No. 30
Opportunities for amphibians and reptiles in the designed landscape

English Nature Science Series

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Opportunities for amphibians and reptiles in the designed landscape

Proceedings of a Seminar at Kew Gardens, Richmond, Surrey held on 24 January 1996

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Foreword

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Wildlife conservation is often seen as an exclusive activity carried out by a select group of individuals and organisations. Or it may be something that is confined to nature reserves or other important wildlife sites. This is not how it should be. The nation's natural assets, whether wildlife or natural features, matter to everyone and everyone has a responsibility for them. The Government is giving very clear messages, through national policy and international commitments, that the conservation of nature is important and that there is a shared responsibility for its stewardship.

Perhaps now more than ever, as people become increasingly separated from wildlife, there is a greater need to take positive action to help our wild animals and plants, and to increase the opportunities for a positive interaction between people and their natural environment. To do this we need to look beyond just those sites where there are special wildlife designations and consider the wider countryside, and also the urban and developed landscapes. It is also increasingly important for us to see that nature conservation is not an activity undertaken in isolation from other activities; nature conservation must become an integral part in everyday activities and planning.

This report and the seminar on which it is based reflect all these principles and show how nature conservation projects can be taken forward through partnerships. Funding for the seminar was provided by British Coal Opencast, who provide a good example of a major company who acknowledge their responsibilities to the environment whilst taking forward their business. This commitment has been formalised through signing a Statement of Intent with English Nature. British Coal Opencast's involvement in the seminar and this report follow on from their appreciation of a need for greater cooperation between industry and nature conservation, and from their specific involvement with a number of amphibian conservation projects. The choice of venue is also significant in acknowledging the involvement of the staff at the Royal Botanic Gardens Kew, who have carried out a conservation project for the great crested newt in the grounds of the gardens.

There is tremendous scope for helping to improve areas of land for wildlife, and in particular in areas that are not specially set aside for this purpose. Opportunities to do this may be missed simply because they are not considered, or because the principles that are needed are not known; quite often only small changes in design or management are necessary. These can be incorporated without conflict to the land's primary purpose if they are planned and designed early enough. This report and the seminar aim to address these issues, looking particularly at the needs of amphibians and reptiles. As a consequence, I hope that new opportunities will arise for the conservation of these animals, and for other wildlife, in some of the areas over which we have most control, namely the designed and the managed landscapes.

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What is a 'good wildlife habitat' ?

Many people will have their own ideas about what constitutes good 'wildlife habitats'. Usually these are large, natural areas such as woodlands or moorlands and consequently there is a tendency to forget about the importance of other areas. Golf courses, playing fields, road and railway embankments and even industrial estates and back gardens can be attractive and important areas for wildlife. However, often they are not. The reasons for this will be as a consequence of what these areas are like and how they are managed.

Although the types of habitats found in an area are important, the presence or absence of certain features can also play an important role in determining its wildlife value. These include hedgerows, ponds, vegetation structure and connections to other sites. Such features can be incorporated in to parcels of land that are used for a variety of different purposes, occur on different soil types and have different natural vegetation. Which features are important will depend on the needs of the animals and plants that you wish to encourage.

It is also equally important to know that no single habitat - regardless of how well managed it is - will be universally good for all species; differences in the ecological needs of the species (or different geographic locations) will mean that some areas are good for some species, perhaps to the exclusion of others. For example, some species need the shade or the cover provided by a woodland while others need open spaces and patches of bare ground. Our rarer species, almost by definition, often require more precise requirements than species that are more common and widespread.

Wildlife in designed and the managed landscapes

The focus of this report will be areas of land that are set aside, and are designed or managed, for a specific purpose other than wildlife conservation. These areas may be amenity 'green space', perhaps for recreation or landscaping; they will include road verges and railway embankments, noise attenuation buffers, balancing ponds, ornamental parks and gardens, schools, hospitals and built areas such as industrial parks and commercial and residential development. In common, these have the need to fulfill some primary function, will be purposely designed and managed. Most will also have opportunities for promoting wildlife conservation. When designing these schemes it is imperative that the ability to deliver the primary role of the land is not compromised.

Some species of wildlife are difficult to conserve, even with intensive effort on dedicated and specially managed reserves. Many of these 'tricky species' will not be able to be accommodated in the types of designed landscape described in the previous paragraph, although there are notable exceptions (rare plants growing on road verges are a good example). Where these rare species are found or where wildlife conservation is the primary land use, much greater effort is often required to ensure that the ecological needs of the species, wildlife communities or habitats are taken on board. Because of this we have deliberately avoided discussing management of nature reserves or addressing the needs of 'mitigation' packages offered as a consequence of development which may be required to address the needs of protected species or habitats; often these require the establishment of

dedicated wildlife reserves. Management of conservation areas requires considerable ecological expertise and monitoring to ensure that the desired objectives are being achieved.

While the principles outlined in this report may have some relevance to specific wildlife management projects, the purpose of this report is to identify opportunities for helping wildlife that would not otherwise have existed and to suggest some measures that may allow wildlife to benefit within land designated for other uses. Landscape design and management all too frequently 'design out' features that would be beneficial for wildlife; our aim is to seek ways of seeing these features are 'designed in' to landscaping schemes.

Considering wildlife in landscape design and management

There is no single prescription for gaining positive benefits for wildlife through landscape design and management. The skill of a designer, following ecological advice and applying certain principles, can provide many opportunities for wildlife that could easily be overlooked. The following identify areas for consideration :

Think 'wildlife':	❑	Consider that wildlife may be able to benefit from using the site
	❑	There are opportunities for wildlife in most design schemes
What do you want ?	❑	Decide what is sensible and appropriate for an area (perhaps seek ecological advice); what scope is there and what are the constraints ?
	❑	Detail of design and management will affect the possibilities for different species
	❑	Will the species or habitats 'recolonise' of their own accord - do you need to consider artificial re-introduction (translocation) ?
Design :	❑	Plan ahead : early consideration of possibilities gives the best chance for developing conservation opportunities
	❑	Design details : ecologists can often give good advice about the needs of wildlife, but designers / land managers are best placed to integrate these in to schemes, especially where the primary land use must not be compromised
Management :	❑	Subsequent management is as important as initial design
	❑	Identify management needs to maintain wildlife interest
	❑	Consider conflicts : the nature and timing of management operations can affect the wildlife on site
Monitoring :	❑	Check afterwards to see if your scheme is working
	❑	Consider possibilities for amending management schemes if appropriate

Why bother ?

There are many reasons why wildlife should be encouraged on a site and the significance of these will depend on an individuals outlook and perception. These include :

- People have moral obligations and duty of 'stewardship' towards wildlife
- Wildlife is enjoyed, gives pleasure and is aesthetically attractive
- Brings back contact between people and wildlife
- Creates a local identity through association with distinctive local wildlife
- Provides a good use of 'spare space'
- Cost : management of 'natural systems' can be cheaper
- Creates a concept of living in the countryside
- Offers scope for good publicity and a 'green image'
- Promotes environmental awareness
- Fulfils conservation policies and national / local Government objectives

Why amphibians and reptiles ?

The seminar and report has focused on amphibians and reptiles. In part this is to promote two groups of animals that are often neglected and that have suffered dramatic declines with major land use changes over the last fifty or so years. A further reason for selecting these is that they are particularly sensitive to landscape design and management. Being fairly small, they have limited capabilities for dispersal and they are quite likely to be lost from area if the habitat is destroyed or the management is wrong. They then will be slow to recolonise, if they return at all. However, they are also animals for which a lot can be done, often quite simply, to help them even in areas that are not primarily intended for nature conservation. They are also sufficiently large to be noticed and appeal to a wide range of people.

Amphibians and reptiles - the species and their ecology

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Introduction

- Amphibians and reptiles are two distinct groups of animals separated by a very long evolutionary history.
- They are often confused with each other, perhaps because the European species are of a comparable size or because some groups, such as the newts (amphibians) and lizards (reptiles) bear a superficial resemblance to each other.
- There are notable differences in the key features and ecological requirements of amphibians and reptiles. These are summarised here as the first two of a series of one-page fact sheets.
- The remaining 'fact sheets' give a brief résumé of each species of amphibian and reptile found in Britain with their specific needs. These are intended to be easy to copy for use by landscape designers and managers.
- Critical factors are presented as a checklist.
- While some species are widespread, others are rare or localised and the likelihood of encountering them will vary in different parts of the country.

Amphibians

Amphibians
- have two stages in their life cycle: a larva (or tadpole) which lives in water, followed by a terrestrial (land-based) immature/adult stage
- undergo metamorphosis (a change in body form from the larva to the immature stage)
- have a variable body temperature which depends largely on the temperature of their surroundings
- lay eggs which have jelly-like envelopes
- need to return to water to lay their eggs (or, occasionally, in damp places)
- have moist, glandular skin
- can breathe through their skin (gills are also used in the tadpole stage; lungs are used in the adults of most species)
- are often most active at night
- are represented by three main types: frogs and toads (tail-less amphibians), salamanders and newts (tailed amphibians), and caecilians (limbless , worm-like amphibians which live in the tropics). There are around 4,000 species worldwide.

Amphibians differ from reptiles by:
- having moist, unscaled skin
- laying jelly-covered eggs with no leathery shell
- often laying large numbers (hundreds or thousands) of eggs
- having a larval stage and undergoing metamorphosis
- needing to return to water (or damp places) to breed

Amphibian species in Britain

- Six species are native to Britain: **common frog** *Rana temporaria*, **common toad** *Bufo bufo*, **natterjack toad** *Bufo calamita*, **smooth** or **common newt** *Triturus vulgaris*, **palmate newt** *Triturus helveticus*, **great crested** or **warty newt** *Triturus cristatus*
- in addition, several foreign species are occasionally encountered (these are generally escaped or released animals), eg the **marsh frog** *Rana ridibunda*, **edible frog** *Rana esculenta*, **pool frog** *Rana lessonae*, **American bullfrog** *Rana catesbeiana*, **alpine newt** *Triturus alpestris*. ✳Note that there is now a suggestion that the pool frog may be a native British species.

Critical factors - amphibians require:

- **waterbodies for breeding - these can range from shallow, temporary pools to large lakes depending on the species. Running water is only occasionally used for breeding.**
- **damp and sheltered vegetated areas near breeding ponds for refuge, especially for young animals**
- **day-time refuges such as logs, rubble piles**
- **invertebrates for food (slugs, worms, spiders, flies, beetles etc)**
- **land habitat for feeding - typically, this will mean grassland, scrub or woodland of some kind**
- **suitably sheltered habitat to allow free movement between breeding, feeding and hibernating areas**
- **hibernation sites - a structure which will protect against frost, flooding and predators in the winter**

Reptiles

Reptiles
- lay eggs on land, or give birth to live young
- have eggs with a leathery shell
- have a variable body temperature which depends largely on the temperature of their surroundings and their behaviour
- have scaled skin
- live in a variety of freshwater, sea and land habitats
- may be diurnal (ie active during the day) or nocturnal (ie active at night)
- are represented by five main types: snakes, lizards, tuataras (lizard-like reptiles from New Zealand), turtles (terrapins, tortoises and marine turtles) and crocodilians (alligators, crocodiles and the gharial). There are around 6,500 species worldwide.

Reptiles differ from amphibians by:
- having scaled skin
- laying eggs with a shell (or giving birth to live young)
- generally producing small to medium numbers of offspring (main exceptions: some turtles and crocodilians, with up to around 100 eggs)
- having development from the egg to the adult body form (ie no larval stage or metamorphosis)
- breeding on land

Reptile species in Britain

- Six species are native to Britain: **common or viviparous lizard** *Lacerta vivpara*, **slow-worm** *Anguis fragilis*, **sand lizard** *Lacerta agilis*, **grass snake** *Natrix natrix*, **adder** *Vipera berus*, **smooth snake** *Coronella austriaca*
- in addition, several foreign species are occasionally encountered (these are generally escaped or released animals), eg **the red-eared terrapin** *Trachemys scripta elegans*, **wall lizard** *Podarcis muralis*.

Critical factors - reptiles require

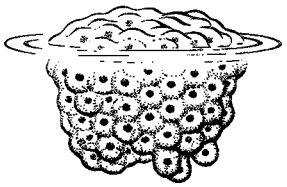
- **sheltered vegetated areas for refuge**
- **open areas for basking in the sun to raise body temperature**
- **night-time refuges such as logs, rubble piles, dense vegetation**
- **animals for food (depends on species; generally lizards eat invertebrates, snakes eat vertebrates)**
- **varied habitats for feeding - this will depend on the species' dietary needs but may include grassland, scrub, woodland, or ponds of some kind**
- **suitable habitat to allow free movement between breeding, feeding and hibernating areas**
- **day-time temperatures usually above 15° C for activity**
- **hibernation sites - a structure which will protect against frost, flooding and predators in the winter**

Common frog *Rana temporaria*

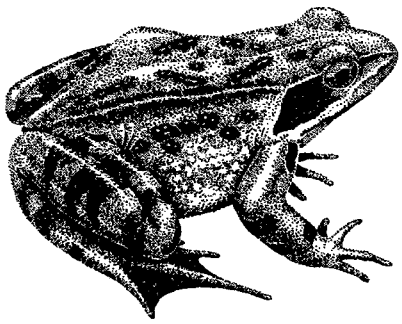
Description

The most familiar of our amphibians, the common frog can attain an adult length of up to around 10 cm. Frogs are very variable in their colouration and markings; most are greenish, brown, or grey, but yellow, orange and red frogs do occur. Unlike toads, there is a dark "mask" immediately behind the eye, and the skin is smooth and moist. Frogs are widespread across the UK and Ireland, are the commonest of our amphibians, having undergone increases in some areas, probably due to colonisation of new garden ponds. However they are probably declining in the wider countryside where pond loss continues.

Legal protection: sale and trade prohibited.



Frog spawn



Adult frog

Frog tadpole

[*not to scale*]

Life history

Frogs lay clumps of eggs in ponds in February-March. Tadpoles hatch out and feed on algae, progressing to a diet of plant and dead animal matter. The rear limbs develop first, and metamorphosis finishes when the tadpole possesses all four limbs, leaves the water and the tail is resorbed. The process of development from egg to froglet takes around 12 weeks. but depends very much on temperature. Males can reach maturity after two years, females after three, and often return to the same pond to breed. Adult frogs are carnivorous, feeding on almost any small invertebrate. Hibernation occurs from around November to February.

Critical factors - frogs require:

- **ponds for breeding - generally shallow ponds, possibly ones which dry up in summer. Spawn develops best in sunny shallows (no more than 30cm deep).**
- **no fish - spawn and tadpoles are eaten by fish, and frogs do better without them**
- **no waterfowl - spawn, tadpoles, and aquatic plants are eaten by waterfowl, and frogs do better without them**
- **aquatic vegetation and invertebrates to feed tadpoles**
- **easy exit from the pond for emerging froglets and adults (ie no steep sides)**
- **damp, vegetated areas around the margins for cover for emerging froglets**
- **areas of rough, preferably damp, grass for foraging and cover**
- **day-time refuges, such as logs, rocks and shrubby vegetation**
- **areas of woodland or similar habitat for hibernation**

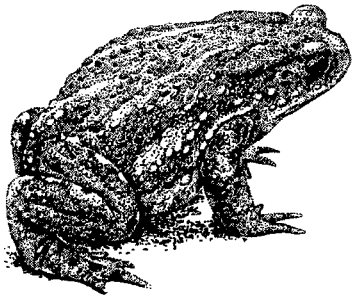
Common toad *Bufo bufo*

Description

The common toad can attain an adult length of up to around 13 cm (females) or 8 cm (males). Toads are more consistent than frogs in their colouration; they are generally brown but can be orange or almost black. The skin is warty, and there are two obvious glands on the top of the body just behind the eyes. The legs are relatively shorter than in frogs, and they walk or hop rather than leap. Toads are widespread across the UK (but absent from Ireland), but have showed declines in many areas due to the loss of breeding ponds and terrestrial habitats.

Legal protection: sale and trade prohibited.

Toad spawn



Common toad (adult)

Toad tadpole

[*not to scale*]

Life history

Toads lay strings of eggs in ponds in March-April. Toads favour larger, more permanent ponds or lakes than other amphibians, and their tadpoles are distasteful to fish. Tadpoles hatch out and feed on algae, progressing to a diet of plant and dead animal matter. The rear limbs develop first, and metamorphosis finishes when the tadpole possesses all four limbs, leaves the water and the tail is resorbed. The process of development from egg to toadlet takes around 12 weeks. but depends very much on temperature. Males generally reach maturity after three years, females after four, and usually return to the same pond to breed. Adult toads are carnivorous, feeding on almost any small invertebrate. Hibernation occurs from around late October to early March.

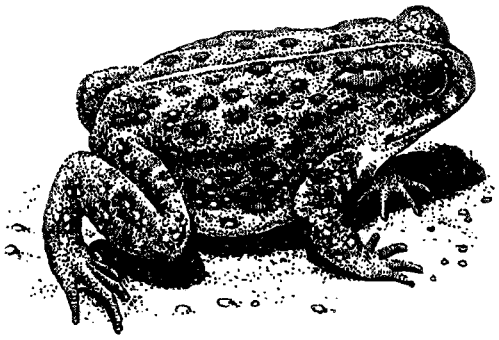
Critical factors - toads require:

- **ponds for breeding - generally large, deep, permanent ponds**
- **aquatic vegetation and invertebrates to feed tadpoles**
- **easy exit from the pond for emerging toadlets and adults (ie no steep sides)**
- **damp, vegetated areas around the margins for cover for emerging toadlets**
- **areas of rough grass for foraging and cover**
- **day-time refuges, such as logs, rocks and shrubby vegetation**
- **a lack of barriers to movement (eg roads), as they may move 2 km from hibernation sites to breeding pond**
- **areas of woodland or similar habitat for hibernation**

Natterjack toad *Bufo calamita*

Description

The natterjack toad can attain an adult length of up to around 7 cm; unlike the common toad, there is little difference in size between the sexes. Natterjacks toads are distinctively marked, with an olive green or greenish-brown background colour and a yellow stripe running down the back. The skin is warty, and the warts often have orange and black mottling. Unlike the other amphibians, natterjack toads are very specialised in their habitat needs, being found almost exclusively in sand dunes, salt marshes, and lowland heath. Partly because of these requirements, the natterjack is the UK's rarest amphibian, being found at only around 50 breeding sites.



Legal protection: 'fully protected' - killing, injuring and handling, disturbing, damage to habitat and sale prohibited. A European protected species.

Life history

Natterjacks have a late and drawn-out breeding season, generally lasting from April to June. Males have an extremely loud and unmistakable call. Spawn is generally laid in shallow, temporary pools with little vegetation. The process from spawn to toadlet is very rapid, taking 6-8 weeks on average (much shorter than for frogs or common toads). Natterjacks tend to take two years (males) or three years (females) to mature. Adult natterjacks are carnivorous, feeding on almost any small invertebrate. Hibernation occurs from around October to April.

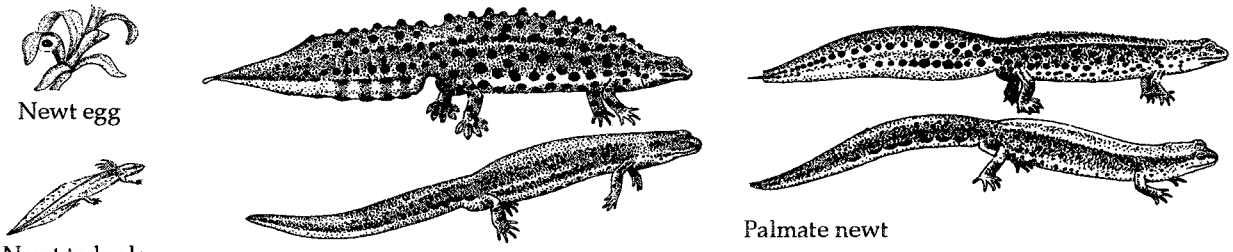
Critical factors - natterjack toads require:

- **ponds for breeding - generally shallow, little vegetated, unshaded pools which dry up in summer.**
- **a soil type which allows burrowing - usually sand**
- **open, sparsely vegetated land habitat (ideally with patches of bare ground) for foraging**
- **a lack of (or at least low numbers of) common frogs and common toads, the tadpoles of which can interfere with natterjack toad tadpole development.**
- **vegetated, ideally damp areas near the breeding pools for emerging toadlets**
- **hibernation areas - ideally in high, sandy banks which protect against flooding and winter frosts**

Smooth newt *Triturus vulgaris* and Palmate newt *Triturus helveticus*

Description

These species are similar in their appearance and ecology. Both reach a maximum adult size of around 10cm. Male smooth newts have a distinct wavy crest all the way down the back and tail; this along with their colouration becomes more pronounced in the breeding season. Male palmate newts have more of a ridge than a crest, and a distinct "thread" at the end of the tail. Female smooth and palmate newts are almost identical in colouration. Both species have widespread distributions, but palmate newts are more restricted in their habitat preferences, and occur more frequently in areas with acidic substrates. Palmate newts tend to be the more common species in the west of the country and on heathlands and boggy sites. Elsewhere smooth newts tend to be found more frequently. Both newts tend to occur in small to medium sized ponds, and have undergone declines in some areas of their range.



[*not to scale*]

Life history

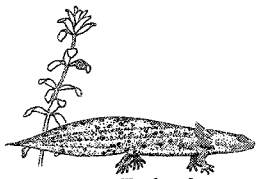
Both newts breed in the spring, from around February through to May or June. Males court the females with an elaborate dance. The females lay eggs individually on the leaves of aquatic plants. The eggs hatch out after around three weeks and the newt larvae take a further two months to transform into juveniles, at which point they leave the water. Unlike frogs and toads, newt larvae are entirely carnivorous (as are the adults), the front legs appear before the rear ones, and they have large, feathery gills. Adult newts only return to the water to breed. Hibernation occurs from around mid-October to mid-February; however, sometimes newts (including larvae) will remain in the water overwinter.

Critical factors - smooth and palmate newts require:

- ponds for breeding - generally shallow to medium depth, well vegetated, unshaded pools which may or may not dry up in summer.
- no fish - newt larvae are eaten by fish.
- no waterfowl - newt larvae and aquatic plants (and hence eggs) are eaten by waterfowl.
- submerged aquatic vegetation for egg-laying
- easy exit from the pond for emerging juveniles and adults (i.e. no steep sides)
- damp, vegetated areas around the margins for cover for emerging juveniles
- areas of rough grass for foraging and cover
- day-time refuges, such as logs, rocks and shrubby vegetation
- areas of woodland or similar habitat for hibernation

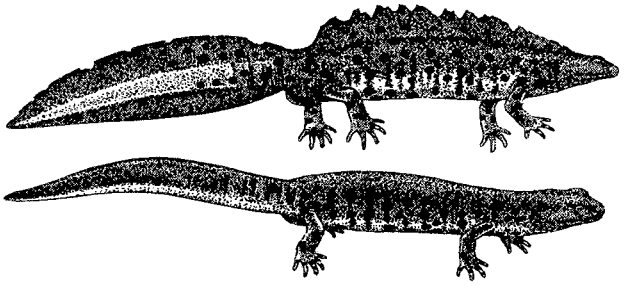
Great crested (or warty) newt *Triturus cristatus*

Description


Tadpole

Adults can reach a maximum length of around 16cm, and have a dark brown or black, warty appearance. Males have a high, jagged crest down the back, and another on the tail; this, along with their colouration, becomes more pronounced in the breeding season. Females lack the crest. Both sexes have a bright orange belly with black blotches. The great crested newt has a widespread distribution in lowland England, but is rarer in the south-west. It is less common in Wales (apart from the Flintshire area) and Scotland. The great crested newt has declined more than any of the other widespread amphibians in recent decades.

Legal protection: 'Fully protected' - killing, injuring and handling, disturbing, damage to habitat and sale prohibited. A European protected species.


[not to scale]

Life history

Great crested newts breed in the spring, from around March through to June. Males court the females with an elaborate dance. The females lay eggs individually on the leaves of aquatic plants. The eggs hatch out after around three weeks and the newt larvae take a further two months to transform into juveniles, at which point they leave the water. Unlike frogs and toads, newt larvae are entirely carnivorous (as are the adults), the front legs appear before the rear ones, and they have large, feathery gills. Adult newts only return to the water to breed. Hibernation occurs from around mid-October to mid-February; however, sometimes newts (including larvae) will remain in the water overwinter.

Critical factors - great crested newts require:

- ponds for breeding - generally medium depth, well vegetated, unshaded pools which may or may not dry up in summer.
- no fish - great crested newt larvae are particularly vulnerable to being eaten by fish.
- no waterfowl - newt larvae and aquatic plants (and hence eggs) are eaten by waterfowl.
- submerged aquatic vegetation for egg-laying
- invertebrates to feed larvae
- easy exit from the pond for emerging juveniles and adults (i.e. no steep sides)
- damp, vegetated areas around the margins for cover for emerging juveniles
- areas of rough grass for foraging and cover - may extend to 500m beyond pond
- day-time refuges, such as logs, rocks and shrubby vegetation
- areas of woodland or similar habitat for hibernation

Slow-worm *Anguis fragilis*

Description

Slow-worms are actually legless lizards. Adults generally grow to around 30cm total length, and usually have blunt tails. Unlike snakes, they have moveable eyelids. They are brown, coppery or grey in colour, and females have dark brown sides and often also a dark central stripe down the back. Young slow-worms of both sexes have the same pattern as adult females. Slow-worms live in many different habitats which provide sufficient cover, including open woodland, heathland, and even quite disturbed areas such as allotments and gardens. They are widely distributed across England, Scotland and Wales, but have declined in numbers in recent years.

Legal protection: Killing, injuring and sale prohibited.

Life history

Slow-worms are very secretive and are rarely seen basking in the open. They feed largely on soft-bodied invertebrates such as slugs. Like other reptiles, activity is very much dependent on temperature. Mating occurs in late spring and around 6-12 young are born live in late August and September. Hibernation occurs from around mid-October to mid-March.

Critical factors - slow-worms require:

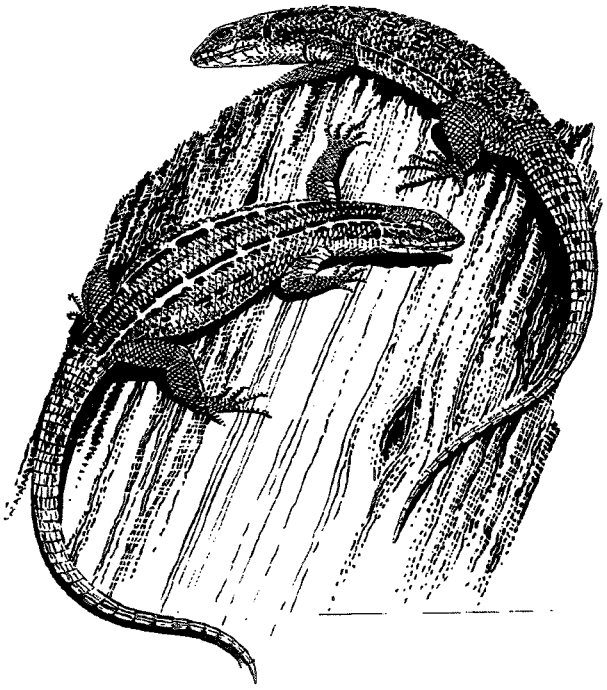
- well vegetated areas (eg rough grass, brambles) for cover
- areas with a sunny aspect to provide a warm enough environment for activity and basking
- in urban areas, protection from predators such as cats
- invertebrates for food; these will be encouraged by a good variety of vegetation types
- refuges, such as logs, rocks and shrubby vegetation
- well-drained, south-facing, banked areas for hibernation

Common (or viviparous) lizard *Lacerta vivipara*

Description

The common lizard is very variable in colouration, but generally has a brown, grey or greenish background colour, with a pattern of darker spots, flecks or stripes. Males have an orange belly flecked with black spots, while females mostly have a plain yellowish belly. Adults generally grow to around 12 cm long. The tail is long and slender and can be shed to confuse predators. Young are around 4cm at birth and are entirely black or dark brown. Common lizards live in open, sunny habitats such as heathland, downland, and moorland. They have a widespread distribution across Britain and Ireland but have declined in recent years.

Legal protection: killing, injuring and sale prohibited.



Life history

Common lizards spend much time basking in exposed locations such as on fallen tree trunks. They feed largely on small invertebrates such as spiders and beetles. Mating occurs in April and May, and 4-10 young are born live in late July and August. They are active in much lower temperatures than the other lizards, and still be found above ground in November in the south of England in some years. They generally hibernate from November to March

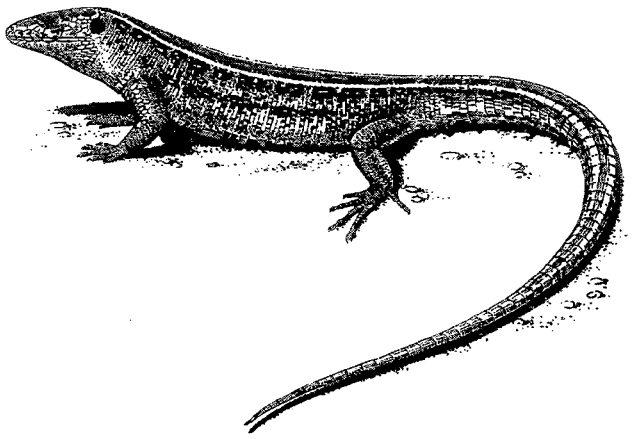
Critical factors - common lizards require:

- well vegetated areas (eg rough grass, brambles) for cover
- areas with a sunny aspect to provide a warm enough environment for activity
- features which are exposed to the sun for basking - eg log piles
- in urban areas, protection from predators such as cats
- invertebrates for food; these will be encouraged by a good variety of vegetation types
- refuges, such as logs, rocks and shrubby vegetation
- well-drained, south-facing, banked areas for hibernation

Sand lizard *Lacerta agilis*

Description

Male sand lizards have vivid green flanks, with a patterned brown back. Females are brown and have black spots with white centres. The young also have distinct spots. Adults can reach around 22cm in length. Sand lizards are very specialised in their habitat preferences, occurring only on lowland heath in parts of Dorset, Hampshire, West Sussex and Surrey, or on coastal sand dunes in Merseyside. In addition, some have been re-introduced to other areas in recent years, including Cornwall and North Wales. However, they remain a very rare animal and receive strict protection in law.



Legal protection: Fully protected - killing, injuring and handling, disturbing, damage to habitat and sale prohibited. A European protected species.

Life history

Sand lizards mate in late April through to June. The female lays eggs in holes which she digs in bare, unshaded sand or light soil patches in June. The eggs take around 10 weeks to hatch, but this depends very much on the temperature of incubation. Sand lizards feed largely on small invertebrates such as spiders and beetles. They have distinct preferences for certain areas containing favoured burrows, which they dig themselves, and live in small colonies. Hibernation occurs in the burrows.

Critical factors - sand lizards require:

- **heathland or sand dune habitat**
- **in heathland, large areas of mature heather**
- **variation in the topography (ie banks, gullies etc are better than flat ground)**
- **areas with a sunny aspect to create warm conditions for activity**
- **sand or light soil to allow burrowing**
- **patches of bare, unshaded sand for egg-laying**
- **well vegetated areas (eg gorse) for cover**
- **invertebrates for food; these will be encouraged by a good variety in vegetation structure**
- **well-drained, south-facing, banked sandy areas for hibernation burrows**

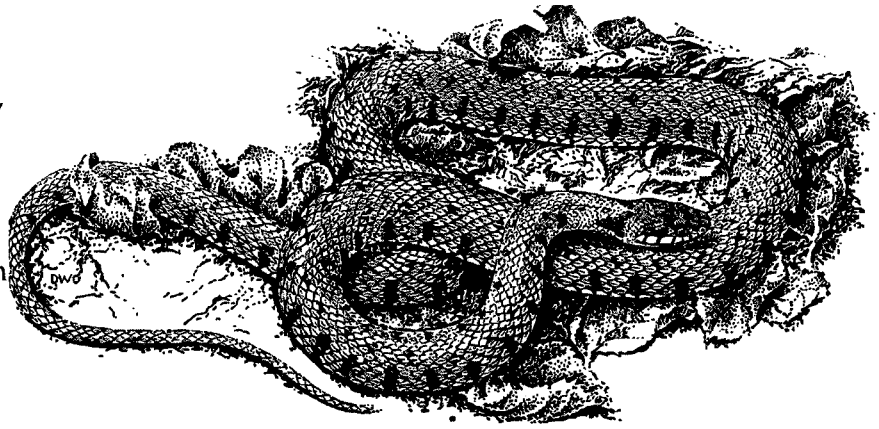
Grass snake *Natrix natrix*

Description

The largest British snake, adult grass snakes generally reach around 80cm. The overall colour is usually olive green, but can vary between vivid green and dark brown. There is a distinct yellow and black "collar", and vertical black bars down the flanks. The colouration of young snakes is the same as that of adults. Grass snakes tend to live in areas close to water (running or still), such as marshes, river valleys and around lakes, ponds or canals. They have a widespread distribution across Wales and central and southern England, but are rare in northern England and absent from Scotland. They have suffered declines in many parts of their range.

Legal protection: Killing, injuring and sale prohibited.

Life history



Grass snakes are very active, fast-moving snakes which may travel widely across large areas of habitat. They mate in April and May, and around 10-40 eggs are laid in late June - July in piles of decomposing vegetation. These hatch in late August-September. Grass snakes feed mostly on frogs, toads and newts, but may also occasionally take fish, small mammals and birds. They hibernate in high, dry areas such embankments, amongst tree roots etc, from October to March.

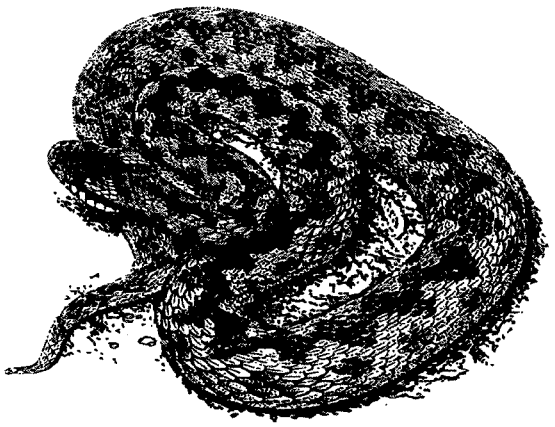
Critical factors - grass snakes require:

- ponds, lakes, streams or other water features which support amphibians
- variation in the topography (ie banks, gullies etc are better than flat ground)
- areas with a sunny aspect to create warm conditions for activity
- open areas with low vegetation to allow basking
- well vegetated areas (eg scrub, rough grass) for cover
- piles of rotting vegetation or similar for egg-laying, eg compost heaps, muck heaps, sawdust piles
- well-drained, south-facing, banked areas for hibernation

Adder (or northern viper) *Vipera berus*

Description

The adder reaches a maximum size of around 75cm, although it is unusual to find one above 60cm. Females are larger than males. There is a distinct pattern: a dark, continuous zig-zag running all the way down the back, with dark blotches on the flanks. Generally, in males, this pattern is black on a greyish background; in females the pattern is dark brown on a lighter, sandy or reddish brown background. Young animals usually resemble the adult females in colouration. The adder is venomous (although rarely dangerous to humans and bites are very uncommon). Adders prefer open, sunny habitats on light or sandy soils, such as heathland, moorland and chalk downland. They have a widespread but patchy distribution across mainland Britain and have declined over much of their range.



Legal protection: killing, injuring and sale prohibited.

Life history

Adders bask in open areas or half hidden amongst vegetation. They often occur in areas which offer a mixture of damp and dry habitats (eg a heathland bordering a valley bog). They feed largely on common lizards and small mammals. Mating occurs in April and early May, and 6-20 young are born live in August. Adders are active in lower temperatures than the other British snake species, and may emerge from hibernation as early as February in southern England.

Critical factors - adders require:

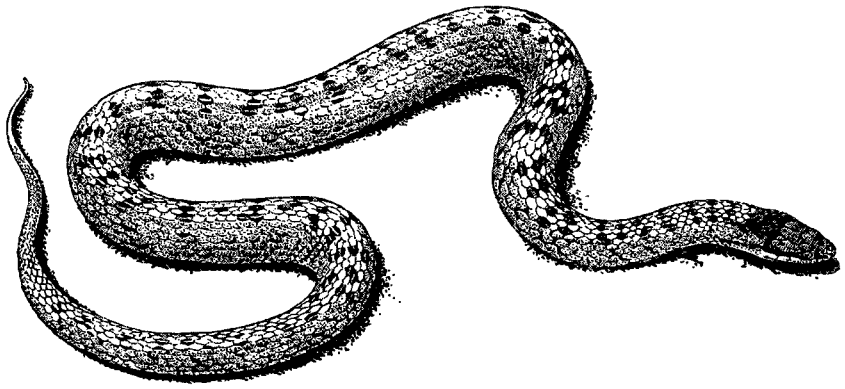
- **well vegetated areas (eg rough grass, brambles) for cover**
- **areas with a sunny aspect to provide a warm enough environment for activity**
- **open features which trap the sun for basking, eg gaps in long vegetation, rocky south-facing banks**
- **in suburban areas, protection from predators such as cats and from human interference**
- **lizards and mammals for food; these will be encouraged by a good variety of vegetation types**
- **refuges, such as logs, rocks and shrubby vegetation**
- **well-drained, south-facing, banked areas for hibernation**

Smooth snake *Coronella austriaca*

Description

Smooth snakes reach a maximum length of around 70cm but are generally up to 55cm. They are slender, with smooth scales. The overall colour is grey or greyish brown, with a double row of dark blotches running down the back. The smooth snake occurs almost exclusively on lowland dry heathland in Dorset, Hampshire, Surrey and West Sussex. Numbers have declined greatly this century.

Legal protection: 'Fully protected' - killing, injuring and handling, disturbing, damage to habitat and sale prohibited. A European protected species.



Life history

Smooth snakes are secretive and rarely bask in the open, preferring to hide amongst vegetation such as heather bushes. They feed mainly on other reptiles and small mammals. Around 4-15 young are born live in late summer. Smooth snakes seem to prefer higher temperatures than the other British snakes, and may not emerge from hibernation until well into April.

Critical factors - smooth snakes require:

- areas with a sunny aspect to provide a warm enough environment for activity
- well vegetated areas (eg gorse, mature heather) for cover
- open features which trap the sun for basking, eg gaps in long vegetation, rocky south-facing banks
- variation in the topography (ie banks, gullies etc are better than flat ground)
- reptiles and mammals for food; these will be encouraged by a good variety of vegetation types
- refuges, such as logs, rocks and shrubby vegetation
- well-drained, south-facing, banked areas for hibernation

Ecological concepts

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Discussion of the problems faced by reptiles and amphibians usually refers to the 'population' as a convenient unit, this may refer to a group of individual animals that use a particular place, or the whole national stock of a species.

The idea of 'Metapopulation' reflects the dynamic nature of many animal populations and includes the following factors:

- **Colonisation**: A new area of habitat is colonised by reptiles or amphibians spreading out from an established breeding site nearby.

- **Establishment**: The new arrivals breed and increase in numbers to the **carrying capacity** of the site (ie the maximum numbers the site is able to sustain in terms of available food, cover, hibernation, sites etc).

- **Extinction**: At the local level extinction might occur due to sheer bad luck - a harsh winter, accidental grass fire, a series of unfavourable summers, or an isolated pollution incident.

- **Recolonisation**: The process starts again with new individuals from a nearby site.

  Probably this is the manner in which most metapopulations operate over long or short timescales. But the process only continues to operate if there are surviving groups of animals which can colonise and recolonise breeding sites.

  For instance, amphibians may persist as breeding populations around a single pond for decades but, inevitably, accidents happen which result in local extinction. This is not a problem if there is another colony nearby which can recolonise the old site. But what if the next colony is 5 kilometres away, or 100 metres away but cut off by a motorway? **It is necessary for there to be corridors of suitable habitat linking one breeding site to the next, so that the dynamic ebb and flow of the metapopulation can operate.**

- Habitat fragmentation

  A small colony without **habitat corridors** is **isolated** and is in the long term doomed to extinction, unless it can be connected to others. **Habitat fragmentation** is widely recognised as a major problem for small animals which are **poor dispersers** - they do not readily move across unsuitable habitat.

  Most habitat fragmentation is due to human activity, by removal or interruption of habitat corridors or dispersal routes. The recent upsurge of interest in **toad crossings** is a classic example of this, where the animals are following age-old migration routes which now cross new, or busier, roads. Often, habitat fragmentation is more subtle, and might involve factors such as over-zealous 'tidying-up' of rough areas in urban parks, a change in storm water drainage as part of a development scheme, leading to wetlands drying out. Sometimes development acknowledges the need to retain wetlands for amphibians without taking account of the need for terrestrial habitat within easy reach of the pond.

How does this fit with current ideas of habitat loss? In fact, habitat fragmentation, when viewed from the metapopulation perspective, is probably a mores insidious threat than obvious habitat destruction. In the short-term, hastily applied conservation measures to stabilise populations around good, but isolated breeding sites may only be stop-gap measures. It may be that we now have numbers of sites for these species which look reasonably safe in 1996, but half may have disappeared due to chance by 2025.

Translocation: Artificial movement of animals between sites can circumvent the problems discussed above. In spite of the fact that multiple unrecorded translocations have already occurred via small children with jam jars, this is an approach to be pursued with caution. Translocation refers to any movement of animals (or plants) from one place to another. This includes activities that release animals into a site - termed **introduction** or **re-introduction** (depending on whether the animals were previously found at the site). The translocation of the great crested newt, natterjack toad, sand lizard and smooth snake is strictly controlled by the licences issued through the Wildlife and Countryside Act 1981 and Conservation (Natural Habitats, etc) Regulations 1994.

The deliberate translocation of animals or plants is somewhat controversial. Many biologists oppose this on the grounds that it is unnatural. However, given certain guidelines it is a useful technique that is often successful. Suitable criteria for the assessment of a species' suitability for (re)introduction have been produced by International Union for the Conservation of Nature (IUCN). They are:

1. Good historical evidence that the species occurred in the area in the past.
2. Clear understanding of the original reasons for local extinction.
3. Cause of previous extinction no longer operates, or can be removed.
4. Unlikely to recolonise naturally.
5. Reintroduction stock should come from the closest population available to the original stock.
6. Sufficient animals must be introduced to minimise any future risk of inbreeding in the new population.
7. The donor population must be sufficiently large to safely sustain the loss of the animals removed for translocation.

Best practice for maintenance of vigorous metapopulations

For amphibians

1. More ponds, **fish free**, and ideally, drying out occasionally, perhaps one year in five.
2. **Clusters** of ponds with connecting habitat corridors. Suitable corridors are hedges or scrub, rough grassland, woodland, but also suburban habitats such as parks (ideally not too closely mown) and back gardens.

For reptiles

1. More rough grassland, 'heathland', patchy scrub and woodland edge type habitats. These species need to bask in the sun so provide **unshaded, open ground with adjacent thick** cover, ie mosaic of different vegetation heights - not total tree cover or total short grass.

2. Reptiles often have more specific habitat requirements than most amphibians so it can be difficult to provide habitat corridors. However, they do colonise a range of habitat types, eg railway lines (especially with embankments) and the fringes of thick hedges. Slow-worms often do very well in suburban back gardens, and grass snakes will use compost heaps/manure heaps for egg laying, often having been attracted to gardens by abundant common frogs breeding in the garden pond.

The key role of the planning system in nature conservation

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Introduction

- The land use planning process has a key role to play in protecting wildlife and in promoting the positive management and creation of wildlife habitats.

- Planning decisions at the local level are made within a framework of national policy which is itself of course influenced by international policy (Figure 1).

National policy guidance

Before looking at the planning system in detail it is useful for us to look at some important aspects of national policy guidance.

- **Sustainable development** - at the Rio Earth Summit in 1992, the UK Government was a signatory of the global Agenda 21 commitment. A key feature of Agenda 21 is the need to achieve 'sustainable development'. In PPG1 issued by the UK Government it states that 'the sum total of decisions in the planning field, as elsewhere, should not deny future generations the best of today's environment'.

- This in practical terms means protecting those features of the environment that are irreplaceable - once lost they are gone forever. This is termed *critical natural capital.* It also requires the maintenance of the overall stock of natural assets - the *constant natural assets* (woodlands as an example).

- **Biodiversity** - the UK Government was also a signatory to the Convention on Biodiversity, the maintenance of the earth's total genetic resources. It is a concept which is fundamentally linked to sustainable development, as recognised in PPG9 (published by the Government in 1994). It states that, 'the components of diversity should be used *sustainably*: that is, in a way and at a rate which does not lead to their long-term decline and which maintains their potential to meet the needs of present and future generations'.

- The UK Biodiversity Steering Group published its report *Meeting the Rio Challenge* in December 1995. It sets out detailed action plans for all of Britain's most rare and vulnerable species, including three species of reptile and amphibian (sand lizard, great crested newt and natterjack toad). Many of the action points relate to the planning system and include the requirement that local authorities should identify the known sites of such species in their local plans. But further, many action plans seek to 'encourage the natural dispersal of the species to new sites through habitat management and re-creation'.

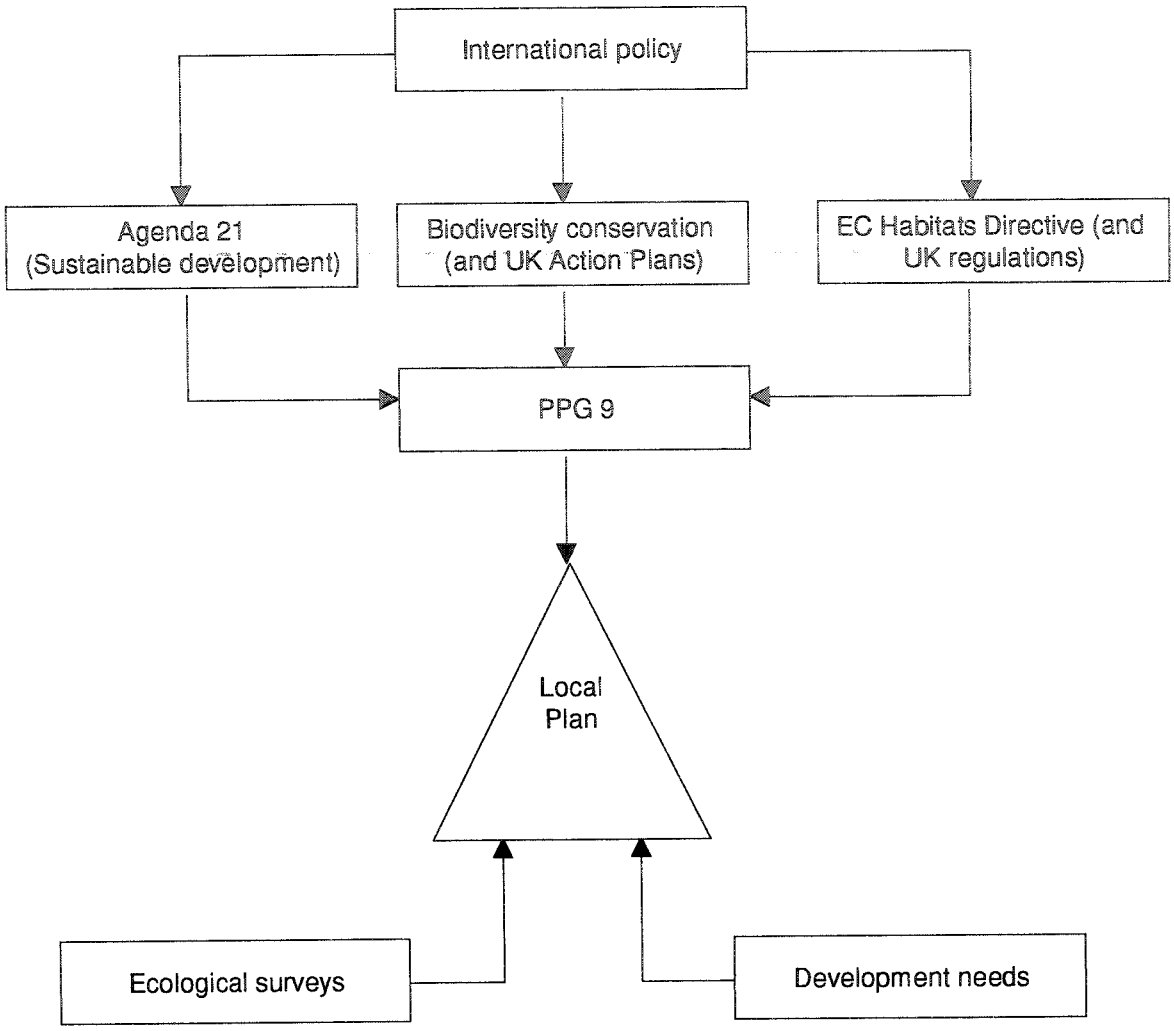

Figure 1. Local plan influences

- **Planning Policy Guidance Note 9 (PPG9)** - this important and highly significant piece of Government guidance is based on the need to achieve sustainable development and to maintain Biodiversity in the UK. PPG 9 is also based heavily on the obligations arising out of the EC Habitats Directive. It interprets and amplifies all these international obligations for the benefit of all those involved in the planning process and like all PPGs its guidance must be followed and therefore reflected in local decision-making.

  Some key features of PPG 9 are:

  - a requirement to protect all sites of national and international wildlife importance (SSSIs/NNRs/SACs/SPAs/Ramsar sites etc);

- a requirement to identify and seek to protect locally important sites (SINCs). In this respect the PPG points out that 'our national wildlife heritage is not confined to the various statutory designated sites, but is found throughout the countryside and in many urban and coastal areas';

- a recommendation (paragraph 16) to protect and manage linear habitat features and 'stepping stone' features such as rivers, hedges, ponds and woods to help resist the fragmentation and isolation of habitats and species;

- a requirement (paragraph 24) that 'nature conservation issues should be included in the surveys of local authority areas required by Sections 11 and 30 of the Town and Country Planning Act 1990 to ensure that plans are based on fully adequate information about local species, habitats, geology and land-forms'.

- a requirement (paragraph 26) that local authorities should take account of nature conservation considerations in assessing sites for any development proposals in the plan';

- a requirement (paragraph 23) that 'local plans shall include policies encouraging the management of features of the landscape which are of major importance for wild flora and fauna';

- a recommendation (paragraph 28) that 'the planning authority should consider the use of conditions of planning obligations in the interests of nature conservation'. It goes on to say that 'planning obligations can accompany permissions in order to secure long-term management, to provide funds for management, or to provide nature conservation features to compensate for any such features lost when development takes place'.

Policy at the local level

Now let us see how these broad policies can be translated into policy and action at the local level. The planning system can be viewed as having three separate but overlapping processes: plan making, development control and implementation.

1. **Plan making** - strategic planning process, setting the policy framework. Take the form of structure, district, unitary and minerals and waste plans.

   It is possible to identify a number of fundamental characteristics that a plan should have in order that it satisfies the requirements of PPG 9:

   - it should be based upon **adequate survey information** so that the nature conservation resource of the area can be quantified and the relative importance of different sites evaluated;

   - it should identify and **give adequate protection** for the most important sites and features (critical natural capital);

   - it should seek to **minimise fragmentation** of natural assets to maintain linkages and seek to provide opportunities for wildlife in those areas where there are identified gaps or deficiencies;

- ❑ it should seek to **maintain and extend the total stock of other natural assets** in the area (constant natural capital) including seeking compensation for losses;

- ❑ it should require **all development to be designed and implemented in a sustainable way** so that nature conservation is always a fundamental consideration;

- ❑ it should seek to **secure the appropriate management of important sites and features** and other natural assets;

2. **Development control** - the day-to-day process whereby broad policies are applied in respect of individual development proposals)a typical assessment process is illustrated in Figure 2).

The development control function and the quality of proposals submitted can be considerably improved through two main means:

- **Supplementary Planning Guidance** - this usually takes the form of planning, development or design briefs or strategies. These amplify and translate broad policy in relation to specific locations or topics and assist developers in formulating better quality proposals, with a greater chance of being approved.

- **Planning Conditions and Agreements** - these are used to secure a satisfactory form of development. Conditions specify matters of detail, eg 'existing trees on road frontage to be retained'. Legal agreements are needed to secure certain agreed matters, eg land transfer, or financial provisions. Government guidance indicates that such agreements and their requirements must be reasonable and not onerous upon the developer and must be related to the development site. However, developers are able to enter into 'unilateral undertakings' as well which do not have to be related to the site.

3. **Implementation** - the process whereby certain action policies - usually relating to environment and infra-structure are put into action by the local authority alone or more usually in partnership with others.

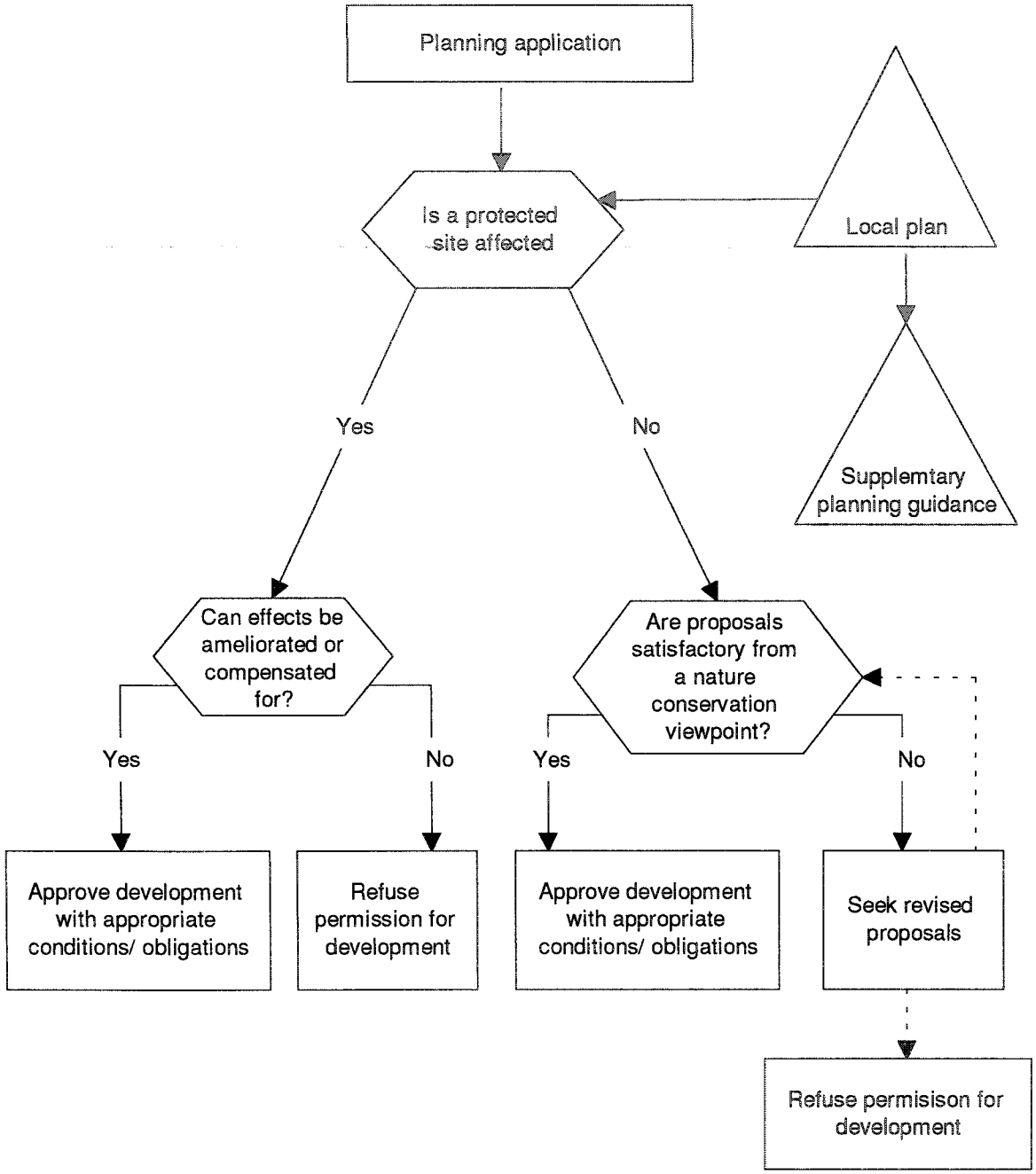

Figure 2. Simplified development control process

Design opportunities: overview

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1. Introduction

Wildlife conservation is increasingly focusing on the wider environment, and on our immediate surroundings as viable wildlife habitats. Consequently the decisions made when designing and managing the external environment strongly influence a site's potential for wildlife. Reptiles and amphibians are good examples of animals which respond to modest changes in landscape design.

Many landscape schemes fall short of achieving this potential. The key reasons for this are:

- Failure to consider a scheme's potential beyond meeting its primary objectives.
- Insufficient consideration of ecology in early assessments.
- Designing wildlife habitats into plans too late in the design process.
- Not having an adequate understanding of basic ecological principles or the needs of species or their habitats.
- Failing to maintain habitats after construction.

It is impossible here to be prescriptive or identify design solutions appropriate to all situations. Instead this chapter recommends a process for closer integration of wildlife opportunities in landscape design schemes and their subsequent management. The following two chapters will consider the design strategies, design and maintenance and management plans for amphibians (Bray, this volume: *Design opportunities: amphibians*) and reptiles (Foxford, this volume: *Design opportunities: reptiles*).

2. Scope for developing opportunities on a site

Within landscape design and management there is a need for greater consideration for the scope for wildlife enhancement. This can be done through more reasoned analysis of what is desirable, technically feasible and through the development of a design strategy. Many factors exist which should be used to promote this approach.

- Planning requirement - determine if the planning process can help proposals and if there are existing conservation measures in place. 'Wildlife gain' may be a planning requirement. Understand planning and development opportunities - exploit the existing planning system to implement proposals (see Lomax, this volume: *The key role of the planning system in nature conservation*).

- **'Political benefits'** is wildlife enhancement of local 'political' significance; does it meet conservation objectives (such as Biodiversity Action Plans) or help achieve the client's/land manager's policy objectives?

- Local or national **Biodiversity Action Plans** may exist for amphibians and reptiles and their habitats. These may provide a useful source of guidance.

- **Environment requirement** - assess the existing condition of the site and what will be required to enhance it. How practical is it to do?

- **Personal initiative** - enlist the expertise of interested individuals to advise, monitor and help.

- **Physical conditions of the site and its surroundings and proposed end use** - determine existing site conditions and develop sites so they maximise opportunities.

3. Design process

Illustrations by way of example to show how opportunities can be designed into landscape schemes are given in Figures 1 and 2 for a highway landscape and Figures 3 and 4 for a games space/recreation area. The paired figures demonstrate how different approaches can be either sympathetic or unsympathetic towards amphibian and reptile conservation.

The stages in a design should:

1. Analyse the site

    - consider the species or animal assemblages likely to be found on site, or that are appropriate to the area; some species are geographically localised;

    - consider what animals could exist in the area if conditions were favourable;

    - obtain specialist advice to see what is acceptable and what is feasible.

2. Develop a **design strategy** for the site to identify general principles and design opportunities based on the general requirements of the target animal group (see section 2 in each of the following two chapters).

3. Provide **detailed design** options for critical factors affecting the target animal species (see section 3 in each of the following two chapters).

4. Create a **maintenance and/or management plan** for long term sustainable population survival (see section 4 in each of the following two chapters).

5. Include a **monitoring plan** to ensure the objectives are being met and to allow changes to design or management/maintenance proposals if needed (see section 4 below, this chapter and section 5 in each of the following two chapters).

4. Monitoring success and revising plans

Although a unusual in normal landscape schemes, monitoring should be an important part of the design model for wildlife. A survey and monitoring plan should be sufficient to assess whether the objectives of the project are being met. Such plans could include any, or all, of the following:

- identifying the presence or the distribution of a species on site;
- seeing how numbers are changing on site;
- checking that the populations are breeding and showing signs of being self sustaining;
- making sure that the management programme is working.

Different survey techniques may be appropriate for different species and for different objectives. Monitoring may require detailed study of the species on sites, perhaps providing a numeric estimate (or a relative estimate for comparison between years), or may be based on an assessment of the condition of the habitats. This needs to be borne in mind when developing a monitoring strategy. It is also worth considering who may be available for undertaking such survey/monitoring work and making sure that any records are forwarded to an appropriate records centre or recording scheme. Further ideas on monitoring and survey are given in Appendix 4 to this report.

Management and maintenance plans should also allow sufficient flexibility to respond to the findings of the monitoring exercise. This way plans can be fine-tuned to ensure that the most appropriate management is being carried out for the target species.

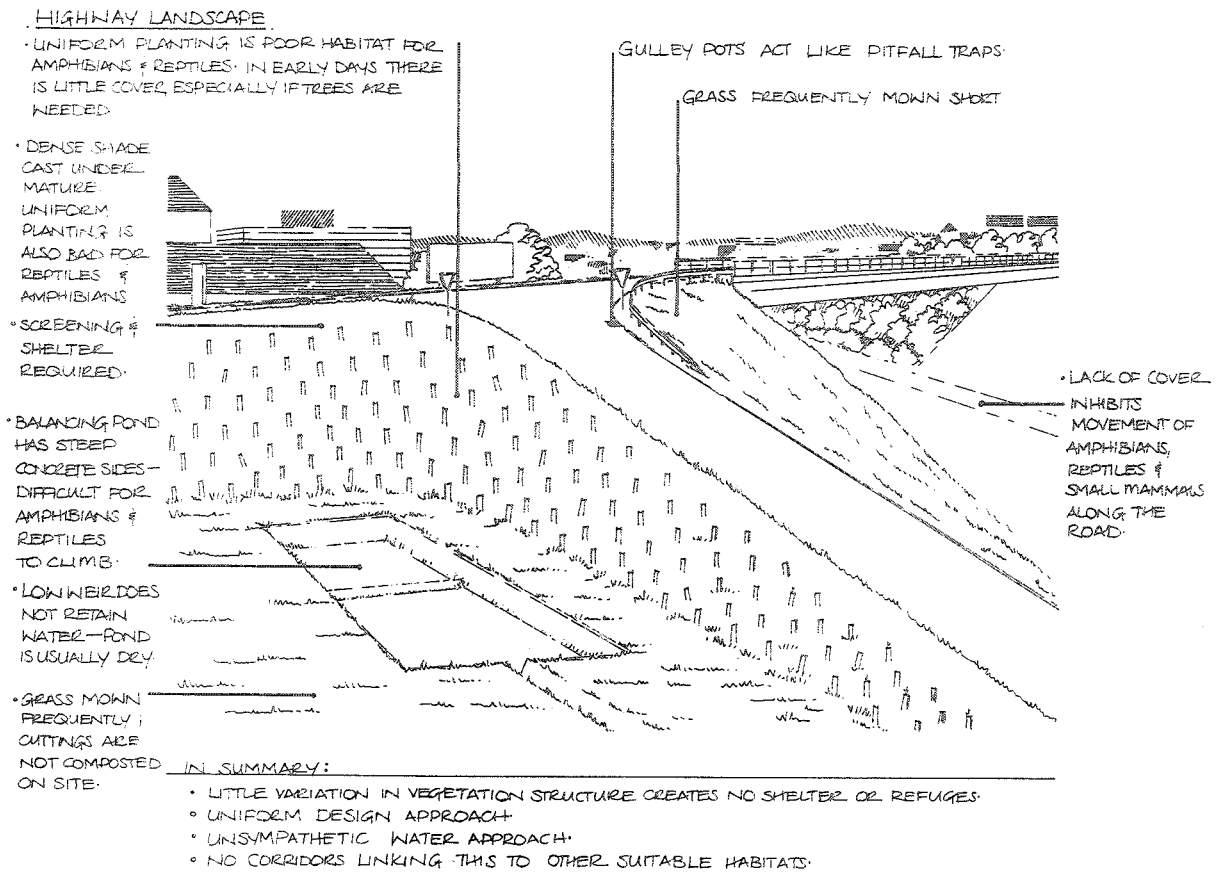

Figure 1. Indicative illustration - highway landscape: design with features unsympathetic to amphibian and reptile conservation

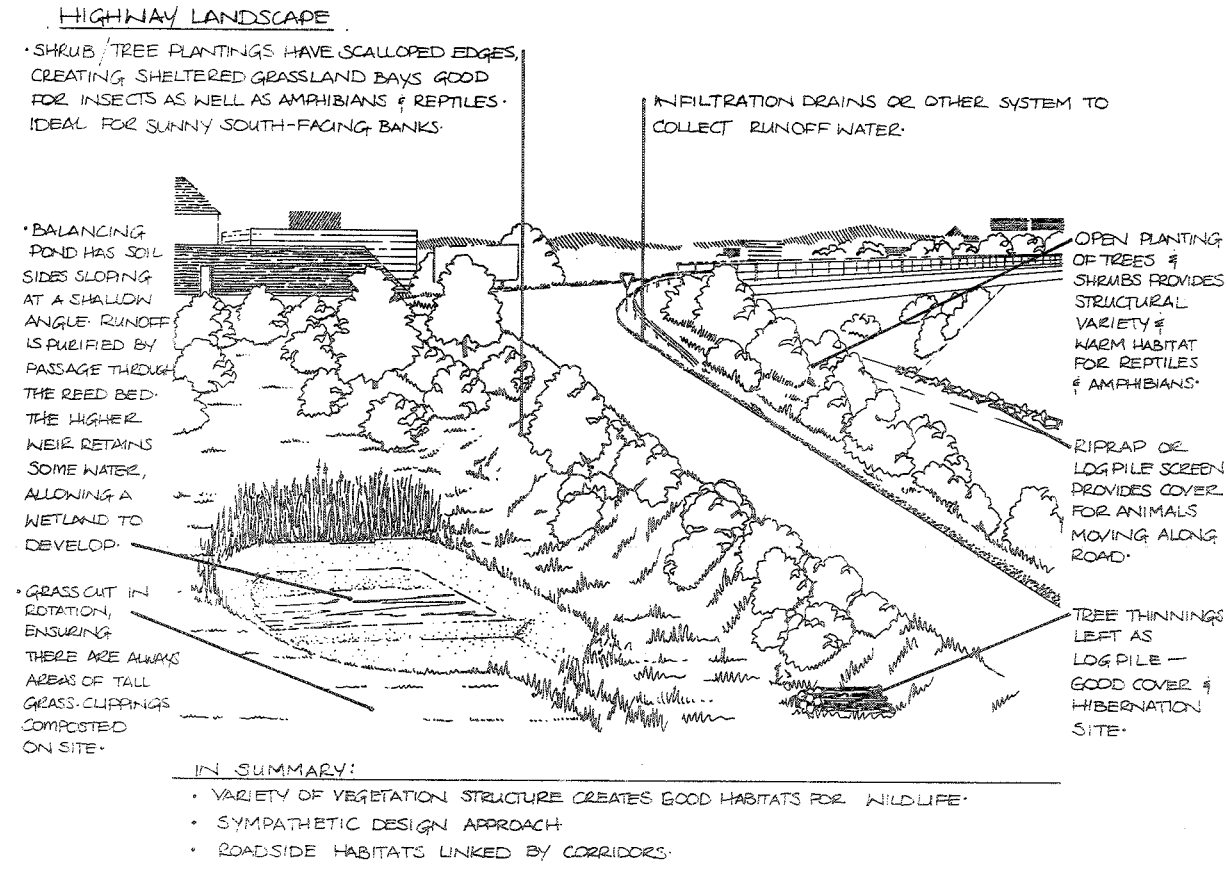

Figure 2. Indicative illustration - highway landscape: design with features sympathetic to amphibian and reptile conservation

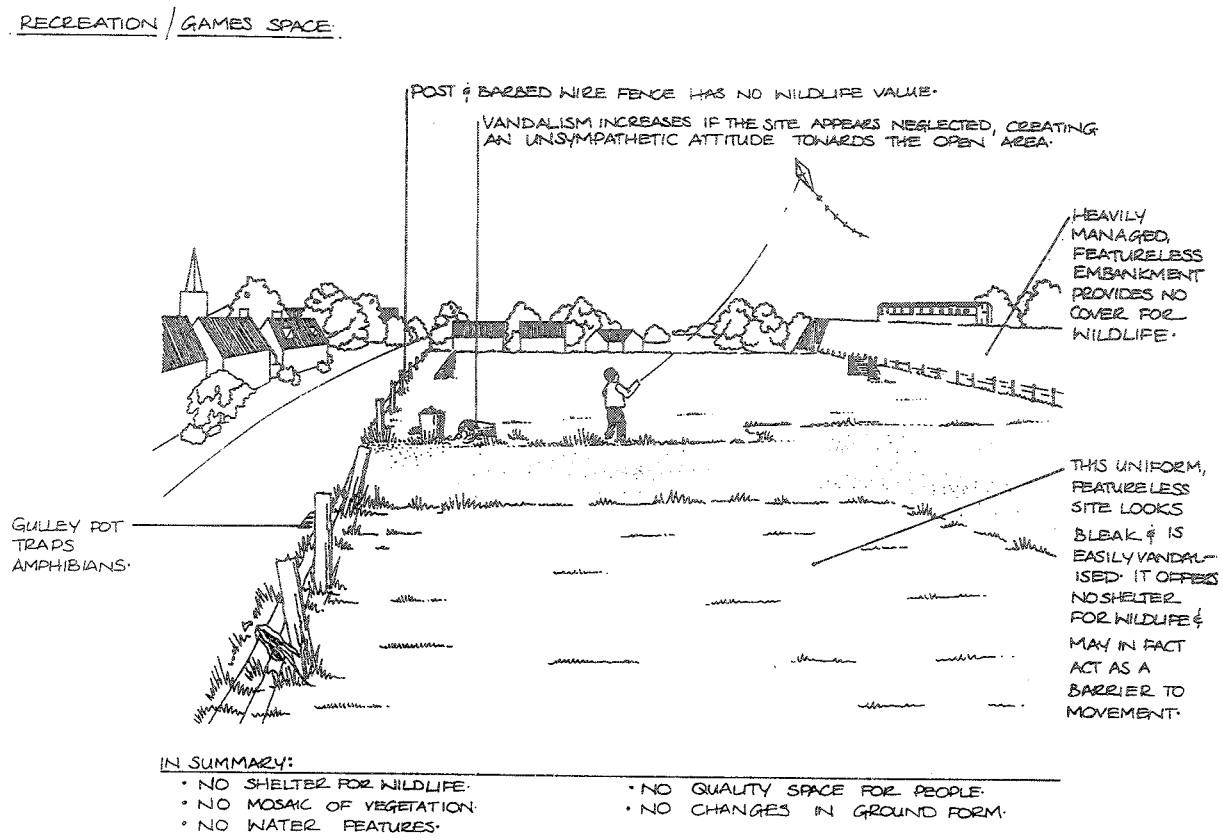

Figure 3. Indication illustration - recreation/games space: design with features unsympathetic to amphibian and reptile conservation

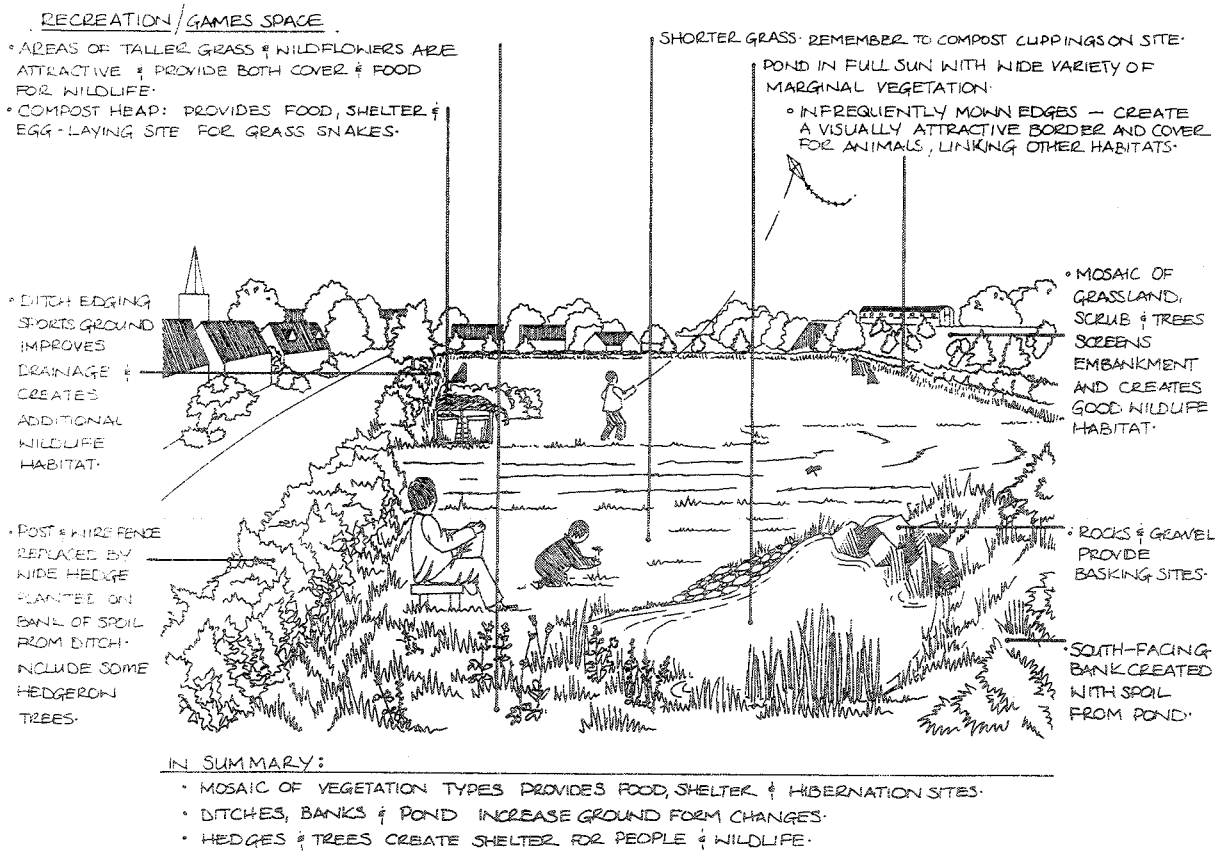

Figure 4. Indicative illustration - recreation/games space: design with feastures sympathetic to reptile and amphibian conservation

Design opportunities: amphibians

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1. Introduction

A general overview for developing opportunities for amphibians and reptiles is given in Bray and Foxford (this volume: *Design opportunities: overview*). It is proposed that a design model should involve the following stages:

- Design strategy: defining principles and identifying opportunities.
- Detailed design.
- Maintenance and management plan.
- Monitoring and revision.

This chapter provides further details about these stages when designing landscapes with amphibians in mind.

2. Design strategies: defining principles and identifying opportunities

The basis of a design proposal should include an analysis of the principles and an identification of the objectives. This in turn identifies the design stages needed.

2.1 *Design principles* (see Foster, this volume: *Amphibians and reptiles - the species and their ecology*)

- **All open space** is potentially suitable for amphibians.
- **Importance of ponds for breeding.**
- Importance **of mosaic of different types of vegetation and topography** when amphibians are out of the water.
- **Importance of connections (and lack of barriers) between breeding sites and 'terrestrial sites'**: animals need to be able to move between all areas that are important for them.

2.2 *General design opportunities*

- **Create a mosaic of vegetation** with cover for feeding, shelter and hibernation.
- **Consider all gardens, shrubberies and ornamental planting** as potential habitat.
- **Consider landscape screen and shelter planting** as potential habitat.
- Consider margins of public open space, parks and fields as potential habitat.

- **Consider path verges**, cycle-ways, roads and railways as connecting habitat.
- **Use ditches and balancing ponds to drain open spaces** instead of conventional drainage and gully pots which trap amphibians, especially when used in conjunction with high kerbs.
- Where traditional drainage systems are unavoidable **site gully pots away from migration routes and use low kerbs** or other mitigation techniques in sensitive areas.
- **Use constructed wetland and 'reedbeds'** to clean drainage water as recommended by the Environment Agency as part of Source Control techniques for managing surface water runoff.
- **Use water features wherever possible** for incidental use by amphibians.
- **Use open retaining structures** such as dry stone walls, earth banks or gabions instead of mass concrete or brick to provide refuges and hibernation sites.
- **Use maintenance** to create amphibian friendly habitat by retaining cover, creating log piles, (generally) avoiding chemical sprays and timing operations to minimise impacts on animals.
- **Use interpretive signs** to inform public and justify actions.
- **Consider the negative effects of design** on wildlife, eg gully pots that trap amphibians, roads that act as barriers to movement, destructive maintenance operations.

2.3 *Strategy statements*

Set out below (Boxes 1, 2 and 3) are examples of Strategy statements, identifying the design stages that need to be followed, for three projects where conservation of the great crested newt has been undertaken.

Box 1. British Coal Opencast - restoration plan

Brief: To create off-site refuge for a great crested newt population and provide proposals for recolonisation of site following restoration.

Principles and opportunities

- Large site with proposed landscape features and large scale habitat re-creation
- Scope for incorporating ponds in design: amphibian breeding habitats
- Scope for terrestrial habitat and habitat linkage
- After use could be consistent with amphibian needs
- Legislative requirement to consider protected amphibians
- Planning need to address nature conservation

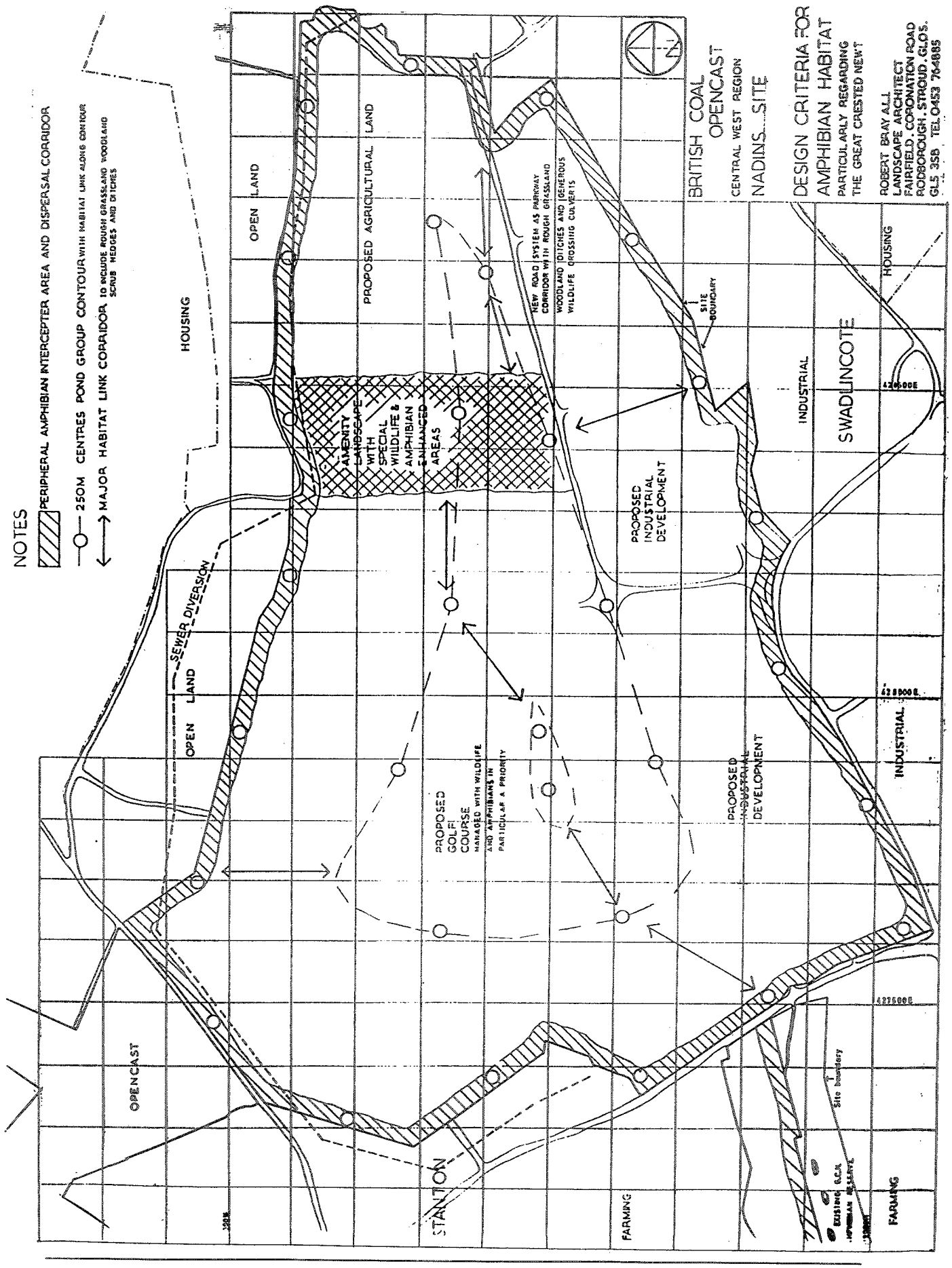
Strategy ***See Plan 1***

- Find out what is currently on the site and monitor existing population
- Create off-site refuge areas to hold animals during mining.
- Translocate adults or tadpoles to the 'holding areas' and away from the mining areas
- Create great crested newt habitats on restored land
- Design corridors and linkage to allow dispersal and colonisation
- Ensure long term management for newts on site
- Incorporate monitoring to ensure all the above stages are achieving objectives

Design stages

- Design off-site refuge areas
- Design translocation programme
- Management plan for refuge areas
- Design habitat corridor access to restored land
- Site restoration: design landscape structure to accommodate great crested newt looking at:
  - ❑ breeding sites
  - ❑ terrestrial habitat
  - ❑ site management needs
- Management plan for restored areas
- Monitoring programme for site and scope for change to management

Plan 1: Design criteria for amphibian habitat: Nadins opencast coal site



Box 2. Royal Botanic Gardens Kew

Brief: To manage an ornamental landscape to encourage amphibians and introduce a great crested newt population

Principles and opportunities

- Extensive botanic gardens with existing habitats and programme of site management
- Scope for incorporating amphibian habitats into long term plans
- Site use is consistent with management for amphibian needs
- It would be appropriate to introduce nature conservation into management objectives of such an establishment

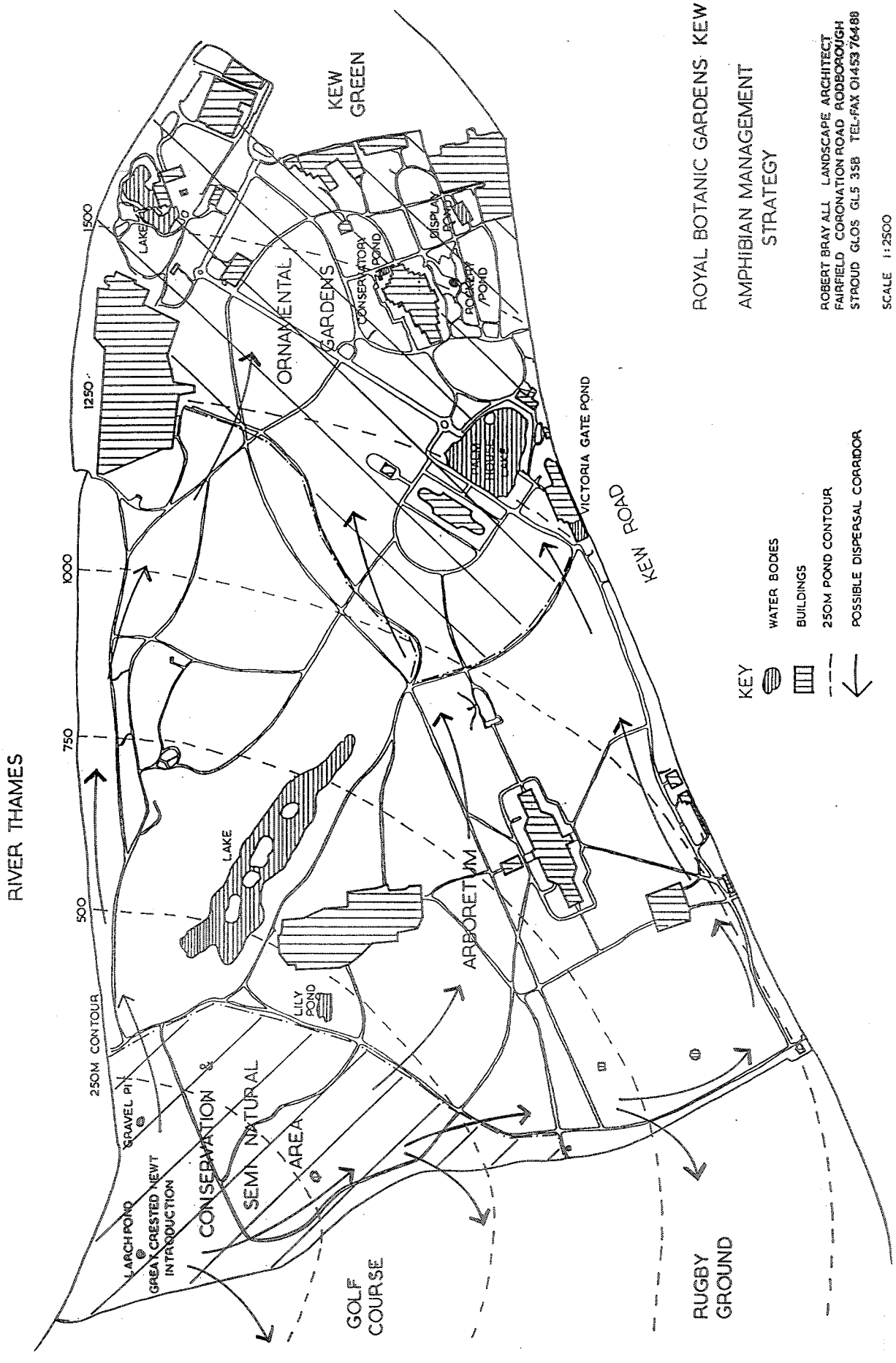
Strategy *See Plan 2*

- Identify the existing amphibians and reptiles in the gardens
- The scheme would be based on an existing nature area
- The project would use the fact that suitable aquatic and terrestrial habitats can be incorporated within the current use of the gardens and could use existing features
- Provide a connected network of ponds within a reasonable distance for colonisation of each other (250 m to the next nearest pond) throughout the gardens
- Habitat patches and corridors would allow the movement of amphibians between ponds and enable animals to survive in areas within the gardens
- Consider scope for natural colonisation or need for introduction
- Correct management of different areas is essential
- Incorporate monitoring to ensure all the above stages are achieving objectives

Design stages

- Survey site
- Prepare project proposal based on 250 m 'contours' from nature area
- Prepare detailed design requirements for habitats looking at:
  - ❑ breeding sites
  - ❑ terrestrial habitat
  - ❑ connectivity of areas by 'green corridors'
  - ❑ site management needs
- Develop management scheme
- Devise a monitoring programme

Plan 2: Proposed amphibian management strategy: Royal Botanic Gardens, Kew



Box 3. Walton Cardiff Tewkesbury for Gloucestershire Wildlife Trust

Brief: To conserve a great crested newt population following change of land use

Principles and opportunities

- Large scale development proposals in area of existing habitats
- Planning requirement to address nature conservation in development plan
- Design of 'green space' on a large scale
- Scope for habitat re-creation and habitat linkage in landscape design plan
- After use could be consistent with amphibian needs
- Legislative requirement to consider protected amphibians
- Compliments Local 'Biodiversity Action Plan' objectives

Strategy *See Plan 3*

- Find out what is there and where it is
- Identify habitat features used by, and constraints on use by, great crested newts
- Identify 'opportunities' within plan area linking to master plan
- Assess 'optimal requirements', identifying features and management needs for the species
- Integrate current distribution of species and existing habitat features, with optimal habitat requirements for the species into a plan based around the identified areas of opportunity

Design stages

- Survey site to:
  - ❑ Identify all ponds: assess for newts or presence of fish (map and field study)
  - ❑ Describe and assess terrestrial habitats (map and field study)
  - ❑ Locate likely corridors (map and field study)
  - ❑ Identify and describe possible refuges, hibernating sites and other features (field study)
- Identify opportunities noting, for example:
  - ❑ Power line and wayleave constraints
  - ❑ Motorway constraints
  - ❑ Flood plain refuge
  - ❑ Stream corridor
  - ❑ Village envelope refuge
  - ❑ Existing conservation features
- Prepare project proposal based on 'optimal requirements' including:
  - ❑ Clusters of ponds at 250 m distance
  - ❑ Fish free ponds
  - ❑ Proximity to existing ponds
  - ❑ Providing terrestrial habitats as mosaics of rough grassland, native woodland and scrub with maximum structural diversity
  - ❑ Linkage through habitat corridors between ponds and terrestrial habitats
- Develop management scheme
- Devise a monitoring programme

Plan 3: Proposed great crested newt conservation strategy following change of land use: Walton-Cardiff, Tewkesbury

3. Detailed design

See also Figures 1 to 4 in Bray & Foxford (this volume: *Design opportunities: overview)* for some further ideas for site design.

3.1 *Detail design-pond design and construction - general considerations*

Size and shape may affect species composition, particularly if the pond is colonised by fish, so vary the area between 10m² and 1200 m² with maximum depth between 0.6 m and 3.0 m.

Things to do:

- **Varied pond profile** that should include shallow areas for human safety, amphibian courtship display, egg laying, feeding and tadpole emergence with deeper areas as daytime refuge, temperature control and to inhibit complete plant cover. Consider different needs for different species (see Foster, this volume: *Amphibians and reptiles - the species and their ecology).*

- **Make ponds in clusters** to provide greater population security (see Quayle, this volume: *Ecological principles*) with two to three ponds within 50 m of each other and within 250 m of other pond clusters.

- **Variety in pond design** (depth, profile, vegetation type, degree of shading, size) within clusters will help diversity and allow different ponds to be used between wet and dry years.

- **Allow occasional drying out of some ponds** as this can be beneficial, particularly for great crested newts, by removing predators.

- **Ensure continuity between pond and terrestrial landscape** with corridors of suitable habitat at least 4 m wide.

Things to avoid:

- **Shaded ponds** inhibit amphibian breeding as water stays cold and vegetation growth is poor.

- **Gully pots** and other open sump structures trap amphibians.

- **Walls, fences and gates** that do not allow movement of animals at ground level (where these are required ensure gaps below fences and gates and gaps in walls).

- **Deep ponds** with steep sides are a safety hazard (health and safety liability) and prevent the growth of marginal vegetation.

- **Ponds near footpaths** as these are more likely to have fish introduced and suffer vandalism so the consequences of public access should be considered. Consider screening.

4. Maintenance and management plans

Both the nature of any planned maintenance and the timing of the work will affect amphibians. Therefore both these factors need to be considered when developing maintenance plans.

Key points:

- Aim to avoid work on ponds during the breeding season and when tadpoles are developing in the pond.
- Major pond maintenance/management should be done in late autumn/early winter.
- Keep some short sward areas regularly mown if necessary for access and appearance but include rough grass where possible.
- Major removal of vegetation from ponds may be necessary particularly if there are high nutrient levels.
- Access can lead to vandalism; so log piles and other such habitat features should be located away from paths.
- Provide interpretation for visitors (and site owners/managers).
- Do not disturb hibernation sites between October-March.
- Plan land management around amphibian activity and movements.

5. Monitoring and revision of plans

Monitoring methods will depend on the objectives of the project. Usually the aims are to ensure the persistence of a population of amphibians; in early days it is often to ensure that the population is becoming established and/or expanding its range across a site.

The usual methods of monitoring will include (see also Appendix 4 to this report):

- Monitoring the presence of adult animals, usually by counting at night during the Spring.
- Checking that breeding has occurred by looking for eggs/spawn or the presence of larvae (tadpoles). Counting 'spawn clumps' provides a good relative measure of population size in frogs for comparison between years.
- Checking habitat condition
  - ❑ Presence of breeding ponds, with unpolluted water and adequate open water.
  - ❑ Pond fish free (especially for newts).
  - ❑ Ponds connected to good terrestrial habitat (structurally varied).