B4 Scoping the environmental impacts of deliberate introduction of non-native and genetically modified species

Explanatory note

For projects which require Environmental Impact Assessment (EIA), a scoping exercise should be undertaken early in the planning stages of the project. This enables the project to be designed to avoid or minimise negative environmental impacts and provides an opportunity to incorporate positive environmental enhancements into the project. Early consultation with all interested parties, including the Environment Agency, is an essential part of scoping. Even if a project does not require EIA under EIA legislation, it may be advisable (and in some cases necessary) to undertake a scoping exercise in any case (e.g. to support applications for other relevant consents and authorisations needed to carry out the project).

This guidance note aims to promote a good practice approach to scoping as part of the EIA process which in some respects goes beyond the statutory EIA requirements. When scoping a project, developers, or their consultants, should satisfy themselves that they have addressed all the potential impacts and the concerns of all organisations and individuals with an interest in the project.

This guidance note provides information on the most likely potential environmental impacts of actions which deliberately introduce non-native and genetically modified species to the environment. However, each project must be considered on a case-by-case basis as the detailed characteristics of the proposal and the site will determine the potential impacts.

This guidance is based on the main legal requirements on EIA stemming from the EC Directive and the UK Regulations. However, developers should seek independent legal advice to ensure that the proposed development is carried out in compliance with the requirements of this and any other relevant legislation relating to planning as well as to pollution control.

This guidance note must be read in conjunction with the *Scoping Handbook*, which provides general guidance on the EIA process and the scoping of projects.

ENVIRONMENT AGENCY

This guidance note must be read in conjunction with the *Scoping Handbook,* which provides general guidance on the EIA process and the scoping of projects.

IIn addition, the following scoping guidance notes are relevant to *all* projects which introduce non-native and genetically modified species to the environment:

- A1 Construction work
- A4 Vegetation management and conservation enhancements

The following scoping guidance notes *may* be relevant in certain circumstances:

- A3 Redevelopment and clean-up of contaminated land
- B2 Arable farming activities and the intensification of previously uncultivated land
- B3 Control of pest species, including disease vectors

Contents

1 Introduction

1.1 This guidance note, in conjunction with the *Scoping Handbook* and the notes listed on the previous page, seeks to help developers and other interested parties identify the potential impacts on the environment arising from the deliberate introduction of non-native and genetically modified species. It should be emphasised that the list of impacts is by no means exhaustive and that a full investigation into positive and negative impacts should be undertaken. Early consultation with the Environment Agency and other relevant organisations will enable the identification of environmental issues and constraints and the avoidance of sensitive areas, thus reducing the need for redesigning and mitigating avoidable impacts at a later stage.

1.2 Following this brief introduction, an overview of the legal requirements for EIA in relation to the introduction of non-native species or genetically modified organisms to the environment is provided. The potential environmental impacts of such projects are identified in Section 3. The text and summary table in this section will enable the reader to begin to identify the likely impacts arising from the particular proposal under consideration. The subsequent sections present the mitigation measures that may be relevant, followed by key references and further reading.

Background to development type

1.3 The introduction of non-native species or genetically modified organisms (GMOs) to the environment, including plants, animals and micro-organisms, may occur for a variety of reasons. These include pest control measures, amenity enhancement of an area, or the production of novel crops that aim to increase agricultural production, reduce the need for chemical pesticides or fertilisers, or produce chemical compounds such as pharmaceuticals. The most recent technology for enhancing crop species is through the use of genetic manipulation, whereby genetic material from one species is inserted into the genome of the crop species to introduce some new trait, such as pesticide resistance or frost tolerance. Considerable debate still continues on the likely environmental consequences of the development of such crops. In the case of new crops, field-scale trials of genetically modified maize, oil seed rape and sugar beet are under way in the UK and have attracted much public attention. The release of GM micro-organisms is currently not permitted. Microbes which can be isolated from natural situations, however, may be released, for example, to treat contaminated land or pollution problems. Such releases are not considered in this guideline. While introductions of species may provide valuable results, a thorough scoping exercise and careful consideration of alternatives are, therefore, of prime importance.

2 Development control and EIA

Development control

2.1 The introduction of species to the environment does not fall under the town and country planning system, but is instead regulated by other legislation. Please refer to the *Scoping Handbook* for information on other relevant legislation.

2.2 The regulatory system for GMOs is, in effect, a hierarchical system based upon the risk assessment of the GMO, its various stages of development and introduction to the market place. These risk assessments are based upon information provided by the proponent with an application to release a GMO, such as a new variety of a higher plant crop. The level of detail provided with the application is designed to be appropriate to the proposed release and its inherent risks. To meet the requirements of the Regulations, information must be provided on the nature of the proposed release; the parental or recipient plant; the genetic modification; the genetically modified plant; the release site; the release itself; control, monitoring post-release plans and waste treatment plans; the potential environmental impact of the release as well as information on previous releases and risk assessments

Environmental Impact Assessment

2.3 The deliberate introduction to the environment of non-native or genetically modified organisms is not included as a separate development type within the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 1999 No. 293). However, the introduction of alien and ornamental species into the landscape, or as amenity enhancements, is possible with any development type. Developers should refer to the information on thresholds contained in the EIA Regulations and in the Department of Environment, Transport and the Regions Circular 02/99, (*Environmental Impact Assessment*), to determine whether an EIA for their proposal might be necessary. Where EIAs are produced these should address all aspects of the development proposal.

2.4 Although a formal EIA of species introduction activities is not required, the Environment Agency and other statutory consultees and regulators may request environmental information concerning the proposal. An EIA may provide the most appropriate method for a developer to collate the necessary information.

Other licences, consents and authorisations

2.5 Certain aspects of activities which introduce species to the environment, such as the erection of fences or grids within a watercourse to contain introduced fish species, may require prior permissions from the Environment Agency. The Environment Agency is responsible for a range of such authorisations including land drainage consents, abstraction licences, impounding licences and discharge consents. Environment Agency consent is also needed for most fish introductions and the area Fisheries Officer should be consulted in all these cases. It is recommended that the developer seek independent legal advice and liaise with the Environment Agency during project design and subsequent stages to identify the consents, licences and authorisations that will be required.

3 Potentially significant environmental effects

3.1 The EIA Directive requires the EIA to "identify, describe and assess the direct and indirect effects of a project on the following factors: human beings, fauna and flora; soil, water, air, climate and the landscape; material assets and the cultural heritage; [and] the interaction between the factors." Socio-economic issues, health and safety in the workplace, material assets and cultural heritage are all considered in EU *Guidance on Scoping* (ERM, 2001a) but are not impact categories for which the Environment Agency is the principal competent authority. Advice on these issues is presented in this guidance note without prejudice to the advice of the relevant competent authority, but the relevant competent authority should be consulted for each of these categories in all cases (further advice on the appropriate competent authority to contact is given in the *Scoping Handbook*).

3.2 An EIA of any proposal that might involve the release of such organisms should determine the potential impacts on the environment of each aspect of the project, including location and management. Careful scoping facilitates this process. This section provides a non-exhaustive description of the environmental issues that might arise during the scoping of such a project. The *Scoping Handbook* provides guidance on how to conduct a scoping exercise.

3.3 Species introduction activities have the potential to affect the environment in many ways. They can differ widely in terms of their intended purpose and location and key issues are likely to vary from site to site. Therefore, it is recommended that expert advice on detailed technical issues be obtained. The issues arising for all environmental receptors will change over time as, for example, the introduced species establishes itself in the environment, or as a genetically modified crop matures and is harvested. Developers and site operators should, therefore, consider the impacts arising from site preparation and management and the ongoing impacts of the species' introduction.

3.4 Potential impacts are discussed here in broad terms only as their nature and intensity will depend on the type of species introduction proposed and the location of the introduction. An EIA of such activities should take these factors into account in assessing potential impacts on the environment.

3.5 The following paragraphs should be read in conjunction with Table B4. This details the activities involved in the preparation and ongoing management of species introduction activities, and the impacts arising from them.

Water environment

3.6 Surface water hydrology can be affected during species introduction operations. In the case of agricultural production of non-native or genetically modified crops, impacts such as increased flood risk and soil erosion arising from improved field drainage may arise. The abstraction of water from streams for irrigation may contribute to reduced flows, especially in the summer months. For further detail regarding the impacts of agricultural operations, reference should be made to B2, which addresses arable farming and the intensification of previously uncultivated land.

3.7 Another form of species introduction, the stocking of watercourses with fish (for example grass carp for reducing excessive aquatic vegetation),

may cause restriction to stream flow from fencing or mesh installed to restrict the fish to the desired stretch of river.

3.8 Surface water quality could be affected by a number of factors arising from species introductions. In the case of grass carp introductions, water quality may improve as the consumption of vegetation at the surface may result in increased oxygenation of the water. The introduction of non-native or genetically modified plant species may necessitate the use of chemicals such as fertilisers and pesticides, which may cause pollution of surface waters via incorrect or inappropriate storage, use and disposal.

3.9 Species introduction activities may have significant impacts on groundwater hydrology and quality, particularly in the case of arable production of genetically modified plants. The novel crop may have irrigation needs greater or less than those of a native crop, with subsequent implications for groundwater and surface water supplies. Additionally, the site may need to be drained to provide suitable conditions for crop growth, resulting in a lowering of the water table, while chemicals applied to the crop (such as fertilizers or pesticides) may pollute groundwater.

3.10 In order to protect vulnerable groundwater resources it is the policy of the Environment Agency to encourage new developments to locate in areas of low vulnerability to groundwater pollution. However, this policy does not imply an automatic prohibition on species introduction activities within source protection zones.

Land

3.11 Species introductions will have implications for the physical characteristics and land use of the site. Issues to consider include: the effect on landscape character of fences, glasshouses, in-stream barriers, or any other structures needed to contain the introduced species. In addition, the potential effects on the soil due to the management practices associated with the introduced species need to be considered.

Air and climatic factors

3.12 Species introduction activities are unlikely to have significant adverse effects on air quality. However, local air quality may decrease from dust generated by vehicles and machinery during any site preparation, cultivation, construction or ongoing maintenance activities.

Ecology

3.13 Any non-native or genetically modified organisms released into natural ecosystems will be in direct competition with the existing native species. This may cause competitive exclusion of some species, resulting in a reduction in biodiversity. Also, the introduction of any species entails a risk that disease and parasites may also enter the environment, causing a detrimental effect on the health of indigenous populations. For example, introduction of grass carp for aquatic weed control has been known to spread parasites to native fish species. However, grass carp may also be beneficial to aquatic ecology, as the opening up of patches of clear water as vegetation is consumed favours species which feed on zooplankton.

3.14 Where exotic species are introduced for the purposes of pest control, this may cause competitive suppression or extinction of native biological control agents and non-target species. In turn, this may disrupt plant and animal populations, food chains and other nutrient cycling processes. Where microbial agents are used for the biological control of certain pests and diseases, they may be toxic to non-target organisms, or they may cause allergic reactions or disease.

3.15 In the event of the accidental escape of species from controlled environments into the wild, consideration needs to be given to the propensity of species to become invasive, the sensitivity of the surrounding environment and also the ease of subsequent control. Such species may have significant impacts upon the aquatic ecology by choking water bodies.

3.16 The potential adverse effects of genetically modified crops are summarised below:

- toxicity and allergenicity of products made by the crop as a result of genetic modification;
- effects on population dynamics in the receiving environment, for example through the reduction of an important food resource which other organisms depend on for survival;
- effects on biogeochemistry, such as changes in nitrogen and carbon recycling due to effects of the GM crop on organisms which are important in soil decomposition processes;
- dispersal of the GM crop in the environment through possible increased persistence, invasiveness and competitiveness with native plant species, which could change the population dynamics of the release site and the surrounding environment. If native plant species decline as a result of competition with an invasive plant, there would also be reductions in the animal species which depend on them for survival;
- hybridisation of other crops or native plants due to transfer of the inserted genetic material through pollination by wind or insects. For example, the inheritance of pest resistance genes in closely related native plant species may cause the hybrid plants to become more competitive and potentially invasive;
- unintended effects may occur where the introduction of the novel trait results in changes to other characteristics of the GM crop. For example, the palatability of the crop to herbivores may be reduced if the balance of substances which influence the palatability of the plant's tissue is altered. If the novel gene becomes transferred to closely related native species, a selective advantage over other native plants may occur due to decreased herbivore feeding.

It should be noted that these impacts are not unique to genetically modified crops and may be just as likely to occur as a result of conventional plant breeding programmes. Further information on these issues is obtainable from the DTLR's (formerly DETR) Advisory Committee on Releases to the Environment (see Section 5, below).

Human environment

3.17 The potential impacts of a species introduction on the human environment may take a variety of forms. They are divided here into sections covering socio-economic and health issues; amenity, visual impact and nuisance issues; and culture, heritage and archaeology.

3.18 The potential for socio-economic and health impacts (real and perceived) arising from species introductions is likely to be considered as significant by the people who may be affected by them. Such operations usually require comparatively small staffing levels and, as a result, employees are not likely to have a significant effect on local socio-economic issues. The location of genetically modified crops may have, or be perceived to have, an adverse effect on neighbouring farming activities, given the foraging behaviour of pollinating insects, especially bees. This in turn can effect honey production. Health issues which should be considered when scoping an EIA include the potential for harm to workers and the general public from any chemicals used during maintenance of a genetically modified crop, or from allergic or toxic reactions to compounds

produced by the crop. In addition, the local public may be concerned about the possible effects of such crops upon their health, even when there is no evidence of such effects.

3.19 The identification of which of these issues are significant or are perceived to be significant is an important function of public involvement during the scoping exercise. Understanding likely public concerns is a key issue and reference should be made to experience of similar species introduction activities and any public representations to the local planning authority or environmental health authority.

3.20 Other issues that commonly need to be addressed are the visual impact of containment structures such as glasshouses, polyethylene tunnels, pens, fences or other barriers, and noise and vibration nuisance from traffic during both preparation and maintenance of the site. Any restrictions to access that may arise as a result of operations should also be considered.

3.21 Impacts on architectural and archaeological heritage may arise if structures are required for the containment of the introduced species. Construction of these structures may damage important features, while their presence may obscure views of such features. The likelihood of there being any unrecorded sites and their potential for discovery should also be examined.

Table B4

3.22 The impact identification table highlights:

- sources of impact (development activities);
- potential impacts;
- receptors for these impacts.

3.23 It is recommended that the table is annotated and used during consultations with other interested parties. Reference should also be made to the prompt lists detailing impacts and sources of impacts in the *Scoping Handbook*.

3.24 The impacts arising from a species introduction may operate over several years, or even indefinitely if the introduced species has competitive dominance over native species. However, if the introduction is intended for a defined time period only, care must be taken to prevent the species establishing itself beyond the site of release. In the case of GM crop production, readers should also refer to Scoping Guidance Note B2 concerning arable farming and the intensification of previously uncultivated land for guidance on the potential impacts of site preparation, ongoing management and harvesting.

Table B4 Summary of key potential impacts of the deliberate introduction of non-native and genetically modified species

Potential receptors of impact		Activities and potential impacts	
		Site preparation	Ongoing maintenance
WATER	Surface water hydrology and channel morphology	**Works next to or near watercourses** • Altered channel morphology • Altered flow characteristics • Altered erosion and deposition regime	**In-stream structures to contain introduced species** • Ongoing effects on stream flow • Ongoing effects on erosion and deposition regimes **Introduction of grass carp for aquatic weed control** • Increase in flow velocities as excess vegetation is consumed
	Surface water quality	**Works next to or near watercourses** • Pollution from suspended material • Disturbance of contaminated soil and subsequent pollution of watercourses	**Use of pesticides and fertilisers** • Introduced species (e.g. a genetically modified crop) may require applications of chemicals, which may enter watercourses and cause pollution **Introduction of grass carp for aquatic weed control** • Increased oxygenation of waters through the action of the fish feeding on surface vegetation
	Groundwater hydrology		**Abstraction of groundwater** • Introduced species (e.g. a genetically modified crop) may require irrigation to ensure success, which may cause a lowering of the water table
	Groundwater quality		**Storage, use and disposal of agrochemicals** • Potential for contamination of groundwater

Potential receptors of impact		Activities and potential impacts	
		Site preparation	Ongoing maintenance
LAND	Landscape	**New buildings and structures** • Changes in appearance of landscape	**Growth of non-native or genetically modified crop** • Changes in character of landscape as crop matures **Buildings and structures** • Ongoing change to appearance of landscape from structures such as glasshouses or polyethylene tunnels **Escapes of non-native or genetically modified species from intended site** • Progressive change in appearance of vegetation cover if native vegetation is displaced through competition with escaped species
	Soils	**Increased site traffic** • Soil compaction and erosion **New buildings and structures** • Soil compaction • Erosion of exposed soil	**Growth of non-native or genetically modified crop** • Reduction in soil erosion as crop matures • Possible disruption or change to nutrient cycling processes due to effects on soil fauna, resulting in reduced soil fertility • Changes to soil chemistry/structure
AIR	Local air quality	**Use of vehicles and machinery** • Dust generation	

Potential receptors of impact		Activities and potential impacts	
		Site preparation	Ongoing maintenance
FLORA AND FAUNA	Aquatic ecology	**Works next to or near watercourses** • Hydrological impacts noted above may affect the numbers and distribution of in-stream species of flora and fauna	**Non-native plant and animal introductions** • May also introduce diseases against which native species have no defence **Escapes of non-native or genetically modified organisms from intended site** • Increased competition with indigenous species • Interbreeding and hybridisation, e.g. via spread of pollen from GM plants • Indirect effects on other species, e.g. reduction of food or habitat resources
	Terrestrial ecology	**Conversion of land use** • Habitat removal, fragmentation or severance • Disturbance to, or loss of, species (including rare and sensitive species)	**Escapes of non-native or genetically modified organisms from intended site** • Increased competition with indigenous species • Interbreeding and hybridisation, e.g. via spread of pollen from GM plants • Indirect effects on other species, e.g. reduction of food or habitat resources

	Potential receptors of impact	Activities and potential impacts Site preparation	 On-going maintenance
HUMAN ENVIRONMENT	Socio-economic[1]	**Earthworks and excavations** • Disruption of services such as electricity, gas, water, or telecommunications • Construction-related employment	**Production of modified crops** • Possible economic benefit from improved production **Production of novel compounds from genetically modified plants** • Economic benefit from sale of products
	Health and safety[1]		**Use of pesticides** • Risk of exposure of workers to toxic substances • Toxins may enter drinking water supplies **Presence of non-native micro-organisms** • May cause disease or allergic reaction in humans • Public concerns over possible health effects **Presence of non-native or genetically modified plants** • May cause allergic reaction (e.g. to pollen) in humans • Public concerns over possible health effects
	Amenity	**New buildings, structures and field boundaries** • Alteration of rights of way or reduction in access **Ecological impacts** • Recreational activities such as bird watching and fishing may be affected	**Buildings, structures and field boundaries** • Continued alteration of rights of way or reduction in access
	Nuisance	**Use of vehicles and machinery** • Noise • Mud and slow-moving traffic on roads	
	Architectural and archaeological heritage[1]	**Conversion of land use** • Damage to features of archaeological or cultural importance	

[1] The Agency considers that key impacts to be identified and assessed are likely to include the following, but further advice and guidance should be sought from the relevant competent authority, as indicated in the *Scoping Handbook*.

Additional site-specific issues:

4 Mitigation measures

4.1 Following the scoping exercise and the identification of potential environmental effects, mitigation measures should be proposed to avoid or reduce potential negative impacts to air, water, land, ecology and humans, or to introduce positive aspects to the development. Guidance has been provided by the Environment Agency to assist developers on a range of relevant subjects in the form of Pollution Prevention Guidelines (see the *Scoping Handbook*). Other relevant publications are listed in Section 5.

4.2 A primary consideration in impact mitigation must be the location of a proposed release of an organism. It should avoid damage to important ecological sites and high quality landscapes. It is strongly recommended, therefore, that developers undertake an assessment of alternative sites.

4.3 General considerations for introducing non-native and GM species include the following:

- where species of flora and fauna are introduced to the environment for any reason, indigenous local species should be used in preference to exotic species;
- the introduction of non-native and genetically modified species must only be made in accordance with the procedures laid down in the relevant legislation (see Section 2) and codes of practice (for agricultural operations – see Section 5);
- the Environment Agency should be consulted before any formal application to introduce an exotic or genetically modified species, to assess if habitat modification work will be required on the proposed site;
- the introduction of exotic or genetically modified species must not be made within a site protected under the Conservation (Natural Habitats & c.) Regulations 1994 (as amended), SI No. 94/2716, a Site of Special Scientific Interest or National Nature Reserve without the agreement of English Nature or the Countryside Council for Wales.

Mitigating the impacts of construction activities

4.4 In some instances, construction and site preparation activities may be necessary. These have the potential to affect all environmental receptors. Reference should be made to Guidance Note A1 which deals with construction works in more detail. However, the following list summarises the mitigation measures most relevant to species introduction activities:

- phasing of construction work to minimise disturbance to wildlife at sensitive times of year, such as during the breeding season or when young are being raised;
- use of techniques to minimise compaction of soil, such as restricting access during wet conditions and using protective boarding and low ground pressure machinery;
- storage of fuel, equipment and construction materials to minimise the risk of soil contamination or water pollution (see Environment Agency Pollution Prevention Guideline 1, *General Guide to the Prevention of Water Pollution*);
- access roads should avoid riparian zones and should be built using appropriate construction materials.

Mitigating the impacts of ongoing site management

4.5 The following measures have been arranged according to their primary receptor. However, it should be noted that many of the following mitigation measures are interrelated. For example, correct storage, use and disposal of chemicals used would reduce the risk of soil contamination, pollution of surface and groundwaters and harm to terrestrial and aquatic ecology.

Protecting the water environment

4.6 In order to minimise potential impacts on the water environment in the design and running of species introduction operations, the project proponent must ensure that:

- an appropriate water management system is used, including, for example, efficient land drainage and the use of constructed ponds for receiving site runoff to reduce the impact on nearby watercourses;
- where it is necessary to erect fish barriers, they should be designed to take account of peak flow and water level conditions.

Protecting the land environment

4.7 Impacts on soils and landscape may be mitigated by the following:

- appropriate designs for any buildings and structures on site;
- appropriate screening for visual impacts;
- effective stabilisation of altered landforms so as to minimise soil erosion and the potential for water pollution from suspended solids.

Protecting the air environment

4.8 Developers should consider the aspects of the development that are likely to lead to air emissions. For such aspects as vehicle emissions and dust generation, suitable mitigation measures may include the use of vegetation screens to act as a barrier to gaseous and particulate emissions.

Protecting ecology

4.9 Measures designed to prevent or reduce impacts to water or land will also benefit ecological populations. The following list identifies further strategies for reducing or avoiding impacts to terrestrial and aquatic species and their habitats:

- risks from the introduction of genetically modified crops may be reduced by using a combination of selective plant breeding and genetic engineering, and agricultural and cultural practices (for example, mowing field margins and verges to reduce the establishment of feral transgenic or hybrid populations, or containment of pollen from GM crops by cultivation within glasshouses); the conservation value of hedgerows and field margins should be considered and benefits weighed against optional action to be taken;
- for plants modified to produce novel compounds (e.g. pharmaceuticals), the spread of GM pollen may be prevented if the product is produced in subterranean organs or in leaf and stem tissue or by harvesting prior to flowering;
- where seed production is necessary, use male sterile (pollen defective) crop varieties; consider using physical methods to reduce the flow of pollen to native species. For example, “barrier rows” of plant species different to the crop planted, or “guard rows” of the same species to intercept pollen entering or leaving fields;

- reduce the possibility of exposure to potentially toxic, allergenic or pathogenic compounds or crops by such measures as using clear labeling during growth and processing and the controlled incineration of crop residues;
- when introducing non-native fish, the water body receiving the species should be secure, in order to prevent fish escaping into adjacent water systems. Any water to be stocked should, therefore, be enclosed and inlets and outlets adequately fenced;
- the Area Fisheries Officer of the Environment Agency should be consulted for advice on the stocking density of introduced fish. Where a species is introduced for weed control densities should not be so great as to remove all aquatic vegetation from a site. In addition, introduced fish should not offer excessive competition with native species for food resources, shelter or spawning grounds;
- a proponent should endeavour to ensure only disease-free species are introduced;
- existing habitat features should be incorporated into site design and protected from change, while further habitats should be created to compensate for habitat losses and to improve the landscape and ecological potential of the site.

Protecting the human environment

4.10 Some of the measures noted above can also reduce possible impacts on humans. For example, clear labelling and incineration procedures would also minimise exposure of humans to potentially toxic, allergenic or pathogenic substances. Further mitigation measures more specific to the human environment are listed below:

- management operations should aim to minimise disturbance to adjacent residential and recreational uses;
- where access restrictions result, arrangements for alternative access should be made with the provision of gates, bridges or stiles as appropriate;
- safety concerns should be addressed by such measures as implementing strict health and safety procedures and the installation of adequate fencing and other site security to prevent trespass and vandalism;
- sites of archaeological or cultural interest should be preserved in situ where possible. As relocation is rarely possible, thorough archaeological investigations should be carried out where damage is unavoidable.

5 References and further reading

1 **Advisory Committee on Releases to the Environment (ACRE), 1993.** *Guidance Note 1 – The Regulation and Control of the Deliberate Release of Genetically Modified Organisms.* Department of the Environment, Transport and the Regions (DETR) Publications, London.

2 **ACRE, 1994.** *Guidance Note 4 – Guidance for Experimental Releases of Genetically Modified Plants.* DETR Publications London.

3 **ACRE, 1994.** *Guidance Note 5 – Guidance for Experimental Releases of Genetically Modified Micro-organisms (excluding virus and similar agents).* DETR Publications.

4 **ACRE, 1994.** *Guidance Note 6 – Guidance for Experimental Releases of Genetically Modified Baculoviruses.* DETR Publications London.

5 **ACRE, 1995.** *Guidance Note 7 – Guidance to The Genetically Modified Organisms (Deliberate Release) Regulations 1995.* DETR Publications London.

6 **ACRE, 2000.** *The Commercial Use of Genetically Modified Crops in the United Kingdom: the Potential Wider Impact on Farmland Wildlife.* ACRE Annual Report No.5, DETR, London.

7 **Bain, M.B. 1993.** *Assessing Impacts of Introduced Aquatic Species: Grass Carp in Large System.* Environmental Management. Vol.17, No.2, pp.211-224.

8 **Construction Industry Research and Information Association (1994)** *Environmental Assessment. Special Publication 96.* CIRIA, London.

9 **Department of the Environment (1995)** *Preparation of Environmental Statements for Planning Projects that Require Environmental Assessment: A Good Practice Guide.* HMSO, London.

10 **Department of the Environment, Transport and the Regions (2000)** *Environmental Impact Assessment: A Guide to the Procedures.* Thomas Telford Publishing, London.

11 **Department of the Environment, Transport and the Regions (1997)** *Mitigation Measures in Environmental Statements.* DETR, Rotherham.

12 **Environment Agency (2000a)** *General Guide to the Prevention of Water Pollution. Pollution Prevention Guidelines No. 1.* Environment Agency, Bristol.

13 **Environment Agency (2000b)** *Works In, Near or Liable to Affect Watercourses. Pollution Prevention Guidelines No. 5.* Environment Agency, Bristol.

14 **Environment Agency (2000c)** *Pesticides. Pollution Prevention Guidelines No. 9.* Environment Agency, Bristol.

15 **Environment Agency (1998)** *Policy and Practice for the Protection of Groundwater (second edition).* Environment Agency, Bristol.

16 **ERM (2001a)** *Guidance on EIA – Scoping.* Prepared by ERM for the European Commission in June 2001. Available from: http://europa.eu.int/comm/environment/eia/eia-support.htm. Commission of the European Communities, Brussels.

17 **ERM (2001b)** *Guidance on EIA – Screening.* Prepared by ERM for the European Commission in June 2001. Available from: http://europa.eu.int/comm/environment/eia/eia-support.htm. Commission of the European Communities, Brussels.

18 **ERM (2001c)** *Guidance on EIA – EIS Review.* Prepared by ERM for the European Commission in June 2001. Available from: http://europa.eu.int/comm/environment/eia/eia-support.htm. Commission of the European Communities, Brussels.

19 **Gates, P. (1995)** *The Environmental Impact of Genetically Engineered Crops.* Biotechnology and Genetic Engineering Reviews. Vol.13 (December) pp.181-195.

20 **Ministry of Agriculture Fisheries and Food (MAFF)/Welsh Office Agriculture Department (WOAD) (1998)** *The Code of Good Agricultural Practice for the Protection of Air.* HMSO, London.

21 **Ministry of Agriculture Fisheries and Food (MAFF)/Welsh Office Agriculture Department (WOAD) (1998)** *The Code of Good Agricultural Practice for the Protection of Soil.* HMSO, London.

22 **Ministry of Agriculture Fisheries and Food (MAFF)/Welsh Office Agriculture Department (WOAD) (1998)** *The Code of Good Agricultural Practice for the Protection of Water.* HMSO, London.