applications; for the latter, it is recommended to use maximum estimates in order to avoid the need for subsequent licence amendments. However, an approximate indication of population size class is very useful. Hence, the methods given here are meant to give an indication of whether the population is small, medium or large in terms of the number of newts present in the breeding pond. This should be based on a spring survey of adult numbers, as egg, larval and juvenile counts can give a misleading indication of overall population size without complex interpretation. It is essential to note that the size of a population is not the same as its importance, as although size is a major factor there are other points to consider (see 5.8.5 Site status assessment).

Examining the results of the survey, the maximum adult count per pond per night gained through torch survey or bottle-trapping should be quoted as the main figure (raw data should also be presented). For sites where there is reasonable certainty that there is regular interchange of animals between ponds (typically, within 250m and with an absence of barriers to dispersal), counts can be summed across ponds (but note that this should only be done for counts obtained on the same visit). Survey results should then be expressed as peak counts per pond and a total site count, if appropriate.

Populations can then be classed as:

- '**small**' for maximum counts up to 10,
- '**medium**' for maximum counts between 11 and 100
- '**large**' for maximum counts over 100.

This categorisation may appear crude, but examination of a wide range of survey results reveals considerable variation, and mitigation schemes using other interpretation methods have frequently met with problems. If six or more counts are conducted, then some indication can be gained as to where the population lies within these broad categories. For example, counts of 57, 83, 89, 92, 92 and 95 would indicate a population at the upper end of the medium size class. It is important to bear in mind that these figures relate to counts and not to population estimates.

5.8.3.2 Assessment of actual population size

Should a determination of the actual population size be required, two methods are suggested:

(i) ring-fencing
Method: pitfall traps set against a drift fence, encircling the pond
Effort: 100 days minimum
Timing: early-February to late-May

(ii) mark-recapture
Method: bottle-trapping and netting
Effort: 20 visits minimum
Timing: early-February to late-May

Note that both of these methods require careful interpretation. Mark-recapture (which normally involves recording belly patterns photographically) in particular requires a considerable amount of statistical expertise. Ring-fencing can provide interesting information on age structure and migration patterns, which may aid the assessment of impacts and the development of mitigation plans. Full methods are available in more detailed texts (see 11. Further reading). Note that even when ring-fencing or mark-recapture is used to provide population estimates, the simpler population size class assessment outlined above should also be quoted in mitigation plans (there are no standard methods for scoring and comparing population sizes).

5.8.4 Factors influencing survey results

The main factors which can affect counts are:

- weather (though most of the significant problems are during low temperatures, high winds or rain, and this should be excluded using the above recommendations)
- turbidity and high density of aquatic vegetation: can reduce the proportion of newts seen or captured
- disturbance: may reduce newt activity or catchability
- torch power: high power torches may render a higher proportion of newts visible
- surveyor experience: more accomplished surveyors may see more newts than novices
- drift fence/pitfall trap efficiency: well designed and installed systems may catch more newts

If any of these points impinge significantly on a given survey, they should be mentioned and any implications explained. At present there are no reliable correction factors to apply to raw survey data in order to compensate for such effects.

5.8.5 Site status assessment

The following aspects should be considered when interpreting survey results to assess overall site importance:

- Quantitative: the number and size of populations
- Qualitative: nature of the habitats and the population – how typical or unusual are they? Does breeding occur on site?
- Functional: how does the site contribute to the connectivity or fragmentation of populations in the area (are newts on the site part of a wider metapopulation?)
- Contextual: the local significance of the population, and its relation to wider great crested newt status.

5.9 Sub-optimal surveys

In some circumstances, for example where the presence of newts is discovered only after a development project has commenced, it may be necessary to conduct surveys in sub-optimal conditions, ie outside the recommended times given above. The table above can be referred to in order to provide the 'next best' option (indicated by +), and ideally additional effort should be employed. Assessing population size outside the guidelines given above is not recommended, but the presence of newts can often still be detected throughout summer, eg by netting for larvae. Note that surveys outside the optimum times can be unreliable, and that surveying between mid-October and mid-February is unlikely to reveal any useful information at all. Negative results gained outside the optimal times given above should not normally be interpreted as an absence of great crested newts.

Where the nature of the proposed development is such that detailed survey information is required in order to assess impacts and produce mitigation plans, licence applications may be refused on the basis of insufficient survey. Similarly, Local Planning Authorities may refuse or defer planning applications on the basis of insufficient information. It is therefore in the interest of developers to ensure that surveys are undertaken at as early a stage as possible.

6. Predicting the impact of development

6.1 Introduction

In order to determine what legal implications the proposed development will have, it is important to examine the survey information, and compare this with the plans for development. This task is made easier by good survey information and detailed maps, showing pre-development and post-development site layout and habitats. Sometimes called impact assessment, this is a critical phase of mitigation planning, since the type and extent of mitigation required will depend on the likely impacts on populations. Impact assessments can also help in considering alternative sites or alternative site layouts. For certain types of project, listed in Schedules 1 and 2 of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999, impact assessments are mandatory. Even when a statutory impact assessment is not required, Local Planning Authorities do have powers (eg under the Town and Country Planning (Applications) Regulations 1988) to direct developers to provide any information they may reasonably require to enable them to determine the application. The High Court recently ruled (R. v. Cornwall County Council ex parte Jill Hardy, 22 September 2000) that for EIA developments, where there are grounds that protected species may occur, environmental information (primarily survey results) needs to be provided to the Local Planning Authority before determination, and that initial surveys to determine the presence of protected species should not be conditioned. It seems likely that these principles apply more widely to non-EIA developments as well, since the guidance in PPG9 regarding protected species being a material consideration is difficult, if not impossible, to implement where no survey information exists. Ideally, an impact assessment should inform the drawing up of detailed development plans, so that impacts can be avoided where possible. It is therefore important that this stage is undertaken as early as possible following survey. Guidance on structure for setting out impacts is given in 10. Presenting mitigation plans.

It is important to consider impacts both at the site level and in a wider perspective. The latter element relates to the assessment of the overall importance of the site (see 5.8.5 Site status assessment). The development 'context' of the site should also form part of the impact assessment. For example, if the site will soon become isolated from the wider countryside by a subsequent spate of development activity around it, the potential consequences for the target population(s) need to be considered. The effects of development on the hydrology of a general area may also be an issue, as may changes to long-standing habitat management regimes.

6.2 Major types of impact and their effects on populations

6.2.1 Pre- and mid-development impacts

There are a number of operations which can affect great crested newts prior to the start of development proper. These include general site clearance, topsoiling, regrading and drainage works, which can seriously degrade habitats or kill newts. Archaeological excavations can also damage sites, and conversely they can sometimes create new waterbodies which may be colonised by great crested newts. During construction work itself, there are a range of activities which will destroy habitats and kill newts. Again, some work may actually create temporary habitats, such as rubble piles, which newts may attempt to use if still on site.

6.2.2 Long-term impacts: Habitat loss

Perhaps the most common and most obvious impact of development, the loss of habitat can have several important effects on great crested newt populations. Pond loss is often seen as the most damaging impact on great crested newt populations, but the loss of terrestrial habitat can also have serious consequences. Great crested newts live on land for the majority of their lives, and so loss of terrestrial areas, particularly those close to the breeding pond, can be very damaging. The main effect of habitat loss is reduction in population size, through reduced breeding and recruitment (if the pond is lost), reduced foraging opportunities, reduced refuge opportunities leading to exposure to predators or harsh conditions, and unsuccessful hibernation. Populations may go extinct where there is a major loss of habitat. Such a loss in viability is also linked to fragmentation (see 6.2.4 Fragmentation and isolation). Small scale losses of terrestrial habitat, especially over 250m from the breeding pond, will probably have little effect on populations but some mitigation may be required.

Consideration should be given to the effects on other important species groups, particularly other amphibians which may be an important food source for great crested newts. Even if great crested newts are found in only one pond of several due to be lost, mitigation may only be effective if all ponds are 'replaced' as prey species may otherwise suffer; in addition, great crested newts may not use every pond each year, so a precautionary approach should be adopted.

6.2.3 Long-term impacts: Habitat modification

Certain types of development may not actually replace newt habitat with built land, but result in modified habitat which is less suitable for great crested newts. This can be exacerbated by a change in habitat management regime. For instance, converting an area of rough grassland into typical gardens, a sports pitch or a children's play area would probably have a negative impact on the population. 'Tidying up' of semi-natural habitats for recreational or aesthetic reasons can also have similar effects.

6.2.4 Long-term impacts: Fragmentation and isolation

Fragmentation occurs when development imposes barriers to dispersal, resulting in disrupted movement across a site, for example between breeding ponds and hibernation areas. Reduced dispersal between populations can also lead to populations becoming isolated, increasing the risk of extinction and genetic impoverishment. Fragmentation can be caused by physical obstructions which great crested newts cannot negotiate, such as built land (buildings, walls, etc), fast-flowing streams, or extreme landforms. 'Softer' barriers comprise habitats across which dispersal is limited, because of its intrinsic unsuitability or increased risk of mortality, for example large areas of hard standing and high traffic-volume roads, respectively.

Note that development can lead to fragmentation effects on populations outside the development area, as well as the population occurring on the site in question. This is largely due to the metapopulation structure which great crested newt populations often form. The loss of dispersal possibilities from one pond may affect newt populations some distance away. Another important point is that fragmentation effects can be severe even when there is only a very small loss of occupied great crested newt habitat.

6.2.5 Miscellaneous impacts

Some types of development may lead to other impacts such as: water table alteration (on and off site), increased siltation, increased shading, increased chemical input or run-off, or reduced prey availability (eg through the loss of common frog or smooth newt populations). It is for the developer and consultant to examine what the likely effects of the development will be, and how these may impact on the great crested newt population.

6.2.6 Post-development interference impacts

Great crested newt populations are fairly robust to modest disturbance, but certain types of interference can be very damaging. The possible increase in the risk of interference needs to be assessed when considering how the development will impact on the population in the medium to long term. Fish are often introduced to breeding ponds close to residential developments, or those otherwise subject to high public pressure. It is recognised that many types of fish, including goldfish and sticklebacks, can lead to population declines and extinction in great crested newts. Once introduced, fish can be very difficult to remove completely. Similarly, there is a much higher risk of the introduction of damaging invasive plants, like *Crassula helmsii*, when the pond is frequently visited by people. Severe disturbance, such as dumping of rubbish or setting of fires, can damage newt sites.

6.3 Temporal and spatial considerations

Some developments entail impacts which affect great crested newts for only a short period of time. For example, pipeline installation frequently involves disturbance only for a period of weeks, following which there is reinstatement. Many operations affecting the land will vary in their capacity to kill or injure newts according to when they are conducted, so the timing of development activities needs to be carefully considered.

As discussed above (5.4 Survey area) the possible impacts outside the development site itself need to be investigated. Impacts on areas used for migration and dispersal between ponds should be considered. For phased developments (including some ‘design and build’ schemes), the potential impact of the entire development needs to be considered. Looking at impacts on a piecemeal basis could prove problematic.

6.4 Poor data situations and ‘last-minute’ discoveries

It is difficult to predict impacts accurately when no or few data are available. Local Planning Authorities may refuse or defer planning permission in such cases. Where attempts have been made to predict impacts based on poor data, mitigation plans will be assessed in the light of the information contained in this section and the previous section on surveys; should the impact assessment not adequately address these points it is unlikely that the proposals will be viewed favourably. A recommendation for further survey is likely in such circumstances. One exception would be where other evidence strongly indicates that the area to be affected by development is of very low importance, and the impacts will be negligible; in this case, a lower standard of survey might be acceptable (though of course detailed survey is always preferable).

In the case where great crested newts are discovered after planning permission has been granted, or after development has commenced, works that would be likely to lead to a breach in the law should cease, and a survey undertaken (note that species protection applies even when planning consent has been granted). Mitigation plans should be developed, recognising that in some cases the potential for mitigation will be reduced. Where a sound survey has been undertaken prior to the development and this failed to detect newts, it is understandable that a developer might feel frustrated at having to delay works or incur significant extra costs. In such circumstances – effectively where the presence of great crested newts could not reasonably be predicted – mitigation plans might be scaled down from the normal expectations. However, where there was no prior survey, or the survey was undertaken to a poor design, it seems likely that the developer would have insufficient grounds for a defence should prohibited activities be undertaken subsequent to the discovery of newts; hence, normal mitigation procedures would probably apply. This might mean that a development needs to be delayed for several months in order to undertake adequate surveys, exclude newts and create receptor habitat. Cases like this are legally complex and each should be considered on its own merits; DEFRA should be contacted for advice on the best way to proceed.

6.5 Summarising the scale of site level impacts

The table below gives a simple classification of the scales of impact for the most commonly encountered development effects. In general, the greater the predicted impact, the greater the level of mitigation will be required. When viewing this table, there are a number of important caveats to consider:

- The scale of impact here refers to impact at the site level; it does not consider the consequences of the development effects in a wider context (for which, see 5.8.5 Site status assessment and 7.2 Key principles of mitigation).
- The assessment here relates to impacts on great crested newt habitats in terms of likely damage to population viability, and should not be confused with an assessment of the risk of killing or injuring individual newts. So, for example, even though temporary ground excavation at 30m distance from a great crested newt pond would qualify here as a low impact in population terms, there might be a high risk to individual newts, depending on timing and methods.
- Individual site characteristics will often mean deviation from this classification is required. The distance figures here are meant to indicate that, all else being equal, impacts closer to ponds are generally more severe than distant ones. However, the figures are indicative and cannot be applied rigidly without reference to site survey. For instance, it might be found that at a given site an area of broad-leaved woodland at 300m from the breeding pond is being used preferentially over closer, lower quality habitats; destruction of such areas would lead to a higher impact level being applied.
- Development effects will be cumulative to some degree, so that a number of low impact effects may combine to increase the overall impact. However, as there is so much variation in the level of impact, and as the ways in which development effects interact to influence populations is complex, a simple additive relationship cannot be derived. In other words, it would be inappropriate to conclude that, for example, two low impact effects always combine to give a medium impact. A judgement on the combined impact should be derived by assessment and reasoning on a case specific basis.
- "Low" impact as stated here does not mean no impact. Generally some mitigation will still be required. However, there will be cases where a given development effect will have no (or negligible) effect on the population or on individual newts, and will not therefore require mitigation.

Table summarising the scale of main impacts at the site level.

Habitat feature	**Development effect**	**Scale of impact**		
		Low	**Medium**	**High**
Breeding pond	Destruction			✓
	Isolation caused by fragmentation			✓
	Partial destruction; modification		✓	
	Temporary disturbance	✓		
	Post-development interference			✓
Other pond used by great crested newts	Destruction		✓	
	Isolation caused by fragmentation		✓	
	Partial destruction; modification	✓		
	Temporary disturbance	✓		
	Post-development interference	✓		
Immediate terrestrial habitat (approx <50m from breeding pond)	Destruction			✓
	Isolation caused by fragmentation			✓
	Partial destruction		✓	
	Modified management, resurfacing, etc		✓	
	Temporary disturbance	✓		
	Post-development interference		✓	
	Temporary destruction, then reinstatement	✓		
Intermediate terrestrial habitat (approx 50–250m from breeding pond)	Destruction		✓	
	Isolation caused by fragmentation		✓	
	Partial destruction	✓		
	Modified management, resurfacing, etc	✓		
	Temporary disturbance	✓		
	Post-development interference	✓		
	Temporary destruction, then reinstatement	✓		
Distant terrestrial habitat (approx >250m from breeding pond)	Destruction	✓		
	Isolation caused by fragmentation	✓		
	Partial destruction	✓		
	Modified management, resurfacing, etc	✓		
	Temporary disturbance	✓		
	Post-development interference	✓		
	Temporary destruction, then reinstatement	✓		

7. Planning mitigation and compensation

7.1 Why mitigate?

This section is aimed to assist consultants and developers decide *what* mitigation is required, whilst 8. Mitigation and compensation methods gives guidance on *how* to undertake it.

The aim of mitigation should be to seek to achieve one of the following outcomes, in decreasing order of preference. Each of these scenarios should be designed to satisfy Regulation 44(3)(b) (see 2.2 Exceptions and licensing):

- no negative impact on great crested newt populations
- where only a minor impact is predicted, compensation by small-scale relocation and exclusion of newts, combined with habitat creation, enhancement or restoration (all occurring on-site or in the immediate surrounding area, ie *in situ* mitigation)
- where a major impact is unavoidable, and it is not possible to compensate through on-site mitigation, translocation of newts away from the site, to an area that provides equivalent or better habitats. To achieve this, new habitats, including ponds, will invariably need to be created, enhanced or restored prior to translocation.

The potential impacts of the development should be considered at the outset, so that plans can ideally be modified in order to achieve the first outcome listed above (no impact). This could entail the use of alternative sites, or the repositioning of structures to avoid impacts. Note that DEFRA licences to destroy habitats, capture newts etc can only be obtained where there is no satisfactory alternative to that course of action.

Another category of works would be where no impact on great crested newt populations is predicted through the survey and impact assessment, but the developer wishes to contribute to conservation by creating or enhancing nearby habitats, thus having a positive impact. However, this would not be classed as mitigation, as there is no impact to compensate for. Such works may require an English Nature conservation licence, depending on exactly what was proposed, but note that most routine enhancement and management works are not licensable if conducted in the appropriate manner. English Nature can advise further on this.

7.2 Key principles of mitigation

The term 'mitigation' is frequently used to refer to all works required to comply with the legislation when developing land occupied by protected species (indeed, these guidelines use the term mitigation in this broad sense). Strictly speaking, there are two elements to this process:

- Mitigation - which, in the strict sense, refers to practices which reduce or remove damage (eg by changing the layout of a scheme, or by capturing newts to avoid killing)
- Compensation – which refers to works which offset the damage caused by the development (eg by the creation of new habitat and subsequent establishment of a population).

Both of these elements need to be considered, with the overall aim being to ensure that there will be no detriment to the conservation status of great crested newts. In practice, this means maintaining and preferably enhancing populations affected by development. The following points should be considered when planning mitigation:

The level of mitigation required depends on the size and type of impact, and the importance of the population affected.

Plans should be based on sound survey, site assessment and impact assessment. The plan should take each predicted impact and address how it can be avoided, lessened and/or compensated for.

Mitigation should aim to address the characteristics picked up by the site assessment, as follows:

- Quantitative characteristics: There should be no net loss of sites, and in fact where significant impacts are predicted there will be an expectation that compensation will provide an enhanced habitat (in terms of quality or area) compared with that to be lost. For example, should an impact assessment indicate that 5 ponds supporting good populations are to be lost, the mitigation plan might involve the creation of around 10 new ponds of equivalent characteristics. The reasoning behind this concept is that the acceptability of newly created areas by great crested newt populations is not entirely predictable; creation of new habitats should therefore go as far as possible to ensure that the new area will be of high value for newts. Generally there should also be no net loss in the summed surface area of ponds for the site. Note that, considering the wider status of ponds in England, there will normally be a requirement for no net loss of quality or number of ponds resulting from development, regardless of their great crested newt status, and that ponds not used for breeding may still be of value to newt populations (see 6.2.2 Long-term impacts: Habitat loss).
- Qualitative characteristics: the plans should aim to retain or replace unusual habitats. For example, it would be unacceptable to create typical field ponds as mitigation for heathland pools to be lost.
- Functional characteristics: compensation should remedy any loss of connectivity brought about through development. Works should aim to ensure that any new populations function in a similar way to those being lost.
- Contextual (range) characteristics: mitigation should take into account the local significance of the population. For instance, schemes which involve translocations from low status areas to high status areas would entail a major loss in the donor area, and would therefore be unacceptable.

Selecting and preparing an appropriate receptor site (or sites) may require considerable time and effort. The success of the scheme will depend to a great extent on this decision. For high impact schemes, additional land may need to be purchased, and hence the costs of compensation can be considerable.

The long-term security of the population should be assured. Mitigation should aim to ensure that the population will be free from further disturbance, and is subject to adequate management, maintenance and monitoring. Any proposals should be confirmed, ideally by a legal agreement or planning obligation, and not left as open-ended options.

Mitigation plans will be open to public scrutiny. English Nature and DEFRA will make plans available to third parties on request wherever possible, because they are part of a decision-making process for a statutory function (licensing) and because freedom of information legislation requires this. If submitted as part of a planning application, they will also be held on file by Local Planning Authorities, and therefore be available for viewing.

Mitigation plans should address the impacts of all phases in phased developments. Individual phases will normally be mitigated for individually, but there should be an overall plan which takes the impacts for the entire scheme into consideration. Licences for habitat creation or restoration as mitigation must be licensed along with the accompanying capture, exclusion or translocation; it is not acceptable to undertake post hoc mitigation for example via an English Nature conservation licence.

Precautionary mitigation, ie going ahead with mitigation before a proper survey has been undertaken, is not normally acceptable. Only in certain limited cases, notably where there is good evidence to indicate that the site is of very low importance and there will be negligible impacts, will it be acceptable to submit mitigation plans based on little or no survey (see section 6.4 Poor data situations and 'last-minute' discoveries).

Mitigation can be complex and costly. Great crested newt habitats are often complex, having developed over long time periods, and they should not be viewed as simple systems which are easily moved or recreated without difficulty. Migration patterns, demographics, breeding and foraging may be disrupted through mitigation, particularly where translocation is involved. Newly created habitats, even where they are larger in extent than the original, are not always qualitatively as good as old ones, and there is an intrinsic value in established habitats that should not be under-rated. Effective compensation may require land purchase and complex planning and legal arrangements, such as s106 agreements, restrictive covenants and adoption as publicly owned land.

7.3 Main components of mitigation

Mitigation for great crested newts normally comprises the following elements:

- Habitat creation, restoration or enhancement – to provide receptor areas for displaced newts, in compensation for areas to be lost or damaged
- Avoidance of disturbance, killing or injury – taking all reasonable steps to ensure works do not harm individuals, by altering working methods or timing to avoid newts; capture and removal; exclusion to prevent newts entering development areas
- Long-term habitat management and maintenance – to ensure the population will persist
- Post-development population monitoring – to assess the success of the scheme and to inform management or remedial operations.

8. Mitigation and compensation methods

8.1 Introduction

This section gives advice on the methods commonly used for mitigation and compensation, paying particular attention to effort and timing. Note that these are not the only methods which could be used, but they are known to be generally effective in appropriate circumstances. They should be applicable to the majority of development schemes. As sites vary in their individual characteristics, and developments differ in their impacts, the information presented is generic rather than prescriptive; consultants may make a case for different techniques and levels of effort on a site by site basis.

8.2 Receptor site selection

8.2.1 Existing great crested newt status

Potential receptor sites should be surveyed for the presence of great crested newts. For most situations, the receptor site should not support great crested newts for clear reasons, but be capable of doing so given habitat restoration, enhancement or creation.

It is normally unacceptable for receptor sites to support a pre-existing great crested newt population unless:

- an *in situ* scheme is planned, where newts are moved or excluded within the same site; or
- only small numbers of newts are to be translocated, such that it is unlikely that they would form a viable population if introduced on their own (a guideline threshold of 20 adults, plus associated immature stages, can be used). In cases like this involving the movement of only a part of a population (or one that has seriously declined or fragmented), it may be better to introduce the newts to an existing population, but only in conjunction with suitable habitat enhancement to increase carrying capacity (eg creation of new ponds, or bringing adjacent areas into more favourable management).

It is sometimes argued that, having sampled a site and found relatively low numbers of newts, further individuals may be added because the population is below carrying capacity. However, in the context of mitigation this approach is flawed. Populations naturally fluctuate and periodically reach the carrying capacity; adding further individuals does not alter the carrying capacity, but will affect the dynamics of the receptor site population. Given that habitat at the donor site is being destroyed, there will be an overall loss of newt conservation status unless additional work is undertaken to increase the carrying capacity of the receptor site. Hence, adding great crested newts to existing populations should always be accompanied by habitat enhancement.

8.2.2 Location, ownership, status and access

Receptor sites should be as close to the donor site as possible, ideally adjacent to it. However, this is of course dependent on the other criteria being met. It is generally recommended that great crested newt populations are not translocated outside the administrative area of the donor site, and that they should remain within the same Natural Area (see English Nature's publications or website for information on Natural Areas). This approach facilitates Local Planning Authorities in assessing the status of the great crested newt resource within their area of operation, whilst ensuring that ecologically relevant boundaries are also observed (ie if populations are translocated, there is parity of habitat and landscape type). It may sometimes be necessary to acquire sites, or gain management agreements for land outside the developer's ownership. The site should be free of development threats in the future, and the Local Planning Authority should be consulted to ensure that the site would not be damaged in future (ideally this should be indicated in the Local Plan/UDP). Translocation into SSSIs would not normally be acceptable unless there are no other suitable habitats in the general area, appropriate enhancement is made, and the release of the animals is consistent with the conservation objectives for the site. It is generally preferable that mitigation sites have no or minimal public access, since there are many problems associated with interference (see 6.2.6 Post-development interference impacts). Ponds can be screened off with fencing and or hedging (preferably including hawthorn or blackthorn to discourage access). Lockable gates may be required to allow monitoring and management access, or to allow controlled entry by school groups etc. Where there is a strong case for open public access to mitigation sites, there should be a significant remedial element in the aftercare plans for the site so that any interference impacts can be promptly addressed.

8.2.3 Habitats

The receptor site should include, or be capable of including, broadly the same habitats as are due to be lost. This is especially important where unusual habitats are to be lost. Generally, if ponds are to be lost, then new ponds need to be created in mitigation, and the same goes for terrestrial habitat; for instance, it would normally be unacceptable to mitigate for the loss of large areas of terrestrial habitat simply by digging new ponds, unless there is no alternative and this approach is appropriate in the circumstances. Even partial loss of terrestrial habitats can impact on populations, especially where this occurs close to the breeding pond, and so compensation for terrestrial habitats is an important issue to address. Note also that the receptor site habitats may also need to adequately accommodate other species as part of the mitigation, eg other amphibian species.

8.2.4 Size and boundaries

There needs to be adequate area to allow for at least an equivalent population as that existing at the donor site. Hence, receptor sites should be of equivalent size to the habitat due to be lost. Smaller sites may be allowable if it can be clearly demonstrated that the receptor site will be of a higher habitat quality. It is not appropriate to set the size of a receptor site solely on the basis of the theoretical minimum area calculated to support a viable great crested newt population; similarly, calculations based on the number of newts an area could theoretically support are often questionable (due to difficulties in accurately assessing population size, and the carrying capacity of a given habitat). The area selected needs to be informed by good land survey data from the site assessment. Note also that other characteristics such as connectivity and habitat quality may be of similar importance to the size of the receptor site.

Generally, receptor sites should not be entirely enclosed by permanent fencing, as this will limit dispersal and is an extra maintenance consideration. Lengths of fencing can, however, be used to prevent access to especially hazardous areas (see 8.3.3 Integration with roads and other hard landscapes). It should be noted that it will not always be possible in mitigation schemes to prevent newts gaining access to areas of potential harm, and a balance has to be made between permanently confining animals in safe areas and setting up more integrated receptor sites that allow freer movement. In general, where there are significant hazards, exclosures are preferable to enclosures.

8.2.5 Arrangements for habitat management, maintenance and monitoring

It will normally be necessary to make arrangements for ongoing habitat management, maintenance (eg fence repairs) and monitoring after the development is completed (see section 8.5 for details on methods), so the implications of this should be considered when reviewing potential receptor sites.

8.3 Habitat creation, restoration and enhancement

8.3.1 Aquatic habitats

As with other types of compensation, the first aim should be to replace qualitatively what is being lost. As great crested newts live in a variety of habitats, a prescription for the ideal pond will not be given here. It would not be in the interests of great crested newt conservation for all mitigation to follow the same pond design, as this would result in an overall loss of habitat diversity. Site assessment should include a habitat description, and this can be followed to create equivalent new habitats in mitigation. However, where the donor site is thought to be seriously declining in quality, mitigation can attempt to correct this. For example, the loss of a heavily shaded pond with indications of a declining population may be replaced in mitigation by creating a more open pond. Likewise, where great crested newts breed in highly artificial waterbodies from which it is unlikely they can exit (eg concrete lagoons, fire ponds or disused swimming pools), then mitigation should replace these with more suitable ponds. As general guidance, great crested newts prefer ponds with the following characteristics:

- Surface area between 100 and 300m^2
- Depth may vary; both deep (up to around 4m) and shallow ponds may be used
- Occasional drying out is not a problem, even if this means a total loss of that year's larvae; the pond should hold water throughout at least one summer in every 3 years
- Substantial cover of submerged and marginal vegetation
- Open areas to facilitate courtship behaviour
- Good populations of invertebrates and other amphibians, for prey
- Ponds in clusters, rather than in isolation
- Absence of shading on the south side
- Absence of fish
- Absence or low density of waterfowl

Note that the above generalises across the species' range and habitat associations, and that some other types of breeding site, (eg wide ditches), may also support good populations.

Where ponds are created in areas that may attract children, it is sensible to use a sloping profile with no sump. This avoids any sudden changes in depth, which are thought by safety experts to be an additional hazard to children should they get into the pond. Note that from a great crested newt conservation perspective, it is often advisable to prevent or constrain access to mitigation ponds (see 6.2.6 Post-development interference impacts)

The construction of new ponds or improvements to existing ponds should take place well in advance of a translocation (6 months minimum before newts will use the pond, ideally 1-2 years) to enable the establishment of plant and invertebrate populations. Some ponds may need to be deepened or made shallower once the water level is established. It is often better to create several smaller ponds rather than one very large one, as this gives scope to provide varied pond types, and less chance of fish introduction and persistence. However, very small ponds may require more management in the medium to long term. Deeper ponds are less likely to silt up or become dominated by vegetation, but the likelihood of deliberate introduction of fish is a greater potential problem for the long-term survival of the population. This risks should be weighed up on a site by site basis.

New ponds should preferably be within 250m of each other, with no barriers to dispersal, and may be sited a similar distance from any existing ponds to speed up the natural dispersal and colonisation of the flora and fauna on which great crested newt populations depend. Where receptor sites are to support other amphibian species that are to be affected by development (this is a common occurrence), attention will have to be paid to their needs too. Ponds that are unsuitable for breeding by great crested newts every year may nevertheless be important for the maintenance of the population (see 6.2.2 Long-term impacts: Habitat loss).

The spoil arising from digging new ponds can be left on site as un-compacted mounds or banks. If mixed with other materials such as clean rubble, this can provide a good newt shelter/hibernation site, with cracks, fissures and, in time, small mammal burrows and tussocky vegetation.

Ponds should be created so as to support a wide range of invertebrates, with a quantity of native marginal, floating and submerged vegetation (of local provenance), with some areas of open water. If ponds are being destroyed on the development site, transfer of water and vegetation may be appropriate. Introducing artificial egg-laying substrates to newly created ponds is not recommended as a habitat enhancement technique, as it does nothing to promote development of the pond ecosystem that newt larvae require for growth and development. When introducing aquatic plants to a new pond, great care should be taken not to inadvertently introduce fragments of aggressively colonising alien plant species such as New Zealand pygmyweed *Crassula helmsii*, water fern *Azolla filiculoides*, least duckweed *Lemna minuta* and floating pennywort *Hydrocotyle ranunculoides*.

The siting of new ponds is important: high levels of human or animal disturbance, agricultural or road run-off, and significant shading from surrounding trees should be avoided. Light grazing can sometimes prevent trees and dense emergents invading and shading the pond (though note that if reptiles are present, grazing may need to be controlled or avoided).

Pond creation is preferable to pond restoration for mitigation schemes. Only in limited cases will restoration be acceptable, for example smaller impact schemes, or areas where there is an existing pond of low quality for great crested newts (and which does not currently support them), but which appears to have potential for supporting a population. The translocation of newts into a pond which already supports the species should be avoided unless there are very low numbers involved (see 8.2 Receptor site selection), and this should be accompanied by some enhancement of the pond and surrounding habitat. An assessment of the impact of introducing great crested newts to the pond should also be undertaken to ensure that no existing interests will be significantly damaged.

In considering the above points, note that inappropriate pond restoration or management can damage existing habitats of high conservation value. For instance, the rare mud snail *Lymnaea glabra* and the protected lesser silver water beetle *Hydrochara caraboides* inhabit shallow, grassy ponds, and silted up ponds may support rare bog mat habitats. Likewise, the temptation to create new ponds in 'lows' or damp, herb-rich areas may damage existing interests. Pond management or creation proposals should therefore be developed by an experienced pond ecologist, rather than a general environmental consultant or a landscape architect with little knowledge in this field.

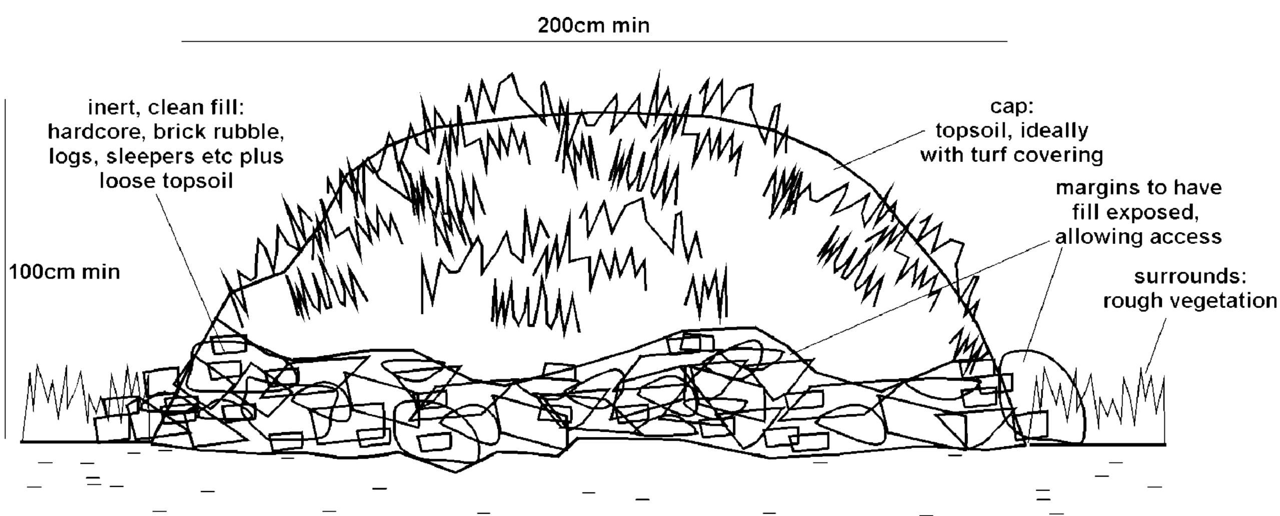
8.3.2 Terrestrial habitats

The area up to around 500m surrounding a mitigation pond should be considered as potential newt habitat, depending on the site layout. Scrub, woodland, hedgerows, banks and ditches, leaf litter, rough grassland, bare ground with fissures, disturbed ground, and pasture are frequently encountered great crested newt habitats which might be created, restored or enhanced as part of mitigation. Again, the aim should be to replace what has been lost and where possible enhance it.

Large piles of rubble, rock, log piles and earth banks (with plenty of mammal burrows and ground fissures present) make good hibernation and refuge sites. These features may be located in sheltered areas which are neither too dry nor prone to winter flooding or freezing (eg in frost hollows). On free-draining soils, these may be located below ground level by excavating a pit or trench, then infilling with a mixture of topsoil and rubble, sleepers, logs, etc. Some of the largest great crested newt populations in Britain occur within old brickworks sites, which usually provide a good range of these type of habitats. For ideas on the design and construction of suitable hibernacula, see Figure 3: Suggested hibernaculum design. Smaller refuges for daytime shelter may also be provided, though on sites which will be heavily used by the public these may not be appropriate unless they are well secured. Great crested newts are known to spend a considerable proportion of their terrestrial phase either underground or just above ground under refuge sites, so it is important that this aspect is addressed in mitigation plans.

Figure 3: Suggested hibernaculum design

This design mimics artificial and natural conditions in which great crested newts have frequently been found over-wintering. Dimensions should not be below 2m length x 1m width x 1m height. The illustrated design would be suitable for locating on an impermeable substrate. On free-draining substrates, the design is largely similar but the bulk of the fill is sited in an excavated depression in the ground. Hibernacula should ideally be positioned across a site, both close to and distant from breeding ponds, always in suitable terrestrial habitat and above the flood-line.



Translocation of newts into terrestrial habitats should be delayed where time is required for maturation from the point of creation or restoration; this may be a year or more depending on soils, vegetation type and weather conditions. Newts should not be moved in to areas before significant habitat modification takes place.

Though great crested newts may use gardens, studies indicate that they are generally of lower value for this species. It is difficult to ensure consistent habitat management in gardens of new properties, and given the vagaries of home ownership and potential for extensions, etc, it is generally not acceptable to rely on gardens as compensation for terrestrial habitat lost to development. The same applies to garden ponds. Only in limited circumstances where there is legal provision (eg through restrictive covenants) for the retention and management of great crested newt habitat would gardens be considered suitable in mitigation.

8.3.3 Integration with roads and other hard landscapes

Great crested newt mitigation often occurs as a result of residential or commercial developments, and this may result in receptor sites in close proximity to roads, car parks, hard standing, buildings, etc. Some of these habitats may be traversable by newts, while others will certainly impose barriers. Studies in recent years have shown that some drainage systems can result in high mortality. A particular problem arises with upright kerbs and gully pots which effectively mimic a drift fence and pitfall trap system. For mitigation plans, information from the survey and development plans should allow an assessment of likely problems.

Where new great crested newt habitats are to be created, such additional mortality should be avoidable through careful design. Newts can be prevented from coming into contact with "traps" such as gully pots by designing drainage schemes which omit sumps. For a range of environmental reasons, there is an increasing move towards Sustainable Urban Drainage Schemes (SUDS) which aim to control and treat drainage at source, rather than convey it to other areas. These schemes typically involve a range of features, such as porous surfaces, swales (grassy ditches), buffer strips, and filter beds. Such schemes can create amphibian habitats, whilst avoiding gully pots and other "trap"-type drains. In order for such drainage schemes to be used, it is crucial to alert developers to their benefits at the early stages of design. References for information on this area are given in 11. Further reading; a good general introduction is given in SEPA's *Ponds, pools and lochans* (2000), including some useful suggestions for enhancing the conservation value of SUDS. Currently, there appears to be reluctance amongst some bodies to promote such approaches, and to adopt roads associated with SUDS. This is often viewed as an unfortunate situation given the wide environmental benefits of SUDS. Where significant newt mortality is indicated, the avoidance of the installation of gully pots by implementing SUDS should be thoroughly explored by developers and consultants, in liaison with local authorities, well in advance of commencing the scheme. Engineers who have not worked on such schemes before can be directed to a range of publications explaining the technical merits of SUDS. Recent experience has demonstrated that SUDS approaches can be adopted even when there is little space available within the development.

Where the use of gully pots etc is genuinely unavoidable, it may be appropriate to exclude newts from the area using permanent amphibian fencing. The most frequently used fencing is commercially produced (see 8.4.2.1 Exclusion fencing and drift fencing), heavy duty plastic with a curved design, though purpose-built walls may also be acceptable. The relative impacts of exclusion and drain mortality need to weighed up on a case by case basis – it is not always desirable to permanently exclude newts from newly created developments. A way of reducing the likelihood of newts getting trapped is to use sloping (battered or dropped) kerbs either side of (and ideally adjacent to) the gully pot, or to eliminate kerbs altogether. Again, these options need to be discussed as early as possible with developers, emphasising the importance for protected species. There is currently no 'amphibian friendly' design of gully pot. Though exclusion using netting over grates, and assisted exit through the provision of 'ladders' may sometimes reduce mortality, these are temporary, maintenance-heavy fixes which are not to be recommended for new developments. In any case, there is little evidence that they are very effective at preventing amphibian mortality (particularly of juveniles). Such modifications may not be allowed by local highways authorities, and normally interfere with the purpose of the drainage systems through increased blockages or problems during cleaning. Rather than dealing with the problem of getting newts out of drains, the aim should be to stop them reaching drains in the first place.

The potential for newts to cross roads successfully depends largely on traffic volume and the presence of any barriers, such as kerbs. Small roads and tracks with low vehicle numbers appear to present no major problems for newts, whilst larger, busier ones can limit dispersal and result in high mortality. Mitigation ponds should be located away from such roads, but where this is unavoidable and problems are likely to occur, permanent amphibian fencing should be used. If this is likely to prevent dispersal to suitable habitat on the other side of the road, tunnels or culverts can be incorporated. At present, there is little evidence on the use of tunnels by great crested newts, though some anecdotal reports have indicated that newts use them. Tunnels should only be used where there is no alternative to maintaining dispersal routes, and monitoring of tunnel use should be put in place to allow assessment of this technique. Tunnels can only be effective where there is a well-planned fencing system to channel newts in, and they will require regular maintenance.

8.3.4 Other considerations

It is not unusual for sites to have other protected species present (eg badgers, bats, reptiles, water voles, nesting birds, the lesser silver water beetle). Where these animals may be present, it is wise to undertake a comprehensive protected species survey prior to planning permission being applied for. Where great crested newt habitat creation, restoration or enhancement is planned, involving hard landscaping such as earth moving, pond construction, tree felling or the erection of fences, other protected species may be overlooked. It is not acceptable for habitat creation, proposed as mitigation, to be sited where it would cause significant damage to existing features of value such as botanically diverse old pasture or marshland.

It should also be noted that habitat creation or enhancement does not override protected species legislation, and due care must be exercised in order to avoid damage to such species and their habitats during potentially disturbing works. This may mean taking measures to avoid killing, excluding them from areas prior to such works taking place, or re-designing the scheme to accommodate their interests.

8.4 Avoidance of disturbance, killing and injury

8.4.1 General points

Most forms of development will involve some works which pose a danger to individual newts. Mitigation should address this by reducing the chance of killing or injury, normally through the removal of newts from the area subject to disturbance, to a receptor site. Capture of newts can occur throughout the active season (February-October), but the efficiency varies greatly according to timing and methods. Capture of adult newts on land is most effective using a ring fence with pitfall traps during the breeding migration, catching newts as they move towards the pond in spring. However, note that some adults may not migrate to a given pond every year. Newts can also be caught from ponds using netting, bottle-trapping and draining down. On land away from the pond, newts are most effectively caught by installing lengths of drift fences with pitfall traps and refuges. Hand searching, including the dismantling of refuges such as debris piles, can also be used. 'Destructive searching' involves the careful, controlled stripping of areas likely to harbour newts, but should be used only once the other methods have been exhausted.

It is normally unacceptable to attempt to capture newts once they have started to hibernate, which occurs when night temperatures drop towards freezing point, typically shortly before the first frosts, around mid-late October. This is largely because it is very difficult to find and capture animals once they have started to find refuges for winter; there is a risk that areas may be searched and declared free of newts when in fact the animals are still present in inaccessible underground crevices or in refuges. Searching destructively in winter, especially without a prior capture effort, is also more likely to result in mortality. In addition, from a welfare point of view it is most unwise to capture and relocate animals which have begun their winter dormancy.

The decision as to where to relocate newts to will depend on the site layout and on season. Newts should always be released in a sheltered area close to a suitable refuge (or in a pond), in weather conditions conducive to activity. Release as soon as possible after capture is preferable, and special care should be taken when releasing newts terrestrially during the day. Night releases are better but newts should not be unduly held in captivity, hence newts caught in pitfall traps that are checked in the morning will need to be released in suitable ground cover. As a general rule, newts captured on land should not be released into water and vice versa, as this may disturb their physiology (an exception being pitfall-trapped newts intercepted at ring fences during immigration to a breeding pond). Careful judgement, and ideally pre-survey, is required when intercepting newts during the breeding migration, so that they can be released in suitable ponds.

Once newts have been removed from the area to be disturbed, they will normally need to be excluded from re-entering it, so fencing is required. Various types of fencing are in use, including temporary, 'permanent' and one-way varieties. These should be selected according to the task required.

If an area proposed for development is found through survey to support newts but there is no pond present, effort must be put into removing newts from the area prior to damaging activities commencing. It is not normally acceptable simply to put up a fence to prevent newts moving into that area from the pond, nor is it acceptable to rely solely on 'passive clearance' methods, such as one-way fencing. Both of these approaches are likely to leave newts on the development site. There are very few cases where the sole mitigation measure will be fencing, since the loss of habitat is inevitable if newts are known to be in the general area; removal of newts plus compensation for the lost habitat will be required.

8.4.2 Capture and exclusion methods

8.4.2.1 Exclusion fencing and drift fencing

Great crested newts can be guided into pitfall traps (see below) by the use of drift fencing. Likewise, they can be prevented from (re-)entering an area using exclusion fencing. Both of these are temporary fences. The designs for general purpose exclusion and drift fencing are similar, although it is often more important that exclusion fencing is well specified, correctly installed and subject to on-going maintenance. Failure to do this could lead to it letting newts through unhindered (though note that it is very difficult to guarantee that exclusion fencing is 100% effective). It should be as 'newt-proof' as reasonably possible over the entire period of works. If great crested newts are allowed to escape back onto a site, development works will normally need to cease and a re-trapping programme implemented after consultation the licensing authority; this can incur considerable delays. 'One-way' fencing may be used to allow newts to cross into a safe area, whilst preventing dispersal back into a development site. Note that there is currently little evidence that such fencing is very effective at allowing one-way passage, but it may still be used as a precautionary measure so long as other methods of active capture are in place.

There are a number of designs for amphibian exclusion fencing. The design of the fencing should be fit for the purpose, durable and repairable should damage occur. A recommended specification sheet for temporary fences is shown in Figure 4. A guide to the most important aspects of temporary exclusion fence installation is given below. The requirements for drift fencing follow the same pattern but are not so rigorous.

- Fencing installation should be instructed by, and if necessary carried out under the supervision of, an appropriately experienced amphibian worker.
- Engaging the services of an experienced amphibian fencing contractor, who can fine-tune construction methods to cope with the different problems associated with different soil types, is strongly recommended. Experience has shown that, despite the apparently simple construction methods involved, general fencing contractors with experience limited to the erection of 'conventional' stock barriers may not be appropriate.
- The proposed fence-line should first be searched and cleared of amphibians if it is likely that they are present. If clearance of the fence-line is required, vegetation can be cut back, taking care to avoid damage to any resting amphibians.
- The fencing layout should avoid gaps through which newts could pass, thus avoiding capture. Stiles can be constructed where a fence crosses a footpath. In exceptional circumstances, in the case of pipelines for instance, it may be necessary to allow farm access, etc across barrier fencing. Where this is necessary, the gap should be as small as possible and each end of the barrier fencing should be turned back at 45° to the fence for a few metres to deflect amphibians away from the gap. Heavy duty plastic flaps which are able to deform under vehicles and then spring back can be installed in the ground across gateways, flush with fencing either side.
- The fence should be installed to the correct height and depth and with an adequate 'under-lap' to prevent newts from passing underneath.
- The backfill should be placed turf downwards in the trench (to suppress re-growth of grass) and well compacted to eliminate any lumps or gaps. Backfill must not remain un-compacted overnight, and all fence trenches must be filled the same day as they have been dug, as amphibians may seek shelter within any un-compacted soil or turf.
- Exclusion fencing should have a overhang or 'top curl' to prevent newts from climbing over the fence.
- The fencing membrane should be of a type that will not break down or become brittle under exposure to the elements, notably UV light. '1000 gauge' transparent polythene sheeting works well in many situations, as do woven polypropylene and black polythene DPC. Ensure that the sheet width is sufficient to permit the forming of the 'under-lap' and 'top-curl' (1m is sufficient for most fences). The blue plastic often used in the building industry is not recommended

because it can become brittle quickly and usually requires replacement after only a few months. Replacing large sections of fencing will cause an unnecessary disturbance to the newts and should be avoided whenever possible.

- The fencing membrane should be as taut as possible without noticeable creases or folds which could allow newts to climb the fence. The use of too heavy a gauge of plastic may make it difficult to remove the creases and folds, and this could be a problem on uneven ground.
- The fence should ideally be secured to the supporting posts by pads and nails or staples (not battens, which may allow newts to scale the fence).
- Fence posts should be positioned on the outside of any receptor area fence, and in the case of drift fencing, on the side of the fence that is least likely to encounter newts.
- One-way fencing should be sloped at an angle of between 45° and 40°. This may allow amphibians to climb over into the receptor area, but prevent them from escaping back into the clearance area.
- Any joins in the membrane must be 'curl-joined' and well secured to a post with pads and nails. This jointing method should continue underground as well as above. Adhesive taped joins are not normally acceptable for long-term repairs to important parts of the fence, as they are not durable.
- A record of fence inspection and damage repair work should be kept by the licence holder as evidence that the newt-proof barrier has been properly maintained.
- Newts may seek refuge in the shrinkage cracks that will occur between the fence and the backfill; therefore special care needs to be exercised when removing fencing. Should any fencing need replacement (including any that has to be replaced due to faulty installation), or during the final fence removal process, then all backfill should be removed carefully by hand under the supervision of the licence holder or an agent, if it is thought likely that newts are present. This will minimise the risk of damaging or killing any amphibians that may be sheltering in the back-fill along the fence line.
- It is sometimes necessary to control the vegetation along the fence-line to prevent the fence becoming overgrown, which helps the newts to breach the fence. This is best achieved by the careful application of an approved herbicide which is licensed for aquatic use (such as Round-up Biactive) to a narrow strip (50cm) on whichever side(s) of the fence newts are being prevented from climbing. Cutting the vegetation using a strimmer may be undertaken but care should be exercised to prevent damage to newts or to the fence.
- In areas where barrier fencing is adjacent to a construction site, or within areas open to public access, the developer will generally be required to erect a security fence to prevent damage occurring to the amphibian fencing. Chain-link or 'Heras' fencing are often used for this purpose.
- In areas where vandalism is likely, regular monitoring of fencing may be required.

When the aim is to exclude great crested newts from an area in the long-term (eg a busy road, see 8.3.3 Integration with roads and other hard landscapes), 'permanent amphibian fencing' may be used. The most frequently cited commercial supplier of purpose-made permanent amphibian fencing in England is ACO Wildlife (Hitchin Rd, Shefford, Beds SG1 5TE; tel 01462 816666; web www.acowildlife.co.uk); the manufacturer's installation specifications need to be followed carefully. Other types of permanent barrier could be custom-made by engineers to take account of specific site characteristics.

8.4.2.2 Pitfall trapping (in conjunction with drift fencing)

It is possible to capture newts by this method throughout most of the frost-free months of the year, though capture is highly dependent on (a) weather conditions, and (b) location of drift fencing. Reduced capture rates should therefore not necessarily be interpreted as indicating an absence of newts. Pitfall trapping during the start and the end of the season may be unwise if frosts are likely to occur, as this may harm trapped animals. Welfare guidelines are given later in section 8.6. Ring-fencing and other intensive trapping programmes can cause considerable disturbance to the newt population (and to other wildlife) and should only be undertaken where there is a genuine need to do so.

Drift fencing should be installed in sufficient quantity to provide an adequate coverage across the site. It would be normal for traps to be installed at a higher density in areas of more favourable newt habitat, such as around breeding ponds and rough grassland. Newts may cross areas of short grass or bare ground, and these areas should not be ignored when designing the fencing layout, especially when in close proximity to breeding ponds.

The following points should be noted regarding the installation and servicing of pitfall traps (see Figure 4: Fence and pitfall trap design):

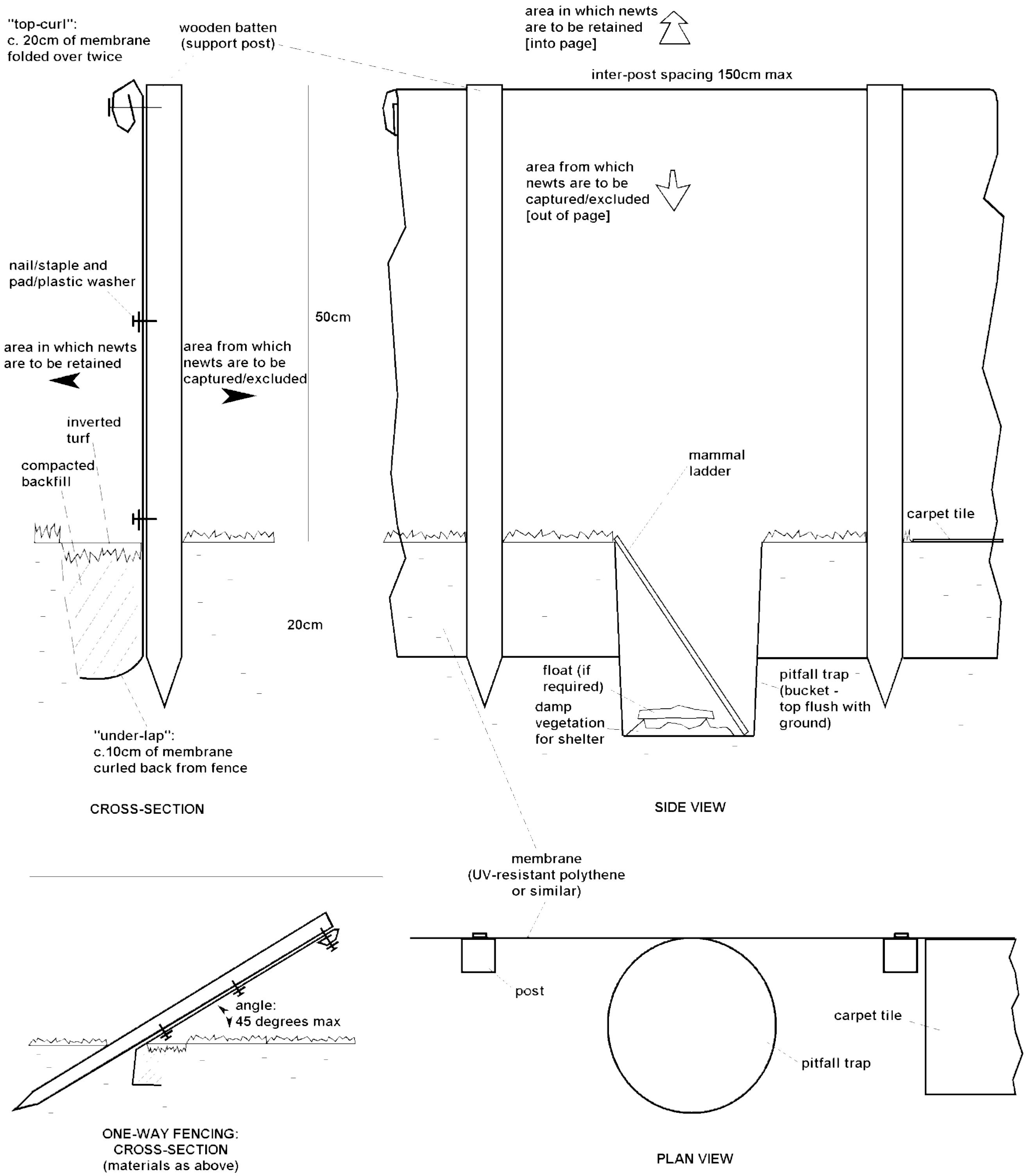
- Pitfall trap design: plastic buckets should lack a top lip, as this might allow newts to walk between the fence and the bucket without falling in. Opinions differ as to whether to use square or round buckets; square buckets may be slightly more effective at intercepting newts but the animals have been known to more easily scale the corners of square buckets and escape. If necessary, plastic tape can be used around the inner edge of the top of the bucket, forming a small overhang to prevent escapes.
- Pitfall traps will only work effectively if they are fitted flush to the barrier fence, with their tops just below ground level. Frequent checks should be made to ensure that the traps have not pulled away from the fence or their tops raised above the ground, especially after periods of heavy rainfall or dry weather. In very wet periods, especially in clay areas where the water table can rise rapidly, the 'empty' buckets are likely to pop out (and therefore become ineffective) unless some form of pegging-down is used. If remedial works are required the bucket-hole and backfill should be carefully searched for newts prior to the trap being re-seated. Drilling holes in traps may improve drainage on free-draining soils.
- Spacing of the pitfalls should generally be between 5 and 10 metres, though higher densities may result in higher capture rates and may be appropriate around key areas (eg breeding ponds, rubble piles).
- To increase the chances of capture, suitable refuges (eg carpet tiles) can be placed along the fence line at a similar density to the pitfall traps. These refuges should also be fitted flush up to the fence. It may take about two weeks for them to become 'bedded-down' enough to be attractive as refuges. Rubber-backed carpet off-cuts, about 50cm square, appear to be moderately effective in creating the desired humid conditions and are substantial enough not to be blown-away in the wind. When attempting to remove newts from very hard surfaces on which pitfall trapping is impractical, such refuges may be appropriate.
- Servicing of pitfall traps and refuges must be carried out on a daily basis before 11am. All captures should be recorded with notes on location, species, sex and life-stage, making it useful to number and label each trap and fence. This information (together with that from any other capture methods) should be compiled to form an accurate record of the capture data for

submission upon completion of the scheme or at any stage it might be requested to review project progress. The plotting of capture locations and numbers caught can be of great assistance when determining and justifying any shift in trapping effort.

- Any amphibians captured must be moved to the receptor area and released as soon as possible, using suitable, lidded containers with air-holes (plastic 3.3 pint 'maggot boxes', available from angling suppliers, are ideal).
- Torchlight searches along the fence-lines on warm, wet nights are an excellent way of improving newt capture rates.
- Hand searching areas of vegetation is usually an inefficient method of site clearance and, consequently, data from such searches should not be used as sole evidence that a site has been cleared.
- Pitfall trapping should be a continuous process, with traps open every day unless the weather indicates zero or very low capture rates. Full and consistent trapping effort should be employed in order to maximise captures and prevent unnecessary disruption being caused to amphibians by preventing access to breeding ponds or foraging habitat for any longer than is necessary.
- Cutting vegetation by hand, strimming, or mowing of vegetation may be acceptable as a technique to encourage newts to move into trapping areas, providing it is done to assist in the capture of the remaining animals after a suitable trapping operation has already been implemented. However, there is little evidence to show that this is very effective. Vegetation cutting is acceptable so long as newts are not endangered; generally there is virtually no likelihood of encountering newts exposed and above ground during the day, but it is recommended that to minimise chances of killing newts where vegetation is dense, cutting should be carried out during periods of hot, dry weather and to leave a sward height of around 15cm. Artificial watering of the ground in dry conditions has been suggested as a technique for raising capture rates in summer but again there are few data on its effectiveness; this may be tried as an additional technique.

Figure 4: Fence and pitfall trap design

Recommended design for exclusion fence (temporary amphibian fence), drift fence, and pitfall trap placement. This design can be used for a variety of capture and exclusion/retention purposes (see text and [Figure 5: Common fencing and trapping patterns](#)).



Effort, trap pattern and timing:

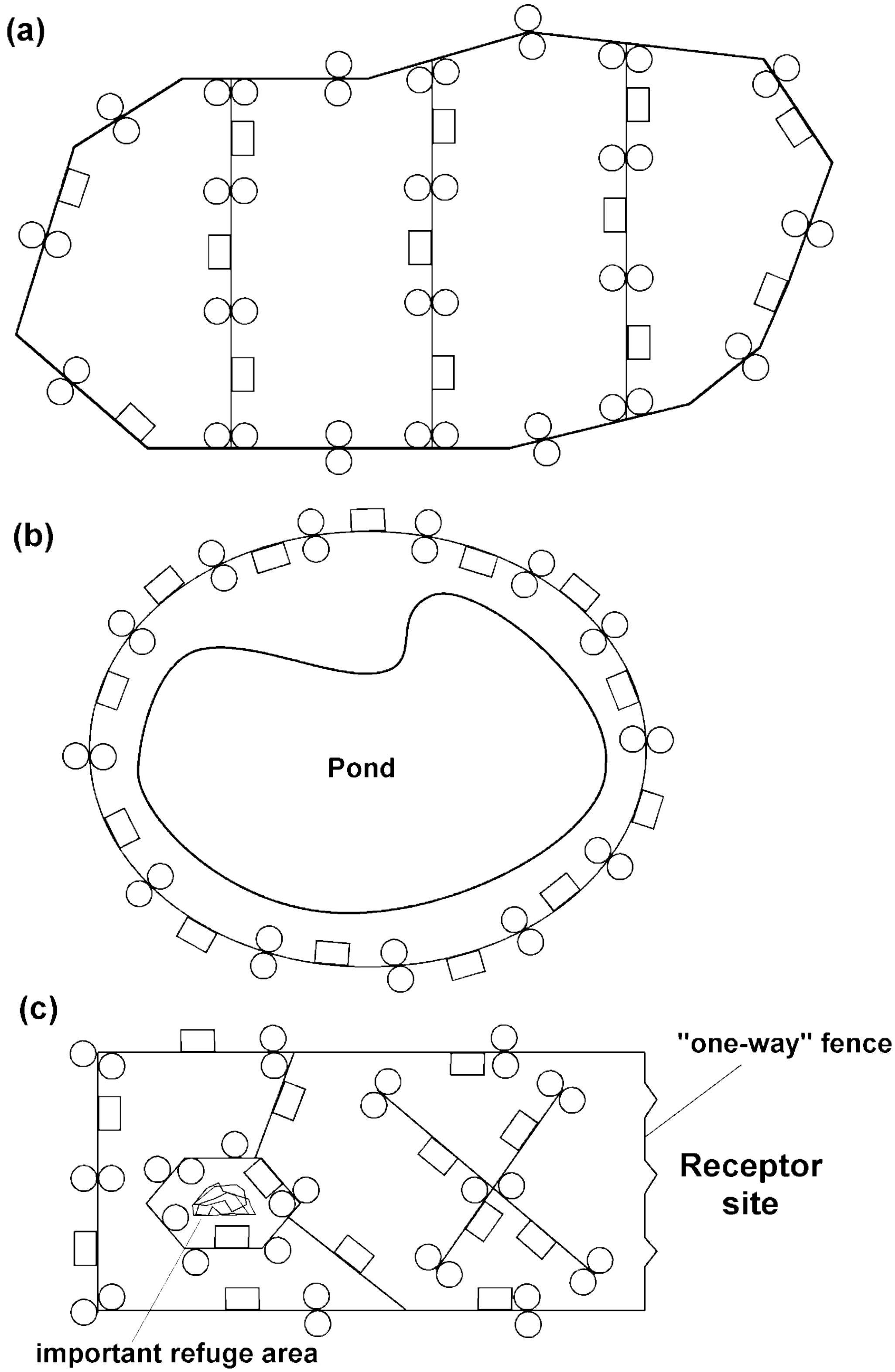
(a) *Breeding ponds*. To remove great crested newts from a site that includes a breeding pond, trapping should last from February to October inclusive, or until capture data clearly indicate that a site has been trapped successfully (see below). There should be, as a minimum, at least one spring migration (February to May inclusive), with breeding ponds ring-fenced (a notable exception being temporary, linear works - such as pipelines - which may be best undertaken outside the migration period to avoid separating newts and other amphibians from their breeding ponds). Pitfall traps should be located on both sides of the fence, as some newts may shelter within the enclosure (see Figure 5: Common fencing and trapping patterns). It will also be necessary to capture adult and immature newts away from the pond, even during the breeding season. Note that even if pitfall trapping on a ring-fence system is undertaken around the pond for an entire year, a significant percentage of the population will normally not be captured (great crested newts normally take two to four years to reach sexual maturity, and during this time they may not visit the pond). For this reason, to be confident of effectively capturing the majority of the population at large sites, ring-fencing over at least three years, combined with trapping effort away from the pond (see below) is advised. However, where considerable extra effort is expended, it may be possible to capture a significant proportion of the population in one year.

(b) *Terrestrial habitats*. Where areas of terrestrial habitat are to be affected by development, drift fencing and pitfall trapping often provide the best solution for removing newts. Fencing should enclose the development area to prevent immigration of newts. Where the receptor site is adjacent to the donor site, one-way fencing may be used at the perimeter. A common trap pattern is to install lines of drift fencing with pitfall traps within the development area so that it is divided into compartments. Within the compartments, further trapping can be undertaken along lines or crosses of drift fencing (compartmentalising is preferable to using fence lines or crosses alone, since it further restricts newt movement and allows areas to be successively 'cleared'; this is especially useful for large sites). The level of effort required will vary according to case details, but the following may be used as a guide:

Population size class assessment (see 5.8.3)	Minimum trap density (traps/ha)	Minimum no. of trapping nights
Small	50	30
Medium	80	60
Large	100	90

Note that a 'trapping night' is counted as one during which the weather and seasonal conditions indicate newt capture is likely. Such conditions are generally taken to be: night air temperature >5°C, with rain (or if no rain, there should have been some rain in the last few days, such that the ground is damp). Hence, a trapping period of 30 nights as indicated in the above table would mean 30 nights on which conditions were suitable. Intervening periods of cold or dry weather would mean that the actual period of capture, from start to end, would be more than 30 nights. Note that these figures are given as a guide, and should great crested newts still be trapped towards the end of the effort indicated here, further effort will often be required. As a guide, 5 trapping nights with no captures would indicate that suitable effort had been expended at most sites. Other methods of capture would normally also be employed to supplement pitfall trapping.

Figure 5: Common fencing and trapping patterns
Fences shown as lines, pitfall traps as small circles and carpet refuges as rectangles. (a) Capturing newts from a large area of terrestrial habitat due to be destroyed. The fencing compartmentalises the site facilitating phased clearance. Traps on the outside of the area capture newts that attempt to migrate into the area to be lost, a method useful in most schemes. (b) Ring-fencing a breeding pond. Note that traps are required on both sides of the fence. (c) Capturing newts from an area of terrestrial habitat due to be lost, where the receptor site is adjacent. The one-way fence is angled upwards towards the receptor site, to prevent newts returning. Intensive trapping is shown around a favoured refuge area.



8.3.2.3 Netting, bottle trapping, draining down and hand searching in ponds
To capture great crested newts from a pond, a combination of methods is normally required. A programme of pitfall trapping would normally be the first stage, as outlined above. Netting is relatively inefficient except in very small ponds or those with hard substrates and little vegetation (eg concrete ponds, lagoons or swimming pools, all of which are generally easier to catch from). Bottle-trapping appears to be more effective. A density of at least 1 trap per 2m of shoreline, with 90 trap nights (night-time air temperature >5°C) over mid-February to mid-June is recommended for removing breeding adults. Bottle-trapping can also be used in summer to trap larvae, but special care is required to minimise harm. Vegetation supporting great crested newt eggs should be moved too, though care should be taken if the donor pond supports fish or invasive exotic species (removing egg-laden leaves and careful washing in clean water may help).

Draining down of ponds can help to catch remaining newts. Screens with a fine (<1.5mm) mesh should be fitted to pumps used for draining down, to prevent any remaining newts (or other wildlife) from being drawn through the pump. Rather than drawing water directly from the pond, it may be possible to dig a narrow trench, connected to the pond, from which water can be drawn-off. A fine mesh screen would still need to be positioned across the mouth of the trench (two pond nets, used alternately as each becomes clogged with vegetation, work well); using this method it is easier to prevent amphibians, vegetation or silt being pulled into the pump. In some cases the use of a pump could be avoided completely if pond water can be trenched away by gravity to a nearby ditch. Newts can be caught by netting as draining takes place, and by hand searching through plants, debris and silt when the pond is dewatered. Care should be taken when working over areas of soft silt; a risk assessment is recommended. Ring fencing with pitfall traps can help capture newts escaping from the pond overnight during the process of draining. Having removed the newts from the pond, in many cases it is beneficial to transfer the pond vegetation, water and a quantity of silt to a newly prepared pond (though beware of transferring undesirable fauna and flora). This can help establish a more favourable pond ecosystem on receptor sites.

8.4.2.4 Hand searching and night searching on land
Some habitats may be searched by hand during the active season. This is useful for finding newts under refuges, but is a poor method when they are underground or amongst very dense vegetation. Newts can sometimes be found by torchlight, walking over land at night in good weather conditions (typically when the ground is wet, and often up against drift fences if used), but this is a very inefficient method. Both these methods are to be used only as additional techniques, alongside the others described here.

8.4.2.5 'Releasing' land for development
Once the capture programme has finished, the consultant should be in a position to make a statement that reasonable effort has been made to remove great crested newts from the development site, allowing earthworks to commence. Fencing and pitfall traps should be carefully removed under supervision of the licence holder, since great crested newts often take refuge in gaps between fences, traps and the ground, and these animals will need to be captured.

Infilling of great crested newt ponds should not normally take place until:

- capture records indicate reasonable effort has been expended to trap newts
- aquatic and marginal vegetation has been translocated to receptor ponds, if applicable
- any pond water required to inoculate new ponds has been taken

- pond water has been carefully drained away or pumped out
- the pond bed and surroundings have been reasonably searched for any uncaptured amphibians

The process should be supervised by the licence holder (or an accredited agent who has experience of pond draining operations) and concluded by infilling immediately the operations listed above have been completed. Great crested newt ponds may best be infilled over winter, as this may remove the need for involved capture efforts associated with draining down. In this instance, though, prior checks should be undertaken to ensure no newts remain in the pond or hibernate in the banks.

Land can be released for development provided that the works will not adversely affect any retained great crested newt habitat, for example by: interfering with migration; interfering with ongoing mitigation works; causing water-level changes in breeding ponds; allowing spoil or stock piles to be stored close to amphibian fencing; allowing insufficient working area for people and/or machinery used in mitigation.

8.4.2.6 Delays in development work

Construction work may be halted or postponed for various reasons beyond the control of the developer or the environmental consultant. Sometimes these can have a bearing on mitigation works. If fences have been erected, they should be maintained for the duration of the delays, as breaches might allow newts to recolonise areas from which they had previously been removed. Additional trapping may be required should vegetation bridge the fence, or should holes appear in it. If fencing is in place to confine great crested newts to small areas, this time should be minimised; removal of some fences and consequent amendments to the mitigation plan may be required. Licence variations may be required to accommodate modified method statements.

8.5 Post-development habitat management, site maintenance and population monitoring

8.5.1 Habitat management and site maintenance

The main issues which may need to be covered by post-development management are:

- Aquatic vegetation management in ponds
- Clearance of shading tree or scrub cover around pond margins
- Desilting and clearance of leaf-fall (infrequent, long-term)
- Mowing, cutting or grazing of grassland
- Woodland and scrub management, eg long rotation coppice

Maintenance should cover work to remedy any significant damage to the site. The following are examples of commonly encountered problems [with solutions in brackets] which should be covered by maintenance agreements:

- Introduction of fish [removal through draining, netting, electro-fishing, and/or chemical treatment; seek advice from English Nature on current recommended methods]
- Pond leakage caused by puncturing of liner, etc [pond repair and refilling]
- Dumping of rubbish on site [removal]
- Fires, acute pollution or other major damage [reinstatement as appropriate]
- Damage to fences [fence repair or replacement]