South Midlands region great crested newt ‘District Licensing’ project

Implementation Strategy

April 2018

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Executive Summary

This Implementation Strategy describes the operational delivery of a new scheme to deliver net gain in conservation status for great crested newts (and, through the creation of both aquatic and terrestrial habitat, benefits for biodiversity generally) in the South Midlands from development. It will be delivered through the operation of a District scheme (8 organisational licences issued to each participating Local Planning Authority for great crested newts), and is written to support the application for those licences.

Chapter 1 introduces the scheme and describes the principles behind it. Chapter 2 examines the definition of Favourable Conservation Status for great crested newts in the South Midlands; it sets out how conservation status is defined and measured in this case, using a series of metrics covering both biotic and abiotic factors such as range distribution, habitat quality and number of occupied squares. For each of these we set a 'Favourable Reference Value' for GCN in the region, consistent with Natural England's rationale elsewhere. We conclude that the appropriate FCS targets for GCN in this region are increases above current levels of 10% in 1 km square occupancy, and 20% in number of occupied breeding ponds. This sets the context, within which the delivery of the District scheme will contribute to those increases, delivering net gain in great crested newt conservation status through the planning system – the models estimate that this scheme will deliver the creation and management of 8 new ponds for every 1 lost. The South Midlands approach ensures that the interpretation of net gain is by an understanding of FCS, considering not only absolute change (e.g. numbers of ponds), but also how the actions are affecting the achievement of FCS.

Chapter 3 considers the long-term monitoring and surveillance programme needed to provide transparent reporting of the delivery of the scheme. It distinguishes between four types of monitoring (of outputs, outcomes, conservation status, and spatial distribution) that the project will deliver. The project will measure the loss of newt ponds and habitat through development, the gain in newt ponds and habitat through the scheme and their management, and the overall status and distribution of newts in the region. The scale of the conservation programme depends on the number of developers entering the scheme – if more developers enter then the scheme needs to provide more habitat, and do more monitoring. The annual cost of delivering the monitoring programme therefore varies with the level of uptake – for example, at '50% developer uptake' the annual monitoring cost is estimated to be £400k.

Chapter 4 examines the cost of delivering the necessary programme of pond and terrestrial habitat creation and management, covering everything from site selection through to long-term management. Costs will vary significantly according to specific circumstance, but a reliable estimate of average cost is £50k per hectare of habitat creation (including 2 ponds, grassland and hedgerow creation) and £2k per hectare per annum for on-going long-term management.

Chapter 5 takes the costs derived in chapters 3 & 4 and considers how much money therefore needs to be assigned across the region fully to deliver the scheme. The total expenditure needs to include not only the costs of habitat creation and management and the costs of monitoring the scheme, but also the operational costs of the two delivery bodies (NatureSpace Partnership and the South Midlands Newt Conservation Partnership). Finally, the costs include also provision of an 'Endowment Fund', created to ensure that the habitat created is managed in perpetuity, irrespective of whether the scheme continues to run. The fact that the scale of delivery (and therefore the scale of funding needed) will vary according to the level of uptake by developers means that three different uptake scenarios (20%, 33% & 50%

uptake) are modelled for illustrative purposes. The financial modelling also accounts for the fact that income to the scheme in the early years will be slow because 'second stage' payments from developers are received only before commencement of the development and there will be inevitable delays in the developers entering the scheme then receiving planning permission.

The models illustrate that, with 40% of income allocated to newt conservation (20% for habitat creation and management and 20% for the "Endowment Fund'), which level it is envisaged would be conditioned in each licence, then this funding ranges from £2.0m per annum (20% developer uptake) to £4.8m per annum (50% uptake), and that these levels of funding will deliver 'in perpetuity' net gain for great crested newts (and significant benefits for other biodiversity). **The scheme expects to deliver the creation of 8 new ponds (and associated terrestrial habitat) for every one newt-occupied pond that is lost (8:1 ratio).**

Finally, Chapter 6 describes the underlying Business Model that yields the necessary income streams under the different modelled scenarios, including the variable two-stage charging strategy for developers which means that the costs to developers are always proportionate to their predicted impact on newts.

Taken together, alongside the maps and other delivery documents that will be provided to Natural England with the licence applications, this strategy demonstrates the case for the project that will, under any scenarios of developer uptake, deliver significant net conservation gain for great crested newts and benefits for other biodiversity (i.e. not merely delivering "no detriment" to great crested newt conservation status of the populations of the species concerned, as is required under regulation 53(9)(b) for the grant of each organisational licence).

Contents

1 Introduction – description of the scheme and key principles

A new approach to protecting great crested newts has been enabled and promoted by Natural England through the publication of four new licensing policies. In general terms, the focus of legal protection has moved away from individual animals and towards populations of the species. Furthermore, Local Planning Authorities may now be granted a District Licence for great crested newts allowing them to *simultaneously* grant planning permission and authorise activities on great crested newts.

Under this District scheme, the surveying work for GCNs is conducted across the Local Planning Authority(ies) at the outset, rather than reactively by the building developer for each planning application. The survey data is analysed and modelled to produce a map of where great crested newts are, or are likely to be – called here an Impact Risk Map (IRM). This map, which has four colour-coded (red, amber, green and white) zones, is used to give developers certainty over their obligations for great crested newts *before* they apply for planning permission because their obligations are pre-determined by the size and location of their development. In most cases, developers will be able to submit a brief habitat survey and make a standard payment, in two stages, to allow them to operate lawfully under the LPA's licence and so avoid liability for criminal offences to GCN. They may need to comply with certain planning conditions, but they do not need to wait for a separate licensing system; they do not need to wait for seasonal windows to survey for GCN populations on their development site; and, subject to any planning conditions imposed, they do not themselves need to mitigate for any GCNs subsequently found on site. A second map – a Conservation Priorities Map (CPM) – sets out in advance a strategic spatial plan for targeting the creation of new habitat for great crested newts. Delivery of compensatory habitat will ensure that the development project not only avoids detriment to the maintenance of the populations of the species concerned at a Favourable Conservation Status in their natural range (as is required by regulation 55(9)(b) Conservation of Habitats and Species Regulations 2017), but will also give rise to a net gain in the conservation status for GCN (and other biodiversity) and thereby contribute to delivering Favourable Conservation Status for the GCN species.

In the South Midlands region in which this implementation strategy applies, income from participating developers will be used to deliver a net gain in conservation status of great crested newts from development. The income from developers will cover:

- the operational costs of the scheme management, delivered through two new organisations - NatureSpace Partnership (NSP) and the South Midlands Newt Conservation Partnership (SMNCP)
- the costs of creating and managing compensatory habitat for great crested newts
- the costs of a monitoring and surveillance programme to ensure transparent reporting on all aspects of the scheme to participating Planning Authorities and to Natural England

Successful delivery of the scheme will allow developers to deliver their developments under the relevant local authority's licence, without the developers themselves needing to mitigate (in the majority of cases) or compensate for great crested newts if they are found, nor assume any long-term liabilities for site management.

This implementation strategy sets out the plans to allow delivery of net gain for GCN conservation status, through the programme of habitat creation and management, and monitoring. It details the future costs of the programme, how it will be delivered and funded, and how funds will be set aside for 'in perpetuity' management of the great crested newt sites. It may be helpful to note here a few key principles:

- The scheme is compliant with the new NE licensing policies as well as compliant with the licensing tests under regulation 55 Conservation of Habitats and Species Regulations 2017;
- This scheme is designed not only "to avoid detriment to the maintenance of the populations of the species concerned at a Favourable Conservation Status in their natural range" (as is required by regulation 55(9)(b) Conservation of Habitats and Species Regulations 2017), but will also give rise to a net gain in the conservation status for GCN and thereby contribute to delivering Favourable Conservation Status for the species, based on a spatial conservation strategy;
- This is a landscape-scale plan. In line with 'Lawtonian' principles overall delivery of the scheme is considered at the regional scale; nevertheless, the metrics used allow us to quantify that net gain for newts is delivered for each participating Local Planning Authority;
- The scheme de-couples individual impacts from wider gain – it is not a piecemeal approach to compensation but works at larger scales, both at the relevant authority level and at the wider regional level, based on Natural England's system of landscape classification, National Character Areas; this means that not every single development will necessarily individually deliver net gain for newts, although taken as a whole, development in total will do so. Conversely, many developments will 'overcompensate' for their impacts on newts, but will choose to do so (voluntarily) because the scheme offers them operational certainty and a release from obligations to survey for newts;
- The scale of the scheme is linked directly to the level of uptake by developers. The scheme is voluntary, so it is not known how many developers will choose to enter the scheme, because the existing licensing route for dealing with great crested newts will still be open to them. However, unlike the earlier Woking pilot licensed by Natural England, this scheme does not assume a pre-determined level of habitat loss through development, and then seek to compensate for that level up-front. Instead, the amount of habitat compensation provided will be directly related to the amount of habitat lost through development. If the uptake by developers is high then the funding into the scheme will be high and the amount of habitat creation will be high. In this strategy we illustrate potential different uptake scenarios and the amount of habitat creation each produces;
- The scheme will deliver a significant net gain in the number of occupied great crested newt ponds. We estimate that, overall, for every pond lost to development, either directly or indirectly, 8 ponds (and, on average an estimated 4 ha of terrestrial habitat) will be created and managed in perpetuity by the scheme – **an estimated 8:1 pond gain:occupied pond lost ratio**;
- The scheme deals with the issue of habitat creation compensating for developmental impact *before* it happens in two ways. Firstly, a separate and discrete facet of this scheme is the deployment of £350k of funding into up-front habitat creation *before* the scheme launches; in this way we will avoid any possibility of a temporal lag. Secondly, charges are taken from developers in two stages, firstly before permission is sought and secondly at least 6 months before commencement of site clearance is permitted;
- Creating ponds, and their surrounding habitat, is a significant change in land use, and is not easily reversed, so it is unlikely there will be much pressure to remove

sites from the scheme once they are created; nevertheless, the scheme further mitigates such pressures through careful site selection at the outset, and through generous annual payment rates. There will be some small annual attrition of ponds, but it will be monitored closely and is likely to be negligible compared to the hundreds of ponds and 8:1 gain ratio that is being created. In any event, to the extent that attrition occurs, replacement ponds will be delivered;

- To ensure funding is created to sustain on-going habitat management indefinitely, rather than, for instance, for a 25 year contract, funding is to be set aside from income for an 'endowment fund' to be created alongside the creation of the new habitat; this means that, irrespective of the duration of operation of the scheme, it will leave behind a legacy of newt ponds and habitat that has a self-sustaining (at 4% investment returns) fund to pay for its management;
- Not only will the scheme deliver the creation and management for great crested newts of 8 ponds for every occupied pond lost to development, it will also provide the funding for delivery of appropriate levels of monitoring and surveillance, and for 'in perpetuity' management. It does this by committing the allocation of a fixed percentages, irrespective of overall income levels, of income to each of these outcomes – 20% to habitat creation, 10% to deliver monitoring, and 20% to the endowment fund. A further 40% of income is predicted to be spent on the operational costs of the two organisations – NatureSpace Partnership (NSP) and the South Midlands Newt Conservation Partnership (SMNCP), and the Local Planning Authorities – in managing and delivering the scheme;
- Finally, through the creation and management of both ponds and terrestrial habitats, the scheme will deliver significant benefits to many terrestrial and aquatic habitats and species other than great crested newts.

2 Great crested newt conservation status and favourable conservation status

2.1 Introduction

The South Midlands region great crested newt District Licensing Project aims to deliver substantial benefits to those working with the regulatory regime, as well as for great crested newt populations themselves. It is widely acknowledged that the existing regulatory regime is not working well in either respect.

One frustration of those working with newts is the paucity of information on where newts are found, and how robust those populations of newts are. For our project to work effectively and transparently we need a way of expressing clearly how great crested newts are faring, as well as an aspiration for their future condition, at the landscape scale. Up until now, a particular drawback has been the logistical difficulty of surveying newt populations given that they potentially occur in a large number of ponds, yet here we demonstrate a method based on field survey and advanced modelling methods.

The future condition we define for newts needs to take into account the scale of losses suffered by the species in recent times. We must have regard to national and international guidance when setting this vision for restoring newt status, and the method we describe below uses the best sources available. We are confident that this innovative work provides the best possible evidence base for our project.

In setting out a method by which newt status can be assessed, and a future goal articulated, we provide a clear context for the proposed revised regulatory approach to development impacts. The definition of current and target newt status, set out clearly in figures and maps, help define a shared objective for stakeholders to engage with. In turn this sets an agenda for delivering conservation actions alongside the new approach to mitigating development impacts. It allows us to say more clearly what conservation action is needed, and where. We are able to say where good quality newt habitat occurs across the District Licensing region, and where development will have the most and least impact. For the first time since protective legislation for newts was enacted, we can express all of this at a landscape scale.

One of the main aims of the Habitats Directive is achievement of “Favourable Conservation Status” (FCS) for threatened species, including the great crested newt. In this section we define how we will use the FCS framework to set tangible goals for great crested newts, and assess progress towards those goals in a way that integrates with revised regulation of development impacts.

The conservation status of a species is considered to be the sum of all influences acting upon it. Conservation status is thus comprised of biological condition parameters (i.e. those that describe the population dynamics, habitat quality and extent, and the species range - the intrinsic ‘biological viability’), and extrinsic parameters (including anthropogenic and climatic factors that impact on the long-term survival of the species). The approach we use here follows the framework outlined in the Bonn Convention 1979 and subsequently refined for the EC Habitats Directive 1992, in which status is assessed through the separate consideration of these different parameters. An understanding of conservation status allows an objective basis for evaluating risk, assessing conservation priorities and a mechanism for assessing trends. These assessments become more meaningful

when the current status is considered in the light of a level that is deemed 'favourable', based on scientific and other objective criteria.

For each biological parameter a value can be assigned to a specific measure (or measures) which describes the current status and a further 'favourable reference value' can be developed to determine the levels considered to be favourable. These metrics are then considered collectively, with all needing to be at or above the favourable level for the species to be considered at a 'favourable conservation status'.

Assigning values to these metrics thus provides a powerful tool for supporting conservation work and can provide a spatial context for delivering conservation action. Maps both help practical conservation action and provide the context for understanding, and validating, the different status metrics.

2.2 The metrics used to assess conservation status of great crested newts

The metrics we use to assess conservation status in this project are:

- Range and distribution
  - Extent of Occurrence km^2
  - Area of Occupancy – number of occupied 10 km and 1 km squares;

- Population
  - Number of occupied great crested newt ponds
  - Number of great crested newt breeding ponds
  - Population size: assessment of newt abundance at the pond level, using a population size class based on counts of individual newts from a sample of ponds.
  - Viability/functionality: assessment of connectivity and viability measure in population units (e.g. 1 km squares)

- Habitat
  - Habitat Suitability Index (HSI) scores for ponds (occupied & unoccupied) categories;
  - Extent of good quality habitat (modelled) (Ha)

- Prospects
  - An assessment of positive and negative factors influencing each of the conservation status parameters (from Poor to Good), and collectively assessed (unfavourable to favourable).

2.2.1 How conservation status metrics for great crested newts are measured in this project

Range and distribution

Extent of Occurrence: is measured via an outer polygon encompassing the species distribution across the whole project area, excluding significant 'gaps' in distribution, broadly following the methods outlined in Article 17 reporting through the Habitats Directive. Applying this method using species data collected only from within the boundaries of the project area could, however, produce a spurious result as the polygons will cross the boundaries and include some areas outside of the project area

and also may fail to include all records collected within them. To address this, a refinement of this approach, using a method that measures the extent of the project area and 'deletes' areas that are in in excess of 5km from any recent record or area modelled to have a high likelihood of occupancy is adopted.

Area of Occupancy: is assessed as the number of occupied **10 km and 1 km squares** defined as those with records or where the likelihood of occurrence based on modelling is >70%.

Population

Number of breeding ponds: We assume here occupied ponds with a Habitat Suitability Index (HSI) score ≥ 0.7 can be regarded as breeding ponds. This is calculated through sampling approaches using eDNA to determine a proportion of pond occupancy and habitat suitability, and related to pond numbers taken from base maps and modified through modelling and ground truthing. Note: the use of HSI values to predict reproduction probability requires some caveats, but has evidential support for great crested newts (e.g. Unglaub et al 2015[1]) and is considered appropriate for application in this project.

Number of occupied ponds: is calculated using occupancy modelling and empirical Bayesian methods and through occupancy rates determined through sampling approaches using eDNA.

Population size: using sampling methods that optimise the survey intensity at ponds across the distribution of species. The assessment is based on counts of individual newts gained by torch survey and/or aquatic trapping, in conjunction with population estimates derived from Capture-Mark-Recapture.

Viability/functionality: this parameter will be developed further during the project. It will be measured through a combination of field survey and an extension of the modelling to provide an assessment of pond density, habitat quality and landscape connectivity, giving a quantitative metric of viability in population units (using 1 km squares and pond).

Habitat

HSI scores: undertaken at a stratified sample of occupied and unoccupied ponds across the Districts.

Extent of good quality habitat: measured via GIS for the Districts and across the South Midlands area from the modelled outputs using GIS.

Prospects

An overall assessment of prospects at the District level for each conservation status parameter, using the Article 17 reporting framework (rating from Poor to Good) and then collectively assessed 'Unfavourable' to 'Favourable'. This is based on 'expert assessment' with reference to the lists of measures and pressures/threats developed for the Article 17 reporting. Consideration is given to developing sample assessments during the project to help quantify this metric and provide a further assessment of

[1] Unglaub, B., Steinfartz, S., Drechsler, A., & Schmidt, B. R. (2015). Linking habitat suitability to demography in a pond-breeding amphibian. Frontiers in zoology, 12(1), 9.

impacts; this will use a 1km square sampling grid as a ground truthing exercise to complement the District level assessments.

2.3 Which metric values indicate *favourable* conservation status for great crested newts in this region?

2.3.1 Rationale

The favourable conservation status (FCS) of great crested newts represents a state where 'the species is doing sufficiently well in terms of quality and quantity and has good prospects of continuing to do so in future' (Evans & Arvela 2011[2]). It includes the concept of 'viability' over the 'long term'. The definition considers the species as a characteristic component of the full range of natural habitats in which it occurs in the region and as a widespread species with population robust enough to withstand natural fluctuations. From a legislative and policy perspective, the levels should not be lower than those existing in 1994 (the year the Habitats Directive came into effect in the UK). However, best practice indicates that, when seeking to deliver favourable levels through restoration, consideration should be given both to a species' previous historic range and occupancy in the habitat, and to levels that are technically achievable in the modern landscape.

Descriptor

- The great crested newt is by nature a widespread species, occupying large connected landscapes. The species occupies clusters of ponds, functioning as metapopulations. Population levels need to be sufficiently large and habitats of sufficient extent and connectivity to ensure viability in the face of potentially large fluctuations.
- The species should be a functioning component of the full extent of different habitats and ecological variability of the species within its natural range.

Favourable reference values for the different metrics

To achieve a conservation status that can be considered favourable, all parameters need to achieve or exceed defined levels, termed 'favourable reference values' (FRVs). The FRV will be based on the following, stepwise considerations:

- Ensuring viable populations across the current distribution
- Achieving the known/ presumed 1994 levels for:
  - population, and
  - distribution
- Restoring an appropriate level of historic (pre-1994) loss.

'Historic loss' should reflect the period over which most significant changes occurred. For great crested newts this is considered to be the 30 year period following the Second World War that saw significant agricultural intensification.

Natural England has developed a draft rationale to define appropriate levels of restoration (of populations/ range/ habitat) for many different species by combining the extent of historic losses with factors such as the significance of the species (Red-listing

[2] https://circabc.europa.eu/sd/a/2c12cea2-f827-4bdb-bb56-3731c9fd8b40/Art17-Guidelines-final.pdf

status/ importance of UK populations), the recentness of decline and statutory requirements for conservation through international obligations. For the great crested newt the Natural England matrix suggests that a restoration of 10% of the pre-1994 level is appropriate for each of the conservation status parameters.

In some cases there will be detailed local level knowledge of changes between 1994 and present day and prior to 1994. In the absence of such local information, local restoration levels are best defined by defaulting to national levels.

Favourable reference values in the South Midlands

Full details are provided in the licence application Annex 7: Favourable conservation status and favourable reference values for the South Midlands. In summary:

- ***Range and distribution***
  - **Extent of Occupancy (EOO):** minimal change is assumed in the overall EOO, the FRV for this parameter is the current value - **398 km²**. This was created by drawing a convex hull around all great crested newt records, both from the Records Centres and the eDNA survey – see Figure 1 below:

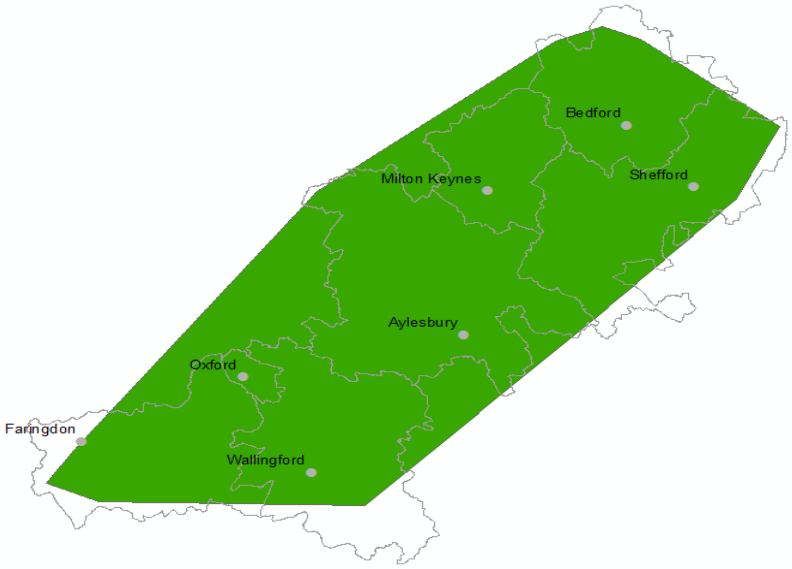


Figure 1 Extent of occupancy

  - **Area of Occupancy (AOO)**: The area of occupancy in the natural range, using 10km and 1km squares. Data are not available to quantify changes since 1950. Changes are not likely to have occurred in the AOO at the large-scale level measured by a 10x10 km square distribution, but may well have occurred at the 1x1 km square level. Indeed, using all available great crested newt records from Local Record Centres, and the comprehensive eDNA survey carried out for this project, we can say that **all** 10km squares that are fully within the South Midlands project area are occupied by great crested newts.

    The species is found in **43** 10x10km squares; and this current value is considered to be the favourable reference value. In five 10km squares, there is no existing positive great crested newt record (the presence of great crested newt is yet to be established). All five of these squares are not fully within the South Midlands, making inference problematic. See Figure 2 below:

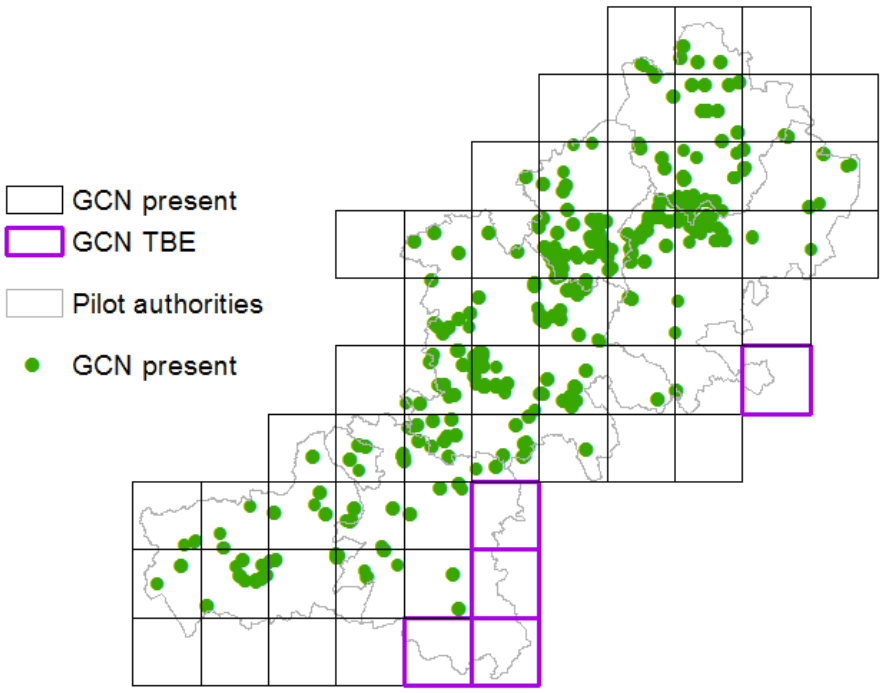


Figure 2.1 Area of occupancy (10km square level)

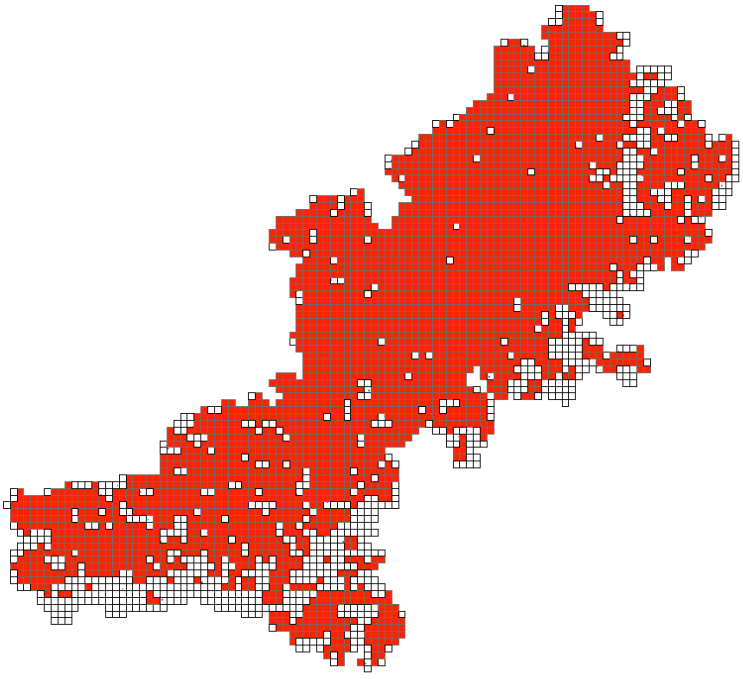


Figure 2.2 Area of occupancy (1km square level)

At the 1km square level our data shows that 2,622 squares are currently occupied (there are 4051 1km squares in the South Midlands region). Data on historic changes in status at the 1km square level are not available; however, it is reasonable to assume that losses at this level of resolution will have occurred in recent historic times through habitat loss and degradation. We use here an increase of 10% above current levels to appropriately reflect the 20% level of pond increase (see population metrics below) as an interim measure. Thus, a FRV will be occupancy of 2,884 1 km squares. This could be revised should further data on changes in Area of Occupancy since 1950 become available.

- ***Population***
  - **Number of breeding ponds (i.e. occupied ponds with an HSI score ≥0.7)** Data are not available to quantify changes in pond occupancy since 1950s. Therefore, changes are based on interpretations of national data to determine an interim FRV for this parameter. This will be revised should further local data on changes in occupancy become available. In the absence of specific local data, an estimate of change in pond occupancy is based around the assumptions that:
    - the stable / net increase in numbers of ponds between 1990 and present day (Countryside Survey/ Lowland Pond Survey) is likely to have helped offset the declines for newt populations, though pond succession and introduction of fish need to be accounted for; therefore, we have modified the presumed (Swan & Oldham 1989) rate of decline down to 1% per 5 years in this period;
    - there was a 2% decline each 5 year period from 1990 to 1975 (based on Swan & Oldham 1989);
    - there was a 50% decline prior to 1975 (Beebee 1975);
    - Thus, we estimate an overall loss of 18.1% in the number of occupied breeding ponds since 1950, and will therefore use a figure of 20% increase above current levels to deliver a FRV for these metrics. This figure is consistent with Natural England's approach elsewhere.

Therefore, across the South Midlands district area:

No. of ponds		No. of occupied ponds*		No. of breeding ponds**	
Current	FRV	Current	FRV	Current	FRV
10,194	12,233	3,262	3,914	1,240	1,488

Full details are provided in Annex A7 (to the licence application document): Delivering FCS and setting FRVs for the South Midlands.

- Population size: The monitoring programme described in section 3 below sets out how this metric will be assessed. The FRV is that the estimated number populations with of medium/ good count (10-100) and large/ exceptional count (>100) is at least maintained. Baseline values will be assessed during the first sampling period. Note: there are acknowledged issues with use of counts of individuals to assess population size, mainly due to variable detectability (i.e. the

chance of finding newts varies widely between surveys). However, this project will minimise the impact of those issues by using a large and structured sampling regime, recording of covariates (i.e. factors that may affect counts), and use of Capture-Mark-Recapture at a sub-sample of ponds to deliver a population estimate with confidence intervals.

- Viability/functionality: a metric will be developed during the project to explore the assessment of viability at a 1km square level; the favourable level will be considered to be an increase of 10% above this baseline level.

- ***Habitat***
  - **HSI** assessments have been undertaken at a stratified sample of occupied and unoccupied ponds across the South Midlands. The current number of ponds in the project with an HSI≥0.7 is 2,956, and the favourable level is an increase of 20%, setting the FRV at 3,547 ponds with an HSI≥0.7.
  - Extent of good quality habitat is measured via GIS for the Districts and across the South Midlands area from the modelled outputs using GIS. The current extent of high quality habitats is 1,420 sq km; the favourable level is an increase of 20% above current levels, so the FRV for habitat is therefore 1,704 sq km.

- ***Prospects***
  - Future prospects for all the parameters should be good, and thus achieve a 'Favourable' overall rating.
  - Current expert assessment is that range = good (at the 10km level), but that population is poor (negative), habitat is poor (negative), and therefore assessed overall as unfavourable.
  - Note that when considering climate change and infectious disease introduction as potential impacts, we take the view that it is difficult to predict with a high degree of certainty the type and magnitude of effects at population level because of a lack of evidence. However, using the precautionary principle, we assume that such factors may have an adverse impact, and that the most appropriate response, in the absence of good evidence for particular interventions, is to increase the robustness of newt metapopulations using established methods.

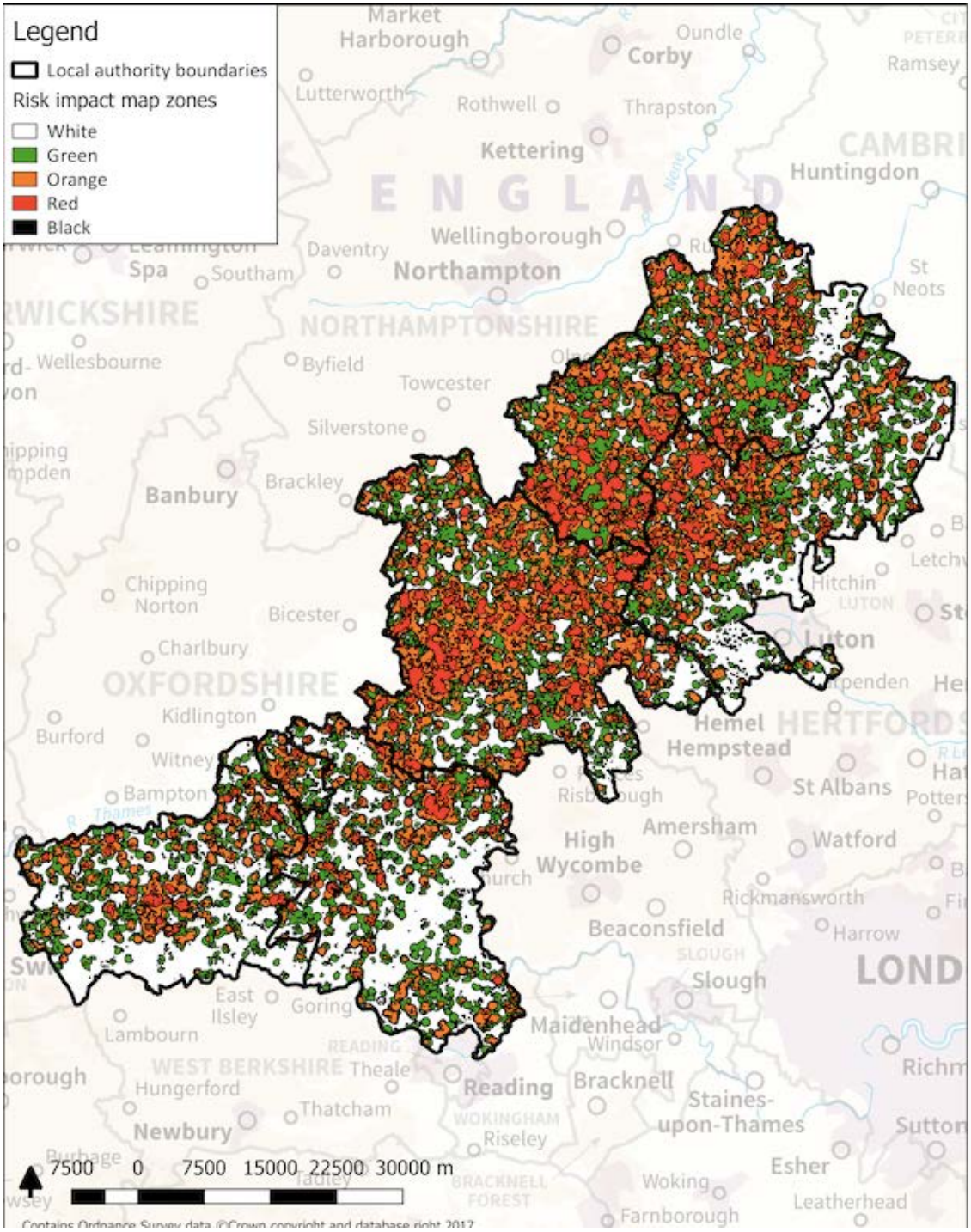
2.4 Spatial distribution - what favourable conservation status looks like in the South Midlands districts

2.4.1 Current status

The areas covered by the scheme represent some of the most important landscapes for great crested newts in England. In a separate exercise to the work above on population metrics, habitat suitability for great crested newts is modelled, using a range of environmental variables such as habitat type, pond density and quality, rainfall etc., and checked against the known distribution of great crested newts derived from the survey work – this is described in detail in Appendix 1.

The modelling thus identifies, and can plot on a map, the probability of occurrence of great crested newts at any place, and this is converted graphically in different coloured zones – red, amber, green and white, according to the suitability of newts being present. We call this map of modelled great crested newt distribution the 'Impact Risk

Map' (IRM). The IRM shows that roughly 40% of the area has high habitat suitability (red and amber zones together), and in these areas, there is a high sensitivity (correct presence prediction (95%). However, newts will not necessarily occur everywhere in the high quality habitats, nor will they be absent from all of the lower quality areas. The modelling work, supplemented by and based on field survey data, allows a visual interpretation of the distribution of newts. The conservation status, though, is considered by looking at *both* the spatial elements (i.e. distribution, spread and locations) of newts and also through the different metrics used to describe it.



2.4.2 *Favourable conservation status*

The favourable conservation status of newts in the region will reflect this broad distribution pattern with higher densities in the areas of better habitat but scattered populations throughout the lower quality habitat areas. The conservation status of the species will be assessed through both the spatial analysis, ensuring a distribution across the range and through all of the different metrics achieving the favourable reference values.

This implementation plan will aim to support the achievement of the favourable levels and, in the first instance, focus on ensuring that the priority great crested newts areas are robust. Mitigation work will also look in particular at ensuring viability across the range, looking to strengthen areas of good habitat and good connectivity, but with low pond density, or looking to improve connectivity.

2.4.3 Updating the current status map and the zoning map for developers

The habitat suitability model and IRM will be updated on a three yearly cycle, to:

- improve its accuracy, particularly as new technologies and enhanced environmental data, become available, and
- reflect temporal changes in newt occupancy within the region.

The first update is planned for Year 3 of the scheme and will focus on upgrading the environmental layers that underlie the IRM. Pond density, for example, is a critical explanatory variable within the model. However, Ordnance Survey pond base layers are often significantly out of date, placing limits on the model's ability to predict great crested newt occurrence. We will significantly improve the accuracy of the IRM in the first two years of the scheme by targeted field data collection for critical variables together with analysis of newly available data (for example through LIDAR and other remote sensing methods).

2.5 Conclusion

The survey, analysis, modelling and status assessment methods set out in this section constitute the most comprehensive regional assessment of great crested newt status ever undertaken. In delivering this, we have established a transparent method for assessing current status, a future goal, and a way to measure progress towards that goal.

We have established that across the South Midlands pilot area, the target status for great crested newts can be defined in a series of numerical measures, describing population, range, habitat and future prospects. This has been done taking into account national and international guidance, lending an invaluable coherence and robustness to our project. Our vision for newts states that a favourable status would be reached with 1,488 breeding ponds, with the species occurring across 1,704 km^2 in well-connected habitats, and with positive measures ensuring good prospects for these populations.

The scale of increase in population status above current levels reflects best practice, and sets an ambition for our project to work towards alongside external efforts. We have set out this aspiration in map format, as well as numerically, in order to help

share our vision with stakeholders, and to help drive conservation delivery. Our methods show clearly where there is good quality newt habitat, where development would likely have the most and least impacts, and where it is most appropriate to undertake improvements for newts.

The methods for assessing progress toward target status have been set out, and are based on current good practice in survey and modelling, involving a sampling approach. These status assessments are expressed in terms that complement the measurement of impacts and net gain achieved through the strategic licensing of development impacts.

3 A programme of monitoring and surveillance for the South Midlands region GCN District Licence project

3.1 Aims

The monitoring programme for the South Midlands region GCN District Licence project will provide sustainable long-term monitoring and transparent reporting of the status of great crested newts against targets.

3.2 Definition of terms

It is worth noting here the distinction between four different types of monitoring.

1. **Conservation *outcome* monitoring** – directly assessing for this project the net gain, as delivered through planning, in great crested newts (as measured by population or pond occupancy metrics) by comparing loss to development with gains from compensatory habitat creation.

2. **Conservation *output* monitoring** directly assessing for this project the net gain in activities, designed and implemented to deliver the conservation outcomes, which includes:
   - Activity monitoring – recording the activities completed as part of the delivery programme of the project, for example the number of ponds, or the amount of terrestrial habitat, created and managed (see below and Section 4).
   - Compliance monitoring – making sure that the ongoing site management agreed with landowners, for which the site managers receive an annual payment, is actually delivered (described in Section 4).

3. **Conservation status monitoring** – assessing region-wide changes to newt conservation status: comprising a combination of region-wide habitat assessments, eDNA based occupancy surveys and a sub-sample of population surveys based on 1km square sample units.

4. **Monitoring designed to update and improve the distribution models (and maps) which support delivery of conservation outcomes** – monitoring data collected to update maps and allow re-evaluation of models defining the extent of suitable habitats, species occurrence and evaluation of habitat connectivity (described in Section 2).

3.3 Principles

The main objective of the monitoring programme is the conservation outcome of the project - to **demonstrate the effectiveness of the South Midlands region District Licencing Scheme in creating an *overall net gain in conservation status of great crested newts across the region and across each participating Local Authority.***

To do this our monitoring programme will:

- **directly measure net gain** using both activity and conservation outcome measures to compare losses to development with gains from habitat creation (see Section 3.4).
- identify **underlying trends** in great crested newt conservation status across the region, to ensure that any net gains we measure are real - and not due to pre-existing trends (Section 3.5).
- identify how our habitat creation contributes to **'Favourable Conservation Status'** across the region (Section 3.5).

The scheme's monitoring programme adds further value (Section 3.6) by:

- generating regional great crested newt data that will contribute towards the *national* assessment of great crested newt status.
- providing information about the scheme's contribution to *wider biodiversity* enhancement.

3.4 How we measure and monitor net gain

Our monitoring strategy aims to provide a robust evaluation of the net gain achieved as a result of habitat creation, based on a combination of activity and outcome measures, both across the participating Local Authorities and across the region as a whole.

To ensure we fully evaluate development losses, we will assess habitat and population loss across all four newt habitat suitability zones (red to white) shown on the Impact Risk map (IRM), although effort will be weighted towards developments in red and amber zones where newt occupancy, and therefore impacts, will be greater.

In red and amber zones of the IRM all development sites will be monitored, after development has occurred, using *activity* measures, and a proportion (between 20 to 40 sites depending on the overall level of uptake of the scheme) will be monitored to provide information on *outcome* measures (see Section 3.4.1 and 3.4.2). In green and white zones a smaller number of development sites (likely c. 25%) will be assessed using activity measures, and in some cases, additional outcome measures. We will review the sampling strategy annually to ensure that sites across the four zones are sufficiently represented to provide a clear understanding of ongoing impacts.

All habitat compensation sites will also be monitored using activity measures, *and* compliance measures, and a proportion will be monitored to provide information on outcome measures.

For schemes which require a metric assessment, prior to any impacts occurring, compensation delivery will be checked to ensure that sufficient functional habitat has been created in the appropriate locations (i.e. within the same LPA and or/ National Character Area). Conservation activity and impacts will all be recorded and tracked to ensure that compensation is always ahead of impacts, and in the appropriate locations.

3.4.1 Activity measures

Our key activity measures are:

- Pond number
- Pond density
- Pond quality

- Terrestrial habitat extent and quality
- Future viability.

The FHT standard definition of a pond is "*Ponds are permanent or seasonal waterbodies between 1 sq.m and 2 hectares in surface area (about 2.5 football pitches). This definition includes temporary ponds that dry up during the year, as well as tiny pools and very shallow ponds like 'wader scrapes'*." For the purpose of creating good quality GCN ponds, the table below sets out specific pond creation aims – including that ponds will be created and managed to high quality breeding standards, using HSI indicators for achieving optimum characteristics (of pond density, pond quality and terrestrial habitat quality.

Table 3.1 summarises the targets for each of the activity measures above, and how they will be assessed and reported.

Activity measures will be monitored across:

- all red and amber zone development sites and a proportion of green and white zone sites (see above)
- all habitat compensation sites.

On-going (contracted) management of all habitat compensation sites will also be recorded through compliance monitoring.

All results will be reported on annually by the SMNCP to NatureSpace Partnership, and by NatureSpace Partnership to the participating Planning Authorities and to Natural England.

Table 3.1 Description of the District monitoring measures and their reporting cycles (CTA = Great crested newt Conservation Target Areas and BOAs)

Measure	General aim	Specific target	Assessment method	Monitoring & reporting cycle
ACTIVITY MEASURES				
Number of ponds	Increased number of ponds through creation and restoration. Ponds able to sustain emerging metamorphs in most years	At least quadruple (4:1) the number of new ponds created than number of occupied ponds destroyed by development	Net number of occupied ponds lost or damaged at development sites, compared to number of ponds created or enhanced at compensation sites. Pond locations mapped and numbered and the National Character Area be recorded.	Initially measured at development site and within 6 months of compensation scheme creation. Updated annually at compensation sites to check for change. Results reported annually
Pond density	Increased pond density at compensation sites compared to development sites. Density at or above optimal levels to sustain newt populations	At least 12 ponds within 1 km radius, or equivalent density per 1 km square (4 ponds km^2)	Number of ponds within 1 km radius or density per 1 km^2 measured at both development and compensation sites	Initially measured at development site and within 6 months of compensation scheme creation. Updated annually at compensation sites to check for change. Results reported annually
Pond quality	Create and manage ponds to high quality breeding pond standards.	All compensation ponds (in row 1 above) fall within HSI Good or Excellent quality categories	Calculate proportion of ponds in HSI categories at both development and compensation sites	Initially measured at development site and within 6 months of compensation scheme creation. Updated annually at compensation sites to check for change. Results reported annually

Terrestrial habitat	Ensure optimal viable terrestrial habitat areas are associated with new and managed compensation ponds.	HSI terrestrial habitat score of Good for all new ponds. Increase in quality and areas of suitable habitat compared to development site.	Calculate increase in area of suitable habitat types in good condition for great crested newt at development and compensation sites. The National Character Area in which compensation takes place will be recorded.	At development site and within 1 year of compensation scheme creation to allow for habitat development. Updated annually to check for change
Future viability	Locate great crested newt enhancement sites within areas that have long-term security from development and have connectivity to other areas of suitable/ occupied habitat. Contributes to resilience, security and longevity of sites and populations.	No potential threats identified. Compensation sites located where long term conservation can be secured.	Assessed for potential threats and pressures e.g. proximity to agricultural land/residential development, future development pressure, flooding. Considers land outside development and compensation areas to include wider threat e.g. fragmentation and predation. Notes any sites which have compliance issues.	At development site and within 6 months of compensation scheme creation. Updated annually to check for change.
OUTCOME MEASURES				
Great crested newt occupation	Significant increase in the number of ponds supporting great crested newt	At least quadruple the number of occupied ponds compared to those lost to development	Net change in the number of ponds supporting great crested newts measured using eDNA (see Figure 3.1)	Baseline measured at development site and within 12 months of compensation scheme creation. Interim data available in all years. First full report on change after 3 years to allow for colonisation of new ponds. Annually thereafter.
Population	Compensation ponds with strong great crested newt populations	More compensation ponds with medium and large count categories than are lost to development	Net change in great crested newt abundance (see Figure 3.1) measured using Capture-Mark-Recapture, based on abundance categories	Baseline measured at development site and within 6 months of compensation scheme creation. First full report on change after 3 years to allow for colonisation of new ponds. Annually thereafter.
HSI >0.7	Significant increase in number of ponds likely to support great crested newt measured using HSI as a surrogate for occupancy	Quadruple the number of compensation ponds with HSI ≥0.7 compared to development	Statistically significant increase and double the number of ponds with HSI≥0.7	Initially measured at development site and within 6 months of compensation scheme creation. Updated annually at compensation sites to check for change. Results reported annually

3.4.2 Conservation outcome measures used at a sample of both development and habitat creation sites

We are using three conservation outcome measures to directly and indirectly measure the effect of the scheme on newt populations at a sample of both development sites (after development has occurred) and habitat creation sites.

These are:
1. Great crested newt pond HSI scores
2. Pond occupancy, measured through eDNA analysis
3. Population size measured through Capture-Mark-Recapture.

1. **HSI scores** of ≥0.7 have been used as a proxy to indicate great crested newt breeding ponds. Because HSI data are simple and easy to collect, we will apply this measure at the majority of development and habitat creation ponds where we

collect activity data (see previous section); to provide a broad-brush indication of possible great crested newt occupancy across the scheme as a whole. However, as shown by analysis of HSI data from our South Midlands dataset, there are issues with both the reliability of HSI scores as a predictor of occupancy, and of the HSI≥0.7 value as a threshold. We will, therefore, mainly use HSI data to provide contextual and supporting information rather than as a primary outcome measure in the short term, and will seek to improve the viability of this metric's threshold in the longer term.

2. **Pond occupancy**: eDNA will be used to indicate the presence or absence of great crested newts in development and habitat compensation ponds.

   To calculate net gain we will undertake an intensive study that compares the occupancy of all ponds in 20 - 40 development sites, with the occupancy in 20 - 40 habitat creation sites (with the total number of both depending on the scale of uptake of the scheme). The number of ponds will depend on scheme uptake (see Table 3.2). Baseline surveys will be undertaken at both site types through years 1-3 of the project as the number of sites in the Scheme builds up. All ponds created/restored under this scheme will have eDNA samples taken and analysed annually, until GCN presence is confirmed in a pond, and then the survey cycle below will commence.

   The full survey will be repeated again when newly created ponds are 3 years old (and hence likely to have colonised), to provide measures of net gain and scheme success (see Table 3.1, Figure 3.1). Interim data from the compensation ponds will be available through compliance monitoring eDNA surveys from year 1 onwards (Section 4.3.1).

   Further full re-surveys of these ponds will be undertaken after 6 years and (probably) 9 years, to indicate whether levels of occupancy are sustained (or increased/decreased): allowing evaluation of the net gain contributed by managed compensation ponds as they mature.[1]

   After 6-9 years the main study will be re-evaluated and potentially re-structured; ensuring that compensation ponds continue to be evaluated across the full range of age cohorts on an ongoing basis.

   The pond occupancy analysis will include data from a resurvey of ponds *remaining in the development* area after development has been undertaken (Figure 3.1). This will ensure that calculations of net gain, include a consideration of on-site mitigation. Similarly, baseline studies will include pre-existing ponds within the habitat compensation unit, to include potential impacts from adding new terrestrial and aquatic habitat on these waterbodies.

3. **Population size data** are expensive to collect and can be difficult to analyse statistically given that great crested newt abundance levels can vary naturally between years. However, newt counts also have the potential to provide a unique insight into the absolute losses and gains in great crested newts that result from the Scheme. For example, they are essential to counter the criticisms justifiably applied

[1] Data collected for the main outcome study of ponds has been designed to maximise the statistical validity of net gain estimates by using repeat monitoring of same-age pond cohorts. However we will also use eDNA data available from annual compliance monitoring, to provide information on pond occupancy in compensation ponds of all ages.

to existing mitigation schemes, that development can destroy ponds with many thousands of newts and replace them with sub-standard new ponds that have very few newts.

To provide population data we will monitor newt abundance at one pond in each of the sites monitored for pond occupancy (n = 20-40), using the survey design outlined in 2 above (Figure 3.1). To ensure rigor, where more than one pond is present in the development area we will survey the pond known, or most likely to, have the highest population of great crested newts. To minimise sampling variability we will use a six visit Capture-Mark-Recapture method.

3.4.3 Reporting cycles

Both activity and outcome monitoring results will be reported annually.

Because the new compensation ponds will take time to colonise, the results of the first *full* analysis of outcome data based on pond occupancy and population size will be available after ponds are three years old, and annually thereafter. Interim outcome results describing occupancy and HSI scores for compensation ponds will be available through compliance monitoring from year 1.

3.4.4 How net gain will be calculated

Net gain in biological outcome and activity measures will be calculated, both for each participating Local Authority and for the whole region, as:

(i) the net change in each measure across all years e.g. total number of ponds lost to development compared to the total number of ponds created in all years, and

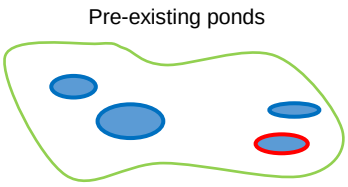
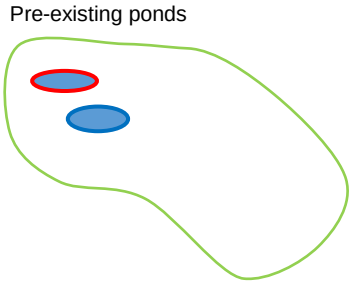
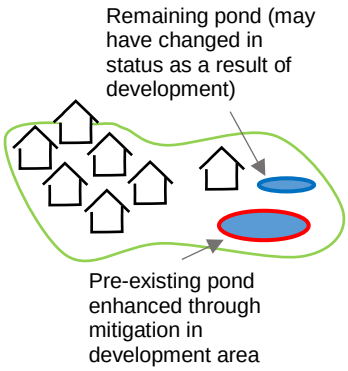
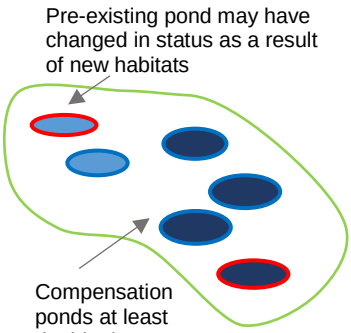
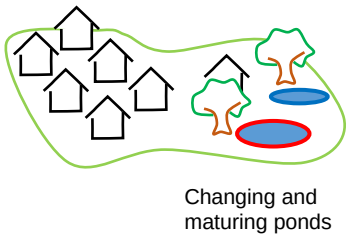
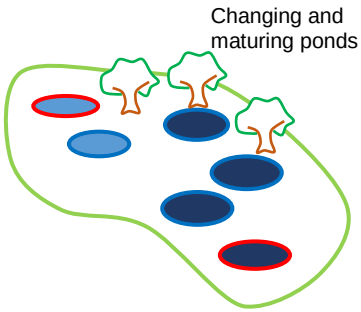
(ii) a statistically significant change in measure values e.g. significantly more occupied ponds after mitigation than before development.

Calculating these statistics takes account of on-site mitigation and other background changes associated with the development and habitat compensation areas (See Figure 3.1).

Significant changes in pond occupancy, HSI and activity metrics will be analysed using a Scheirer-Ray-Hare test, looking both within treatment (before and after) and between treatments (development vs compensation sites).

Net gains in great crested newt populations will be analysed as a 2-way ANCOVA (or equivalent non-parametric method) within and between treatments, with two covariates: starting population and year.

Figure 3.1 Outcome measures: survey methodology for measuring net gain based on pond occupancy and population

	Development site	Habitat compensation site	
Pre-development baseline (t1) 20-40 development and compensation sites monitored. *Sampling method*: (i) All ponds sampled for occupancy (eDNA), (ii) Population count (CMR) for 1 pond if GCN are present			**Key** Pre-existing pond Compensation pond Occupancy survey Population count survey
New ponds at 3 years old (t2) *Sampling method*: (i) All pre-existing ponds sampled for occupancy, (ii) One pond has population count. *Analysis* calculates: (i) Change within each site between t1 and t2 (ii) Net loss from development sites compared with net gain from habitat creation sites to measure net change between the two treatment types			***Questions answered:*** **(i) To what extent have: (a) the number of occupied ponds, and (b) newt populations, increased as a result of the Scheme after 3 years?** **(ii) Are the differences statistically significant?** *Additional insights gained:* (i) What happens to GCN populations in ponds retained on development sites? (ii) How effective are on-site mitigation measures? (iii) Do pre-existing ponds in habitat compensation areas benefit from new habitat creation nearby?
New ponds at 6 years old (t3) *Sampling method*: (i) All pre-existing ponds sampled for occupancy, (ii) one pond has population count *Analysis* calculates: (i) Change between t1 and t2, (ii) Change between t1 and t3, (ii) Net change between development and habitat compensation treatments for each time period.			***Questions answered:*** **(i) To what extent have: (a) the number of occupied ponds, and (b) newt populations, increased as a result of the Scheme after 6 years?** **(ii) Are the differences statistically significant?** *Additional insights gained:* (i) How do occupancy and populations change as new ponds mature? (ii) How does pond management affect population & occupancy? (iii) In the longer term, what happens to: existing ponds left on development sites, ponds subject to on-site mitigation & pre-existing ponds in habitat compensation areas?

3.5 Establishing GCN status and FCS at District level

The second element of the monitoring programme assesses the status of great crested newts at the South Midlands region level.

Great crested newt status will be assessed across the region through a stratified random selection of 1 km squares. 50 squares will be assessed annually, providing a district-level data set of 150 squares on a rolling three-year basis.

In each square, all ponds will be visited (subject to access permission), with eDNA sampling and HSI assessments undertaken to investigate pond occupancy and quality. Additional habitat quality indices including connectivity will be assessed via modelling and ground-truthed. Great crested newt abundance data will be collected for a sub-sample of these ponds. Because of the considerable cost of collecting count data, the number of ponds surveyed will depend on scheme uptake (Table 3.2b). Prospects metrics will be assessed for each 1 km square.

These data will be analysed to show how status is changing, and identify the contribution to Favourable Conservation Status made by the Licencing Scheme.

3.5.1 Additional analyses

Compatible data (occupancy, HSI, habitat quality and connectivity) will also be collected from all 1 km squares in which the 20-40 development and 20-40 habitat creation study sites occur (Section 3.4). These data will be analysed in conjunction with the 50 square wider countryside data above, to provide an objective measure of background changes that could influence our net gain analysis (Section 3.4). This analysis will ensure that we do not over-estimate net gain from the Scheme if newt trends are, in any case, rising in the region. It will also guard against misinterpretation of low net gains that could occur if, for example, a disease outbreak caused widespread loss of great crested newts across the region.

Data from these studies will also be re used to: (i) develop the mapping and modelling work and (ii) contribute to the national status assessment.

Used together, they will also make it possible to answer important questions about the value of the scheme and its wider contribution to FCS. For example:

- *Do new developments reduce newt populations in surrounding areas – i.e. beyond the development boundary?*
- *Does adding new newt habitat and increasing landscape connectivity strengthen newt populations in surrounding countryside areas?*

3.5.2 Identifying the contribution our Licencing Scheme makes to delivering FCS in the South Midlands region

Status monitoring as outlined in the sections above will provide an assessment of the species status across the region. These data will allow an evaluation relative to the favourable references values and hence a region/District level assessment as to whether the species is in a Favourable Conservation Status.

To ensure these analyses are as comprehensive and robust as possible, we will supplement our data with information from other sources, for example through records centres or local volunteer schemes where this is useful.

3.6 Monitoring subsidiary scheme objectives

In addition to providing data to evaluate conservation outcomes, the scheme's monitoring data have the potential for wider usage.

3.6.1 Contributing to *national* GCN conservation status reporting

The metrics we describe above are compatible with the metrics used for national reporting on great crested newt status, enabling our data to feed directly into the 6-yearly national reporting cycle.

3.6.2 Monitoring wider biodiversity

Creation and management of high quality ponds and terrestrial habitats for great crested newt has the potential to benefit a far wider range of plant and animal species.

Our aim is that these broader biodiversity benefits *at least* off-set any damage that may arise when existing ponds (and other habitats) are managed to specifically benefit great crested newt as part of mitigation work (see also Appendix 4).

Beyond this, given that our conservation programme specifically aims to create high quality sites with clean water and semi-natural surrounds, we expect the project to deliver a significant net gain in a wide range of both terrestrial and aquatic biodiversity.

We will quantify and report these wider benefits as part of the scheme's monitoring regime, focusing on:

(a) Broad assessment of habitat quality and biodiversity gains, particularly those which contribute to regional and national reporting e.g. Priority Ponds creation.

(b) The scheme's broader contribution to the biodiversity and connectivity of the wider landscape based on the Lawton principles of 'more, bigger, better and joined'.

3.7 Transparent reporting of results

Transparent reporting of the scheme data and results will be achieved through:

1. Provision of monitoring protocols that detailed the methodology used
2. Annual reporting against targets to Natural England and Local Planning Authorities for the region as a whole and for each participating Local Authority
3. Timely release of raw monitoring data, made freely available to all.

3.8 Further use of monitoring data

Scheme monitoring will produce a substantial and original dataset with considerable potential for reuse. We will facilitate this through a policy of *providing open access to our raw data*[4] and by pro-actively encouraging collaborative research. As a result, we anticipate that further analysis of the Scheme's data by ourselves and others will provide a range of new insights leading to improvements in the way great crested newt habitats are created and managed (examples in Figure 3.1).

[4] Excepting personal data protected under the Data Protection Act 1988 et seq.

3.9 Summary costs

This section is commercially sensitive.

3.9.1 Summary

Our monitoring strategy provides a robust methodology that quantifies the net gains created by the Licensing Scheme and identifies how these gains contribute to achieving a region-wide increase in Favourable Conservation Status for great crested newt.

We have set ambitious habitat compensation targets which include a commitment to create four times as many occupied ponds as are lost to development.

To assess net gains:

1. The monitoring programme directly measures net gain using five groups of activity measure and three measures of conservation outcome, to compare losses to development with gains from habitat creation
2. Our measures of conservation outcomes use a statistically sound before-and-after approach that also considers on-site development mitigations and the temporal effects on habitats as they mature and change
3. Our survey methodology identifies the underlying trends in great crested newt conservation status across the region, to ensure that any gains we see are real and not due to pre-existing trends
4. The monitoring programme assesses the ongoing status of great crested newts at District level and identifies how the Scheme's habitat creation programme helps to achieve Favourable Conservation Status across the region.

The monitoring programme adds further value by:

- Providing data that will create additional insights into great crested newt conservation issues including the impact of development on ponds remaining in the near surrounds, and the ability of new newt habitat to strengthen populations in surrounding countryside areas
- Generating regional great crested newt data that contributes towards the *national* assessment of great crested newt status
- Providing information about the scheme's contribution to biodiversity more widely.

Transparent reporting of Licencing Scheme data and results will be achieved through:

- Provision of, and adherence to, detailed monitoring protocols
- Annual reporting against targets
- Provision of our raw monitoring data, made freely available to all.

4 A programme of habitat creation and management

This section sets out the programme of high quality habitat creation and management to deliver a net gain in conservation status of great crested newts in the South Midlands region.

The scope of the programme addresses our commitment, set out in Section 3, to quadruple the number of ponds lost to development, ensure these ponds are high quality and able to support strong great crested newt breeding populations, and to increase the quality and extent of suitable terrestrial habitat compared to that lost to development to ensure that populations remain healthy and secure.

In this section, our habitat creation programme's principles, working practices and costs are given for each of three delivery stages:

- Site selection and screening (Section 4.1)
- Habitat creation, including pond and terrestrial habitat restoration and creation (Section 4.2)
- Long-term habitat management, maintenance and monitoring of sites (Section 4.3).

4.1 Site selection and screening

4.1.1 Spatial selection of habitat creation sites

The choice of location for habitat creation sites will be driven by the spatial strategy for the South Midlands region (Section 2); with conservation delivery focussed in the areas that are identified on the Conservation Priorities Map (CPM, Appendix A3 of the licence application – also shown in Appendix 2 to this document). Generally, habitat creation/management will be undertaken in the local authority district in which impacts have been authorised, and/or within the National Character Area in which the impacts occur. Whilst impacts will be compensated, and net gain delivered, in or adjacent to the local authority districts in which development impacts authorised under the scheme are felt, it is also relevant that this scheme operates at a wider landscape level and net gain for GCN populations (and wider biodiversity) is delivered across the whole of the South Midlands region. Therefore, compensation will be delivered in the context of National Character Areas (a system of landscape classification published by Natural England in 2014). The numerical targets for habitat creation (e.g. number of ponds created) are given in Section 3 (Table 3.1).

4.1.2 Temporal selection of habitat creation sites

To deliver the scheme, compensatory habitats will be created ahead of development impacts being authorised. To start this process, at the outset of the project we will invest a total of £350k to establish at least one habitat compensation scheme in each participating Local Planning Authority within the South Midlands region.

Each of the pond creation sites are located within 500 metres of existing GCN populations, with no barriers to movement so that natural colonisation can take place

quickly. We have commenced early discussions with landowners and undertaken the initial screening for these sites, but in the absence of a licence and funding (the early funding for the upfront habitat creation is conditional on the licence and funds cannot be drawn down until a licence has been granted) detailed agreements cannot be finalised.

In more general terms, habitat creation does not immediately deliver habitat that is 'functional' for great crested newts, although usually only a few months are required because great crested newts are an early colonising species. Therefore, we will aim typically to initiate the habitat creation process at least 6 months before developmental impacts occur. This will be delivered through a planning condition that requires payment by developers of the 'second stage' charge (required for higher impact schemes) at least 6 months prior to commencement of development. There will be advance notice of impacts which are likely to be coming forward, as the metric assessment will be carried out before, and to inform, the planning application. NSP will record and track all impacts which are assessed through the metric, and keep the SMNCP informed through the use of live database and trackers – so SMNCP will be aware of likely impacts even before they are granted planning consent and so early preparations for habitat creation can begin. Of course, not all schemes assessed through the scheme will subsequently be granted planning consent, but this does provide a gauge of impacts locations and extent well in advance.

4.1.3 Selecting habitat compensation sites

Site selection is the most critical step in delivering good quality habitat creation. Poor choices at this stage have adverse repercussions on the ultimate success of mitigation schemes, and particularly their long-term sustainability. It is more effective to invest resources ensuring good site selection, so that sites are only created where there is a high confidence of their long-term viability, than it is to design and implement legal enforcement measures to force unwilling landowners to maintain their sites against their wishes. Our programme, therefore, puts considerable emphasis and resources towards a two-stage site selection and screening process that will ensure the creation of high quality sites such that the vast majority (we estimate 95%) will remain as good habitat in the long term.

The likely compensation requirements (arising from expected levels of forthcoming impacts) will also be taken into account, to ensure that habitat creation is undertaken in a timely way, and that sufficient habitat is being created in the appropriate locations (within the relevant National Character Area) to compensate for impacts and provide net gain.

Stage 1 Site search

(a) Broad search to find sites – focus for sites will primarily, but not exclusively, be within the GCN conservation priority areas identified on the Conservation Priorities Map. This will be undertaken through our wide range of established contacts amongst those involved in land management including agricultural land agents, land holding NGOs and other organisations (e.g. Forestry Commission).

(b) Initial landowner liaison - site-based discussion with landowners to introduce the scheme. Ultimately we envisage that our site portfolio will include a broad spectrum of land managers from commercial farmers to nature conservation NGOs. Our policy will be to favour land managers who are broadly sympathetic to great crested newt conservation in order to ensure good long-term outcomes for newts.

We expect a high drop-out rate at this preliminary stage of site identification. Our cost calculations assume a 20% success rate to reflect this.

Stage 2 Site screening

Screening assessments will be used to establish whether habitat creation at a site is likely to be viable and sustainable. Screening will be based on a combination of desk study investigations (geology, archaeology, protected species, services e.g. overhead or buried electrical lines, National Character Area, planning and infrastructure proposals) and field data collection (water quality, water levels, habitat quality). Standard protocols will be used to ensure consistency and quality.

The main screening attributes used to assess sites at this stage are summarised in Table 4.1. They are based on the assumption that the majority of habitat compensation sites will be located in GCN Conservation Priority Areas. Additional screening will be undertaken at pond *restoration* sites (where outcomes tend to be more unpredictable), to optimise success (Appendix 4).

Following site screening and discussions with land managers we expect a moderate drop-out rate, either because sites are not suitable for high quality habitat creation or because they are withdrawn by land managers. Our cost assumptions are based on a 60% success rate.

4.1.4 Site selection costs

This information is commercially sensitive.

Table 4.1 Attributes used to assess site potential at the screening stage

Assumes that habitat compensation sites are located in relevant National Character Area.

Aim of screening	Reason	How we pick this up at the screening stage
Avoid damage to existing sites (biology, archaeology)	Habitat creation or restoration should not damage existing areas of value for (any) species or archaeology.	• Identification of designated sites – SAC, SPA, SSSI's. • Extended Phase 1 habitat survey, followed by Phase 2 surveys where required • Pond management risk assessment, followed by detailed surveys where required • Archaeology desk top assessment and county archaeologist check
Ensure sufficient water permanence in breeding ponds	Breeding ponds need to be permanent or semi-permanent to avoid drying out before efts have developed	• Desk-top assessment of near-surface geology • Onsite assessment of local catchment topography • Auger (hand or drill) survey of lithology and water levels • May require installation of dip wells monitored for up to 1 year
Ensure breeding ponds have clean water (low levels of nutrients, heavy metals, oils)	• Need to retain clear unpolluted water suitable for breeding and eft development • Good potential to support aquatic and marginal plant communities suitable for egg-laying, and a diverse invertebrate food source	• Desktop and on-site assessment of landuse and pollutant sources • Chemical analysis of water quality (on-site rapid test kits or laboratory as appropriate) • Ensure ponds can be fed by good quality groundwater and/or surface water draining from semi-natural areas. Avoid stream or ditch inflows

	• Reduced need for, and cost of, ongoing management • Benefits for wider biodiversity	• Ensure sites have limited public access (e.g. ponds not adjacent to public footpaths to avoid turbidity and pollutant impacts from dogs)
Fish unlikely to colonise, or be introduced to, breeding ponds. Water fowl unlikely to be an issue	Fish and waterfowl can have adverse impacts on great crested newts both directly through predation and growth inhibition, and indirectly through reduction of macrophytes and water quality & clarity	• Ensure new ponds would have limited public access to avoid fish introduction • Avoid stream inflows as a water source for ponds
Suitable terrestrial habitat is present or can be created in proximity to existing populations	• Great crested newt populations thrive best where terrestrial habitat offers good cover, hibernation and foraging opportunities (meadow, rough grassland, scrub or woodland) • To increase quality of existing habitat and create new high quality and accessible habitat • To increase habitat linkages, enabling existing populations to extend into.	• Desk study, to check for existing records, proximity to occupied ponds, potential barriers and likely dispersal /colonisation timeframe • On-site assessment and discussion with land manager
Ensure site is free from development threats	Subsequent development on or near to GCN sites may destroy or degrade habitat and affect the long-term prospects of a site	• Liaison with LPA to check for planning allocations/permissions/applications • Liaison with LPA, PINS, online resources, etc. for Nationally Significant Infrastructure Projects (NSIPs) and other large infrastructure or non-LPA projects

4.2 Habitat creation

Conservation delivery will largely be through three complementary mechanisms:

(i) creation and restoration of breeding ponds,

(ii) improvement of adult terrestrial habitats to provide greater cover, and foraging opportunities,

(iii) improvement of landscape connectivity to increase opportunities for dispersal and maintain genetic diversity.

The choice of measures at any site will depend on the priorities identified within spatial strategy and the on-site opportunities presented. However at most sites we expect to undertake a combination of at least two of these activities.

4.2.1 Creating ponds

A typical 5 hectare pond creation site is based around a mosaic of 10 largely permanent ponds, with a range of maximum depths to insure against the vagaries of an uncertain future climate. Pond design will follow the published and online advice for great crested newts from Amphibian and Reptile Conservation Trust and Freshwater

Habitats Trust[5], with an emphasis on ensuring that ponds will remain clean water habitats for the long term and are likely to suffer low impacts from fish and waterfowl.

On average we assume that each new great crested newt pond will be moderately large with a surface area of c. 600m^2 (20 m x 30 m), an average water depth of 1 m and an overburden depth of 1 m (i.e. total average depth from top of bank of 2 m). Our strong preference is for creation of un-lined ponds. Lined ponds create issues with longevity and constrain after use (e.g. cattle grazing and management) and they are also more expensive (2 to 5 times greater cost depending on the type of liner used). There are likely to be occasions when creating lined ponds is unavoidable but we anticipate these will be relatively few in number, and this option is not costed separately below.

4.2.2 Restoring ponds

Pond restoration will include:

a) managing ponds that do not have great crested newts

b) enhancing great crested newt ponds that are currently in poor condition (e.g. HSI<0.7) or have poor prospects to increase population numbers.

Restoring ponds to increase suitability for great crested newts typically encompasses a combination of:

(i) dredging vegetation and silt from ponds that are too shallow or overgrown to support breeding newt populations

(ii) re-profiling banks to create marginal plant habitats (cover, habitats for egg-laying and invertebrate foraging opportunities)

(iii) reducing the extent of overhanging scrub and trees to enhance the growth of marginal and aquatic plants for cover, egg laying and foraging.

Fish removal can also be an effective restoration technique both for reducing great crested newt predation and increasing water quality and clarity.

Pond restoration costs

The cost and difficulty of dredging ponds varies enormously depending on the size and depth of the waterbody and the extent to which bottom sediments are consolidated. The costings assume that dredging is undertaken using a specialist long-reach excavator and dumpers, with semi-solid sediment deposited on the same land holding and either spread locally or contained in a sediment lagoon. Excavating large deep ponds with loose sediment can require expensive specialist dredging equipment, whilst the cost of disposing of liquid spoil off-site is prohibitive. This means that it may not be cost-effective to dredge some otherwise appropriate waterbodies.

Fish removal costs are based on a moderately large pond which is partially drawn-down to facilitate seine netting or electro-fishing. Overall, the cost of removing fish from a pond is roughly two-thirds the cost of combined dredging and scrub clearance. However, costs per site are not dissimilar if, as is often the case, the drawdown for fish removal provides an opportunity for additional management such as partial dredging

[5] Amphibian Habitat Management Handbook. John Baker, Trevor Beebee, John Buckley, Tony Gent and David Orchard (2011). Amphibian and Reptile Conservation, Bournemouth. ISBN: 978-0-9566717.
Creating ponds for amphibians and reptiles. Million Ponds Project species dossier. Freshwater Habitats Trust http://bit.ly/2hb1ZE9

or tree removal. For the purposes of the cost summary (Table 4.4) fish removal is, therefore, regarded as broadly equivalent to the more traditional management above.

In most new ponds plant colonisation occurs very quickly and it will usually be unnecessary to plant up ponds. There may be exceptions at sites that involve the recovery of very small newt populations. However this will be atypical and, since any plants are likely to be sourced from nearby ponds, costs will be minimal. Planting is therefore not included in the costings.

4.2.3 Creating terrestrial habitats

A pond typically requires at least 0.5 hectare of suitable habitat in its vicinity to provide good cover and foraging opportunities for great crested newts. The management and creation of terrestrial habitats is therefore assumed at all habitat compensation sites.

This will typically include a variable proportion of densely structured habitats like blackthorn scrub where newts can take refuge and over-winter, and rough grassland with a tall sward height to provide food and cover. Hibernacula will be created at sites that initially lack good ground cover.

For bare sites, such as reversion from agriculture, new tree planting areas will be mulched to provide a litter layer and additional log, rock or turf stacks will be introduced to provide immediate cover.

Terrestrial habitat costs

The costs assume that for a 1 ha site with two ponds, approximately 30% will be planted as mulched low scrub and 40% maintained as rough grassland. It is likely that some sites will need to be fenced: the costs assume that c. 15% of plots are fully enclosed.

4.2.4 Improving terrestrial connectivity

Habitats such as ditches and hedges can increase opportunities for great crested newt dispersal and help to maintain genetic diversity of newt populations.

The costs below include provision for 500 m of hedgerow per ha of habitat creation specifically planted to increase landscape connectivity. Hedgerows will either be planted adjacent to the new pond and terrestrial habitats to link them into the existing ditch and hedge infrastructure, or be strategically located further afield to improve connectivity within the wider landscape.

Other measures likely to increase connectivity (such as road tunnels) may also be implemented where this is expected to result in significant benefits to local or regional newt populations. However, these activities are likely to be the exception and are not costed separately here.

4.3 Long-term management and maintenance of sites

All habitat compensation sites will require ongoing management to maintain them in an optimal condition so that they are able to sustain strong great crested newt populations in the long term.

For this reason we have made a major commitment to long-term, preferably ‘in-perpetuity’, management of the habitat compensation sites.

Site management will be delivered by landowners, under a permanent rolling contract with an initial non-negotiable 5 year period, to the South Midlands Newt Conservation Partnership (SMNCP). All sites will have a long-term management plan agreed with the site manager. This will form the basis of a site-specific contract which lists the detailed prescriptions for management of both aquatic and terrestrial habitats.

Site managers will receive an annual payment, at an estimated average cost of £2,000 per ha per annum, paid in arrears, with satisfactory evidence of compliance triggering payment (see below).

Long term (in perpetuity) funding of site manager payments will be provided for by an endowment fund (see Section 5).

To support site managers SMNCP will provide a range of training, information and ongoing advice including:

- training and upskilling workshops
- stand-alone management guides
- YouTube management videos
- telephone support line

Creating ponds, and their surrounding habitat, is a significant change in land use, and is not easily reversed, so it is unlikely there will be much pressure from landowners to remove sites from the scheme once they are created; nevertheless, as noted above, the scheme further mitigates such pressures through careful site selection at the outset, and through generous annual payment rates. These measures are considered more effective than prescriptive legal enforcement clauses which, in the absence of conservation covenants, are difficult to enforce and highly unattractive to potential participating landowners. We accept the possibility therefore that there will be some small annual loss of ponds, through landowners withdrawing from the scheme, but it will be monitored closely and will be negligible compared to the hundreds of ponds that are being created each year – expected to be to a 8:1 gain:loss ratio (but with a minimum target of 4:1).

4.3.1 Compliance monitoring

All habitat compensation sites will be subject to compliance monitoring, undertaken in advance of the release of annual payments.

During the first five years, all sites will receive an annual check from SMNCP staff. This will include:

(a) A compliance check against the site's habitat management prescriptions.

(b) Liaison with the land manager to discuss management for the coming year.

(c) Additional checks needed to better understand the site condition for great crested newts (e.g. water quality, eDNA for great crested newts or fish, chytrid swabs). Information from these checks will be used to inform site management and, where necessary, update the site management prescriptions for future years.

If there are compliance issues i.e. the site is not being managed according to the rolling contract, then payments in arrears will not be made until the issue is rectified and, if the issues continue, then ultimately funds will be permanently withheld and the contract with the landowner terminated.

If, after five years, there are no on-going compliance issues at a site, site visits may be staggered (probably every three years). In intervening years sites will be evaluated through site photographs provided by the land manager.

Compliance monitoring is costed at an average of £550 per pond which covers administration of the scheme, together with on-site checks and collection of eDNA and water quality samples where necessary. eDNA samples will be taken annually from every created/restored pond until such a time as GCN presence is confirmed in each individual pond.

4.4 Summary

Through a programme of habitat creation and management for the South Midlands great crested newt District we will deliver:

1. A rigorous site selection and screening process that ensures strategic creation of high quality habitats in the GCN Conservation Target Areas identified by the Spatial Strategy, to meet the new habitat number, area and quality targets outlined in Section 3.
2. Extensive newly created areas of aquatic and terrestrial habitats: optimised to support strong and sustainable great crested newt populations; designed and implemented by the UK's national experts.
3. Provision of many kilometres of additional habitats (hedges) to increase landscape connectivity within region.
4. In perpetuity management of our habitat compensation sites, sustained though an endowment fund.
5. A fully-funded monitoring and surveillance regime which will ensure that the quality of each site can be maintained in the long term.

5 Funding site management and monitoring

This section is commercially sensitive.

6 The business model and charging strategy

This section is commercially sensitive.

Appendix 1 Summary of the modelling methods

This information is commercially sensitive

Appendix 2 Conservation - zoning methodology and Conservation Priority Map

Methodology

The Conservation Priority Map identifies the zones (great crested newt Conservation Target Areas) where we will prioritise conservation work to ensure the scheme not only creates no detriment to FCS but creates a net gain for great crested newt populations. Specifically:

- Ensure that the core areas of existing good quality habitat for great crested newts in the South Midlands are maintained and extended.
- Achieve a net increase in the number of occupied 1 km squares, and to increase the number of ponds occupied in 1 km squares where newts are present.

To develop the map we used the following information to identify the priority Conservation Target Areas:

1. The distribution of red zones (i.e. the areas with highest likelihood of newt occurrence), which combine good quality terrestrial habitat and high pond densities. The conservation zones focus on the larger continuous or semi-continuous red zone areas, omitting the smaller isolated modelled high quality habitat patches, typically those covering less than c0.5-1 km2.
2. The distribution of amber zones which are broadly areas of good terrestrial habitat with lower pond density. Typically we have identified a 1-2 km band of amber zone habitat around core red areas as these are locations with good terrestrial habitat and close proximity to existing newt populations, making them optimum sites for creation of new pond and terrestrial habitat, and improving existing ponds.
3. Areas with concentrations of eDNA and traditional records for great crested newts; although these broadly overlap with the red zones there are some important concentrations of newts which are outside the red zone which we have included as conservation priority zones.
4. Areas outside of floodplains (1:100 year flood): we have broadly excluded floodplains, except in areas where extensive low-lying grasslands lie on the fringes of the 1:100 flood envelope. In the South Midlands these can provide important areas of newt habitat, both terrestrial and aquatic, and where relevant they are included in the Target Areas.
5. Barriers to movement through the landscape, particularly major roads and larger rivers.
6. Land allocated to developments: we do not intend to undertake conservation works in areas which are allocated for development, and where they overlap conservation priority areas they will be excluded from any practical works.

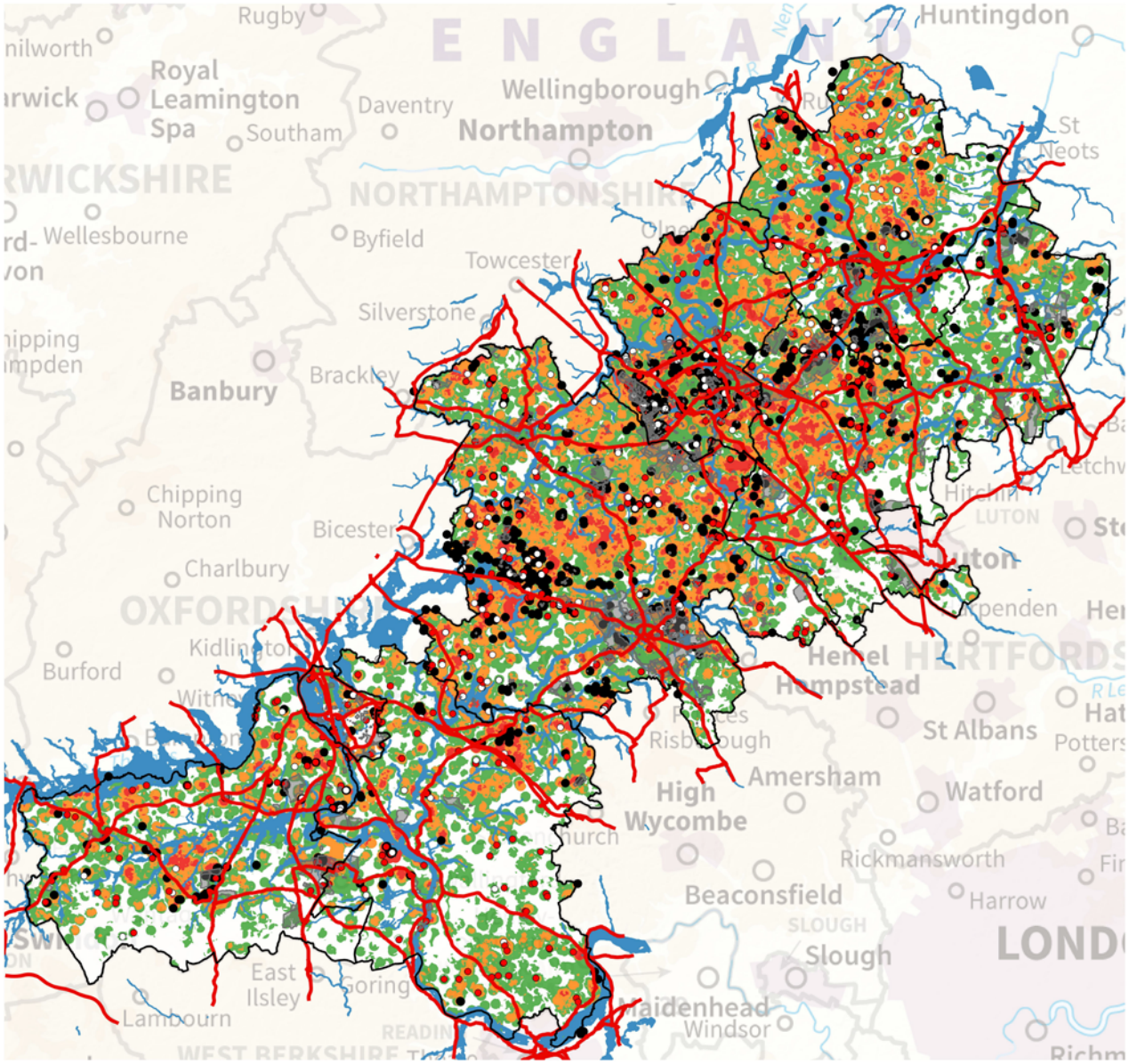
Modelling of these data has been combined with expert judgment in consultation with Local Planning Authority ecologists and other relevant specialists.

The zones identified provide areas of search where any habitat creation and management work will be (a) in habitats likely to be of good quality for great crested newts (b) close to existing populations so maximising the likelihood that they will benefit great crested newts.

Our implementation of the conservation programme will be focused on the great crested newt Conservation Target Areas. However, we will also consider on a case-by-case basis, opportunities to protect more isolated populations (for example in South Oxfordshire Chiltern woodlands) where there may be opportunities to ensure the continued existence of isolated populations in sub-optimal landscapes.

The Didcot / Milton area is a well-known local hotspot for great crested newts where significant urbanisation is taking place on brownfield (Didcot Power Station) and greenfield sites. An important part of this population is located in green spaces in the urban matrix, and we aim to help support this population and enable it to spread to the remaining open areas where former gravel pit workings, other brownfield sites and new greenfield habitat creation provide opportunities to maintain the range of the newts in this area. The conservation target area has been amended to exclude most of the development allocations. In this area ownership or leasing of sites by conservation bodies is likely to be necessary to ensure long-term site integrity as part of green infrastructure. For example, Freshwater Habitat Trust is currently in discussion with a mineral company about the adoption of a former minerals site in this area. Additionally, previous landfills prevent further urbanisation and provide opportunities for long-term greenspace maintenance adjacent to landfilled area. However, this is perhaps the most challenging of the priority areas and may require further revision if it proves impossible to find sufficient habitat creation opportunities in the priority zone. Overall, our plan is to treat this area somewhat experimentally by attempting to replicate approaches adopted in Milton Keynes where large numbers of newts are retained in greenspaces in an urban matrix.

The Target Areas are optimized for the protection of great crested newts. In a number of areas they overlap with existing Biodiversity Opportunity Areas (BOAs) and as far as possible we will attempt to undertake newt conservation work in these areas to strengthen the biodiversity priority areas. However, it should be noted that BOAs were not designed specifically with great crested newts in mind and exclude some of the important ‘newt landscapes’.



Map 1. Basemap

The map summarises the main sources of data on which the identification of priority great crested newt conservation zones is based.

Legend

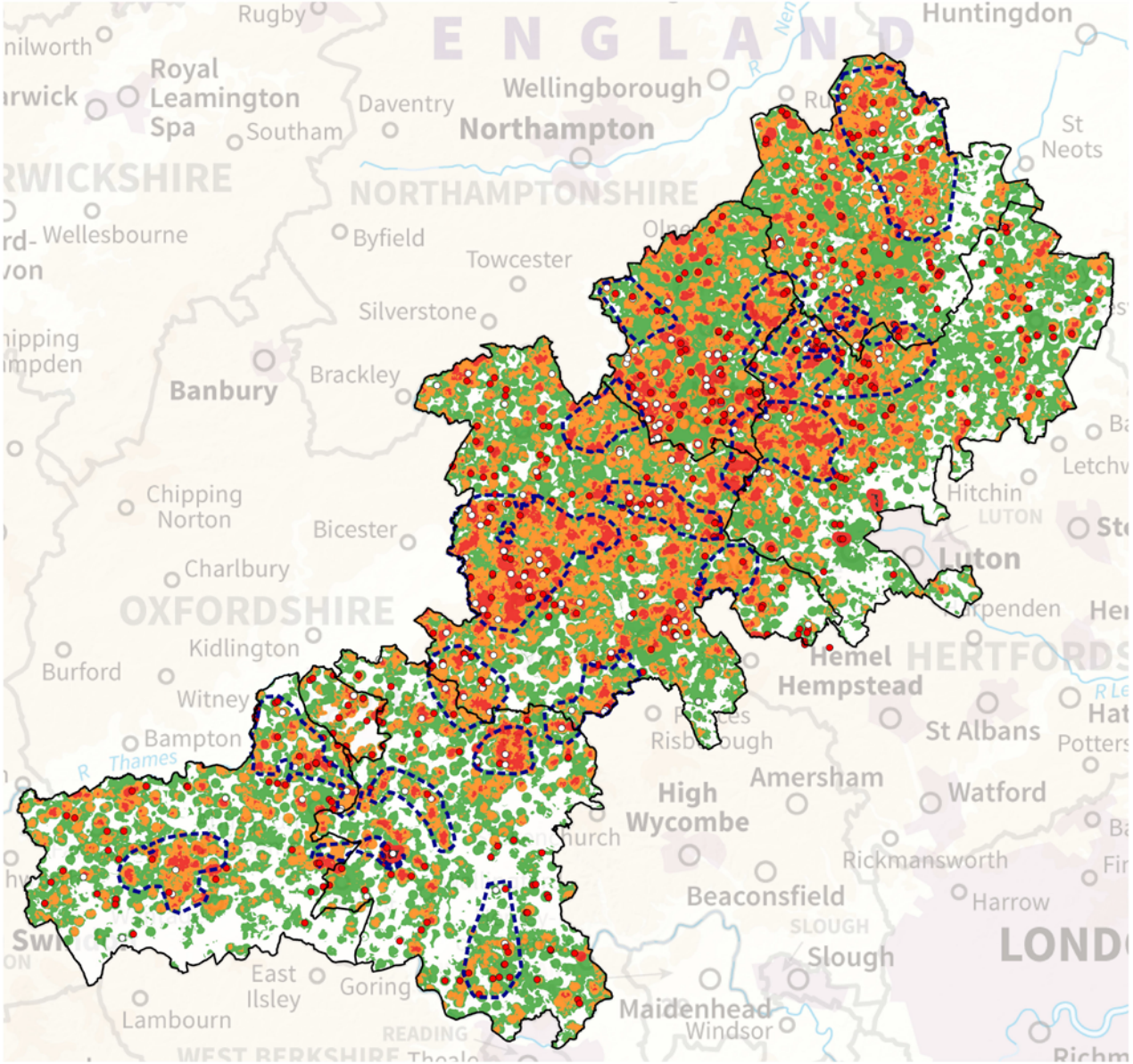
- Local authority boundaries
- Motorways and A roads
- National flood zone 3
- Land allocations
- LERC GCN records

eDNA Results

- Positive
- Negative

Landscape zones of importance for GCN

- Black
- Red
- Amber
- Green
- White



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Map 2. Priority great crested newt conservation landscapes

Map is simplified to show how conservation landscapes are designed to capture red zones of high importance for GCN and high concentrations of eDNA positive records.

Legend

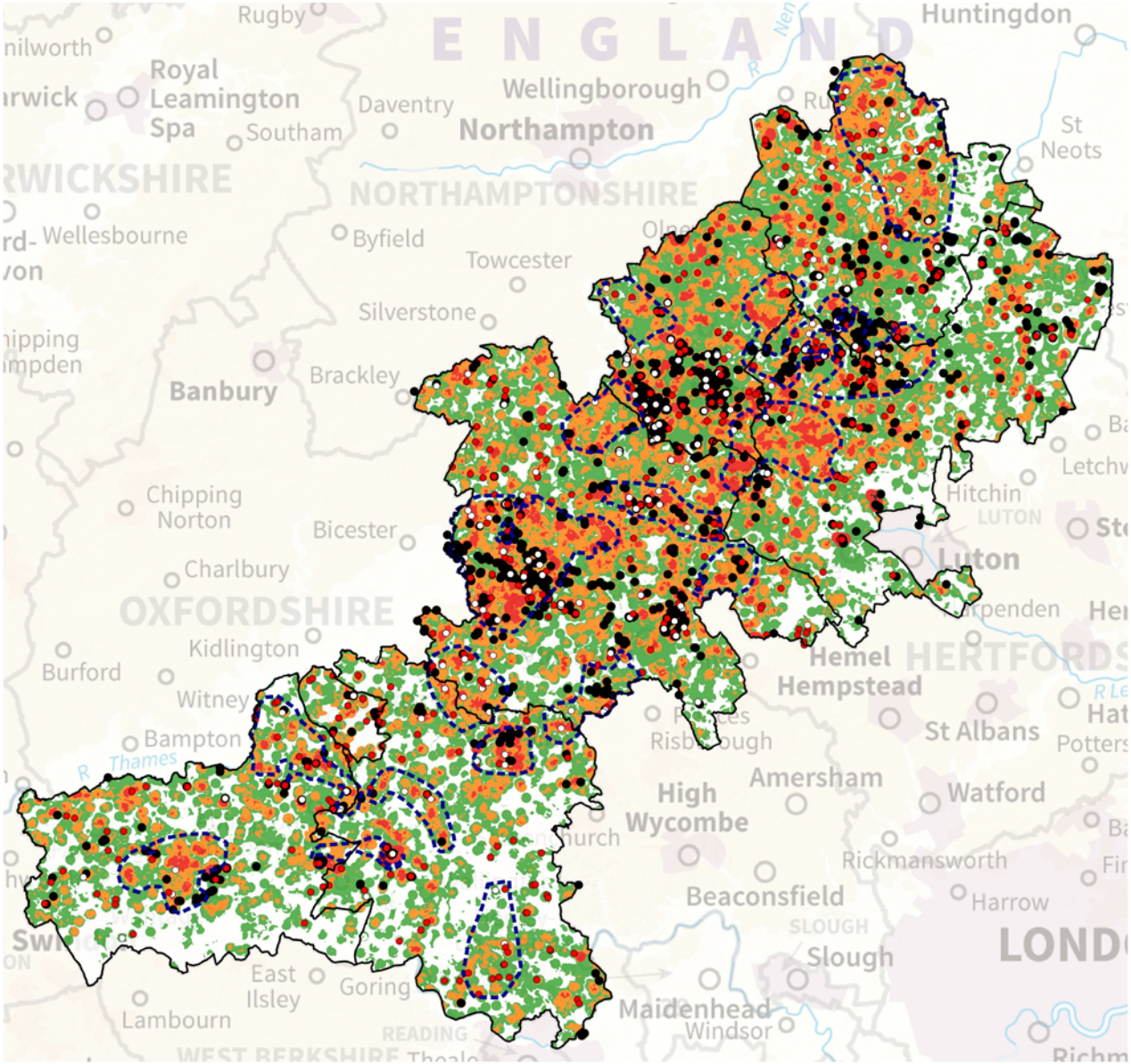
- Local authority boundaries
- Priority GCN conservation areas

Landscape zones of importance for GCN

- Black
- Red
- Amber
- Green
- White

eDNA Results

- Positive
- Negative



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Map 3. Priority great crested newt conservation landscapes

Map is simplified to show how conservation landscapes are designed to capture red zones of high importance for GCN, LERC records and high concentrations of eDNA positive records.

Legend

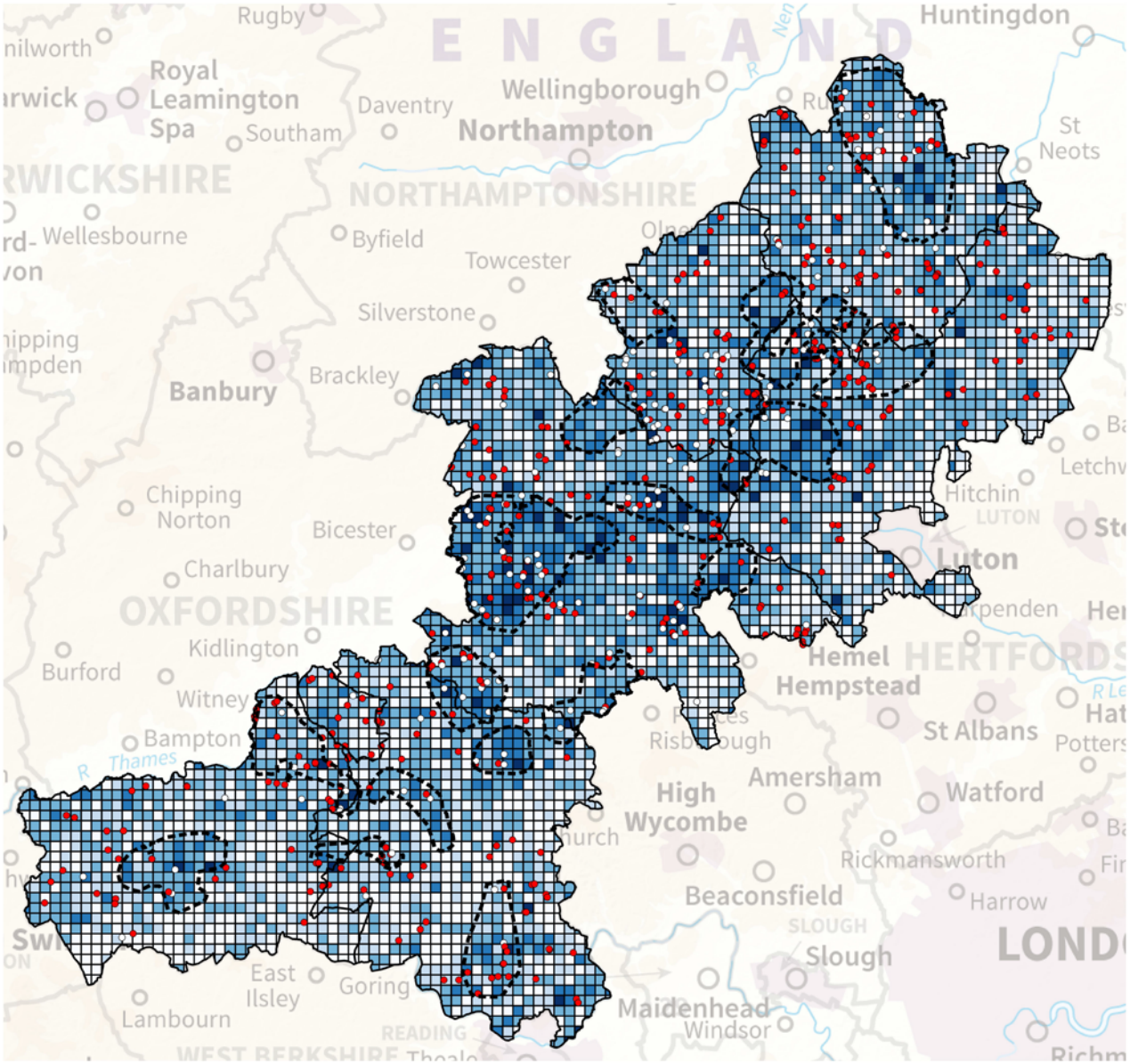
- Local authority boundaries
- Priority GCN conservation areas

Landscape zones of importance for GCN

- Black
- Red
- Amber
- Green
- White
- LERC GCN records

eDNA Results

- Positive
- Negative



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Map 4. Priority great crested newt conservation landscapes in relation to pond density at 1km square level

Within each conservation zone, pale 1km squares show areas to prioritise for habitat creation (especially pond creation).

Legend

- Local authority boundaries
- Priority GCN conservation areas

eDNA Results

- Positive
- Negative

Pond Density

- 0 ponds / km square
- 1 pond / km square
- 2-5 ponds / km square
- 6-10 ponds / km square
- 11+ ponds / km square

Appendix 3 eDNA survey methods

The overall objective of the survey was the collection of a stratified random sample of great crested newt presence and absence data and extended Habitat Suitability Index (HSI) data for the development of General Linear Models (GLMs) of great crested newt distribution. Specifically, the aim of the sampling programme was to sample a set of sites which were representative of the landscapes of the South Midlands pilot area. The sampling strategy followed the same methodology as that recommended by Ewald and Biggs (2017)[1] for Natural England's district licensing pilot projects in Cheshire, Essex and Shropshire.

In the South Midlands, the total project area is 3705 km^2. The sampling strategy covered the full extent of the seven Local Planning Authority areas in the project area, treating this area as a single sampling unit. Surveys of 629 ponds were undertaken, located in 486 1 km squares across the South Midlands project area. Squares were selected at random, within a stratification based on existing records for pond occupancy and landuse (Ewald and Biggs 2017).

Sampling locations were stratified according to five main environmental factors identified by Bormpoudakis et al. (2015)[26] as potentially important ($p<0.25$) in determining the distribution of great crested newts: pond density, geology and the extent of arable land, grassland and urban areas, including major roads. Note that GLM models also use climatic variables and we assumed that, with a wide spread of samples across the project area our sampling locations would capture climate variation in the project area. In the South Midlands project area, we did not further stratify the sample towards agri-environment scheme areas and simply sought permissions from all available landowners. When it was not possible to survey a particular pond and there were no others within the 1km grid cell, the approach was to select as far as possible the next adjacent 1 km square to the originally randomly selected site, working clockwise in a spiral pattern around the original square until a new suitable site could be found. The square selection order was N, NE, E, SE, W, SW, W, NW in an expanding spiral. This was the approach we designed for Natural England in the eDNA sampling strategies for Cheshire and Shropshire.

In some instances, two ponds were sampled in the same square because we originally intended to create a separate set of newt positive squares for modelling, and newt positive squares for model testing. Because there were relatively few squares where there were pre-existing newt records, it was necessary for us to visit the same square twice in some instances to obtain the planned model testing dataset. In practice a different process was used to test the model, so the duplicate sites were discarded from the modelling process. A small number of sites were also visited in error twice by different surveyors, but we retained these records as they helped to provide some empirical evidence of result replicability, although not a formally designed test.

The sampling programme was undertaken mainly by five staff (providing 4 FTE equivalents), assisted part-time by three other staff to mop up sites towards the end of the survey period.

[1]Ewald N and Biggs J. 2017. A strategy for the collection of eDNA samples for the development of GLM models of Great Crested Newt distribution in Cheshire, Essex and Shropshire. Freshwater Habitats Trust, Oxford.

[2]Bormpoudakis D, Foster J, Gent, T, Griffiths, RA, Russell L, Thomas Starnes T, Tzanopoulos J, Wilkinson J (2015). Developing models to estimate the occurrence in the English countryside of Great Crested Newts, a protected species under the Habitats Directive. Defra Project Code WC1108. Durrell Institute of Conservation and Ecology, School of Anthropology and Conservation, Canterbury and Amphibian and Reptile Conservation, Bournemouth.

The surveyors were trained by the FHT team that developed the procedures for collecting eDNA samples in the UK. The training covered the basic background to eDNA testing, the field survey procedures, the identification of great crested newt preferred activity areas in ponds and an outline of the laboratory processes. Particular emphasis was paid to the key issue in eDNA sampling which is avoiding cross contamination between sites, between equipment and operators clothing and between laboratories. Approaches to cleaning equipment were explained and discussed - including biosecurity procedures needed for eDNA surveys. Before training the surveyors viewed the eDNA and clean water training videos prepared by FHT, and other written guidance material. Field sampling followed the protocol set out in the DEFRA report WC1067.

The surveyors were also trained in rapid test kit water sampling and in the procedures for calculating the HSI score.

The FHT team has extensive experience in this work having developed many of the UK's standard pond survey procedures and having trained hundreds of people over the last 20 years in these methods. The training was provided by Dr Jeremy Biggs who wrote the Defra UK protocol for eDNA testing.

The permission strategy was broadly similar to that adopted for the PondNet monitoring network and differed for the 'newt positive' and 'newt negative' squares. All landowners were initially contacted as quickly as possible by post with an introductory letter seeking permission to survey, using the Land Registry to obtain contact details. A small proportion of these landowners replied quickly and mostly positively (c. 10%). Many of the newt positive squares were in well-known locations and permission could often be quickly obtained by a follow-up telephone call. Permissions to visit 'newt negative' squares were generally harder to obtain, but again telephone contacting was the quickest method. Once surveyors began working in the field there were sometimes also opportunities to speak to landowners on site, although this is generally a rather time-consuming approach and is not the optimum method for getting permissions. We then attempted to telephone all remaining landowners, quickly moving on to alternative sites if it proved difficult to reach the original selected landowner. The site replacement strategy was to choose the nearest neighbouring pond within the 1 km square which had a different landowner, and then the next nearest 1 km square, proceeding in a clockwise expanding spiral from the originally selected survey squares until a site was chosen.

Survey data were collected from 623 ponds - which equates to a density of approximately 1 eDNA survey site per 6 km^2 - greater than in the other proposed Natural England pilots in Cheshire, Shropshire and Essex (1 eDNA survey site per 8, 12 and 13km^2, respectively). At a very small number of sites (n=6), data from surveys in 2017, either undertaken using traditional consultancy torching and trapping methods (n=3) or by the surveyor encountering great crested newt eggs before taking the eDNA sample (n=3), were used in the place of eDNA. A small number of traditional surveys were used opportunistically to help reach our 600-site target. Traditional and eDNA methodologies can be combined in the same survey, provided equal amounts of effort are involved in identifying negative sites. Following the protocol set out in the Great Crested Newt Mitigation Guidelines (English Nature, 2011) and tested in Biggs et. al. 2013 and 2015, to confirm a negative requires one eDNA survey or 4 visits using traditional methods. For positive sites where traditional and eDNA methods are being used, sites once confirmed as positive do not need to be repeatedly surveyed.

All eDNA surveys were undertaken between 11th May and 30th June 2017. Spring and summer 2017 started rather dry, with the possible threat of drought, which did not subsequently materialize. Although there were concerns that more ponds might dry up than in a year with average rainfall, this did not transpire. The proportion of ponds which were dry at the time of survey is probably a reasonable reflection of the proportion of temporary ponds,

of those marked on OS maps, that are actually temporary. Note that many smaller temporary ponds are not shown on maps.

At most ponds, the presence or absence of great crested newts was determined by eDNA analysis (n=536). At the time of survey, 14% sites were dry and, following the approach adopted in the national eDNA great crested newt survey (Freshwater Habitats Trust, unpublished data), were treated as sites where newts were absent (n=85). At all ponds, an 'extended' HSI assessment was undertaken, which included all the standard indices plus additional information on whether there was an inflow or outflow to/from the pond, on advice from DICE (Durrell Institute of Conservation & Ecology, University of Kent). Water chemistry tests were also undertaken at 523 ponds using nitrate and phosphate test kits (using the FHT Clean Water for Wildlife methods).

A fully detailed description of the approach recommended to Natural England for the identification of representative sampling of eDNA locations is given in Ewald and Biggs (2017).

The subsequent eDNA analysis followed the protocol set out in the Defra report WC1067, implemented by NatureMetrics Ltd. In addition to the procedures set out in the Defra specification, operations were split over two sites to minimise laboratory contamination risks. The first site was used for preparation of reagents, handling of low-concentration DNA samples up to the point of DNA extraction, and storage of DNA from these samples. This site contained a Category 7 cleanroom with positive pressure airflow and integrated UV lighting, which is used for DNA extraction from water samples. The second site was where high-concentration samples were handled (e.g. tissue samples and positive controls) and where PCR and post-PCR workflows were carried out. A unidirectional workflow was maintained throughout, with no movement of staff between laboratory sites during the course of the GCN season.

There were no obvious reasons to think there were any false positive great crested newt records. These seem generally to be a low risk in eDNA work, although it is hard to test for their occurrence. Although a small proportion of false negatives is inevitable (as is the case with traditional 4 visit methods), there was no evidence that these were occurring at rates substantially different to the original Defra pilot work (Biggs et al. 2014). The results overall appeared to reflect known concentrations of great crested newt records (e.g. Aylesbury Vale, Milton Keynes) as well as highlighting new areas not previously recognised, such as rural north Bedfordshire.

At some sites known to have great crested newts, and with multiple ponds, failure to record newts may have been the result of surveying only one pond in a group. In the Defra/Natural England national monitoring survey run by FHT in the PondNet project, on average great crested newts are only detected in 55% of the ponds present in occupied 1 km squares. This means that there will be occasional absences on sites where newts are known, but multiple ponds are present, when not all ponds are surveyed.

Overall, the project suggested that the South Midlands region is a nationally significant hot-spot for the great crested newt. The region has a pond occupancy rate slightly over double the national average, measured using the NARRS approach of surveying a single pond nearest to the south-west corner of each surveyed 1 km square.

Appendix 4 Pond management risk assessment

Management of existing ponds to benefit great crested newts needs to ensure that invasive actions (dredging, felling surrounding trees) do not irrevocably damage the current conservation value of sites.

Ideally, all ponds should be surveyed before they are managed in order to ensure that unacceptable damage can be avoided. However Freshwater Habitats Trust (FHT) data shows that some ponds are far more at risk from management damage than others.

Based on this information FHT have developed a management risk assessment which can be used to evaluate whether it is likely to be necessary to carry out a full biological assessment before management is undertaken. This risk assessment is shown in Box 1.

Risk Categories from Box 1

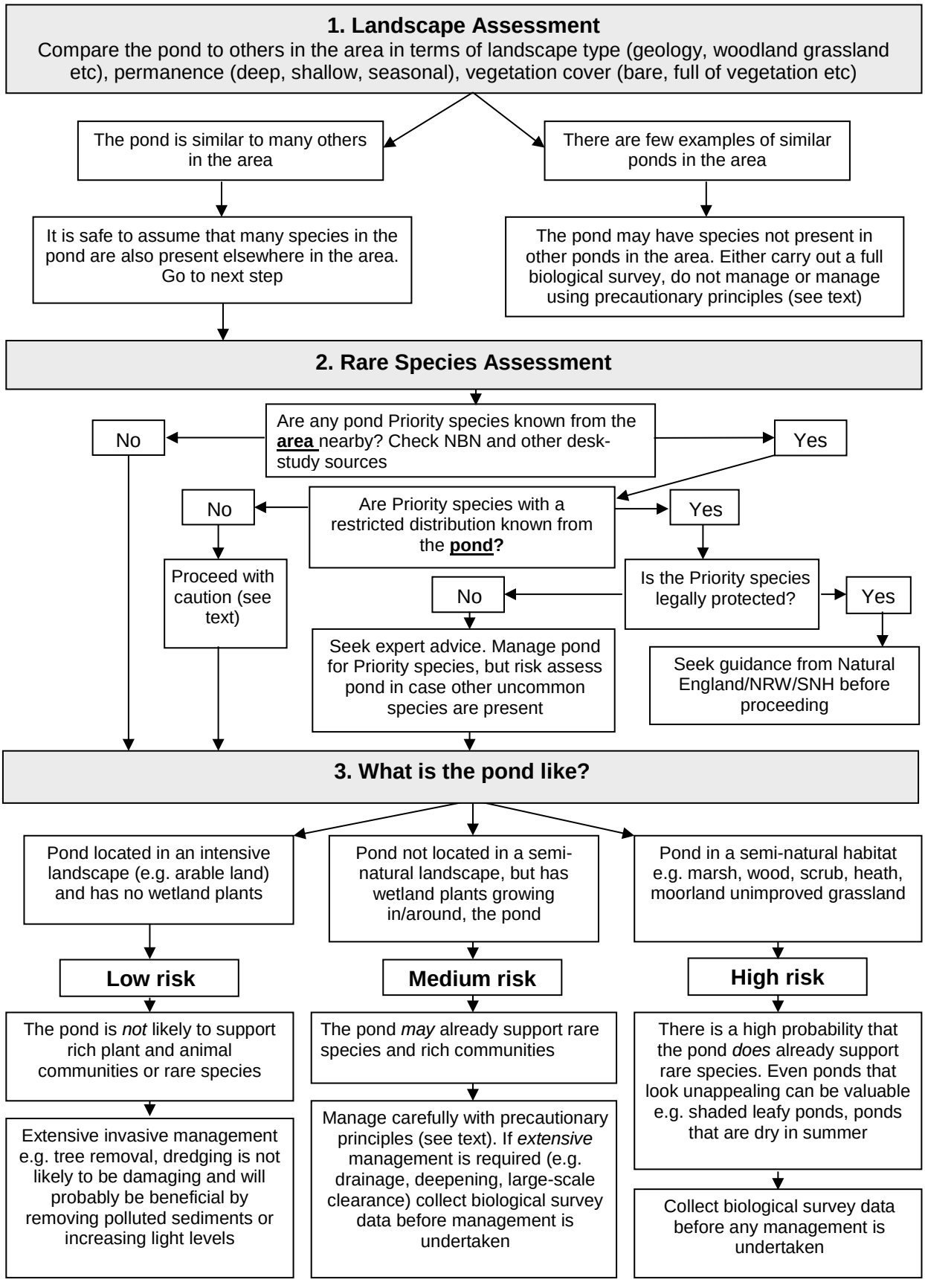
In practice, the most important factor predicting pond wildlife value is surrounding landuse. Ponds surrounded by arable land or intensive grassland, and which *also* have no wetland plants[7] growing in or around the pond, rarely support high value pond communities and will generally benefit from management to improve their conservation value. In contrast, around 1 in 4 ponds in semi-natural landscapes support red listed species; most typically uncommon aquatic invertebrate species. There is a particular risk where ponds are located near to ancient wetlands such as coastal grazing marshes and floodplains.

On this basis ponds can be classified into 3 broad categories depending on the level of risk involved in managing them without a prior survey:

1) Low risk ponds – Usually OK to manage these without survey information.
2) Medium risk pond – Collect full biological survey information before management or manage cautiously using precautionary principles (see below).
3) High risk – Collect full biological survey information before management.

[7] Wetland plants include tall emergent plants like bulrush, low-growing wetland marginals like water mint or grasses like creeping bent, together with floating-leaved plants such as water lily or duckweed and submerged aquatics like pondweeds, hornwort or water milfoil.

Box 1. Pond management risk assessment



Low risk ponds

The lowest risk ponds are ponds which are both located in areas of intensive land use *and* which have virtually no wetland plants[1] in or around the pond. This includes, for example, over-shaded ponds in arable fields, or polluted ponds draining farm buildings. These ponds typically have high levels of pollutants in their water and sediment and few species. There is only a low risk that they support uncommon plants and animals.

Drastic management can often be beneficial for these ponds, especially if it includes dredging out polluted sediments and buffering the pond to reduce future pollutant inputs. Removing some overhanging shade may also be beneficial if it allows marginal plants to grow.

Note, however, that managing a polluted pond is likely to be most worthwhile if it is also possible to remove the *source*(s) of pollution. If the pond will simply re-fill with polluted sediment, consider alternatives such as recreating a new clean water pond in a place where it is easy to keep the pond unpolluted in the long term.

Medium risk ponds

Medium risk ponds are sites that are either located in *moderately* intensive landscapes (e.g. improved pasture) or in intensive landscapes BUT which have good stands of emergent or aquatic plants. Sometimes these ponds turn out to be distinctly "average" in terms of their biodiversity – but they can still be important for retaining wetland species that are declining in the countryside. Some have Priority species such as Common Toad or the protected Great Crested Newt. A few turn out to be exceptional, for example temporary ponds in Kent farmland with the very rare Fox Sedge (*Carex vulpina*) and ponds in intensive grassland near the Somerset Levels with populations of the rare and protected Lesser Silver Water Beetle (*Hydrochara caraboides*). Care should be particularly taken with ponds in or near to "wetland" areas. This includes ponds on floodplains, or on the valley slopes above, ponds on coastal plains, and ponds in areas, such as Cheshire, with a high density of ponds. All of these wetland areas have a high likelihood of supporting rare species.

Medium risk ponds are the most difficult to assess with confidence. So FHT recommends that:

- If highly invasive management is under consideration (e.g. complete dredging/plant removal, clear felling around the pond), then a full biological survey should be undertaken.
- If no survey is possible, then management of medium risk ponds should be undertaken using precautionary principles (see below).

High risk ponds

The *riskiest* ponds are those located in semi-natural habitats such as woodlands, scrub, marshland, heathland and unimproved grassland. A high proportion of these sites (at least 1 in 4) support nationally rare species including Red Data Book and Priority species.

Because of the potential for damage, we recommend that these waterbodies are not managed without good survey data to describe the plant and animal communities in both the ponds and any surrounding areas that could be affected.

Note that valuable ponds in semi-natural areas do not necessarily look appealing: dark leafy depressions, summer-dry hollows, and even damp track ruts *do* support valuable species, even though this can seem unlikely at first sight.

Managing ponds using precautionary principles

If ponds are at medium risk of damage from management *and* there is no potential to gather survey information to guide management, then the best approach is to manage gently and with caution in a minimally-invasive way that will reduce the likelihood of harm.

Specifically

(a) identify all the different habitat types in and around the pond, and

(b) retain a "good" proportion of all of them.

For example:

- Don't deepen seasonal ponds (which dry out in summer) to make permanent water.
- Don't remove more than 1/4 of the pond's sediment over a 3 year period.
- Don't remove more than 1/4 of the vegetation as a whole, or of an individual plant species, in a 3 year period.
- Don't link ponds to drains or streams: these will usually add pollutants to the pond.
- Don't steepen the water's edge profile or reduce the extent of the drawdown zone (the area of the pond that is wet in winter, dry in summer).
- Don't allow the surrounding landuse, and particularly the pond's surface water catchment area, to become more intensive (e.g. buildings, roads, arable land).
- Don't destroy any habitat type in the pond completely.
- Don't drain the pond.
- Don't cut down more than 1/4 of the trees, either in or around the pond, over a 3 year period.

If it is not possible to fulfil these principles, then a full biological survey of the pond is strongly recommended.

Appendix 5 Roles and Responsibilities

The licences will be held by the eight planning authorities, but each of the authorities will be supported by two new organisations set up specifically to deliver the district scheme underpinning each licence: a planning management and monitoring company - NatureSpace Partnership Ltd (NSP); and a habitat delivery organisation - the South Midlands Newt Conservation Partnership Ltd (SMNCP) (see descriptions of roles below).

Role of local planning authorities

The 8 planning authorities will each hold a licence and will be responsible for securing compliance within its area of its licence's terms and conditions. When a planning application comes forward in the authority's area, and where the relevant developer wishes to rely on the authority's organisational licence to render lawful its development activities (which would otherwise lead to criminal offences against GCN) the developer will need to enter the scheme underpinning the licence. The planning authority will accordingly follow the protocols set out in the Decision Tree (Annex A5) and the Checks and Balances (Annex A6) when determining that planning application. The authority will then monitor compliance with any planning conditions imposed on any planning permission granted (as a result of the developer entering the scheme) and will bring planning enforcement action where necessary to ensure that a developer reliant on the authority's licence (under the scheme) is complying with its responsibilities under the planning consent granted (and therefore in turn under the licence). Under this scheme, in most cases developers will have either no or few limitations imposed on the delivery of their developments through the planning approval, but there will be working restrictions on development in some "higher risk" cases (e.g. timing restrictions to works).

Role of NatureSpace Partnership Ltd (NSP)

NSP will design, instigate and run the district scheme underpinning each of the 8 licences on a commercial basis. NSP will operate the scheme for each of the LPAs holding a licence (and the developers operating under each such licence), and will calculate, receive and manage the scheme payments made by developers when entering the scheme so as to benefit from the organisational licence. NSP will administer certificates and reports to developers as appropriate, following the protocols set out in the Decision Tree (Annex A5). NSP will monitor the delivery of the scheme outcomes, as will be required under each licence, and will report these to Natural England (and the participating LPAs). NSP and each of the LPAs have signed a Memorandum of Understanding (Annex A9) setting out the commitments to each other.

Role of South Midlands Newt Conservation Partnership (SMNCP)

SMNCP is an asset-locked not-for-profit Community Interest Society (a type of Community Benefit Society), which is owned and managed by the Amphibian & Reptile Conservation Trust and the Freshwater Habitats Trust. The SMNCP will, under contract to NSP, deliver the necessary GCN conservation measures to discharge the organisational licences' habitat creation and management requirements, by managing the habitat conservation funds and entering into contracts with landowners for the delivery of habitat creation and management across the District. The SMNCP is also responsible for activity (or output) monitoring under the scheme. The structure of this company means that everything it does must be for the benefit of the community and its rules include a statutory 'asset lock', which limits what can be done with SMNCP's assets. Its assets can only be transferred to charities or other asset-locked bodies, or used in a way which benefits the community. This rule cannot be changed, as a matter of law, so anything the society owns is safeguarded for the benefit of the community in the long term. As a community benefit society, SMNCP is run along democratic principles. Each member has one vote, regardless of how much money they have invested in the society. This means that the SMNCP will deliver transparency and auditability for the funds provided to it by NSP within a not-for-profit context and enables environmental NGOs

(ARC and Freshwater Habitats Trust) to control the delivery of the nature conservation programme.

Role of developers

Developers proposing development within the areas licensed under any of the 8 licences can either opt into the scheme and carry out their development under the legal protection of the relevant licence held by the relevant local authority (provided the development proposal is acceptable / can be accepted into the scheme), or alternatively follow the “standard” licence application process by carrying out GCN surveying and, where necessary, applying to Natural England directly for a GCN licence to be held in that developer’s name for the build out of that development project. Where a developer chooses to opt into the scheme, they must pay the appropriate initial charge and, where appropriate, a second payment (payable prior to commencement of works) to NSP. Where the GCN metric is required, the developer will need to provide NSP with some basic development site information (see Annex A10) to facilitate this. The resulting NSP report (see Annex A11) will be provided by NSP to the developer, for submission to the planning authority as part of their planning application (in lieu of a standard GCN survey (and mitigation) report). If a developer decides not to submit the NSP report to the planning authority, the developer will be expected instead to commission GCN surveys in the usual way.

Role of Natural England

Natural England is the licensing authority and will monitor use of and compliance with each of the licences.