Eradication	40%	-2,280.00	Works to Areas D, E, F and G only
Deduct Retention	10%	-2,615.00	All Works
Assessment 2 Net Sub-Total		**21,255.00**	
Deduct previous payment		-9,105.00	
Assessment 2 Net Payment		**12,150.00**	

Step	1	2	3	4	5	6

Assessment 3 (July of Year 3)			
EMPLOYER AGREES: Areas A B and C completed and payment due for Areas D, E, F and G			**Notes**
Retention Free Works	SUM	8,450.00	
Eradication of Area A	SUM	12,000.00	Remains free of knotweed
Eradication of Area B	SUM	8,000.00	Eradication proven by testing
Eradication of Area C	SUM	11,500.00	Eradication proven by testing
Treatment of Area D	3 year	2,550.00	
Treatment of Area E	3 year	2,850.00	
Treatment of Area F	2 year	2,400.00	
Treatment of Area G	2 year	1,800.00	
Assessment 3 Sub-Total		**49,550.00**	

Deduct Additional Retention on Eradication	40%	-3,840.00	Works to Areas D, E, F and G only
Deduct Retention	10%	-4,955.00	All Works
Assessment 3 Net Sub-Total		**40,755.00**	
Deduct previous payments		-21,255.00	
Assessment 3 Net Payment		**19,500.00**	

In this example, completion is achieved and certified at July of Year 3, and the Defects Date is set at July of Year 4. (The Contractor could apply for partial release of retention in accordance with clause 50.1 and 50.6.5 once the Completion certificate is issued).

Step	1	2	3	4	5	6

Assessment 4 (September of Year 3)			
EMPLOYER AGREES: no regrowth in Areas A to F since Assessment 3			**Notes**
Retention Free Works	SUM	8,450.00	
Eradication of Area A	SUM	12,000.00	
Eradication of Area B	SUM	8,000.00	
Eradication of Area C	SUM	11,500.00	
Treatment of Area D	3 year	2,550.00	
Treatment of Area E	3 year	2,850.00	
Treatment of Area F	2 year	2,400.00	*Paid treatment could continue in Year 4
Treatment of Area G	2 year	1,800.00	
Assessment 4 Sub-Total		**49,550.00**	
Deduct Additional Retention on Eradication	0%	0.00	Works to Areas A to G
Deduct Retention	5%	-2,477.50	All Works
Assessment 4 Net Sub-Total		**47,072.50**	
Deduct previous payments		-40,755.00	
Assessment 4 Net Payment		**6,317.50**	

Step	1	2	3	4	5	6

Defects Correction Certificate is issued following minor remedial works, and a final Assessment is made.

Assessment 5 (September of Year 4)			
EMPLOYER AGREES: no regrowth in Areas A to F since Assessment 4			**Notes**
Retention Free Works	SUM	8,450.00	
Eradication of Area A	SUM	12,000.00	

Eradication of Area B	SUM	8,000.00	
Eradication of Area C	SUM	11,500.00	
Treatment of Area D	3 year	2,550.00	
Treatment of Area E	3 year	2,850.00	
Treatment of Area F	2 year	2,400.00	
Treatment of Area G	2 year	1,800.00	
Assessment 5 Sub-Total		**49,550.00**	
Deduct Additional Retention on Eradication	0%	0.00	Works to Areas A to G
Deduct Retention	0%	0.00	All Works
Assessment 5 Net Sub-Total		**49,550.00**	
Deduct previous payments		-47,072.50	
Assessment 5 Net Payment		**2,477.50**	

Appendix B

Specification For Assessment Of Eradication

Definition: in this contract, 'eradication' means that there shall be no living rhizome, stem or leaf material of Japanese Knotweed within the defined area.

Refer to point c) for verification of knotweed 'eradication' on site.

Specification for Assessment	Guidance Note
a) The locations, outlines and identification codes of each of the areas of Japanese Knotweed to be treated shall be shown on the tender drawings, verified and pegged out by the contractor on commencement of the contract.	GPS surveying makes it practical to identify each area and sufficient adjacent detail that it can be clearly located for pegging out. Large stands should be subdivided into areas based on ground features or the intended future use of the sites. The number of areas should reflect the scale of the contract and the effort involved in assessment.
b) Each knotweed area shall be assessed in July, or 6 months after the most recent treatment, whichever is the later, in the assessment year. Assessment shall consist of visual inspection by the Employer, including the excavation of rhizome samples. Areas which have any evidence of living knotweed shoots or rhizomes shall be recorded as incomplete, notwithstanding that an area may previously have been recorded as free from knotweed growth. Areas which are completely free from knotweed growth shall be recorded and certified for payment.	This will mean that a retention is required, because the money due could be less than that already paid. Where residual herbicide is used then an assessment made in the first year of the contract should recognise that most areas would be free of visible knotweed but suppressed rhizome would remain. The size and number of knotweed areas identified in the tender should be judged with consideration of the supervision effort involved and the contractor's need for cash flow.

c) The contractor may elect to commission and pay for independent rhizome sampling and viability testing in order to verify eradication. Sampling and testing shall conform to the requirements set out in this document. Such test results shall be accompanied by a certificate addressed jointly to the contractor and the employer.	Tests using vital stains which react to cellular processes in living plants have been developed[2]. The contractor should obtain the employer's agreement to the proposed independent testing organisation before commissioning the tests.

Requirement for rhizome sampling and testing

Step 1. Rhizome fragments shall be taken from not less than five points in the knotweed area, covering the full extent and depth. Two fragments per point shall be taken, each not less than 150mm long and 10mm in diameter. Each fragment shall be inspected by the Project Manager for signs of root or bud growth, and for the condition or health of the fragment. The findings shall be recorded. If any fragment appears to be alive then the test shall be concluded and the knotweed area shall be treated further.

Step 2 Alternative A. Fragments shall be washed to remove soil, and placed still damp in a clear polythene bag which shall be loosely tied and labelled with the knotweed area reference and sampling date. The bag shall be kept dark and at between 60°F and 70°F (15-21°C). The Project Manager shall inspect the bag and contents weekly for 8 weeks for signs of root or bud growth. Only if the Project Manager is satisfied that all the fragments are dead will he give approval. All sample material shall be burned at the end of this test.

Step 2 Alternative B. One fragment per sample point shall be sent, in a sealed plastic bag labelled with the knotweed area reference and sampling date, to an approved viability testing laboratory. Only if the testing laboratory certifies that all the fragments are dead will the Project Manager certify completion or give approval.

The test results shall be accompanied by a certificate in the following form, signed by the authorised representative of the testing organization.

'We hereby certify to [names of employer and contractor] that we have tested the samples of Japanese Knotweed rhizome listed below and that all fragments in each sample were dead.'

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2 *Tests announced in 2008 and made available on commercial basis by one company. The cost depends on the number of samples (min £100).*

Appendix C

Checklists for Assessing Method Statements

A Method Statement For The Excavation Of Japanese Knotweed

- What equipment will be used for excavation?
- What expertise will be available to supervise the excavation?
- How will the areas be checked for services before excavation?
- How will spillage during excavation or loading be avoided?
- How will the area be cleaned off at the end of excavation and loading?
- How will the equipment be cleaned, and what will be done with the soil cleaned from the equipment?

B Method Statement For Loading And Transporting Japanese Knotweed

- What equipment will be used for loading and transport?
- What expertise will be available to supervise the loading and deposition?
- How will spillage and dust-blow be prevented?
- For deposition within the site, how will the material be placed and graded?
- For removal from site, what is the final destination of the material and what arrangements are there for the collation of transfer notes?
- How will the area be cleaned off at the end of loading?
- How will the equipment be cleaned, and what will be done with the soil cleaned from the equipment?

C Method Statement For Application Of Herbicide To Japanese Knotweed

- How will infested and treated areas be marked on site during the works?
- Which herbicide will be used?
- If a persistent herbicide is proposed, is there any reason why it should not be used (eg follow-up planting)?
- Does the proposed strategy conflict with the proposed end use of the site?
- What equipment will be used for application?
- Are all personnel applying herbicide in possession of appropriate Pesticide Application qualifications (eg PA1, PA6)?
- Does the proposal state and recognise the need for a period of dry weather during and immediately after application?
- Will the application be near a watercourse and if so, has a WQM1 approval been obtained from the Environment Agency?
- What precautions should be taken to ensure public safety and environmental safety?

Identification Guidance

Spring

Japanese Knotweed produces shoots rapidly in spring, growing over 40mm (nearly 2 inches) a day in good weather.

The plant spreads by rhizomes (underground stems).

Each rhizome fragment can regenerate into a new plant.

Summer

Growth can be up to 2m (7 feet) tall.

It can grow through loose block-work and damages riverbank protection works, tarmacadam and paving.

Winter

Stems and foliage die back in winter to leave an unsightly mass of tangled dead vegetation.

Large above ground crowns are evident in established stands, particularly visible in winter and spring.

Bottom far right:
Spring crown growth.

Root/rhizome identification chart – Japanese knotweed

Plants commonly found on development sites

Japanese knotweed *Fallopia japonica*
(and other Asiatic invasive knotweeds).

Japanese Knotweed is commonly encountered on brownfield sites, where soil disturbance and fly-tipping are common. Close proximity to rivers, roads and railways may also provide a source of invasion.

External appearance of root or rhizome

Colour: Dark brown, lighter when dried.

Texture: Smooth skin, becoming rough when desiccated.

Features: Often forming long knotty lengths. May support small red buds, particularly on crowns (base of stem). Fine hair-like roots common, particularly on thinner sections.

Snap test

Snapability: Very carrot-like in structure and colour when fresh. More woody when dry. Older material, particularly near the crow, can be very woody. Colour can vary from deep red to pale yellow, with organic the most common. Younger fresh material usually has a different coloured core.

Scrape Test

Outer layer: Thin skin, easily removed when fresh.

Inner layer: Pale threads often run through darker fibrous flesh, particularly in larger rhizome. Often variations in colour through rhizome when split lengthways. Crown material is often caked with soil and can be hard to recognise. Cleaning should reveal buds and characteristic flesh.