

## A1: Scoping the Environmental Impacts of Construction Works

### Explanatory Note

For projects which require Environmental Impact Assessment (EIA), a scoping exercise must be undertaken early in the planning stages of the project. This enables the project to be designed to avoid or minimize 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 construction works, particularly associated with major developments requiring EIA in their own right. 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 pollution control.

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

**In addition, the following scoping guidance notes are also relevant to *all* construction projects:**

- ♦ 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
- ♦ B3 Control of pest species, including disease vectors

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- ◆ B4 Deliberate introduction of non-native and genetically modified species
  - ◆ K4 New roads, road widening and other road improvement schemes

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### **1. Introduction**

- 1.1 This guidance note, in conjunction with the Scoping Handbook and the other notes listed on the previous page, seeks to help developers and other interested parties identify the potential impacts of construction works on the environment as a whole. 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 construction works is provided. The potential environmental impacts of such projects are identified in Section Three. 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 to construction works, followed by key references and further reading.

#### *Background to development type*

- 1.3 Construction projects can take a variety of different forms and vary in scale from a small residential development to a large complex industrial or commercial site. In addition, the creation of many different types of infrastructure also constitute large civil engineering construction projects. Consequently, the individual characteristics of the development project will determine the precise nature of the resultant environmental impacts. This guidance note provides a description of the generic characteristics of construction projects and, as such, may exaggerate or understate the importance of a particular issue for the particular project under consideration.
- 1.4 Construction activities can be divided into four phases, site investigation, site preparation, the construction activities themselves and the structures that result. Site investigation is different from the other three phases, in that it should take place as part of a feasibility study and, as such, should occur before any formal request for project authorisation takes place. The main consideration in site investigation is to establish the precise nature of the site, including any liabilities or problems that may be associated with it. This would be especially important for so-called “brownfield” site development. For other sites such investigations may be required, for example, to determine the load-bearing properties of the site.

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- 1.5 Site preparation involves a range of activities. First, development sites are hazardous and must be made secure against trespass. Thus, security fencing is constructed early in the operations. Site clearance, in essence, means the removal of any unwanted features on site such as old buildings which will be demolished or vegetation that would interfere with construction activities. In addition, soil will be stripped and, if required for site restoration programmes, stockpiled on site or exported off site for reuse or disposal as appropriate. Alternatively, if fill is required this will be brought from off site or obtained from a borrow pit. Blasting may be involved in winning these materials or in removing particularly intractable features, such as rock outcrops which cannot be removed by mechanical excavators. Streams running across the site that cannot be incorporated into the site design must be diverted or, under exceptional circumstances, culverted. If high water tables are a constraint on the development of the site, a dewatering scheme will be initiated at this stage and may continue throughout construction.
  - 1.6 The actual construction phase also involves a number of different activities. Foundations must be dug for any buildings that are to be constructed on site and piling may be required if the ground is not sufficiently well consolidated. Materials will be brought on site and stored including bulk materials such as cement, aggregate, timber, concrete and fuel, as well as specialist equipment. The delivery of some of these materials will be a regular occurrence while large and specialised items may only be brought on site infrequently.
  - 1.7 Materials are generally stored at temporary locations on site, as space is a major constraint on most construction sites. Onsite storage areas will be subsequently reinstated or used in a later phase of the development. Alternatively, such temporary areas may even be located offsite if circumstances demand.
  - 1.8 For major projects, the immediate locality may not be capable of meeting the labour demands of the construction phase. In such cases, workers may be brought in from elsewhere and can number several thousand. Especially in sparsely populated areas, there may not be adequate accommodation to house them, in which case, temporary accommodation will have to be provided.
  - 1.9 The nature of the completed development is not considered in this guidance note, as this will depend upon the end use. Three general features of a completed development site can be identified. Their relative proportions on an individual development will vary. These are buildings, hard and paved surfaces, such as roads and parking areas, and soft landscaping.

## 2. Development control and EIA

### *Development Control*

- 2.1 Construction activities will generally fall under the Town and Country Planning system, though developers should contact their local planning authority to confirm whether or not their proposals require planning permission (or are subject to any other form of development control). They should also seek advice on the impact on their proposals of other planning-related legislation (for example the Conservation (Natural Habitats etc.) Regulations 1994).

### *Environmental Impact Assessment*

- 2.2 Virtually all of the development types listed in the Schedules to the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 1999 No 293) will involve some form of construction work. Developers should, therefore, consult these Regulations for further information on the thresholds applicable to their particular development type, to determine whether a full EIA might be required. Where EIA is required for a particular project, the construction phase must be assessed and discussed in the resulting environmental statement. Special consideration must be given to outsized items which have to be transported from some distance location. The ability of the road network,

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especially the parts of the journey which do not occur on major roads and motorways, to accommodate such movements must be given very careful consideration.

- 2.3 The DETR has published guidance (referred to in the Scoping Handbook) which helps in the decision on whether, in respect of Schedule 2 projects, impacts are significant and whether EIA should be required. The guidance thus contains “indicative criteria”, although area sensitivity and project-specific issues must be taken into account and the decision is still discretionary.
- 2.4 Whether or not a formal EIA of proposed construction works is 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 a construction project may require prior permission from the Environment Agency. These may include, for example, land drainage consents, abstraction licences, impounding licences and discharge consents. 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 issues**

- 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 [above] factors.’ Socio-economic issues, health and safety in the workplace, material assets and the cultural heritage are all considered in EU Guidance on scoping (ERM, 2001b) but are not impacts 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 The issues arising for all environmental receptors will change over time as the project matures and will vary from one site to another. Developers and site operators should, therefore, consider the impacts arising from the various phases of construction described above and expert advice on detailed technical issues should be obtained.
- 3.3 Environmental impacts can affect both humans and ecological resources. Potential impacts are discussed here in broad terms only, as their nature and intensity will depend on the physical characteristics of the project and the composition of any polluting materials. An EIA of proposed construction works should take these factors into account in assessing potential impacts on the environment.
- 3.4 The following paragraphs should be read in conjunction with Table A1. This details the activities involved in construction activities and the impacts arising from them.

#### **Water environment**

- 3.5 If construction takes place in the vicinity of a watercourse, bank destruction and instability may occur and the watercourse itself may suffer from increased sediment load and oil and fuel contamination from vehicles and access roads. The use of heavy machinery and vehicles during construction may result in the compaction of topsoil and, therefore, a change in surface water drainage patterns. Watercourses may be affected by any engineering works that are

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required for features on site such as diverting watercourses. The removal of vegetation and topsoil during site preparation will lead to increased erosion which may, in turn, cause increased sediment loads in nearby rivers and streams. Furthermore, changes in flow patterns and volumes which are a result of site works can have a significant adverse impact after development.

- 3.6 Where a brownfield site is being developed there is a risk of contaminated materials being brought to the surface or mobilised. Such materials constitute a risk to surface water quality and may also have implications for groundwater quality. Groundwater may also be affected if it is necessary to lower water tables for constructional activities. Depression of the water table may cause contaminated, or in coastal locations, saline groundwater to ingress.
- 3.7 Leakages from garages and parking areas for vehicles and from materials stores may cause pollution of local watercourses from leaks and spills of fuel and oil. In addition, sewage effluent from the workforce may also contaminate nearby rivers and streams.

#### **Land**

- 3.8 Construction will require some land-take and much of the site is likely to be subject to intense use during construction activities. Temporary construction facilities such as storage areas, canteens, parking areas and offices, may cause considerable damage away from the main concentration of construction activity. Land may also be required off site for temporary workers' accommodation, which may affect agricultural land, natural habitat or sites of environmental or archaeological interest. The use of machinery and vehicles during construction may cause short and medium-term adverse impacts on landscape character. This could take the form of loss of natural features or features of visual interest, or loss or change in vegetative cover. Construction itself may introduce artificial structures into what may be a very natural landscape. The magnitude of such a visual impact will depend on the management of the site as well as the siting, purpose and design of the components of the project. Works undertaken in a manner sympathetic to the surrounding area are likely to reduce impact on the landscape character.
- 3.9 The use of construction vehicles and machinery may cause compaction of soils and a change in soil structure. Soils may become exposed during construction, leading to increased erosion. Construction may also involve the removal or mixing of soils on site which may have an impact on soil characteristics. During construction and maintenance, soils may become contaminated from spills or leaks of fuel and oil. On completion of the project it may be necessary to import soils for landscaping purpose, which may lead to the introduction of invasive species present in the soil. Alternatively, soil stored on site may be used for landscaping although stored soils will lose some of their fertility and structure during prolonged storage.
- 3.10 Compaction will influence the infiltration capacity of the soil, which may reduce water movement and vegetation cover. Reduced rainwater interception and surface protection due to the loss of vegetation cover may increase surface erosion. Rills and gullies may develop due to the removal of vegetation which acts to stabilise soil. Tracks perpendicular to contours may channel run-off and increase erosion.

#### **Air and Climatic Factors**

- 3.11 During site preparation and construction works, local air quality may decline somewhat as a result of dust created by such activities. In addition, dust will be generated by vehicles moving on exposed surfaces during dry weather. Dust generation and impact is dependent on site specific factors including meteorological conditions. Redeveloping brownfield sites on contaminated land may disturb surface matter with significant dust plumes in dry conditions. Subsequent deposition may affect sensitive species and habitats.

**Ecology**

- 3.12 Infrastructure associated with the development site may involve direct land take resulting in disturbance or destruction of terrestrial and aquatic environments with associated habitat loss. Sensitive species may be displaced leading to a change in the composition of the community. This may occur throughout the site preparation and construction phases. Subsequent landscaping of the completed site may also have ecological impacts, if inappropriate non-native species are used. This is likely to be less of a problem for developments situated in urban locations compared to development in rural areas.
- 3.13 The removal of vegetative cover may result in the loss of feeding and breeding habitats. Some species may be displaced and may migrate to unfamiliar or less suitable territory. Noise generated by site preparation and construction activities may also cause sensitive species to be displaced. Impact studies should consider that wildlife populations in areas of low ambient noise might be adversely affected by increases in ambient noise levels.

**Human environment**

- 3.14 Construction of new developments may cause temporary disturbance and disruption to local residents, farmers, tourists, businesses and users of the area. This may be due to noise or dust emanating from a development site, or by closure of roads or footpaths while construction work is undertaken. Sites of archaeological or historical interest may be adversely affected by construction. In addition, the presence of a large temporary team of construction workers from outside the area may cause considerable social tension, especially, if the lifestyle of the construction workers differs markedly from that of the local people. These tensions are likely to be particularly significant in sparsely populated areas. Their presence will also put additional pressures on formal and informal social services.
- 3.15 The construction period on some sites is characterised by the transport of major items of plant to the development site. Exceptional items of plant, described as abnormal indivisible load (AILs) require special transporters. These slow moving vehicles can cause congestion and the disruption of existing traffic patterns. Without careful appraisal these wide, heavy loads may damage bridges and roadside features.

*Table A1*

- 3.16 The impact identification table highlights:
- ◆ sources of impact (development activities);
  - ◆ potential impacts;
  - ◆ receptors for these impacts.
- 3.17 It is recommended that the table is annotated and used during consultations with other interested parties. Reference should be made to the prompt lists detailing impacts and sources of impacts in the Scoping Handbook.

**Table A1. Summary of Key Potential Impacts of Construction Works.**

		Activities and Potential Impacts
Potential Receptors of Impact		Construction phase
<b>WATER</b>	surface water hydrology & channel morphology	<p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>• erosion from soil stripping operations and resultant exposed areas deposited in streams as sediments</li> <li>• changed morphology of streams from diversions</li> </ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>• erosion of fines from haul roads and other exposed working surfaces</li> </ul> <p><b>Structures</b></p> <ul style="list-style-type: none"> <li>• increased and more rapid run-off from area because of hard surfaces</li> </ul>
	surface water quality	<p><b>Site investigation</b></p> <ul style="list-style-type: none"> <li>• drilling boreholes may expose contaminated material leading to risk of water pollution</li> </ul> <p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>• stream diversions leading to increased downstream sediment loads from new stream bed</li> </ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>• leakage from fuel and materials storage areas contaminating watercourses</li> <li>• oil and suspended solids in run-off from vehicles and access roads may pollute watercourses</li> <li>• proximity of construction works to watercourse may lead to bank destruction or instability</li> <li>• waste from temporary worker accommodation affecting water quality</li> </ul> <p><b>Structures</b></p> <ul style="list-style-type: none"> <li>• oil and suspended solids in run-off from vehicles and hard standing may pollute watercourses</li> <li>• use of heavy machinery may lead to a change in surface water drainage</li> </ul>
	groundwater hydrology	<p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>• site de-watering may lower the water table in the surrounding area</li> </ul> <p><b>Structures</b></p> <ul style="list-style-type: none"> <li>• hard surfaces may prevent groundwater recharge</li> </ul>
	groundwater quality	<p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>• site de-watering may cause ingress of contaminated groundwater to the surrounding area</li> </ul>

		Activities and Potential Impacts
Potential Receptors of Impact		Construction phase
<b>LAND</b>	landscape	<p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>visual impact</li> </ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>visual impact of general construction activities and temporary worker accommodation</li> </ul> <p><b>Structures</b></p> <ul style="list-style-type: none"> <li>visual impact of buildings, infrastructure and landscaping</li> <li>change in landscape character</li> </ul>
	soils	<p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>erosion of exposed soil from soil stripping</li> <li>compaction of soil from use of heavy vehicles</li> <li>removal of soils from site, including that resulting from land take</li> <li>mixing of topsoil and subsoil</li> <li>loss of fertility in stored topsoil mounds</li> <li>dispersion of dusts (including potentially contaminated dusts) off-site</li> </ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>excavation of service trenches may provide migration routes for landfill gas</li> <li>importation of topsoil containing aggressive alien species or possible chemical contamination</li> <li>contamination of on-site soils due to leaks and spillages</li> </ul>
	geology	<p><b>Site investigation</b></p> <ul style="list-style-type: none"> <li>generation of information on solid and drift geology from boreholes</li> </ul> <p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>exposure of solid and drift geology during site preparation</li> </ul>
<b>AIR</b>	local air quality	<p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>generation of dust by soil stripping activities</li> </ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>dust generation from haul roads and other exposed surfaces and from general building operations</li> </ul>

		<b>Activities and Potential Impacts</b>
<b>Potential Receptors of Impact</b>		<b>Construction phase</b>
<b>FLORA &amp; FAUNA</b>	aquatic ecology	<p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>• change in species composition and displacement of sensitive species</li> <li>• habitat loss</li> <li>• loss of conservation value</li> <li>• reduction in ecological diversity</li> <li>• risk of damage from spills or leaks of fuel, oil, and chemicals</li> </ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>• works in proximity to watercourse may result in bank instability and compaction which may disturb/destroy aquatic communities</li> <li>• increased sediment load in watercourses may lead to aquatic impacts due to increased turbidity</li> <li>• change in species composition and displacement of sensitive species</li> <li>• loss of conservation value</li> <li>• reduction in ecological diversity</li> <li>• risk of damage from spills or leaks of fuel, oil, and chemicals</li> </ul> <p><b>Structures</b></p> <ul style="list-style-type: none"> <li>• direct land-take resulting in disturbance or destruction of riparian and aquatic habitat</li> </ul>
	terrestrial ecology	<p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>• felling of trees.</li> <li>• loss of conservation value</li> <li>• change in terrestrial community</li> <li>• change in species composition and displacement of sensitive species from blasting and general site preparation.</li> <li>• risk of damage from spills or leaks of fuel, oil, and chemicals</li> </ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>• change in species composition and displacement of sensitive species by noise or other disturbance from general construction activities and by temporary workers' accommodation</li> <li>• risk of damage from spills or leaks of fuel, oil, and chemicals from materials stores</li> <li>• delivery of materials may lead to casual damage of roadside vegetation, or by road upgrading for special equipment deliveries.</li> <li>• Damage to roadside features by AILs</li> </ul> <p><b>Structures</b></p> <ul style="list-style-type: none"> <li>• direct land-take resulting in disturbance or destruction of terrestrial habitat and loss or disturbance of soil systems</li> <li>• change in species composition and displacement of sensitive species</li> <li>• use of inappropriate alien species in landscaping.</li> </ul>

		<b>Activities and Potential Impacts</b>
<b>Potential Receptors of Impact</b>		<b>Construction phase</b>
<b>HUMAN ENVIRONMENT</b>	socio-economic <sup>1</sup>	<p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>• creation of direct and indirect employment opportunities</li> </ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>• creation of direct and indirect employment opportunities</li> <li>• temporary direct land-take for construction work and workers' accommodation</li> </ul> <p><b>Structures</b></p> <ul style="list-style-type: none"> <li>• creation of employment opportunities</li> <li>• increased local revenues</li> </ul>
	health and safety <sup>1</sup>	<p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>• risk of injury</li> </ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>• risk of injury</li> </ul>
	amenity	<p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>• visual segregation by installation of site security fencing</li> </ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>• visual impact of general construction activities and from temporary workers' accommodation</li> <li>• social intrusion of workers from outside of the area</li> <li>• damage to bridges and roadside features by AILs</li> </ul> <p><b>Structures</b></p> <ul style="list-style-type: none"> <li>• adverse visual impact</li> </ul>
	nuisance	<p><b>Site preparation</b></p> <ul style="list-style-type: none"> <li>• adverse visual impact</li> <li>• noise from blasting and site preparation operations</li> <li>• dust from soil stripping and other operations</li> <li>• increased movement of heavy vehicles in the vicinity of the site</li> <li>• congestion caused to traffic by AILs</li> </ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"> <li>• adverse visual impact</li> <li>• noise and vibration from piling and other construction activities</li> <li>• dust from haul roads and general construction operations and haul roads</li> <li>• dispersion of dust and mud on roads can both be locally significant</li> </ul>
	architectural and	<b>Site investigation</b>

<sup>1</sup> 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.

	<p>archaeological heritage<sup>1</sup></p> <ul style="list-style-type: none"><li>• borehole drilling damage to buried structures</li></ul> <p><b>Site preparation</b></p> <ul style="list-style-type: none"><li>• topsoil stripping damage to buried structures</li><li>• blasting damage to architectural features</li></ul> <p><b>Construction activities</b></p> <ul style="list-style-type: none"><li>• excavation damage to buried structures</li><li>• vibration damage to roadside buildings from heavy vehicles</li></ul>
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**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 and maximise 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 detailed in Section Five.
- 4.2 A primary consideration in impact mitigation must be the siting of construction works. The development should avoid damage to important ecological sites and high quality landscapes. Also, it is Environment Agency policy to seek the preferential location of developments in areas which are not vulnerable to groundwater pollution (Environment Agency, 1998e). It is strongly recommended therefore that developers undertake an assessment of alternative sites.

### Mitigating the impacts of construction works

- 4.3 The following measures have been arranged according to their primary receptor, however, it should be noted that many of the following mitigation measures are inter-related. For example, correct handling and storage of chemicals, plus bunding to contain spills, would serve to reduce the impacts of such an incident on soils, surface and ground waters and ecology.

#### *Protecting the water environment*

- 4.4 In order to minimise potential impacts on the water environment, the design and execution of construction works must ensure that:
- ◆ an appropriate water management system is used, including, for example, sustainable drainage systems to minimise the impacts of the developers' site on receiving watercourses;
  - ◆ the use of permeable surfaces is used wherever possible to reduce runoff and facilitate groundwater recharge (runoff reduction will assist in soil protection);
  - ◆ hazardous or potentially polluting materials such as fuel, oil or wastes, must be sited on an impervious base away from water, properly bunded and kept locked when unattended;
  - ◆ access roads avoid riparian zones and are built using appropriate construction materials;
  - ◆ car parks are carefully sited and, perhaps, built at an early stage to provide areas for temporary storage compounds and parking areas for workers;
  - ◆ stream diversions are minimised and, where they are necessary, constructed to reproduce the geomorphological conditions of the diverted reach;
  - ◆ culverting is avoided but where there is no alternative, it is adequate to accommodate maximum predicted flood flows and designed to reduce impact on the movement of fish and mammals;
  - ◆ if necessary, a sump area is created on the lowest part of the site to intercept site drainage water providing settlement of suspended solids prior to discharge;

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- ◆ a risk assessment is carried out for each substance to be used or stored on site, and the appropriate containment measures installed;
  - ◆ an Emergency Plan is formulated and tested through exercises to ensure that procedures to prevent or mitigate impacts due to accidents or spillages are in place and operate effectively (some developments may require such plans to be formulated and the Environment Agency should be consulted to identify where this is the case).

*Protecting the land environment*

4.5 Certain measures noted above for protecting the water environment, such as bunding to contain spills of fuel or chemicals, will also reduce the likelihood of soil contamination. Impacts on soils and landscape may also be mitigated by:

- ◆ use of techniques to minimise compaction of soil, such as restricting access during wet conditions, and using protective boarding and low ground pressure machinery. If necessary, soil should be carefully removed and stored for subsequent reinstatement;
- ◆ storage and handling of soils should be undertaken so as to maintain soil structure as far as possible;
- ◆ imported soils should be carefully selected and properly cared for during and after emplacement;
- ◆ appropriate designs for buildings and structures on site;
- ◆ appropriate screening for visual impacts;
- ◆ effective stabilisation (e.g. by use of vegetation) of altered landforms to minimise soil erosion and the potential for water pollution from suspended solids;
- ◆ use of drip trays under stationary machinery to prevent oil and grease contaminating soil and groundwater;
- ◆ adoption of waste minimisation strategies.

*Protecting the air environment*

4.6 Suitable mitigation measures to reduce impacts to air include:

- ◆ minimise exposed areas to reduce dust generation;
- ◆ areas generating dust during dry weather should be sprayed with water to reduce dust nuisance, but this may not be acceptable during periods of drought;
- ◆ the use of vegetation screens to act as a barrier to dust;

*Protecting ecology*

4.7 Measures designed to prevent or reduce impacts on 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:

- ◆ phasing of construction work to minimise disturbance to wildlife at sensitive times of the year, such as during flowering, fish spawning and bird breeding seasons, or when young are being raised;
- ◆ sensitive terrestrial habitats and trees should be avoided during construction work;

- ◆ existing habitat features should be incorporated into site design and protected from change;
- ◆ further habitats should be created to compensate for habitat losses and to improve the landscape and ecological potential of the site;
- ◆ restoration plans should incorporate measures to improve the ecological status of the site;

*Protecting the human environment*

4.8 Some of the measures noted above can also reduce possible impacts on humans, notably the risk assessment and emergency planning measures. Further mitigation measures more specific to the human environment are:

- ◆ management operations should aim to minimise disturbance to adjacent residential and recreational uses, for example by setting the route and timing of construction traffic so as to avoid residential areas or other sensitive human receptors (e.g. schools, hospitals, nursing homes);
- ◆ where access restrictions result from the development, arrangements for alternative access should be made with the provision of gates, bridges or stiles;
- ◆ identification of appropriate route for AILs
- ◆ 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 feasible, thorough archaeological investigation should be undertaken where damage is unavoidable.

## 5. References and further reading

1. Buildings Research Establishment (1993) An Environmental Assessment for New Office Designs. Buildings Research Establishment, Watford.
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