Newcastle Borough Council Nature Recovery Network Mapping

FINAL REPORT

January 2023

Staffordshire Wildlife Trust

Staffordshire Ecological Record

Table of Contents

1. Executive Summary

Staffordshire Wildlife Trust were commissioned by Newcastle Borough Council to carry out a strategic assessment of The Borough's biodiversity and habitat networks. This document outlines the existing picture of the districts nature network and describes locations where habitats may be created or enhanced to contribute to nature's recovery (the Nature Recovery Network), as well as delivering against objectives set out in national planning policy legislation.

Existing data, previous biodiversity opportunity mapping, along with local, regional and national landscape designations and projects were taken into consideration in this assessment methodology.

The methodologies developed aim to deliver against national policies and are used in conjunction with the Department for Environment Food and Rural Affairs biodiversity metrics 3.1 to carry out a strategic broad scale district level spatial assessment of the 'quality components' described in the metric. This included:

1. Habitat distinctiveness
2. Strategic significance (of habitat areas)
3. Habitat connectivity

By using the results above and specific habitat connectivity modelling software it has been possible to define Habitat Connectivity Opportunity (HCO) areas based on habitat types. This is an important next step in identifying areas which possess existing good habitat connectivity and where there is potential for future habitat creation or restoration to contribute to a more successful nature recovery network.

The HCO areas are described in terms of their key opportunities, threats, key species and other habitats which they support along with any potential 'add-on' benefits (e.g. ecosystem services) which could be derived from having well-connected diverse habitat networks contributing to a healthy nature recovery network.

The opportunity map is not static and as physical habitats change on the ground and are subsequently mapped and monitored, the map itself will evolve with these updates. The opportunity areas themselves are where work to enhance habitats can be focussed, where the opportunity to get the greatest benefits lies.

Analysis and opportunity areas mapped within the nature recovery network completed as part of this study are to a fine scale and based around a more robust defensible methodology that can more clearly deliver against National Planning Policy Framework and Planning Policy Guidance objectives, as well as those outlined in the Environment Act.

2. Statutory requirement for a Nature Recovery Network

Staffordshire Wildlife Trust were commissioned by Newcastle Borough Council to carry out a strategic assessment of the districts biodiversity and habitat networks, to form part of an evidence base in order to ensure biodiversity is an integral part of policy development.

The commission required phase one habitat survey, habitat connectivity analysis and mapping and Local Nature Recovery Mapping. Whilst these are district studies they will provide a complement to form an integral part of the evidence base for Newcastle Borough Council. These elements will enable the district to address the requirements referenced within paras 174 – 188 of the National Planning Policy Framework 201; specifically, para 179:

"To protect and enhance biodiversity and geodiversity, plans should:

a) Identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity61; wildlife corridors and stepping stones that connect them; and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation62; and

b) promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity"

(Ministry of Housing, Communities and Local Government, 2019)

It must be noted that since previous opportunity mapping was carried out in Newcastle Borough, there have been changes both in the knowledge and practical assessment and planning of landscape ecology as well as more statutory obligations for LAs to consider how to protect, enhance and restore biodiversity and the services that it provides.

Key stimulus in updating spatial environmental objectives were documents such as the Making Space for Nature: A review of England's wildlife sites and ecological networks report by Lawton et al. (2010), the government's 25 Year Environment Plan (2018) and most recently The Environment Act.

The fundamental principles behind the Making Space For Nature report are for England's ecological network to be 'more, bigger, better and joined' to ensure the survival of species in

the face of multiple pressures at a range of scales. The government's 25 year environment plan puts more impetus on the statutory need to consider the conservation of biodiversity and ensure that it is effectively accounted for through the spatial planning system and the DEFRA Environment Act.

The Environment Act sets out environmental principles directed toward the restoration and enhancement of nature and plots a course for how these should be achieved through Nature Recovery Network mapping at a local level ('Local Nature Strategies') and will be a key document in driving the way that these networks are developed and delivered.

Additionally, updated guidance through the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2019) and Planning Practice Guidance (PPG) (Ministry of Housing, Communities and Local Government, 2019) have all served to put more emphasis the protection and conservation of nature and our natural resources through spatial planning, providing further justification for the need to have a Nature Recovery Network in place to create a roadmap of where these enhancements could and should go. This coupled with the emergence of mandatory biodiversity net gain provision. The Biodiversity Metric 3.1 has been revised, which provides a means of assessing changes in biodiversity value (losses or gains) brought about by development and changes in land use management. The metric is habitat based and gives consideration to improved ecological connectivity. Habitat opportunity maps are designed to be used in conjunction with Biodiversity Metric 3.1 but can also be used to both inform the metric and target the location and application of future ecological enhancements contributing to a functional nature recovery network.

3. Review of previous biodiversity opportunity mapping assessments

Prior to the commencement with any novel and innovative methods of spatially assessing and targeting opportunities for the enhancement of biodiversity, it is important to review the existing methods to ensure that new methods:

1. Can work in conjunction with previous methods where appropriate to provide additional detail which compliments the objectives and results of existing methodologies.
2. Are more appropriate than existing methods or provide standalone detail which can be used as evidence in its own right, additional to that of other methods.

The previous biodiversity opportunity mapping assessment carried out for Newcastle Borough Council (appendix H). The previous opportunity assessment was reviewed and used as a benchmark to compare the results of the updated methods and models used, as part of the new nature recovery network assessment.

The previous methodologies used for biodiversity opportunity mapping in the county were based wholly on the local expert knowledge and stakeholder engagement via practical mapping exercises. Stakeholders and local experts were asked to highlight areas geographically that they saw as priorities for specific habitat and species conservation within a local authority (LA) area. The results of this were sense checked by Staffordshire Wildlife Trust, using available environmental data synthesized into a combined opportunity map and report, which defined spatial landscape areas and detailed conservation priorities within each LA area. The resulting map was effective in that by using expert knowledge, alongside ecological data, as opposed to purely relying on available datasets, it was possible to produce an opportunity map with zero white space (areas of a map which have no information). This is something which is crucially important to inform decision making on a broad scale and to bring forward a nature recovery network.

It was concluded that whilst new methodologies can clearly provide a level of additional detail, local expert knowledge was still vital to provide credibility and justification to the use of any standalone spatial analyses and metrics. For this opportunity mapping exercise, a range of spatial analyses have been carried out, which in previous iterations were either not used or were not available. Crucially, the input from local experts and stakeholders continues to drive the mapping. This provides the all-important justification and ratification of the methods, to ensure that they are meaningful, delivering an accurate and comprehensive coverage of the study area.

4. Existing evidence base review

Gathering a robust evidence base is the vital first step to inform the assessment of opportunities to enhance habitats, without an evidence base there would be no way of producing or justifying meaningful opportunity areas or assessing ecosystem service potential. An inventory of available datasets is one way of bringing together an evidence base forming a platform on which to carry out further analysis.

4.1 Available environmental datasets

A list of relevant Geographic Information Systems (GIS) datasets available for use in completing the mapping assessment was provided by the local authority, these are listed in appendix .

A further comprehensive list of datasets has been published by the Natural Capital Committee (2017) which were also considered for use in in the practical mapping work.

Additionally, datasets held by Staffordshire Ecological Record (SER) were identified as being of importance for the mapping work (some of these datasets are the same as those identified in Appendix B, which have previously been provided to the local authority by SER through a service level agreement).

Using the data held by SER and SWT along with publicly available datasets accessible either through an Open Government License (OGL) or through Creative Commons licensing identified in the Natural Capital Committee workbook it was possible to bring together a comprehensive inventory of datasets for review.

Many of the datasets in the inventory are raw or primary data generated directly from information gathered from either desk based or field surveys and remote sensing.

The identification of the coverage and quality of a local authority's environmental dataset inventory provides the baseline from which to begin further work to analyse how it can be protected and enhanced to continue to provide both public and further environmental benefits. By aggregating and using all of the datasets in conjunction it is possible to build a composite assessment of the biodiversity within an area without any white space

4.2 Phase 1 habitat mapping via remote sensing and aerial photography interpretation

Habitat mapping in areas of the district where there was no existing habitat data available (i.e. 'white space') were carried out to provide a more complete coverage of habitat data across the borough.

Due to the size of the study area the habitat mapping exercise was completed via a desk based methods, predominantly via remotely sensed land-use classification and manual verification using high resolution aerial imagery. Staff experienced in ground survey, aerial interpretation habitat survey and remote sensing were used to complete the mapping, however no ground-truthing was carried out so accuracy and confidence of the digitised habitat data is subject to limitations (see section 4.3 for full data limitations).

The completion of this mapping exercise has resulted in a more complete[*] Phase 1 habitat dataset for the local authority area. This dataset is a composite of habitat data from a wide range of sources and ages.

4.3 National Character Areas in Newcastle Borough Council

There are 159 National Character Areas (NCA) in England, each of which is distinctive with a unique 'sense of place'. These broad divisions of landscape form the basic units of cohesive countryside character, on which strategies for both ecological and landscape issues can be based. The Character Area framework is used to describe and shape objectives for the countryside, its planning and management. These NCA areas are very broad and can encompass a number of different objectives and opportunities depending on the designated landscape and its respective character, biodiversity and challenges.

Newcastle Borough is covered by 2 NCA's (Appendix H); the Potteries and Churnet Valley NCA occupies the North of the borough and the Shropshire and Staffordshire Plain. The key statements of environmental opportunities for each of the NCA's are as follows:

Potteries and Churnet Valley:

- Manage, expand, link and buffer the characteristic semi-natural woodland and protect the ancient woodland, for example in the Churnet Valley, reducing habitat fragmentation to benefit landscape character, biodiversity, resource protection and regulation; and enhancing the recreational and experiential qualities of the NCA.

- Protect and manage the rivers, streams and springs to enhance the riverine character of the many valleys and cloughs to protect the quality of water from diffuse pollution to benefit biodiversity; and expand riparian habitats to mitigate flood events and to improve the experiential qualities of the NCA.

- Manage and expand areas of characteristic unimproved grassland pastures in the Churnet Valley and heathland and moorland of the Staffordshire Moorlands, reducing habitat fragmentation and restoring traditional boundary features to benefit landscape character, sense of place, biodiversity and resource protection while enhancing the recreational and experiential qualities of the NCA.
- Protect and manage historic landscape character and associated heritage assets that include the historic transport network and industrial heritage and improve the

[*] There may be small gaps in habitat data arising from digitising error or difficulty of creating a seamless fit based on existing data and newly created data.

understanding of its intrinsic links with geodiversity; and find sustainable solutions to manage visitor pressure at popular attractions, for example Alton Towers and Trentham Gardens, thus supporting the tourist economy and maintaining a high level of public access to enjoy the wealth of recreational experience that the NCA offers.

- Protect and manage historic landscape character and associated heritage assets that include the historic transport network and industrial heritage and improve the understanding of its intrinsic links with geodiversity; and find sustainable solutions to manage visitor pressure at popular attractions, for example Alton Towers and Trentham Gardens, thus supporting the tourist economy and maintaining a high level of public access to enjoy the wealth of recreational experience that the NCA offers.

- Identify and protect a stock of open mosaic habitats on previously developed land, to conserve these sites that often provide habitat that cannot be recreated and for the sense of history they provide.

Shropshire and Staffordshire Plain

- Restore, manage and protect from diffuse pollution the rivers, streams, lakes, ponds and wetland habitats (including flood plain grazing marsh and wet woodland) and support partnerships to maintain the integrity and unique conditions for the preservation of the internationally important meres and mosses and River Dee, to benefit water availability, water quality, landscape character, biodiversity and climate regulation.

- Protect the landscape of the plain, recognising its importance to food production and incorporating well-maintained hedgerows, ponds and lowland grassland margins within agricultural systems, to secure resource protection and maintain productivity, while reducing fragmentation of semi-natural habitats to benefit a wide range of services, such as landscape character, sense of place, water quality and biodiversity.

- Manage and restore lowland heathland and ancient and plantation woodland, support partnerships to plan appropriately scaled new woodland cover, particularly where this will link and extend existing woodlands, restore and reinstate traditional orchards and increase biomass provision to mitigate the impact of climate change, where this will benefit biodiversity, landscape character and enhance the experiential qualities of the area.

- Protect and manage the nationally important geological sites and heritage features demonstrating how the interaction of natural and historical factors influenced the distinctive character of its landscape and settlement patterns, and help to promote greater understanding of the link between wildlife, heritage and geodiversity, particularly the importance of former extraction sites for both geodiversity and biodiversity.

- Find sustainable solutions to manage visitor pressure at popular attractions, for example the Sandstone Trail, woodlands, canals and National Nature Reserves,

while encouraging a high level of public access to enjoy the wealth of recreational experience on offer.

4.4 Minerals Safeguarding Zones in Newcastle Borough Council

A large proportion of the district is within a mineral safeguarding zone which both presents challenges and opportunities in planning for nature conservation.

There is a need to consider minerals safeguarding zones in the nature recovery network mapping as these areas present both challenges and opportunities from a nature conservation perspective. Whilst the nature recovery network mapping is not spatially aligned on the minerals safeguarding zones, nor did it drive the mapping it is important to recognise that that these areas could potentially have a huge impact on the nature recovery network in future, either positively, negatively or both and where overlaps exist between the maps, there is opportunity to deliver multiple outcomes.

Whilst the likelihood is that much of the safeguarding area will never undergo any mineral extraction, planning any developments within them must be considered to ensure that this will not prevent mineral extraction on potential future extraction sites.

It is possible that high quality habitats may be lost as a result of mineral extraction, a mineral safeguarding zone may also provide protection to important habitats by protecting them from other types of developments. Whilst it is always best to avoid the loss of habitats and improve the diversity of the existing landscape, any ecological impact of mineral extraction can be negated through careful planning and ensuring that a suitable minerals restoration plan for the site is in place which recreates and expands the area of habitat on a like-for-like basis in the case of losing high quality habitats. Post extraction habitat restoration should be guided by the nature recovery network map to create habitats which will most suitably contribute to habitat connectivity within the landscape. In doing this it is possible for mineral extraction sites in the long term to actually benefit to the creation of a diverse and well-connected landscape providing further justification to not avoiding these areas when planning for nature conservation.

When considering planning for nature conservation for example through nature recovery network mapping such as this, mineral safeguarding zones cannot be excluded from the mapping exercise, land within the safeguarding zone may never be worked for minerals in the long term but could be of huge value in terms of contributing to diverse well connected habitats and landscape either if no mineral extraction were to occur or through well planned sympathetic habitat restoration which may lead to more diverse habitats in the long term.

4.5 Data used and limitations

It is important to determine the limitations of any datasets identified to ensure that the best possible dataset(s) are used to give the best outcomes for connectivity mapping.

A number of factors can influence whether a dataset is suitable, for example age of the data and whether the data is in a format which can easily and readily be interrogated are crucial in deciding which datasets should be used.

Following a data review the combined habitat map produced during the earlier stages of this was used as a primary baseline from which as this represented the most complete habitat dataset for the area and would easily work with the preferred methodologies to generate the desired technical outputs detailed in sections 5-7.

Several datasets were used in the production of the Nature Recovery Network mapping, justification on their use and relevant limitations can be found in appendix B & C.

A full inventory of available datasets has been collated (appendix C) where each dataset was allocated a ‘confidence’ rating based on the dataset’s desirability and reliability which helps to justify a hierarchy of use i.e. where there is commonly high desirability and reliability there is a higher ‘confidence’ in that dataset and it is placed further up in the hierarchy than a dataset which for instance may have a high desirability but a low reliability.

5. Mapping the opportunities to enhance habitats for biodiversity

The first step in analysis to establish opportunities for natures recovery is to take the data evidence base established previously and a carry out a variety of habitat analyses to determine distinctiveness / character for use within other recognised methods (for example, biodiversity metric 3.1 etc). Furthermore, using the evidence base to apply methods to identify strategic habitat areas and habitat connectivity opportunity areas in relation to creating a robust nature recovery network for the district.

By utilising the knowledge of the counties habitats and species, experience of technical GIS systems and data management, coupled with the available datasets identified in the evidence base, it was possible to produce a number of outputs which are robust, challengeable and can deliver the districts nature recovery network.

5.1 Biodiversity metric 3.1

The DEFRA Biodiversity metric 3.1 is designed to quantify biodiversity to inform and improve planning, design, land management and decision-making.

The metric can be used to both:

- Assess or audit **the biodiversity unit value** of an area of land and
- to **calculate the losses and gains** in biodiversity unit value from changes or actions which affect biodiversity, for example building houses or a change of use in a land holding.

The biodiversity metric 3.1 has 4 components namely:

- **Distinctiveness** – based on the type of habitat present. For example, modified/amenity grassland is given a score of “2”.
    - Distinctiveness is determined by the habitat distinctiveness mapping (see section 5.2).
- **Condition** – based on the quality of the habitat. This is determined by condition criteria set out in the technical supplement.
    - This cannot be achieved as part of this exercise due to the difficulty of determining condition from a desk based methodology.
- **Strategic Significance** – based on whether the location of the development and or off-site work has been identified locally as significant for nature.
    - Strategic significance is determined by the individual habitat strategic areas and the combined strategic areas map (see section 5.4).

- **Connectivity** – based on the proximity of the habitat patch to similar or related habitats.

    - Connectivity is determined by combined strategic areas map & habitat connectivity opportunity maps (see sections 5.4 & 6).

Through the current study 3 of the 4 quality components have been assessed and defined at a district scale, the only exception being habitat condition which cannot realistically be assessed through a desk based methodology and would require further ground-truthing to determine actual unit values (for example through a Preliminary Ecological Appraisal (PEA)).

5.2 Habitat distinctiveness mapping

Habitat distinctiveness mapping is one of several elements included within the biodiversity metric 3.1 by using habitat as a proxy for wider biodiversity value via associating and scoring different habitat types according to their relative biodiversity value. An example of this would be irreplaceable ancient woodlands scoring very highly (higher biodiversity value) whereas intensively managed amenity grassland or highly improved agricultural arable land score lower (lower relative biodiversity value).

The criteria used for the creation of the habitat distinctiveness map was based on the Biodiversity Metric 3.1 which loosely defines what habitats are included within each distinctiveness band. These metrics are currently emerging and form the basis of the Environment Act, but represent the most comprehensive set of standards for which to base the distinctiveness mapping on.

The distinctiveness map (map 1) was produced using Phase 1 habitat data by associating a distinctiveness value to each specific habitat type (e.g. arable land) in a GIS package based on guidance provided in BNG metric 3.1, selecting and isolating the habitats spatially into the 5 respective distinctiveness bands. Further ratification to the irreplaceable habitats in the very high distinctiveness band was completed by use of priority habitat inventory (Ancient Woodland Inventory) boundaries. A spatial GIS file was produced for each distinctiveness band.

Further detail of the habitat distinctiveness mapping and the breakdown of habitats included within each distinctiveness band can be found in Appendix E.

Habitat distinctiveness mapping provides multiple uses outside of the biodiversity metric 3.1, including:

1. Identifying areas of high biodiversity value which are a priority for protection and expansion within a local plan whilst working in line with biodiversity mitigation hierarchy (avoid, minimise, remediate, compensate).

2. Flagging areas that may contain medium value (semi-natural) habitat. These could be highlighted in policy as requiring a comprehensive biodiversity evaluation if they

are put forward for planning purposes (based on mitigation hierarchy). Biodiversity offsetting/compensation may be required in these areas if they are developed.

3. Identifying possible wildlife corridors which can be highlighted and designated as part of a local plan/Green Infrastructure Strategy. These areas could be the target of restoration projects/funding/aspirational opportunity areas funded through development compensation (obviously the allocation of funds is based on broad scale spatial analysis as opposed to the methods of calculating the offsetting requirement of a specific site).

Planning policy supports application of the mitigation hierarchy which determines a hierarchy of actions when using the biodiversity metric 3.1. This may mean retaining habitats in situ or avoiding habitat damage. It is easier to achieve biodiversity net gains where habitat impacts are avoided due to the way that habitat creation and enhancement risks are accounted for. The mitigation hierarchy is in the desirability order as follows:

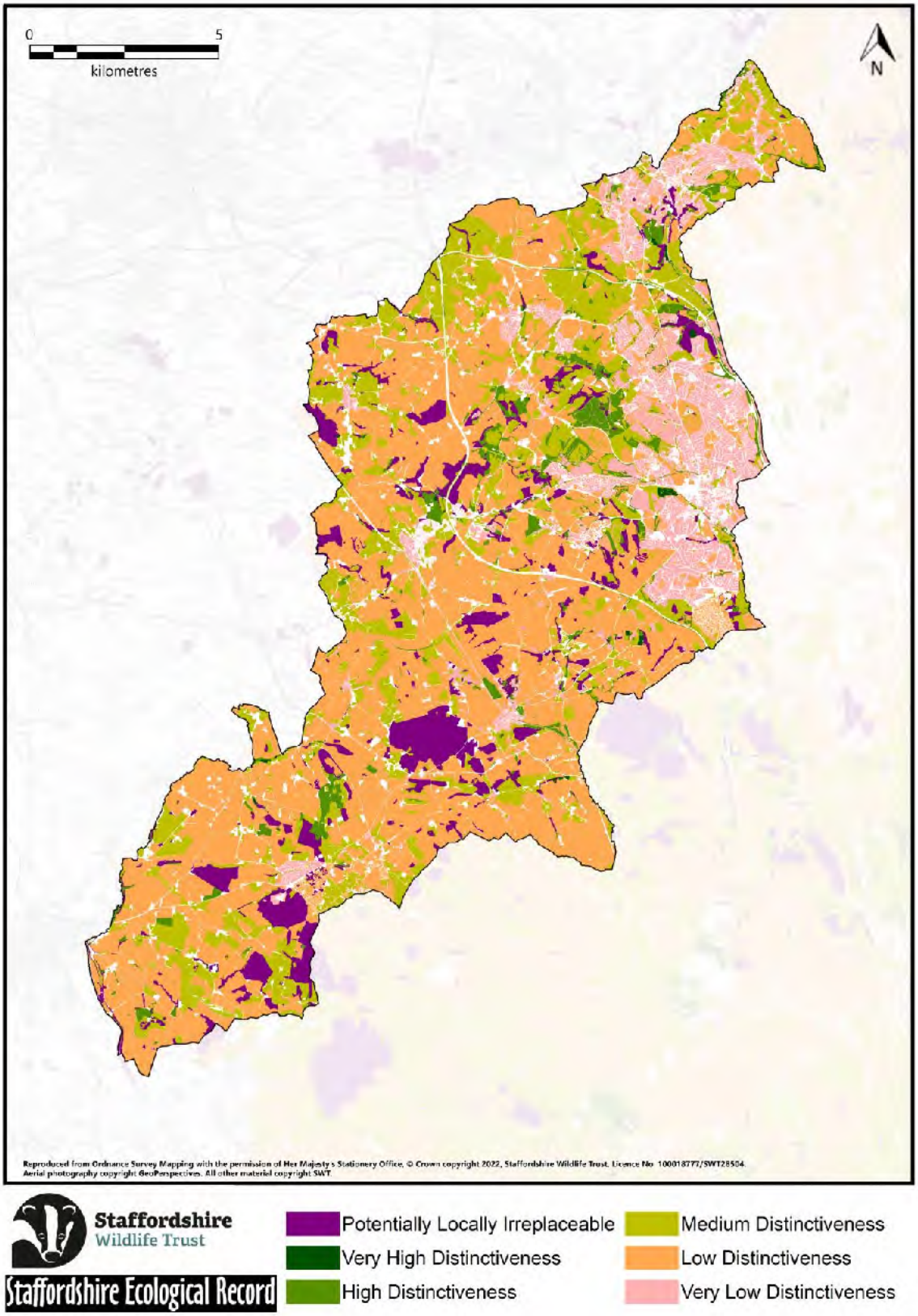
- **Avoid** – Where possible habitat damage should be avoided
- **Minimise** – Where possible habitat damage and loss should be minimised
- **Remediate** – Where possible any damaged or lost habitat should be restored
- **Compensate** – As a last resort, damaged or lost habitat should be compensated for

The mitigation hierarchy corresponds with the habitat distinctiveness mapping, e.g. very high distinctiveness habitats such as irreplaceable ancient woodlands should be avoided from development, low and medium distinctiveness habitats could be restored to a higher quality habitat.

The habitat distinctiveness mapping is based on available habitat data and the designated nature conservation site boundaries for the borough, including UK Biodiversity Action Plan (UKBAP) and priority habitat areas.

Habitat distinctiveness mapping does not include species explicitly. Instead, it uses broad habitat categories as a proxy for the biodiversity ‘value’ of the species communities that make up different habitats. The metric does not change existing levels of species protection and the processes linked to protection regimes are outside the scope of the metric.

Habitats are assigned to distinctiveness bands based on an assessment of their distinguishing features including for example rarity (at local, regional, national and international scales), and the degree to which a habitat supports species rarely found in other habitats.



Map 1 Habitat distinctiveness map for Newcastle Borough (October 2022)

5.3 Habitat distinctiveness mapping limitations

The distinctiveness mapping has been carried out using a desk-based methodology utilising available habitat datasets at a landscape scale with a view of being able to quickly determine on a wider scale the likely impacts of a development, as such the landscape level distinctiveness map in some cases may not provide an accurate account of a sites full habitat distinctiveness at a finer scale (for example at site level). Due to this, developments requiring distinctiveness mapping as part of biodiversity offsetting net gain analysis should be subject to a thorough Preliminary Ecological Assessment (PEA) to determine the full extent of in situ habitats and the expected biodiversity impact of any potential habitat loss or damage.

5.4 Strategic Habitat Areas

The Strategic habitat area methodology we have applied was developed and is currently being implemented by Warwickshire County Council (WCC) and was developed in partnership with Warwickshire Habitat Biodiversity Audit (WHBA), The University of York and Warwickshire Wildlife Trust. The methodology forms part of WWCs Sub Regional Green Infrastructure Strategy[*] and is used in targeting areas for habitat enhancement through biodiversity offsetting compensation.

This methodology was chosen for this mapping assessment because it can be relatively easily applied with the habitat data available; it is robust having been peer reviewed during development, it is already in use by an adjacent local authority and it is based on the fundamental principles of habitat connectivity identified in Lawton et al. (2010).

The mapping works by assessing the proportion of broad habitats e.g. woodland, grassland, heathland etc. within an area to determine whether these are ‘strategic’, ‘semi-strategic’ or ‘non-strategic’ for the creation or restoration of further habitat based on the proportion of habitat already present in the area.

The strategic habitat areas were produced using the composite Phase 1 habitat data identified in the evidence base review. Firstly specific higher quality habitats were selected and isolated from the composite Phase 1 habitat map (e.g. heathlands or species-rich grassland). The proportion of the selected habitats that overlap individual Ordnance Survey 1km grid squares was then calculated in a GIS package and each square subsequently classified into one of the area bands below, based on the area of habitat overlapping the 1km square. Specific details on the strategic areas are listed in Appendix A.

The strategic habitat areas can be viewed as a hierarchy when it comes to the creation of a particular type of habitat:

1. **Strategic areas** are key areas to focus habitat creation or restoration. There is some high quality semi-natural habitat but additional high quality semi-natural habitat would improve the function of the network.

[*] https://www.warwickshire.gov.uk/directory-record/2160/sub-regional-green-infrastructure-strategy

2. **Semi- strategic areas** are the next preferred areas in terms of habitat creation – These areas already have a relatively large area of high quality semi-natural habitat but more would still be of benefit.

3. **Non-strategic areas** are where there is very little or no high quality semi-natural habitat where it would be difficult to create enough high quality semi-natural habitat for it to be functional. (This is not to say that semi-natural habitats should not be created in this area but that it is lower in the overall hierarchy).

The strategic area mapping described will be crucial in delivering the fundamental principles in Lawton et al. (2010).

An overall strategic areas map was produced based on the combination of all the habitats analysed as part of the strategic mapping exercise (map 2). For this map, the criteria for strategic and semi-strategic areas have been swapped so that strategic areas are those with the highest amount of overall habitat. By altering the methodology in this way it is possible to create a coarse overall 'connectivity map' by highlighting the areas with highest combined overall habitat availability and connectivity as opposed to those areas where it is best to create habitats.

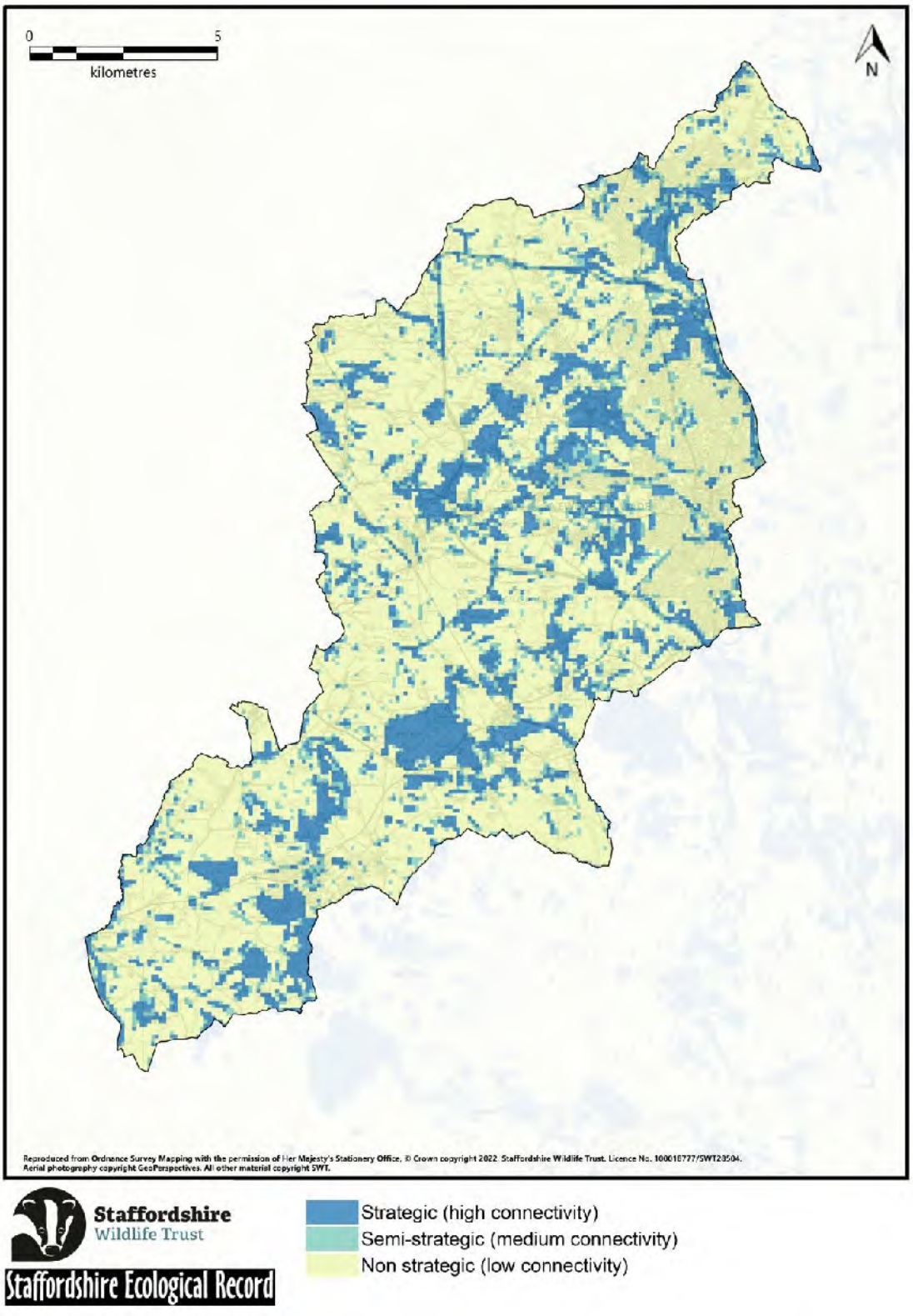
The strategic areas are not static and are merely a snapshot in time, changes are an inevitable part of the mapping as available habitat data changes. To an extent the strategic areas mapping is self-fulfilling, as opportunities to enhance habitats described by the map are practically implemented on the ground, mapped through subsequent monitoring and the new habitat data being incorporated into future maps will influence future changes in the areas on the map (described in more detail in section 10.2).

Loss of habitats will be worst in areas where there is already a high proportion of habitats and good connectivity, therefore the strategic areas in this map correspond to the highest strategic significance category in BNG 3.1 metric (Table 1Table 1 - Application of Staffordshire specific strategic significance to BNG 3.1 strategic significance categories).

Inversely it is more beneficial to create or enhance habitats in areas which already have some semi-natural habitat but potentially not enough to be as functional from a connectivity standpoint. Enhancement or creation of additional habitat in these areas is likely to have a greater impact than in areas where there is little or no habitat as it is contributing to a small existing network rather than trying to create potentially isolated areas from scratch. Table 1 shows this by placing the 'formally identified in local strategy' category against the 'semi-strategic area' class based on the principle that these have some but not a lot of semi-natural habitat with that area already.

Table 1 - Application of Staffordshire specific strategic significance to BNG 3.1 strategic significance categories

BNG 3.1 Strategic Significance category (Site habitat baseline)	**BNG 3.1 Strategic Significance category (on and off-site habitat creation/enhancement)**	**Category identified in East Staffordshire strategic significance mapping**
Formally Identified in Local Strategy	Location ecologically desirable but not in local strategy	Strategic area
Location ecologically desirable but not in local strategy	Formally Identified in Local Strategy	Semi-strategic area
Area/compensation not in local strategy	Area/compensation not in local strategy	Non-strategic area



Map 2 Combined strategic areas map for Newcastle Borough (October 2022)

6. Establishing the Habitat Connectivity Opportunity Areas (HCO) for Newcastle Borough Council

The strategic areas mapping described previously still leaves gaps between areas deemed to be strategic or semi-strategic for a particular habitat type, therefore the creation of habitats solely within these areas may still end up leaving isolated patches of habitats which potentially do not link to one another within a landscape. In the interests of driving habitat creation in the direction of connecting these isolated spaces it is important to map an aspirational 'ideal' connected habitat network to work towards: A Nature Recovery Network.

Using local knowledge coupled with additional datasets including soils, nature conservation site boundaries, Staffordshire Biodiversity Action Plan (SBAP) Ecosystem Action Plan Areas (EAPs (Appendix J) and priority habitat inventories along with a piece of ecological modelling software called Condatis (Wallis & Hodgson, 2012), it was possible to further scrutinise and refine the strategic areas map to define comprehensive Habitat Connectivity Opportunity (HCO) areas map for the district based on individual habitats.

The HCO areas add another dimension to the strategic areas modelling detailed previously to define where habitats are both already well connected and equally as crucially broadly identify where to direct the delivery of habitat creation or restoration to create a connected habitat network.

6.1 Habitat Connectivity Opportunity Areas Rationale

The decision to use Condatis to build upon the strategic mapping was in part due to the fact the software has previously been used to identify habitat connectivity in other areas of the county (Churnet Valley Landscape Ecology Pilot Partnership, 2014), where it worked well at identifying rough habitat corridors. Condatis also works on a per habitat basis it is therefore possible to analyse habitat connectivity on an individual habitat basis (A full technical explanation of the Condatis software can be found in Appendix F). Condatis has some limitations in that it only takes into account a single habitat at a time and does not account for other potential connectivity barriers, for example urban areas. It is therefore crucial that these outputs were vetted against other relevant datasets such as soils data; ensuring that identified connectivity opportunities fall in line with the SBAP EAPs areas and that crucially the connectivity opportunity areas correspond with how local expert knowledge would expect the habitat connectivity areas to look in the district, to sense check what is produced by the models.

7. Results

7.1 Habitat Connectivity Opportunity Areas identified

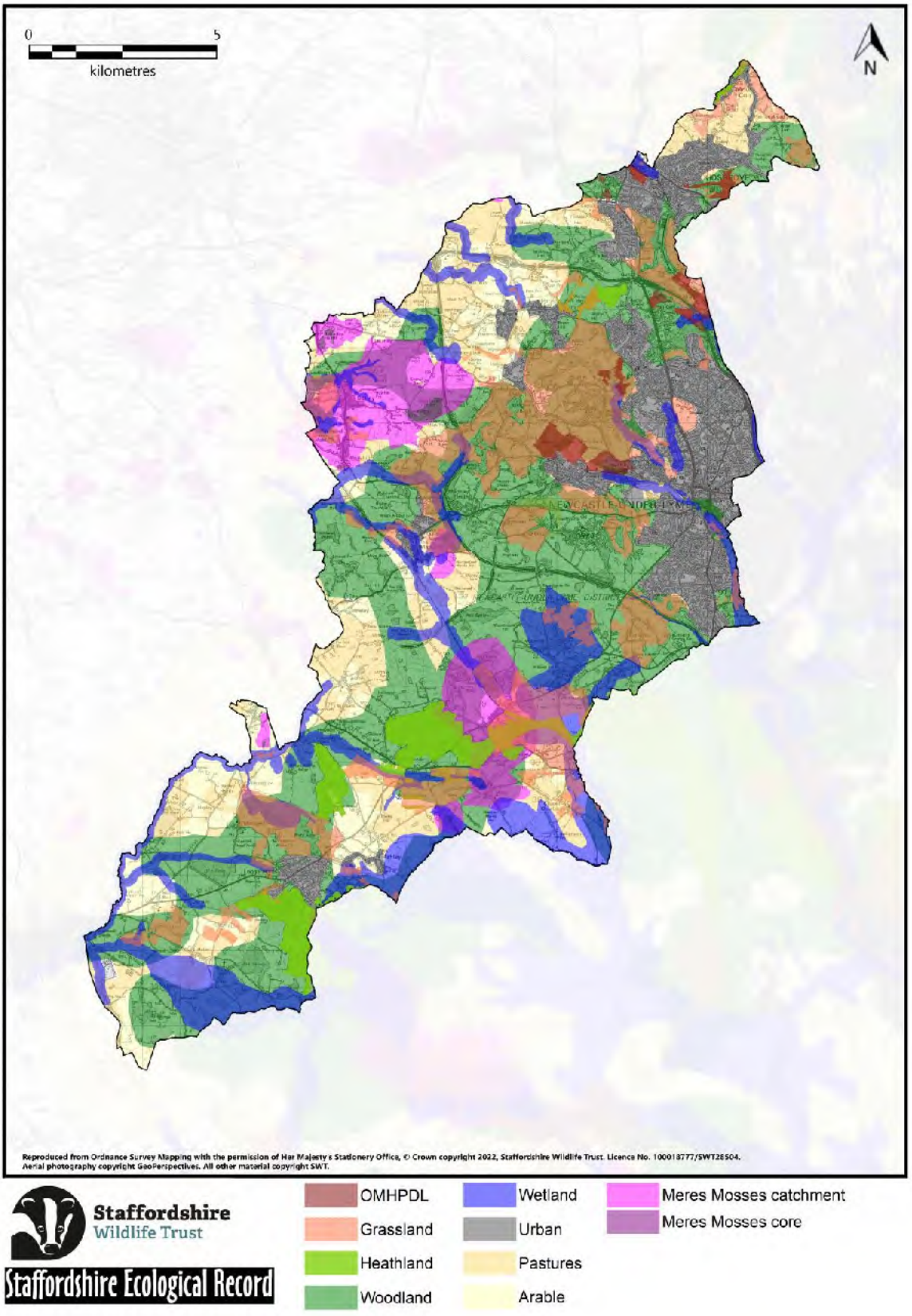
A total of 6 separate Habitat Connectivity Opportunity area types have been identified and mapped covering the entirety of Newcastle Borough Council:

1. Woodland
2. Grassland
3. Heathland
4. Meres and Mosses
5. Wetland
6. Open Mosaic Habitats on Previously Developed Land (OMHPDL)
7. Pastures
8. Arable
9. Urban

Each opportunity area is described in terms of its key habitat or habitats. This should not be taken to mean that other habitats are absent from the opportunity area, or that habitats identified as a priority in the opportunity areas should replace existing non-target high quality habitats of a different type.

The Habitat Connectivity Opportunity areas were brought together to produce a combined HCO map for the district (map 3).

Each opportunity area is described in more detail in the following sections, along with relevant associated land uses, environmental issues, and the overarching objectives and opportunities for each zone.



Map 3 Combined habitat connectivity opportunity areas map for Newcastle Borough (October 2022) NB: some of the HCO areas overlap one another which can lead to the colouring of the map being distorted.

7.1 Woodland Opportunity Area

Newcastle Borough possesses a good portion of the county's diverse ancient woodlands, as such a significant portion of the borough is recognised in the Staffordshire Biodiversity Action Plan as the 'wooded quarter'.

Wet woodlands are also a prevalent feature of the borough, especially in the area to the south of Keele, as well as providing high biodiversity value these also contribute to flood mitigation.

The woodland network around Wrinehill and Loggerheads possess flora and fauna species either scarce or not present elsewhere in the county, habitat continuity in these locations will be of vital importance to safeguard the long-term survival of species such as Hazel Dormouse.

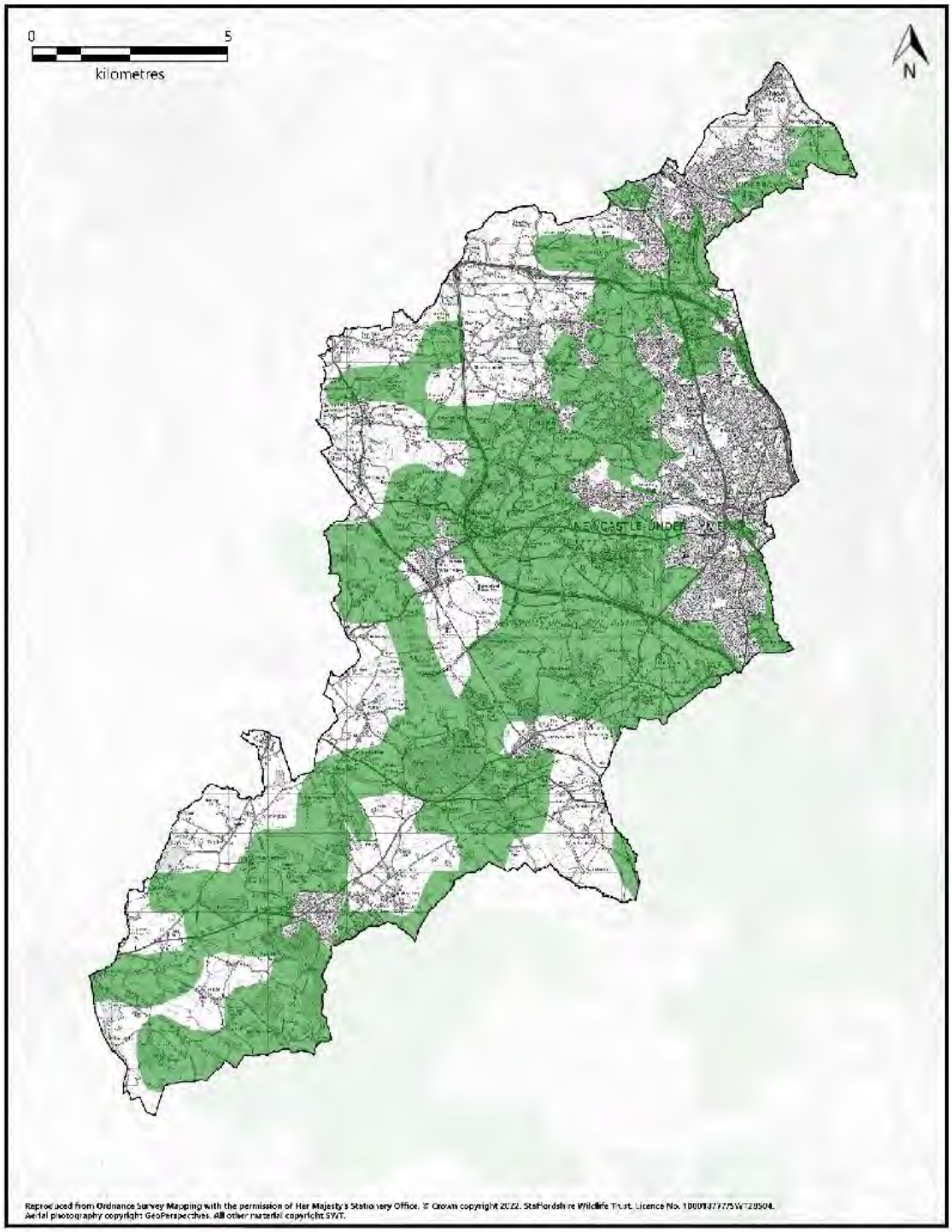
There are a number of large re-planted ancient woodland sites for example Burnt Wood and Bishops Wood, parts of which are designated as a Site of Special Scientific Interest and host significant populations of a number of rare invertebrates, particularly moths. There are other large woodlands not listed on the ancient woodland inventory such as Maer Hills which historically was known for its reptile populations, particularly Common Lizard. In general, these are concentrated to the Southern end of the borough, and cumulatively support good populations of a range of species.

7.1.1 Key Habitats	7.1.2 Key species
• Woodlands • Hedgerows • Scrub • Urban green spaces • Veteran trees	• Cuckoo • Bluebell • Hazel Dormouse • Amphibians and reptiles Particularly common Lizard.
7.1. 3 Threats	**7.1.4 Opportunities**
• High Speed 2 development presents the biggest threat to woodlands in the borough, both in terms of direct losses and fragmentation of existing connectivity. • Loss and fragmentation of irreplaceable woodland habitats (ancient woodland inventory sites). • Both residential and industrial development. • Inappropriate management of species-rich and/or ancient woodland sites either directly within or surrounding these sites leading to deterioration and lowering overall diversity. • Loss or deterioration of hedgerows and other associated habitats severing	• Protection of existing sites, particularly ancient woodland inventory sites and woodlands which are designated as Local Wildlife Sites. Planting of further future woodlands on sites which do not already support a priority habitat to improve connections of existing areas of high quality woodland and increase the area of woodlands which are ecologically functional for the species that they support. • Encourage relaxed management on the fringes of woodlands to provide a softer edge (e.g. scrub formation) habitat which is able to support both more and a wider diversity of species, particularly birds and butterflies. • Expand the area of existing woodlands. Create new areas of woodland that are in strategic locations

connectivity between woodlands and to other habitats. • Unsympathetic or poorly thought out woodland planting and creation on sites which already support another habitat, such as wildflower meadows, causing irreversible loss. • Replanting of ancient woodland sites with species which are not characteristic or native to the area.	and are of suitable size to act as stepping stones between existing woodlands. Woodland expansion and creation must not be detrimental to other high quality habitats for instance diverse grassland habitats. • Use historical maps and data to determine the past extent of woodland areas, particularly where there may still be a rich ground flora in the seedbank for the restoration and expansion of ancient woodland sites. • Planting new and maintaining existing hedgerows to better connect smaller isolated woodlands benefiting species migration and chances of breeding. • Avoidance from or incorporating key woodlands into development sites, this is achievable through mitigation hierarchy in the biodiversity offsetting system. • Restoration of Planted Ancient Woodland sites (PAWS) to native broadleaf or diversification of coniferous woodlands to include more native planting. • Ensure that there is no loss or damage to known wood-pasture or parkland sites. • Identification of, and promotion of the importance of veteran trees, both in woodland and in the wider landscape.
7.1.5 Specific opportunities	
• Ensure that the Sprinks, Drumbles and wet woodlands to the south of Keele are protected from development pressure to prevent degradation of the woodland quality, including water quality. Natural flood management and other 'working with natural processes' techniques could be targeted within the woodlands to enhance the existing mitigation and benefit biodiversity. • Creation of additional woodland designed specifically for Hazel Dormouse in the areas around Loggerheads to enhance the habitat connectivity for the species, particularly in light of the impacts of High Speed 2 railway construction. • Seek to establish regeneration and appropriate tree management on the dis-used Keele golf course.	
7.1.6 Opportunities to enhance other benefits	
• Flood risk mitigation • Carbon storage	

- Recreation and aesthetic
- Cultural heritage
- Wood fuel, timber and fibre
- Foraging / wild food

7.1.7 Map of Woodland Opportunity Area



Staffordshire Wildlife Trust

Staffordshire Ecological Record

7.2 Grassland Opportunity Area

Species-rich grassland is of particular importance within the district however in many areas this is a result of species recolonisation or re-introduction on post-industrial land rather than long-established lowland meadow type habitats characterised by long periods of traditional land management conserving their species richness.

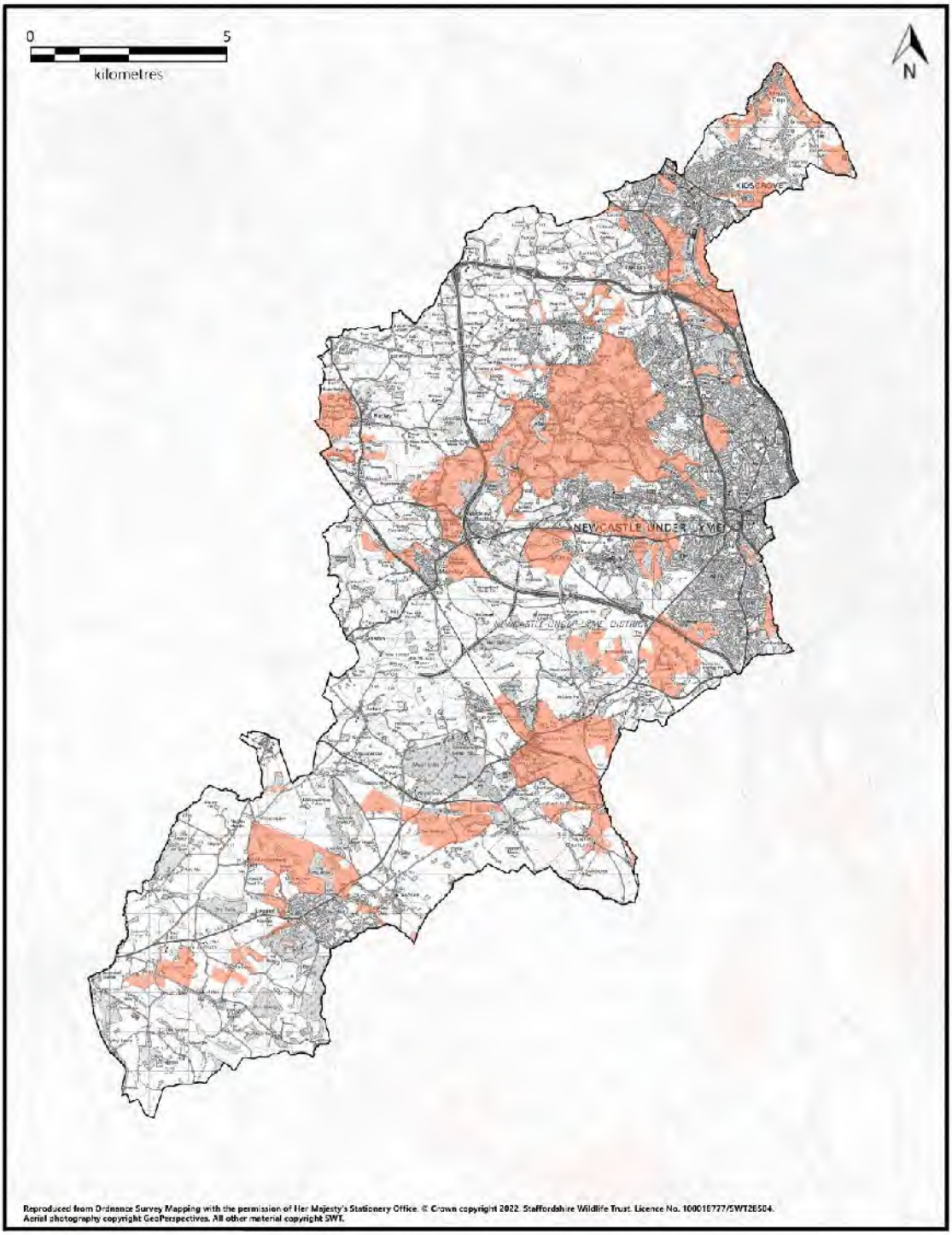
There is a large core area of species rich post-industrial grassland centred around the Apedale, Silverdale and Bateswood area which stretches westwards toward Madeley, uncommon species such as grass vetchlingare found throughout these grasslands, not often found elsewhere in the county. Patches of Lowland Meadow Biodiversity Action Plan habitat exist in areas throughout the borough but are generally small and isolated in their extent. Particularly important areas of diverse grassland existing in Butterton, the areas surrounding Baldwins Gate, and loggerheads. Generally, these are neutral or marshy grasslands, however the sandy acidic nature of some of the soils in the borough give rise to areas of more species rich acid grassland, particularly around Betley, Baldwins Gate, Kidsgrove and Mow Cop.

Connecting these smaller diverse patches of important grassland into a wider ecological network of other high-quality habitat is crucial to ensure long-term species survival.

7.2.1 Key Habitats	7.2.2 Key Species
• Lowland meadows • Pastures • Hedgerows • Arable land • Open mosaic habitat on previously developed land	• Barn owl • Brown Hare • Grey Partridge • Skylark • Farmland birds • Bats (specifically Brown Long-eared, Noctule and Pipistrelle species) • Lapwing • Grass Vetchling
7.2.3 Threats	**7.2.4 Opportunities**
• Development pressure • Poor management of key diverse sites including: ○ Over-grazing ○ Poaching ○ Neglect of Hedgerows ○ Over-cutting of Hedgerows • Nutrient intensification both from agricultural practices as well as diffuse pollution sources - nitrogen deposition. • Agricultural intensification • Management neglect of key diverse sites. • Global and local climate change.	• Ensure that all high-quality grassland sites remain in positive conservation management, securing vital areas which can be used as sources of biodiversity into the future. • Protection of existing high-quality grasslands and buffering these from potentially detrimental neighbouring land uses such as intensive farming practices. This could be achieved through encouraged uptake of agri-environment schemes, landowner liaison/education • Enhancement of any existing grassland sites or restoration of degraded sites so that they may achieve Local Wildlife Site Status and ensure that the management

• Habitat loss and fragmentation	of these sites persists to ensure that they remain diverse. • Reversion of arable land to diverse grassland where soils dictate. This is usually only carried out in certain circumstances due to the difficulty and cost associated however there are examples of this being successfully carried out in the borough. • It is critical that areas of high quality grassland are linked with mosaics of other high quality grassland to ensure that species reliant upon these habitats are able to move freely between them. • Use of Light Detection And Ranging (LiDAR) imagery to identify historical field patterns and features i.e. ridge and furrow to indicate where grassland restoration may be most successful as these areas have not or are unlikely to have undergone any serious agricultural improvement in the past.
7.2.5 Specific Opportunities	
• Ensure existing high-quality grasslands under local authority ownership are maintained (for example grasslands at Bateswood Nature Reserve). • Enhance more of the LPA owned grassland into species rich wildflower meadow habitat to enhance connectivity, particularly within urban areas.	
7.2.6 Opportunities to enhance other benefits	
• Pollination • Recreation and aesthetic • Cultural heritage	

7.2.7 Map of Grassland Opportunity Area



Staffordshire Wildlife Trust

Staffordshire Ecological Record

7.3 Heathland Opportunity Area

The main core areas of heathland in the Borough are concentrated around Mow Cop at the southern end of Congleton Edge. The soils in the borough are generally acidic and capable of supporting heathland, remnants of which do exist in some areas alongside acid grasslands, these are evident around Butter's Green and Wedgwood's Monument.

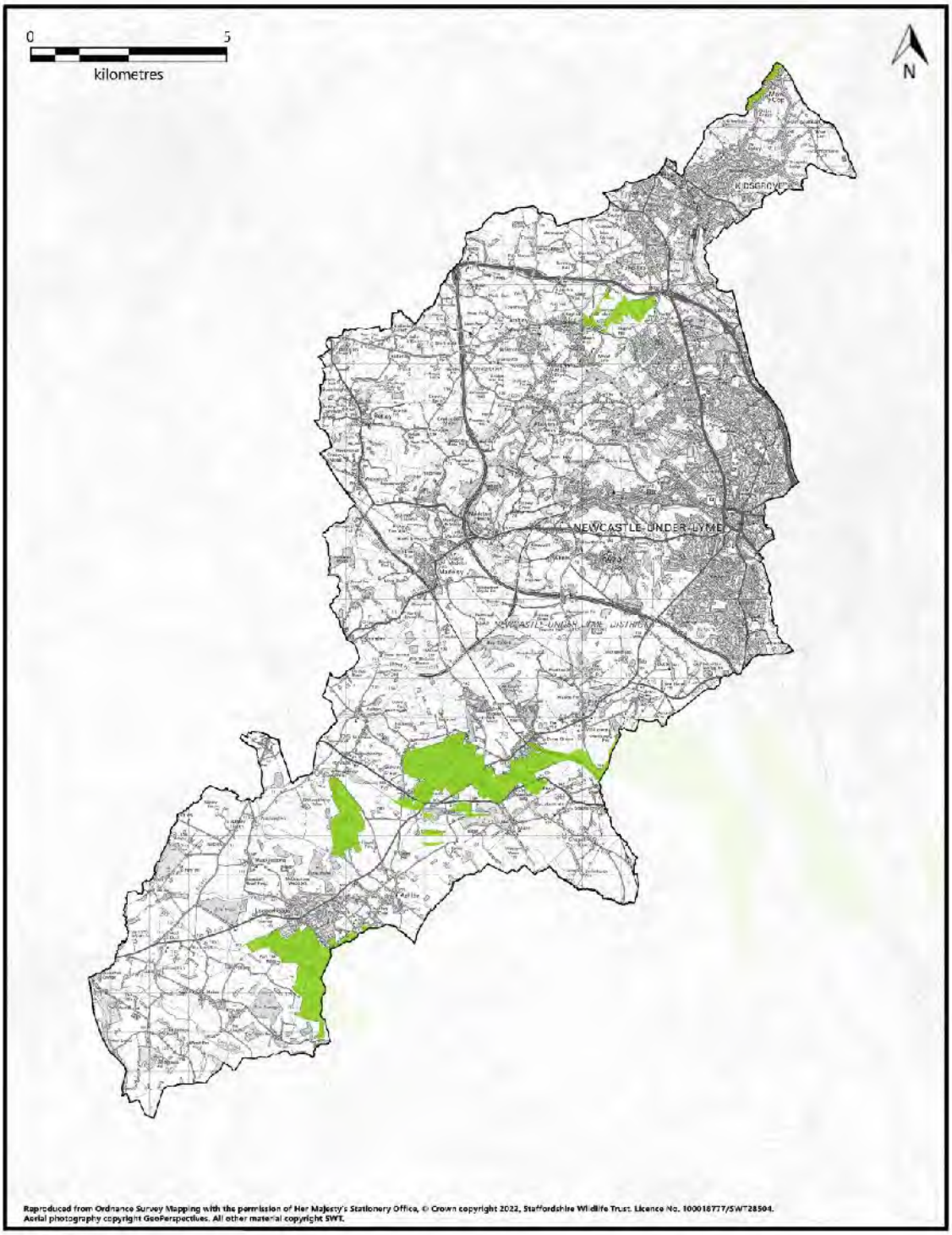
Whilst the amount of extant heathland in the borough is very low, the soil types and more widespread presence of habitat such as acid grassland, along with historic map data, and place names for example Madeley Heath, Whitmore Heath suggests that there is scope for potential heathland restoration in other areas of the borough.

Additionally, Newcastle possesses the highest proportion of lowland meres, mosses and bogs in the county which can often be associated with wet heath habitats, therefore heathland creation/restoration may be appropriate within the catchment of bogs, meres and mosses.

7.3.1 Key Habitats	7.3.2 Key Species
• Heathland • Woodland • Arable (buffer strips, set-aside etc.) • Grassland • Open mosaic habitat on previously developed land	• Heather • Nightjar • Fly agaric • Green Hairstreak Butterfly • Reptiles and Amphibians • Bog Bush-cricket
7.3.3 Threats	**7.3.4 Opportunities**
• Pollution both from acute and diffuse sources leading to nutrient intensification – e.g. Nitrogen loading. • Lack of management, improper management or neglect leading to scrub encroachment. • Potential hydrological impacts on areas of wet heath, for example extensive drainage on surrounding land which may lead to excess water leaving the site and a lowering of the water table. • Tourism and recreational pressure. • Mineral extraction. • Agricultural intensification, both on and surrounding core areas of heathland. • Urban development.	• Protection of existing areas of high quality Lowland Heath through sympathetic management and ensuring that positive management continues and prevent degradation due to neglect. • Seek to create areas of new Heathland in key sites. This could be through development sites as part of biodiversity offsetting mitigation, reverting plantation woodland stands into areas of heathland post harvesting similar to those carried out by the Connecting Cannock Chase project or through incorporating into existing habitat management such as arable field margins or relaxing the management regime in pastures etc. • Regeneration of former sand and gravel sites by inoculation with heather seed and brash to kick start habitat formation and secure sympathetic management of these sites in future.

	• Mitigate potential impacts of recreation pressure on sites such as Cannock Chase and Gentleshaw Common to ensure that the habitats and species which exist there can thrive, but can also be enjoyed by those who live in and visit the area. • Ensure that sites listed on Natural England's Heathland Inventory are appropriately managed and monitored to retain key connectivity sites within the district.
7.3.5 Specific opportunities	
• Ensure that the existing areas of heathland around Mow Cop and Butter's Green/Wedgwood's Monument are conserved and seek to expand the area of current heathland through creation and restoration. • Using the habitat connectivity opportunity mapping and where soil conditions allow, seek to restore areas of historic heathland to better connect the extant heathlands in the borough and to those in neighbouring Local Planning Authorities and Counties. • Explore the opportunity for heathland creation or restoration in the south of the borough to connect up with areas of heathland around Bishops Wood in Stafford borough	
7.3.6 Opportunities to enhance other benefits	
• Pollination • Cultural Heritage • Carbon Storage • Flood risk mitigation • Recreation and Aesthetic	

7.3.7 Map of Heathland Opportunity Area



Staffordshire Wildlife Trust

Staffordshire Ecological Record

7.4 Wetland Opportunity Area

The watercourses and wetland environment are a unique part of the Newcastle's ecology, numerous wet woodlands (often called sprinks or drumbles), wet grasslands, pondscapes and areas of peat soils can be found in the borough.

Newcastle is unique in Staffordshire in that it is the only borough to have three separate watersheds, therefore depending on the location of precipitation water could discharge into either the Trent/Humber (via the Lyme Brook), the Severn (Via the Tern and Coal Brook) or the Mersey (via the Dean Brook, Valley Brook and others).

The wide shallow floodplains along the headwaters of the River Tern, which rises at Cop Mere have enabled the formation of shallow areas of peat, in turn creating several stretches of diverse habitat along the rivers short stretch before it enters Shropshire.

There are numerous upwellings and springs in the borough, forming the headwaters of a number of brooks which feed the three main watersheds. Additionally, these upwellings in some cases feed important ponds and pondscapes, which are dense concentrations of small waterbodies in close proximity acting as a larger overall network. Small waterbodies are important refuges for wildlife in a landscape, especially for reptiles and amphibians. Alongside other habitats e.g., woodland they act as stepping stones through the landscape. In Newcastle, pondscapes occur in both rural and urban settings, particularly in the south and western areas of the borough and in some of the post-industrial urban areas such as Apedale and Chatterley, where some pondscapes are of considerable importance for Great Crested Newt.

Historic watercress beds are present along some of the watercourses and tributaries, particularly in the south of the borough, suggesting that the water in these areas is or was once very clean.

7.4.1 Key Habitats	7.4.2 Key Species
• Woodland • Grassland • Pasture • Arable • Urban fabric/mosaic habitats	• Otter • Great Crested Newt • Freshwater White-clawed Crayfish • Numerous waders and wildfowl • Harvest Mouse • Reptiles and Amphibians • Lapwing • Bittern
7.4.3 Threats	**7.4.4 Opportunities**
• Mineral extraction. • Pollution from acute and diffuse sources. • Poor land management, livestock in and near watercourses and waterbodies, soil erosion leading to eutrophication of water bodies and loss of habitat in watercourses.	• Protection of existing high quality wetland sites particularly those with a nature conservation designation. This will be achieved through the identification of environmental issues for example pollution from agricultural run-off and subsequent remediation for instance through Rural SuDS. These sites should be buffered from any potential sources of damage both

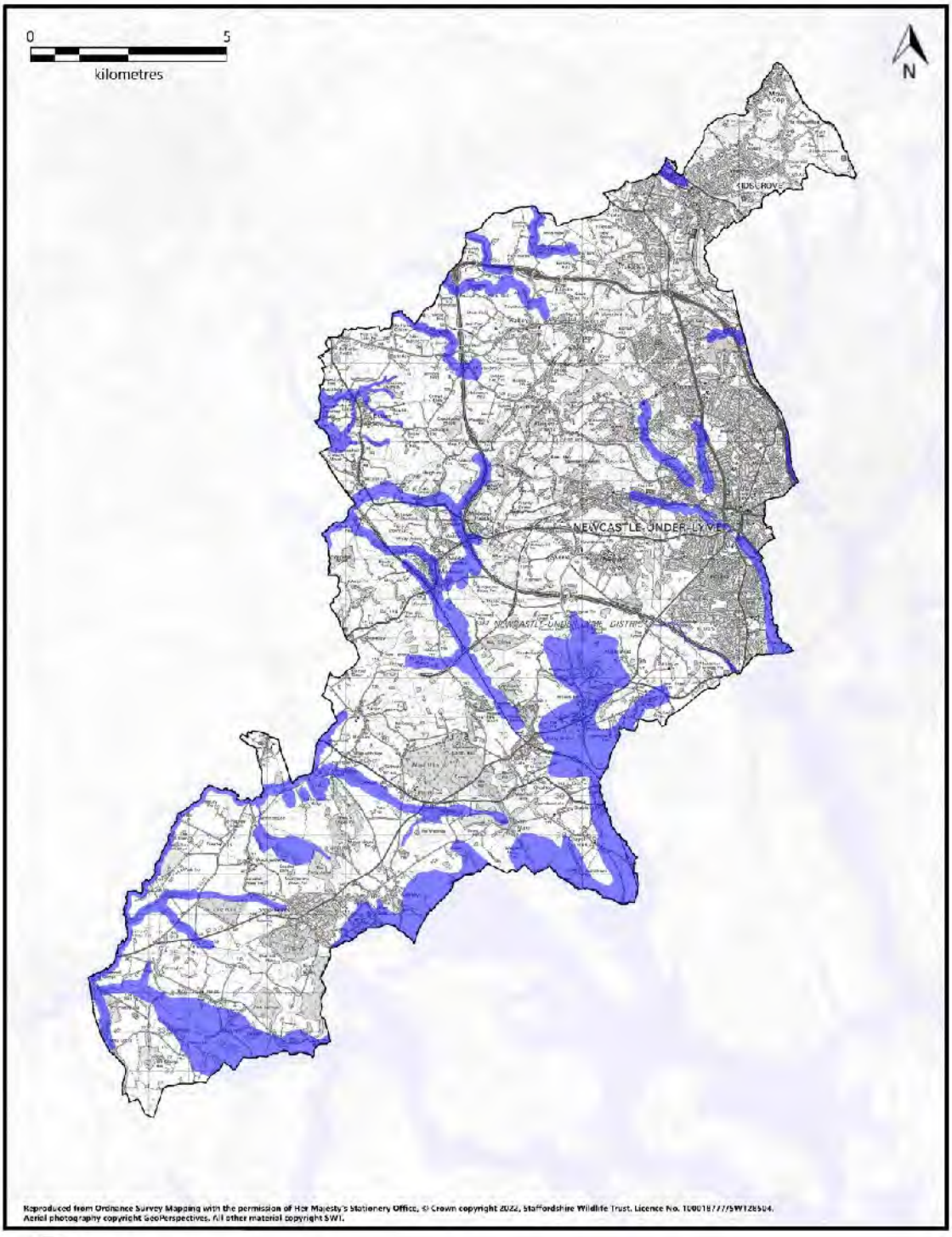
● Historic deepening and straightening of watercourses, meaning that rivers and streams lack natural features such as gravel beds. Water is disconnected from floodplains. ● In some areas removal of tree cover and grazing leading to habitat degradation. ● Lack of understanding of the need to protect water throughout the catchment including areas where there are no obvious watercourses. ● Global and local climate change. ● Loss of 'coarse' habitat to development or agricultural intensification which would otherwise impede the flow of water leading to: ○ Increased flood risk. ● Invasive Non Native Species (Himalayan Balsam (*Impatiens glandulifera*), Parrot's-feather (*Myriophyllum aquaticum*), *Azolla* sp, *Crassula helmsii* etc.). ● Disease/Biosecurity.	through creation of habitat around key sites to provide a 'soft edge' habitat and landowner liaison to address issues. ● Identification of the most suitable locations for the targeting and prioritisation of further wetland creation and enhancements. These should be connected to other ● Seek opportunities to deliver Natural Flood Management delivery to address flood risk as well as provide additional areas for habitat provision. ● Look for opportunities to carry out river reprofiling/naturalisation, improve flood storage and provide additional habitats suitable for a range of species particularly breeding waders and wintering wildfowl. ● Use historical maps and LiDAR information to identify historical wetland and river features, sluices, water meadows etc. which could potentially be restored to deliver both flood risk mitigation and habitat improvements. ● Use flood models to dictate where work can be targeted to both deliver improved flood mitigation as well as deliver further habitat works ● Ensure that sand and gravel quarry extraction sites are effectively restored and provide additional benefits for wildlife. There is a huge opportunity here to deliver biodiversity and flood mitigation objectives. ● Effective mitigation for the loss Great Crested Newt habitat as a result of development. (Priority areas for the creation of compensatory pond clusters would need to be addressed at a finer scale using Great Crested Newt (GCN) metapopulation data and modelling).
7.5.5 Specific opportunities	

- Ensure that the extensive areas of shallow peat along the River Tern are protected from damage and encourage schemes to enable the restoration and re-wetting of a number of key sites along this important stretch of watercourse.
- Newcastle has a rich pondscape network which supports one of the best populations of Great Crested Newt in the county, ensure that any impacts to ponds are effectively mitigated. Seek to strengthen pondscapes, particularly in the south of the borough, around urban fringes and in post-industrial areas.
- Establish a water management plan for the former Keele golf course, working with natural processes to establish flood mitigation and provide additional wetland habitats.

7.4.6 Opportunities to enhance other benefits

- Flood risk mitigation
- Water quality
- Recreation and aesthetic
- Cultural eritage

7.5.7 Map of Wetland Opportunity Area



Staffordshire Wildlife Trust

Staffordshire Ecological Record

7.5 Meres and Mosses Opportunity Area

This opportunity area covers the few areas of rare mere and moss habitats in the borough many of which are internationally, nationally and globally important nature conservation sites which are highly sensitive. Newcastle Borough possesses more lowland meres, mosses and bogs than any other Local Authority in Staffordshire. There are a total of nine distinct mosses/bogs in the borough, along with their associated catchment areas (the area of land which drains directly into the mere/moss site). Catchments from moss sites outside of the borough itself also overlap into some areas of the borough. The meres and mosses in Newcastle are on the Western edge of a larger network of associated sites which spread throughout the Shropshire, Staffordshire and Cheshire Plain National Character Area, previously a focal point of the Meres and Mosses of the Marches Nature Improvement Area.

Meres and Moss sites are very important sites as they are generally formed by processes which took place a long time ago and have taken many years to develop, creating deep areas of peat and in the process storing carbon. Only three of the meres and mosses in the county have legal nature conservation protections in place (i.e. designated as a SSSI, or greater).

In addition to recognised meres and mosses there are also areas of the borough which possess shallower peat soils. Whilst these areas haven't or may never develop into mere or moss sites, the conservation of the soils in these areas is nonetheless still important both for the habitats they are capable of supporting as well as helping combat climate change.

Whilst many of these sites are only a fragment of their former size owing to past human exploitation they still support a number of plants and animals which are found nowhere else in the county. It is unlikely that these sites will ever be completely drained due to the way in which they were formed however this is not to say that irreparable damage cannot be done by poor practices.

As both meres and mosses are finite and fixed it is obviously not possible to artificially create new sites therefore the focal point must be on strengthening and improving those sites which we already have making them bigger and better. Instead of thinking about the extent of remaining mere and moss habitat we must instead think of what is called 'Functional Ecological Units' (FEU).

The FEU is defined on the basis of the topography, hydrology and geology and consists of two elements, the 'core' which includes the boundary of the mere or moss itself along with the range of associated wetland habitats that might be expected directly adjacent to such a site. The second element is the landscape context of the core area, primarily the catchment of surface water and groundwater which feed the mere or moss, it is likely in this area where we can have the most impact in terms of water quality to improve the quality of the core.

All of the peat sites in Newcastle have been altered or degraded in some way in the past, in some areas this is still ongoing through pollution from acute and diffuse sources or land-use change in the direct of surrounding area. These are some of the greatest threats to these sensitive sites, leading to nutrient intensification, drying out, soil erosion and could ultimately result in complete loss of the core area of peatland. It is therefore vital to secure protection and establish practical mechanisms to prevent further damage and start to restore these areas

7.5.1 Key Habitats	7.5.2 Key Species
• Woodland • Grassland • Arable • Pastures	• Sundew species • Sphagnum moss • White-faced Darter dragonfly • Water Shrew
7.5.3 Threats	**7.5.4 Opportunities**
• Pollution from both acute and diffuse sources. ○ Nutrient intensification • Neglect or lack of management on some sites. • Afforestation. ○ direct loss of habitat and drying out of adjacent land • Lack of appropriate conservation management which have a direct or indirect effect on the core areas of mere and moss sites. • Agricultural intensification. ○ Poor soil management ○ Application of pesticides and man-made fertilisers • Hydrological changes ○ Drainage of surrounding land shrinking core area. • Invasive Non-native Species	• Protect and enhance the core area of wetland mosaic in key sites, ensuring that appropriate sensitive management is in place, ideally managed by bodies or individuals with proven track record of managing sensitive nature conservation sites. • Seek to enhance the catchments of meres and mosses with interventions to improve water quality such as rural SuDS schemes, encouraging the uptake of agri-environment schemes with options beneficial to water quality and habitat improvements. • Ensure that drainage from all urban infrastructure including roads etc. is properly maintained to ensure that no pollutants are being allowed to feed into meres and mosses either through surface water or groundwater. • Ditch and drainage blocking within the core wetland mosaic to slow the movement of water away from the site and permanently raising the water table.

7.6.5 Specific opportunities

- Primary focus should be on the meres and mosses themselves, particularly sites with no legal protection e.g. sites at Chorlton, Craddocks Moss, Willoughbridge, Maer, Madeley and Wrinehill, ideally these sites should be formally recognised and adequately protected from development pressure, both in terms of their statutory designation and through local planning policy.
- Restoration of degraded peat sites, either those listed above or sites which exist on peat soils through re-wetting, sympathetic habitat creation and working with natural processes.
- The core area of legally designated sites (Cop Mere, Cranberry bog and Betley Mere) must be buffered through the creation, enhancement and restoration of habitats which protect this core area for example from surface run-off pollution or extensive drying out of the core site.

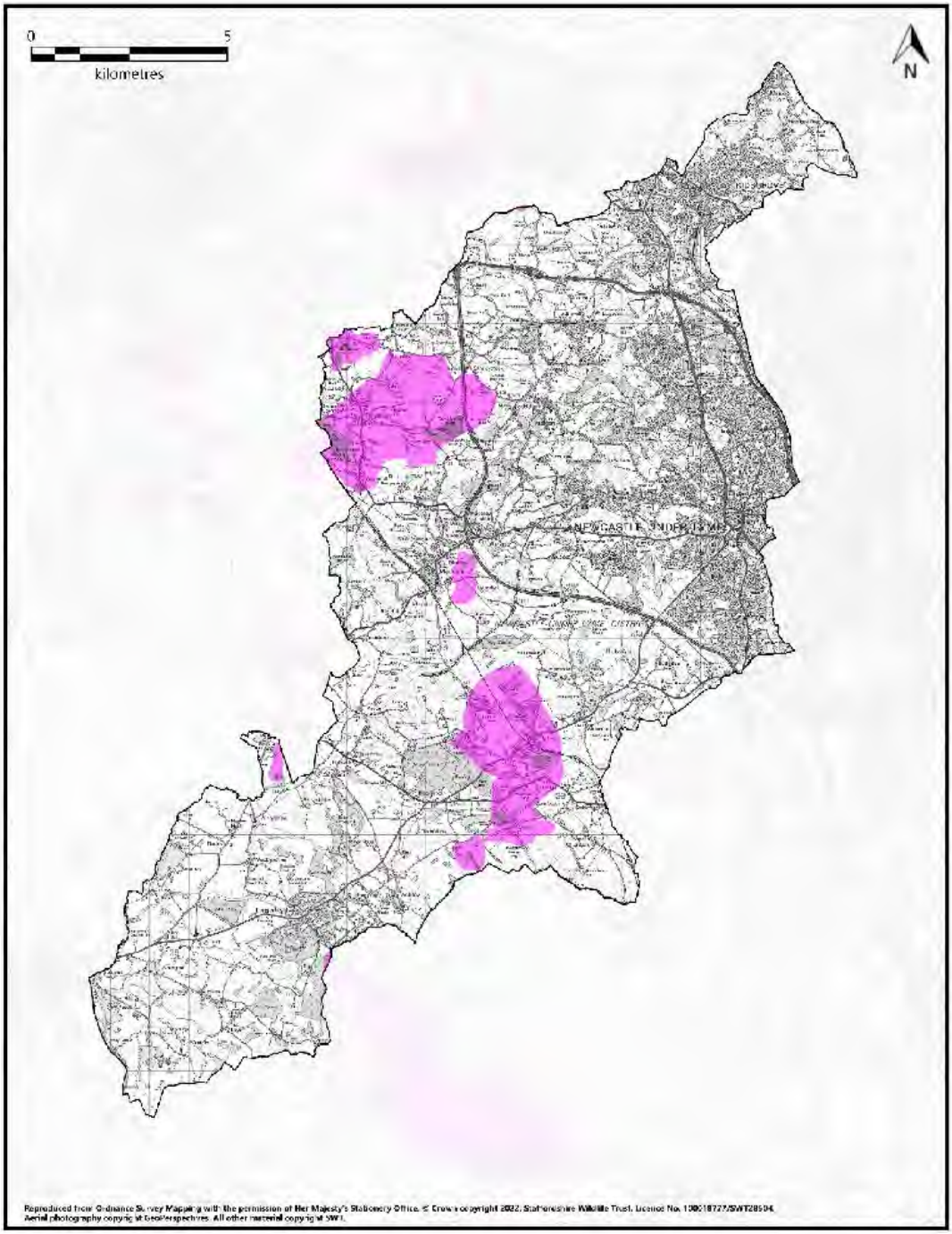
- Engage and work with landowners within the wider Functional Ecological Unit catchment areas of the above sites to ensure that land practices are sensitive and sympathetic to the core site as well as seeking to create or restore additional beneficial habitats.

- Securing appropriate nutrient and water management systems both in the direct vicinity and the wider catchment of these sites will be crucial for their long-term survival.

7.5.6 Opportunities to enhance other benefits

- Carbon storage
- Flood risk mitigation
- Water quality
- Recreation and aesthetic
- Cultural heritage

7.5.7 Map of Meres and Mosses Opportunity Area



Staffordshire Wildlife Trust

Staffordshire Ecological Record

7.6 Open Mosaic Habitats on Previously Developed Land (OMHPDL) Opportunity Area

Often referred to as 'brownfield' land due the fact this habitat type only occurs on areas with a history of disturbance or development. OMHPDL habitats are essentially a matrix of a number of different habitat community types for example mosses, liverworts, lichens, ruderal (plants which grown on waste ground), plants associated with inundated areas, open grasslands and heathlands (JNCC, 2010). The sites will also consist of a variety of other features such as unvegetated areas, loose substrate or ponds/pools, often on contaminated ground with impede drainage. All of these features will be intermixed into non-discrete areas making it difficult to map individual habitats therefore can be classified as OMHPDL habitat.

OMHPDL is incredibly important for a wide range of species and are often extremely diverse. The fact that they are often so nutrient poor and can have a range of contaminants only certain species are able to grow in these conditions which are usually outcompeted in other habitats. OMHPDL often support rich assemblages of invertebrates, often containing a number of locally or nationally scarce species, and are classified as Biodiversity Action Plan priority habitats.

There are a number of existing brownfield sites throughout Newcastle, both managed as brownfields (for example Silverdale Country Park) and sites which are the result of previous development which have not yet been developed

The Void at Silverdale Country Park is an outstanding example of successful management of brownfield habitat in the borough. Not only providing accessible greenspace and recreational value to a lot of people but also hosts one of the most significant populations of Dingy Skipper butterfly in Staffordshire. Apedale and Bateswood Country Parks are also post-industrial sites which have been restored but retain some very good quality areas of OMHPDL supporting a range of species.

7.6.1 Key Habitats	7.6.2 Key Species
• Grassland • Heathland • Scrub • Bare ground • Ephemeral vegetation • Ponds	• Dingy Skipper Butterfly (Bird's-foot-trefoil plant) • Common Cudweed • Great Crested Newt • Orchid species • Dragonflies • Many species of invertebrates, particularly Aculeates (bees, wasps etc)
7.6.3 Threats	**7.6.4 Opportunities**
• Development pressure, undoubtedly the biggest threat to OMHPDL irrespective of habitat quality as these are often the sites which are in the pipeline for development already.	• Provide habitat for species which rely solely on these kinds of habitats for example Dingy and Grizzled skipper butterflies

• Can be considered un-aesthetic particularly when not/poorly designed in their creation. This may potentially lead to public pressure for alternative habitat creation.	• Regeneration of post-industrial sites into highly diverse biological sites can help engage and educate the public on the importance of brownfields on a range of different species. • Sites such as Silverdale Country Park show that with good design and multiple use factored in that OMHPDL can provide multiple benefits to a range of stakeholders as well as provide excellent habitat. • Retention of cultural/industrial heritage within the landscape.

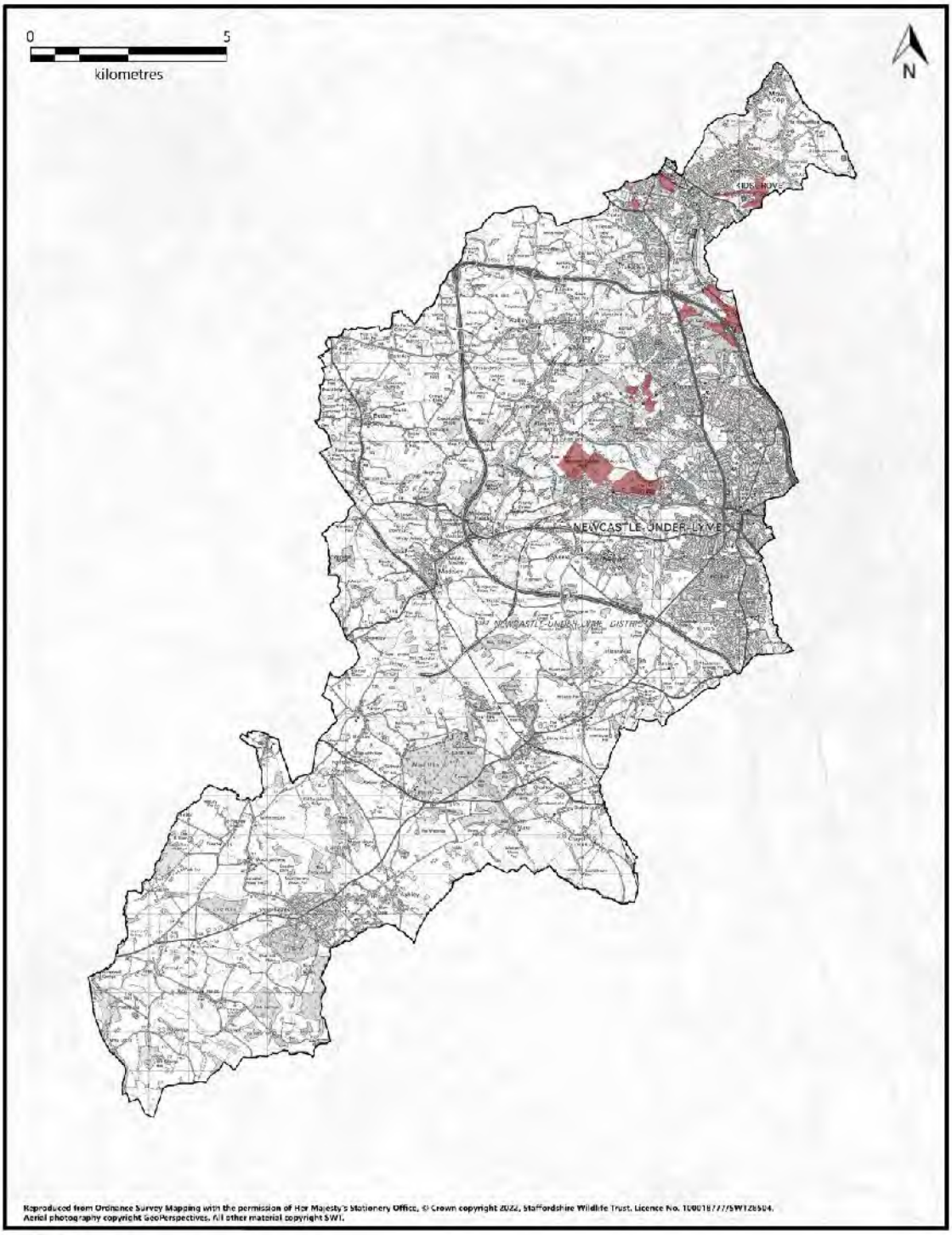
7.6.5 Specific opportunities

- Whilst it will be difficult to justify the retention of all brownfield sites, and in many cases these sites are likely already earmarked for development due to increased demand for housing and protections on greenfield/greenbelt land. There needs to be increased recognition of the biological importance of brownfield sites, this should happen through appropriate development control ensuring the full extent of a site's diversity, including rare or important invertebrate assemblages should be taken into account when assessing sites.
- Whilst the retention of specific sites is potentially unrealistic, a commitment to retain a certain area of OMHPDL either as part of development schemes or within the local authority area should be sought to ensure there is habitat continuity.

7.6.6 Opportunities to enhance other benefits

- Cultural heritage
- People engagement and education
- Recreation

7.6.7 Map of Pasture and Arable Opportunity Area



Staffordshire Wildlife Trust

Staffordshire Ecological Record

7.7 Pasture and Arable Opportunity Area

Pasture is the most common land use across the borough as much of the borough's green space devoted to the agricultural production with a number of large dairy farms as well as smaller units rearing sheep and cattle and small hobby farms and equestrian liveries.

Field sizes within the borough are generally large due to historic agricultural intensification, however scattered smallholdings do still remain with handfuls of small enclosed field systems, particularly in proximity to villages and hamlets.

As a result of agricultural intensification pasture and arable areas generally tend to be fairly wildlife poor, aside from either highly generalist or highly specialist species which favour more open habitats. Generally, within the more intensely farmed areas the best remaining habitats tend to be hedgerows and headland/field margins, particularly where set-aside is practiced, and can in some cases be very diverse. Hedgerows are recognised as an important landscape feature in these areas not only providing supporting habitat but also benefitting habitat connectivity.

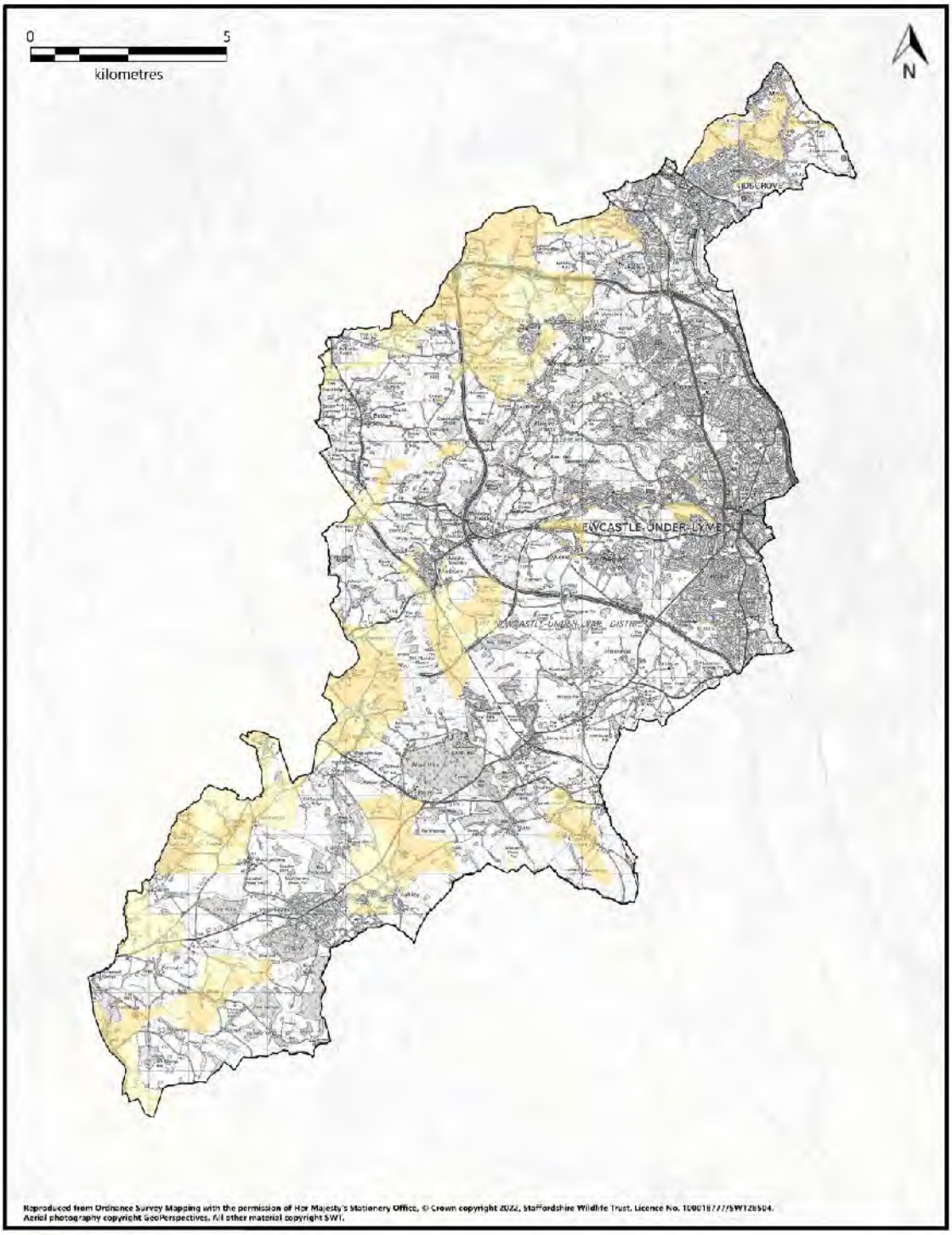
There is ample opportunity within this area to enhance both the habitats themselves through agri-environment schemes or farm diversification as well as ensuring that areas of higher quality habitat are suitably connected through restoration and management of linear features such as field margins and hedgerows.

7.7.1 Key Habitats	7.7.2 Key Species
• Grassland • Woodland • Hedgerows • Mature and veteran trees	• Barn Owl • Brown Hare • Harvest Mouse • Polecat • Grey Partridge • Wall Brown butterfly
7.7.3 Threats	**7.7.4 Opportunities**

• Habitat fragmentation.
• Agricultural intensification.
• Urban encroachment.
• Pollution of waterways.
• Loss and deterioration of ponds for example through changes in water management or nutrient intensification.
• Improper management e.g.
  ○ Over-grazing
  ○ Poaching
  ○ Neglect of hedgerows
  ○ Over-cutting of hedgerows
	• There are a wide range of opportunities for more intensively farmed agricultural land ranging from very small interventions such as leaving one corner of an arable field as set aside to provide feeding opportunity for farmland seed eating birds to large whole farm scale interventions for example reversion of large areas of arable land into diverse grassland. Obviously the scale of the intervention is down to what is practical and ultimately what is desirable, cost effective and sustainable in the eyes of landowners and land managers.

	• Link up existing semi-natural habitats through the creation of habitat corridors and networks using hedgerows, arable field margins and watercourses where possible. • Reversion of arable to other habitats with a higher biodiversity value for example species rich grassland. • Encourage uptake or movement toward organic production methods or holistic grazing management over reliance on supplementary feeding or indoor systems for example. • Where developments are likely to impact on large areas of intensive farmland, ensure that as a result some of the developed area is dedicated to the provision of high quality semi-natural habitats which may greatly improve habitat availability and connectivity within the landscape.
7.7.5 Specific opportunities	
• The gently rolling topography of the borough and the high proportion of sensitive wetland features means that water management is key within the farmed landscape. Encouraging landowners to work with natural processes and diversify farm businesses to benefit biodiversity as well as providing food security and sustainable, profitable farm businesses. •	
7.7.6 Opportunities to enhance other benefits	
• Water quality • Cultural heritage • Food production	

7.7.7 Map of Pasture and Arable Opportunity Area



7.8 Urban Fabric Opportunity Area

The majority of the urban environment in Newcastle is concentrated to the North-east of the borough, on the boundary with Stoke-on-Trent unitary authority. The historic industrial nature of the area and gradual expansion of Newcastle town itself to incorporate the nearby villages over the past century has resulted in a complex matrix of different land-uses dispersed amongst the urban areas. Newcastle and the surrounding conurbation now cover an area of approximately 3.3 square Kilometres when including Kidsgrove, however, for a large urban conurbation there still exists a very high proportion of green space, including trapped farmland, regenerated post-industrial sites, public open green space such as parks, gardens and woodlands.

The urban areas in the remainder of the borough consist of small hamlets and villages situated amongst farmed landscapes. The village of Loggerheads sits in a largely woodland setting and the village itself is well connected to the habitats in the surrounding landscape.

7.8.1 Key Habitats	7.8.2 Key Species
• Grassland • Woodland • Open Mosaic Habitat on Previously Developed Land (brownfield habitats) • Wetland • Rivers and streams • Street trees (particularly those in environments where other green space is lacking)	• Hedgehog • Great Crested Newt • Slow Worm • Invertebrates and pollinators • House Sparrow • Toads and other amphibians • Finch species. • Water Vole (along the Lyme Brook)
7.8.3 Threats	**7.8.4 Opportunities**
• Habitat fragmentation through the loss of both sources of biodiversity as well as habitat ‘stepping stones’ and linear pathways which species require to be able to disperse. • Pollution both from acute and diffuse sources leading to the loss of diversity in waterways etc. • Urban expansion • Redevelopment of Open Mosaic Habitats on Previously Developed Land (OMPDL) which are often important sites for a number of species in urban areas. • Intensive management of urban green spaces leading to: • Invasive species	• The key objectives in these areas is not to connect urban areas together but to enable permeability between rural and urban landscapes, especially where high quality semi-natural habitats exist in close proximity to or within these areas. In doing this it is possible to benefit habitat connectivity but also bring wildlife closer to people. • Ecological enhancement of existing urban green spaces, for example through improving the diversity of amenity grassland in parks by seed sowing and green hay strewing, enhancement or creation of wetlands in SuDS • Creation of new habitats when planning new urban developments, make new developments as green as possible to bring high quality habitats

● Increased flood risk due to increased area of hard impermeable surfaces.	and improve habitat connections in the urban environment. This may include for example green roofs/green walls, wildlife friendly SuDS which can be planted with native wetland species, rain gardens to slow the flow of water. ● Ensure that urban green spaces are managed appropriately to provide the best benefits for wildlife and people - this may include relaxing mowing regimes to create and maintain more diverse grasslands, thinning of plantation woodlands to improve structural diversity or invasive species control. ● Ensure that linear features such as canals, old railway lines, road verges, hedgerows are managed for the good of wildlife as these are often critical pathways for biodiversity in and out of the urban environment. ● Provide suitable opportunities in existing and new developments for protected and Biodiversity Action Plan (BAP) species for example bats, hedgehogs and pollinators.

7.8.5 Specific opportunities

- Ensure that habitats in Lyme Valley Parkway continue to be managed sympathetically and establish connections with other public green space in the nearby area e.g. N-U-L cemetery, Three parks walk etc.
- Retain the area of green space alongside the Lyme Brook which provides important wetland/grassland linking corridor to the wider countryside to the south. Where possible seek to enhance the areas of grassland to provide additional species-rich habitat and encourage sympathetic management of the woodlands in this area.
- Seek to establish areas of species rich grassland at the Wammy to enable connectivity between the high diversity grasslands adjacent to the Lyme Valley Business Park to the north and the disused railway line to the south.
- Work with natural processes to enhance the areas of wetland at Pool Dam marsh and provide additional flood mitigation benefits to the Lyme Brook.
- Enhancement/creation of species-rich grasslands in some of the larger areas of public green space around Wolstanton and Bradwell.

7.8.6 Opportunities to enhance other benefits

- Recreation and aesthetic - improved access to and increased number of natural resources.
- Health and wellbeing - improved access to an increased number of natural resources.
- Flood risk mitigation - More green areas lead to increased habitat coarseness which slows the flow of water, Sustainable Drainage Systems (SuDS) schemes increase habitat and hold water away from vulnerable areas.

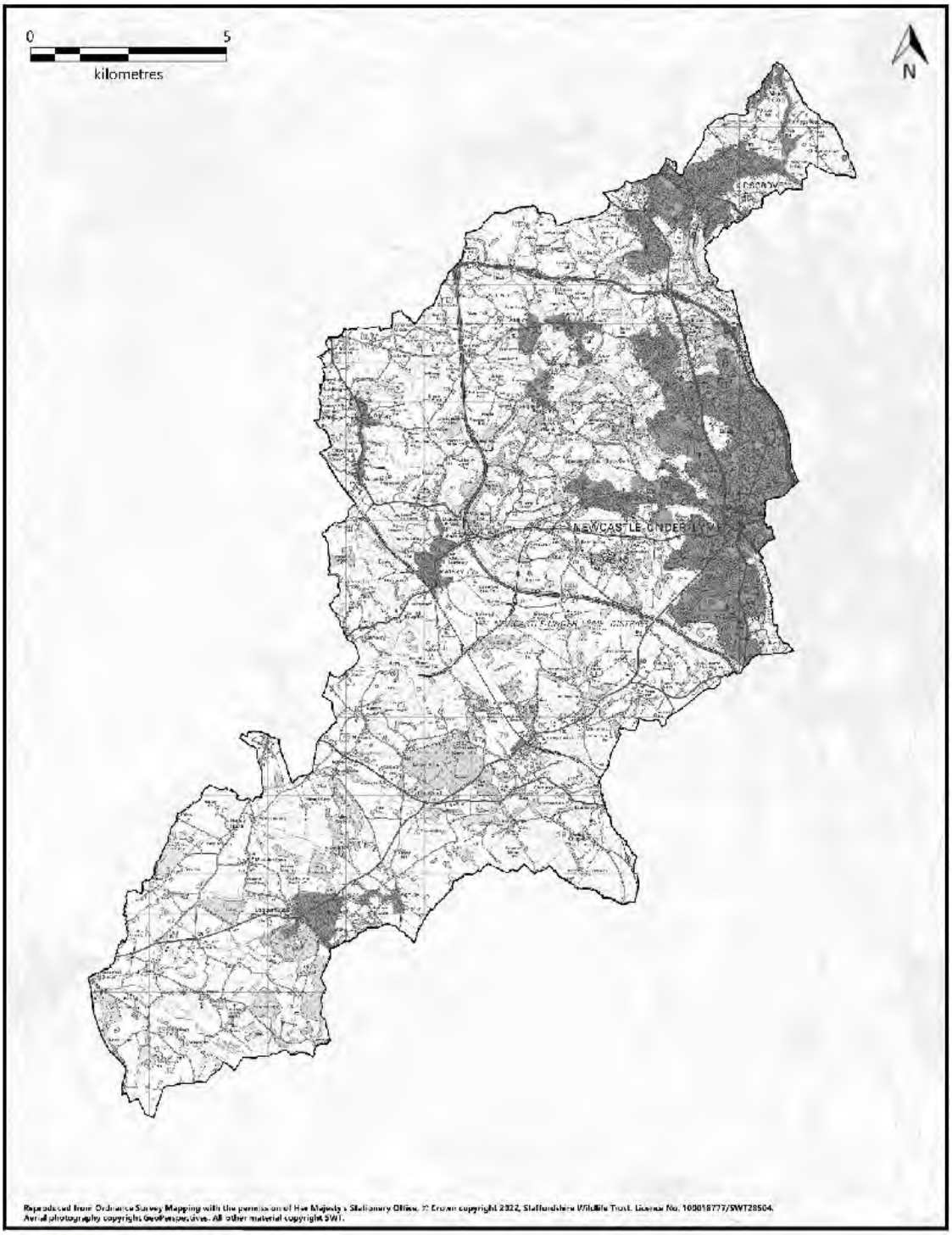
- ‘Pocket Parks’ encouraging local people to take up management of small urban green spaces to benefit both wildlife and those which live nearby. By adopting multiple pocket parks it is possible to create a stepping stone network throughout the urban environment.

- Urban cooling – suitable tree planting, increased green space and green developments, green walls, green roofs etc.

- Cultural heritage - access to nature and traditional landscapes.

- Public engagement - opportunity to educate people on ecology and the natural world and what people can do to provide space for wildlife in gardens, allotments, local parks etc.

7.8.7 Map of Urban Fabric Opportunity Area



Staffordshire Wildlife Trust

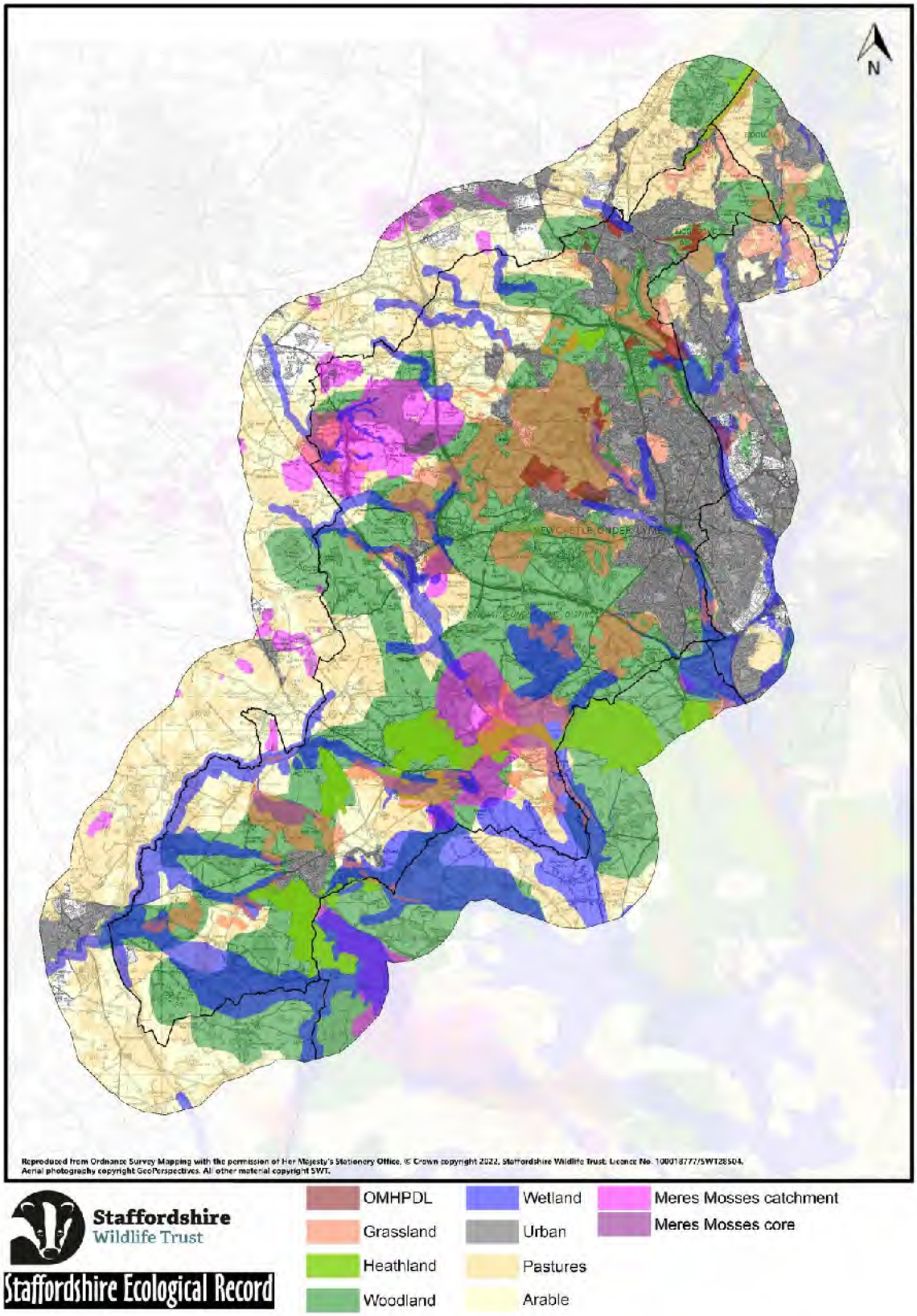
Staffordshire Ecological Record

8. Cross boundary habitat connectivity

As habitats and wildlife do not adhere to political boundaries it is important to take into account habitats which exist on the other side of political boundaries to ensure that there is no ‘hard edge’ where for example a Habitat Connectivity Opportunity area ceases to exist at the edge of a county or district boundary despite there being suitable habitat

Map 4 illustrates this, showing the Habitat Connectivity Opportunity (HCO) areas combined map including a 2km radius buffer around the district boundary. Despite the buffered radius falling outside of the district and county boundaries habitat connectivity into these areas has been considered as part of the mapping to ensure this ‘hard edge’ has been avoided. It must be noted however that the HCO areas do not extend large distances into neighbouring authority areas with the ultimate goal that all authority areas will have a mapped Nature Recovery Network which dovetails with this NRN mapping.

The cross boundary HCO areas in neighbouring local authorities may be subject to change based on any future NRN mapping which may be commissioned by the respective local authority in its jurisdiction. At this stage Habitat Connectivity Opportunity areas identified outside of the district should only be considered potential and may be subject to future changes. These areas have been included in this assessment to demonstrate the duty to cooperate across boundaries has been considered in this mapping exercise.



Map 4 Combined habitat connectivity opportunity areas map for Newcastle Borough including a 2 kilometre buffered radius of the district boundary (October 2022). NB: some of the HCO areas overlap one another which can lead to the colouring of the map being distorted.

9. Practical Application of the maps

The HCO maps are designed to be used in conjunction with the biodiversity metric 3.1 to both inform the metric calculations and target the location and application of future ecological enhancements contributing to a functional nature recovery network.

The HCO areas are based around the principle of habitats being ecologically functional and well connected to one another within the landscape. This means that habitats are able to both support a high population and diversity of species, meaning these species have the ability to be able to move freely within the landscape, as a result of good habitat connectivity.

These areas promote the conservation, restoration and enhancement of certain priority habitats, ecological networks and contribute to the protection and recovery of associated priority species within defined geographic areas.

Crucially the habitat connectivity opportunity areas mapping has no white space as there are always opportunities for the delivery of habitat creation or enhancement anywhere in the landscape irrespective of whether it has been identified as a connectivity area for a priority habitat or not. Taking this approach ensures that the landscape as a whole can remain permeable for our flora and fauna and resistant to both local and global impacts. See appendix G. for full technical details on the principles of HCOs and mechanisms for delivery.

The habitat connectivity opportunity areas identify the key areas where the creation of new habitat is best prioritised to benefit habitat connectivity within the landscape. Targeting additional habitat creation in this way will have the greatest impact on both availability and connectivity of habitat within the landscape as it builds upon areas which already possess some good quality habitats but by increasing their size, quality, coverage and connectivity within the landscape will enable those habitats to become more functional.

Within these areas there are further opportunities to deliver environmental outcomes within existing spatially defined partnership schemes.

The way that the opportunity areas are generated means that habitat opportunities are not mutually exclusive of one another i.e. there can be overlapping areas for multiple habitat types; for instance an area defined as an opportunity for woodland enhancement may also provide a good opportunity for improving grassland and wetland habitat enhancement and connectivity. The on-site prioritisation of what habitat to create where must therefore rely upon both the opportunity areas as well as local ecological expert knowledge so as not to risk either damaging connectivity or destroying existing good quality habitats.

10. Next Steps

10.1 Habitat connectivity bottlenecks

Bottlenecks highlight the areas of habitat which have the highest ‘strain’ in terms of supporting connectivity within the nature recovery network. These areas are where there is a high flow of species through an area with relatively few links and over a long distance (i.e. a very concentrated flow of species movement squeezing through a very small area of habitat and being forced to jump large distances between patches of suitable habitat). Producing detailed guidance in how this can best be addressed will enable informed focused positive impacts that directly reduce strain on the habitat connectivity network.

Bottlenecks can be used to determine the optimal locations to create and restore habitats to benefit connectivity and reduce ‘strain’ on the habitat network. Creating, enhancing and restoring habitat in these locations will not only benefit by reducing strain on the network but also reduces the risk or likelihood of losing what may be an important link in a habitat connectivity network which is already under pressure.

10.2 How the strategic mapping will evolve over time

As discussed previously, the opportunity map is not static and as physical habitats change on the ground and are subsequently mapped and monitored the map itself will evolve with these updates. It must be stressed that the opportunity areas themselves are where work to enhance habitats is focussed as this is where the opportunity to get the greatest benefits lies, the following example purely illustrates how the process of habitat improvement over time can influence changes in the map itself.

11. In Conclusion

The analysis and opportunity areas mapped within the new nature recovery network are much more fine scale and are based around a more robust defensible methodology that can more clearly deliver against NPPF and PPG objectives, as well as those outlined in the Environment Act.

12. Glossary

Term	Definition
Biodiversity Action Plan/ UK Biodiversity Action Plan	A biodiversity action plan (BAP) is an internationally recognized program addressing threatened species and habitats and is designed to protect and restore biological systems. The original impetus for these plans derives from the 1992 Convention on Biological Diversity (CBD). The UK Biodiversity Action Plan (UK BAP) was published in 1994, and was the UK Government's response to the Convention on Biological Diversity (CBD).
Geographic Information System (GIS)	A computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. By relating seemingly unrelated data, GIS can help individuals and organizations better understand spatial patterns and relationships.
Light Detection And Ranging (LiDAR) imagery	Remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth to create a digital topography elevation map.
Local Wildlife Site (LWS)	Local Wildlife Sites are areas with locally significant nature conservation value. They come in all shapes and sizes, from small wildflower meadows and secluded ponds to ancient woodlands. Most are owned by private individuals.
Natural capital	Natural capital can be defined as the world's stocks of natural assets which include geology, soil, air, water and all living things.
Nature conservation site	This is a blanket term used to describe all sites which have a land use designation relevant to nature conservation or are managed in the interests of nature conservation and wildlife for example, Local Wildlife Sites, SSSI or Nature reserves.
Non-statutory nature conservation site	Non-statutory sites (specifically LWS) receive some protection from development via local planning documents which recognise the need to protect and enhance designated sites and those of interest without a statutory designation.
Site of Special Scientific Interest (SSSI)	Sites of Special Scientific Interest (SSSI) are areas of very high nature conservation value which are legally protected nationally, these sites are normally the best remaining examples of natural habitats and may also have an international designation e.g. Special Area of Conservation (SAC).
Statutory nature conservation site	A site with a designation which is upheld and protected by law e.g. SSSI or SAC
Sustainable Drainage Systems (SuDS)	Sustainable drainage systems (SuDS) are a technical solution to addressing issues that arise with the increasing problem of excess surface water. Originally used in urban areas, they are now used for some roads and towns in rural areas.

	SuDS are always site specific, and require bespoke design that take into account the underlying hydrology, functional purposes of the area, and the present and future needs of people using the area.
White space	Areas of a map which have no information, i.e. gaps in a dataset.

13. References

Burkhardt, B., Kandziora, M., Hou, Y. & Muller, F. (2014) Ecosystem Service Potentials, Flows and Demands - Concepts for Spatial Localisation, Indication and Quantification. *Landscape Online.* **34**, pp.1-32.

Churnet Valley Landscape Ecology Pilot Partnership. (2014) *Churnet Valley Landscape Ecology Pilot: Habitat Networks Modelling.* Staffordshire.

Hölzinger, O. and Everard, M. (2014) *Staffordshire Ecosystem Assessment*. Staffordshire County Council, Stafford.

Lawton, J.H., Brotherton, P.N.M., Brown, V.K., Elphick, C., Fitter, A.H., Forshaw, J., Haddow, R.W., Hilborne, S., Leafe, R.N., Mace, G.M., Southgate, M.P., Sutherland, W.J., Tew, T.E., Varley, J., & Wynne, G.R. (2010) Making Space for Nature: a review of England's wildlife sites and ecological network. Report to Defra.

Ministry of Housing, Communities and Local Government. (2019) *National Planning Policy Framework.* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf [Accessed 24 September 2019].

Ministry of Housing, Communities and Local Government. (2019) Collection: *Planning practice guidance.* [online] Available at: https://www.gov.uk/government/collections/planning-practice-guidance [Accessed 24 September 2019]

Natural Capital Committee. (2017) How to do it: a natural capital workbook. Version 1. [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/608852/ncc-natural-capital-workbook.pdf [Accessed 10 June 2019].

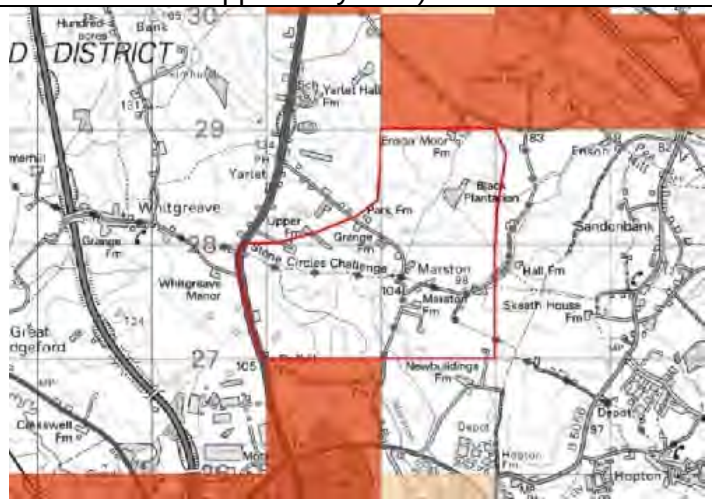
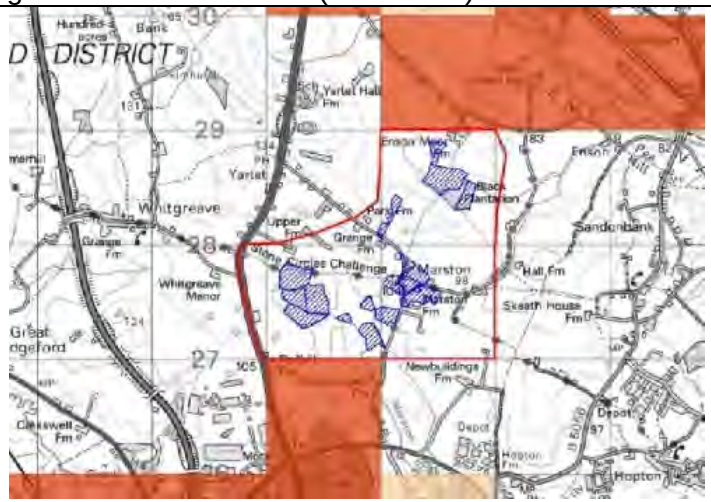
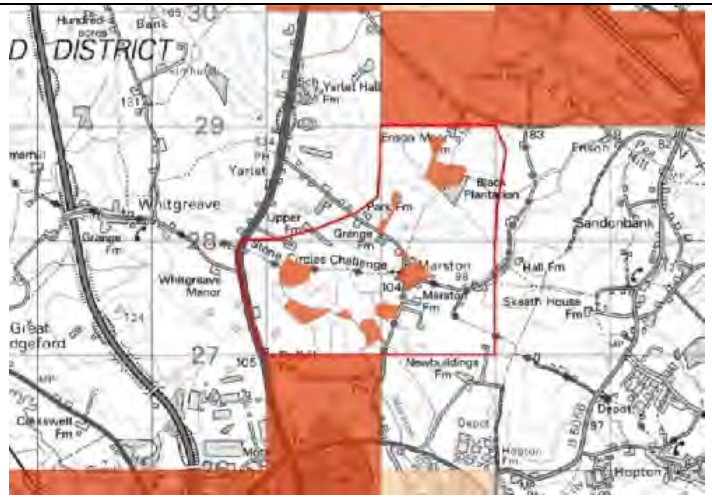
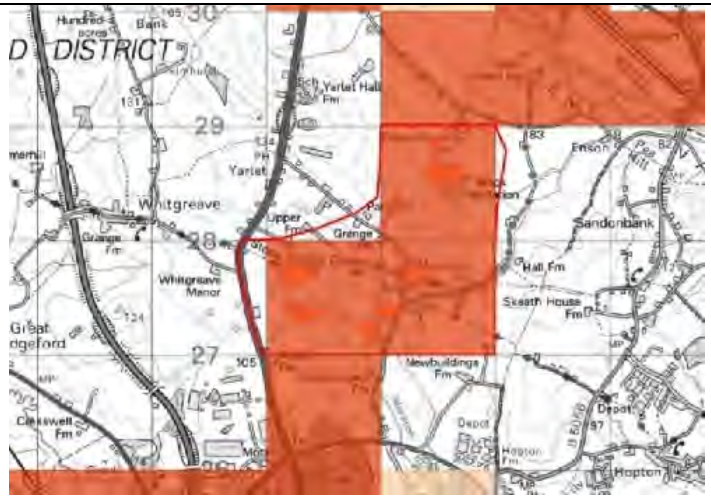
Noake, B. Liu, V., Lawley S. & Glaisher, A. (eds) (2016) *The State of Staffordshire's Nature - Summary Report*. Staffordshire Wildlife Trust and Staffordshire Ecological Record. Wolseley Bridge, Stafford.

The Wildlife Trusts. (2018) *Towards a Wilder Britain, Creating a Nature Recovery Network to bring back wildlife to every neighbourhood*. A Report to Westminster Government by The Wildlife Trusts.

Wallis, D.W., Hodgson, J.A. (2012) *Condatis, software to assist with the planning of habitat restoration*. [version 0.6.0, desktop]. Available from: http://wordpress.condatis.org.uk/

14. Appendices

Appendix A – Example of the process behind how the NRN mapping will evolve over time as new data becomes available (example for illustrative purposes only, not a true to life example).

1: A small gap is identified between opportunity areas for grassland (Orange shaded squares denote the opportunity area).	**2:** Broad scale aspirations for the creation, restoration or enhancement of species-rich grassland are identified (blue areas).
	
3: In time some of the aspirations are realised, leading to enhanced grassland habitat, changes monitored and mapped (orange areas).	**4:** The newly mapped habitat data has now influenced the opportunity area connecting two previously separate opportunity areas.
	

Appendix B – GIS datasets used in the generation of the NRN mapping for Newcastle Borough

Dataset	Used in	Justification	Limitations
Habitat Composite Region (including newly mapped areas as part of brief)	Strategic areas mapping. Habitat distinctiveness mapping	Provides complete coverage of the district	Wide range of ages and sources (See appendix 2) which may limit accuracy.
OS MasterMap	Creation of new habitat polygons for Part A of the brief – Phase 1 study.	Spatial information for each field parcel, house garden etc.	No 'habitat' data within the background table data.
Land Classification data	Defining 'Pasture and Arable' and 'Urban' areas in the Habitat Connectivity Opportunity areas.	Quickly and easily define 'habitat' for large areas of land.	Very broad scale areas, covering multiple fields etc.
Functional Ecological Units	Habitat Connectivity Opportunity mapping	Only current dataset which reflects the overall areas of influence for Meres and Mosses in Staffordshire.	
Species Data (Protected Notable BAP etc.) from Staffordshire Ecological Record (SER)	Provide detail of species presence in the Habitat Connectivity Opportunity mapping.	Most complete and up-to-date database of species records in the county.	Not a consistent survey – may be some species present which are missed.
Natural Englands Priority Habitat Inventories	Strategic Areas mapping, Habitat distinctiveness mapping, Habitat Connectivity Opportunity mapping	Identification of key habitat sites within the landscape to be conserved and connected. High value sites within the Habitat distinctiveness mapping.	
Local Wildlife Sites (LWS)	Strategic Areas mapping, Habitat distinctiveness mapping, Habitat Connectivity Opportunity mapping	Identification of key habitat sites within the landscape to be conserved and connected. High value sites within the Habitat distinctiveness mapping.	
Statutory sites maps (SSSI, SAC, RAMSAR etc.)	Strategic Areas mapping, Habitat distinctiveness mapping, Habitat Connectivity Opportunity mapping	Identification of key habitat sites within the landscape to be conserved and connected. High value sites within the Habitat distinctiveness mapping.	
British Geological Survey (BGS) Soil Property Data WMS	Habitat Connectivity Opportunity mapping	Scrutiny of modelling output of condatis for production of Habitat Connectivity Opportunity Areas ensuring that HCO is within the relevant soil type for that habitat based on the where habitats already exist on that soil type.	

Natural England National Character Areas (NCA)	Strategic Areas mapping, Habitat distinctiveness mapping, Habitat Connectivity Opportunity mapping	To ensure that the identified network aligns with national priorities for species, habitats and landscape.	
Staffordshire Biodiversity Action Plan (SBAP) Ecosystem Action Plan Areas (EAPS)	Habitat Connectivity Opportunity mapping	Ratification that the new Habitat Connectivity Opportunity areas are based on what has been identified as a priority in the SBAP.	

Appendix C – Evidence base confidence review (table supplied as a digital appendix)

Staffordshire Wildlife Trust (SWT)/Staffordshire Ecological Record (SER) hold and manage the a large quantity of the counties primary ecological data which is a key factor in being able to establish a robust evidence base for any strategic environmental work. It is critical that a thorough investigation of the available datasets both in-house and those available either through Open Government Licences, a Creative Commons open licence or via a paid licence subscription to ensure that we are using the best possible datasets in the creation of the NRN.

Desirability and reliability values were scored out of 10, a list of positive and negative indicators were used to define the values for each dataset. The desirability and reliability figures were then multiplied together to give the overall ‘confidence’ rating which is scored out of 100, the higher the score the higher the ‘confidence’ of the dataset contributing to a meaningful evidence base. It must however be noted that the dataset confidence ratings are only accurate to the time that they were produced, as new datasets become available and the existing datasets are updated the confidence ratings will alter to reflect any relevant changes. The inventory therefore must be kept up to date and reviewed prior to starting any future large scale projects to ensure that the best evidence base is being used.

Appendix D – Breakdown of habitats and sites included in the habitat distinctiveness mapping bands

Distinctiveness Band	Habitats included within the band	Action (in order of preference)
Very High	● Irreplaceable habitats (e.g. ancient woodland) ● International, national or regional value species populations. ● Priority habitats as defined in Section 41 of the Natural Environment and Rural Communities (NERC) Act that are highly threatened, internationally scarce and require conservation action e.g. blanket bog	Avoid loss, Enhance, Link, Create new habitat adjacent (expand existing habitat)
High	● County and district value ● Habitats known to support county and district value species populations. E.g. all rivers and good quality streams. ● Priority habitats as defined in Section 41 of the NERC Act requiring conservation action e.g. lowland fens	Avoid loss, mitigate loss, last resort compensate loss. Enhance, link and create new habitat.
Medium	● Local Value ● Habitats of Principal Importance and Staffordshire Biodiversity Action Plan (SBAP) habitats that don't meet LSW criteria, semi-natural habitats that act as corridors and stepping stones, arable land which is in a relevant stewardship agreement or organic status. ● Local Value species populations. ● E.g. hedges, ponds, copses and low quality woodland, rough grassland, ruderal vegetation, degraded watercourses/ditches. Habitats known to support priority species. Buildings with protected species presence that aren't high value. ● Semi-natural vegetation not classed as a priority habitat e.g. hazel scrub	Mitigate loss, compensate loss. Enhance, link and create new habitat.
Low	● Site Value ● Intensive arable, improved and amenity grassland, manicured landscaping, isolated poor semi-natural habitat. ● Semi-natural or modified vegetation not classed as a priority habitat and of lower relative value to most wildlife e.g. Temporary grass and clover ley; intensive orchard; rhododendron scrub	Compensate large losses. Enhance, link and create new habitat.
Very Low	● Buildings (unless supporting protected/priority species), hard standing, roads, regularly disturbed bare ground. ● Habitats and land cover or little or no value to wildlife e.g. Developed land sealed surface	Create new habitat where connectivity exists or functional size is achievable.

The mapping works by assessing the proportion of broad habitats e.g. woodland, grassland, heathland etc. within an area to determine whether these are ‘strategic’, ‘semi-strategic’ or ‘non-strategic’

Ordnance Survey 1km grid squares were classified based on the principle that if 20% or more of that square has, for instance woodland habitat within it then it is considered to function ecologically (species associated with that habitat are able to move freely within this square). Based on the above, classification of 1km squares are defined as:

- Strategic: between 5-20% of the 1km square is covered by a habitat e.g. woodland/grassland. Priority as this requires further habitat to reach the 20% threshold to be considered ‘ecologically functional’ for that specific habitat.
- Semi-strategic: 20% or greater specific habitat in the 1km square. Already meets the 20% threshold to be considered ‘ecologically functional’ but the creation of further habitat will strengthen ability for species to be able to exist and move through this square.
- Non-strategic: less than 5% of the 1km square is covered by a specific habitat making it too onerous to bring the amount of habitat to meet the 20% threshold, it is therefore not a priority area to target biodiversity compensation.

Strategic area mapping is carried out on a per habitat basis, e.g. a strategic areas map is produced for each habitat analysed, however an overall strategic areas map has been produced based on the combination of all the habitats analysed as part of the strategic mapping exercise (map 2). For this map, the methodology has been altered so that the criteria for strategic and semi-strategic areas have been swapped e.g. anything with over 20% habitat coverage is now considered strategic. By altering the methodology in this way it is possible to create a coarse overall ‘connectivity map’ by highlighting the areas with highest combined overall habitat availability and connectivity as opposed to those areas where it is best to create habitats.

As only higher quality habitats are assessed through this analysis (e.g. species rich grassland) and lower quality habitats are not included (table F1) (e.g. improved grassland or poor semi-improved grassland) as they do not adequately contribute to the network as they cannot support the same level of species diversity as higher quality habitats and therefore would not be able to support this diversity. This is not to say that these habitats do not contribute to the network in some way but are not presently of a high enough biodiversity value to act as a potential source site for biodiversity or to support species typical of that habitat indefinitely.

It is important to note that updating the strategic area maps over time requires up-to-date mapping data which should be sent to the Local Environmental Records Centre (LERC) when available in a suitable format to incorporate into the Nature Recovery Network Mapping.

Table E1 – Habitat types included in the assessment of strategic habitat areas (habitats without an 'X' in a relevant habitat column were not used in the assessment).

Habitat survey type	HABCODE	Habitat description	Woodland	Wetland	Grassland	Heathland
UKBAP	CF1	Coastal floodplain grazing marsh		X	X	
UKBAP	WW	Wet Woodland (Where identified)	X	X		
Phase 1	A111	Broad-leaved semi-natural woodland	X			
Phase 1	A112	Broad-leaved plantation	X			
Phase 1	A121	Coniferous semi-natural woodland	X			
Phase 1	A122	Coniferous plantation	X			
Phase 1	A131	Mixed semi-natural woodland	X			
Phase 1	A132	Mixed plantation	X			
Phase 1	A21	Dense continuous scrub	X			
Phase 1	A22	Scattered scrub	X		X	
Phase 1	A31	Broad-leaved parkland/scattered trees	X		X	
Phase 1	A32	Coniferous parkland/scattered trees	X		X	
Phase 1	A4	Recently felled woodland				
Phase 1	A5	Orchard	X		X	
Phase 1	B11	Unimproved acidic grassland			X	
Phase 1	B12	Semi-improved acidic grassland			X	
Phase 1	B21	Unimproved neutral grassland			X	
Phase 1	B22	Semi-improved neutral grassland			X	
Phase 1	B31	Unimproved calcareous grassland			X	
Phase 1	B32	Semi-improved calcareous grassland			X	
Phase 1	B4	Improved grassland				
Phase 1	B5	Marsh/marshy grassland		X	X	
Phase 1	B6	poor semi-improved grassland				
Phase 1	C11	Continuous bracken				
Phase 1	C31	Tall ruderal			X	
Phase 1	C32	Non-ruderal				
Phase 1	D11	Acid Dry dwarf shrub heath				X
Phase 1	D2	Wet dwarf shrub heath				X
Phase 1	D3	Lichen/bryophyte heath				X
Phase 1	D4	Montane heath/dwarf herb				X
Phase 1	D5	Dry heath/acidic grassland mosiac			X	X
Phase 1	D6	wet heath/acid grassland mosaic				X
Phase 1	E11	Sphagnum Bog		X		
Phase 1	E2 (any)	Flush and Spring		X	X	
Phase 1	E3 (any)	Fen		X	X	
Phase 1	F (any)	Swamp, marginal and innundation		X		
Phase 1	G (any)	Open Water		X		
Phase 1	I21	Quarry				
Phase 1	I22	Spoil				

Phase 1	I24	Refuse tip				
Phase 1	J11	Arable				
Phase 1	J112	Allotments				
Phase 1	J113	Set-aside (field margins)			X	
Phase 1	J12	Amenity grassland				
Phase 1	J13	Ephemeral/short perennial				
NVC	A (Any)	Aquatic Communities		X		
NVC	CG02	Festuca ovina–Avenula pratensisgrassland			X	
NVC	CG03	Bromus erectusgrassland			X	
NVC	CG07	Festuca ovina–Hieracium pilosella–Thymus praecox/pulegioides grassland			X	
NVC	H08	Calluna vulgaris–Ulex galliiheath				X
NVC	H09	Calluna vulgaris–Deschampsia flexuosa heath				X
NVC	H09/MG 10	Calluna vulgaris–Deschampsia flexuosa heath / Holcus lanatus–Juncus effususrush-pasture		X	X	X
NVC	H09/U05	Calluna vulgaris–Deschampsia flexuosa heath / Nardus stricta–Galium saxatilegrassland			X	X
NVC	H09/U2	Calluna vulgaris–Deschampsia flexuosa heath / Deschampsia flexuos agrassland			X	X
NVC	H09a	Calluna vulgaris–Deschampsia flexuosa heath				X
NVC	H09b	Calluna vulgaris–Deschampsia flexuosa heath				X
NVC	H09c	Calluna vulgaris–Deschampsia flexuosa heath				X
NVC	H09e	Calluna vulgaris–Deschampsia flexuosa heath				X
NVC	H12	Calluna vulgaris–Vaccinium myrtillus heath				X
NVC	H12a	Calluna vulgaris–Vaccinium myrtillus heath				X
NVC	H12c	Calluna vulgaris–Vaccinium myrtillus heath				X
NVC	M22	Juncus subnodulosus–Cirsium palustre fen-meadow		X		
NVC	M23	Juncus effusus/acutiflorus–Galium palustrerush-pasture		X		
NVC	M24	Molinia caerulea–Cirsium dissectumfen-meadow		X		
NVC	M25	Molinia caerulea–Potentilla erectamire		X		
NVC	M26	Molinia caerulea–Crepis paludosa mire		X		
NVC	MG04	Alopecurus pratensis–Sanguisorba officinalis grassland			X	
NVC	MG05	Cynosurus cristatus–Centaurea nigragrassland			X	
NVC	MG08	Cynosurus cristatus–Caltha palustris grassland			X	
NVC	MG09	Holcus lanatus–Deschampsia cespitosa grassland			X	
NVC	MG10	Holcus lanatus–Juncus effusus rush-pasture		X	X	
NVC	S (Any)	Salt-marsh communities		X		
NVC	U01	Festuca ovina–Agrostis capillaris–Rumex acetosella grassland			X	
NVC	U02	Deschampsia flexuosa grassland			X	
NVC	U03	Agrostis curtisii grassland			X	
NVC	U04	Festuca ovina–Agrostis capillaris–Galium saxatilegrassland			X	
NVC	W (any)	Woodlands and Scrub	X			

Condatis works by modelling a landscape of habitats as if it were an electrical circuit. A circuit board consists of a number of wires joining up resistors in combinations. When a voltage is applied to the board at one end, the current will pass through the board to the other end but the amount of current passing through each wire will vary according to the resistances it meets through each pathway. Condatis considers a landscape as analogous to a circuit board, with a source population of species being considered the voltage, the links between habitat useable by these species being the resistors, and the flow of species colonising the available habitat across those links being considered the current. Condatis is able to measure the flow of a hypothetical species across a landscape based on the availability of a distinct habitat category e.g. woodland or grassland.

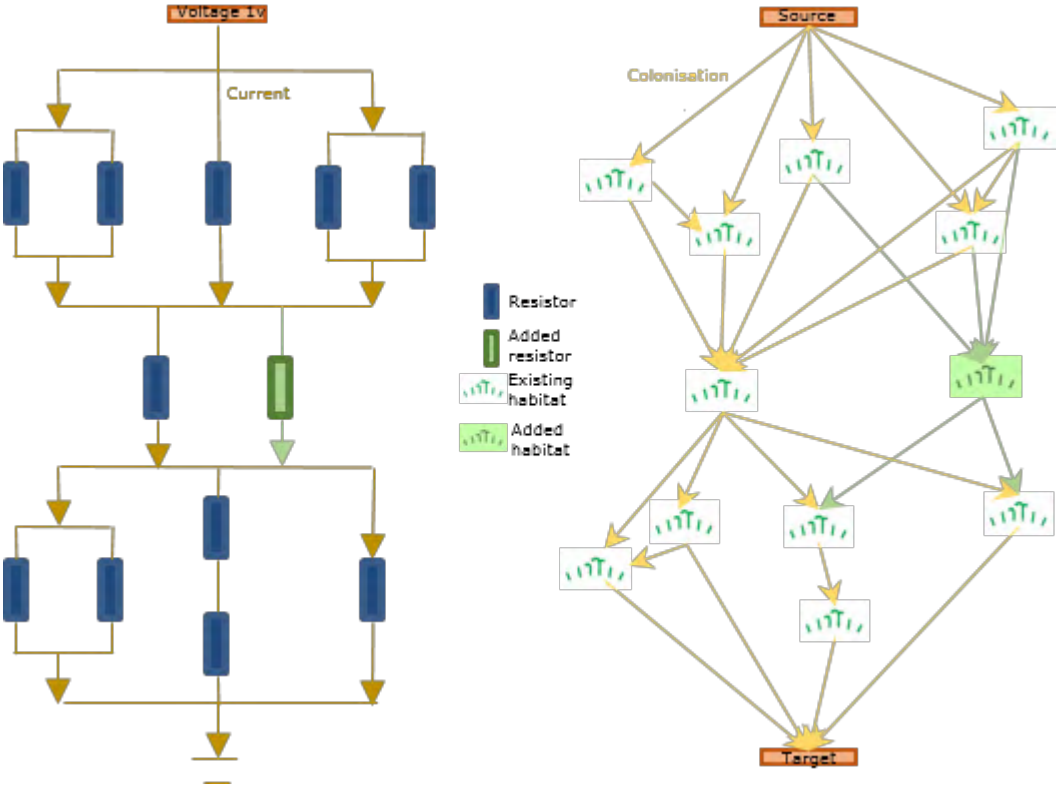


Image 1 Electrical circuit on the left and comparable stylised habitat map on the right. Green represents adding a resistor or additional habitat to each to increase the number of pathways available and therefore improve the flow. Image available at: http://wordpress.condatis.org.uk/

Habitat source and target locations are specified: the source either representing a nominal population of species or an actual population (in this case a nominal population was used), the target representing an area for eventual colonisation. The direction of travel is defined by the placement of source and target and will depend on the purpose of study. For instance, if looking at likely species movement due to climate change, a south to north or lowland to upland direction might be required. A South-north orientation was chosen for the source and target to reflect the likely species movement change in response to climate change. Condatis looks at how the habitat in between the source and target could contribute to the species progress over multiple generations, so it is not designed to look in detail at individual patch-to-patch movements.

By using Condatis to output the relative flow of a species through the landscape for a given habitat type it is possible to more accurately define where wildlife corridors exist and where they could be improved.

- The mapping takes into account existing local wildlife-rich habitats and existing ecological networks as well as local national and internationally designated nature conservation sites.

- The aim of the HCO areas is not to replace large areas of farmed land; we must continue to rely on working with farmers and landowners to manage existing habitats and create areas of new habitat.

- Developments whose primary objective is to conserve or enhance biodiversity particularly those which are aligned with the opportunity areas should be supported, and opportunities to incorporate biodiversity improvements in and around developments should be encouraged especially where this benefits overall biodiversity and habitat connectivity for example the creation of species rich grassland within the grassland opportunity area.

- When delivering against the mapping, care should be taken to ensure that the best possible habitat for that area is being created; it may be tempting for example where an area is both within a connectivity zone for woodland and grassland to plant large tracts of woodlands as this is easiest and most cost effective when in fact this may in some cases may result in the loss of important habitats whereas species rich grassland enhancement would be both more beneficial and provides better outcomes for habitat connectivity.

- The main aims are to ensure adequate habitats are large enough to resist harmful effects, and are well-enough connected to ensure that species are able to move around and sustain populations. Harmful effects may be localised, e.g. flooding or be much more far-reaching for example climate change. The need for more, bigger, better and joined up habitats is explained in detail in Lawton et al. (2010).

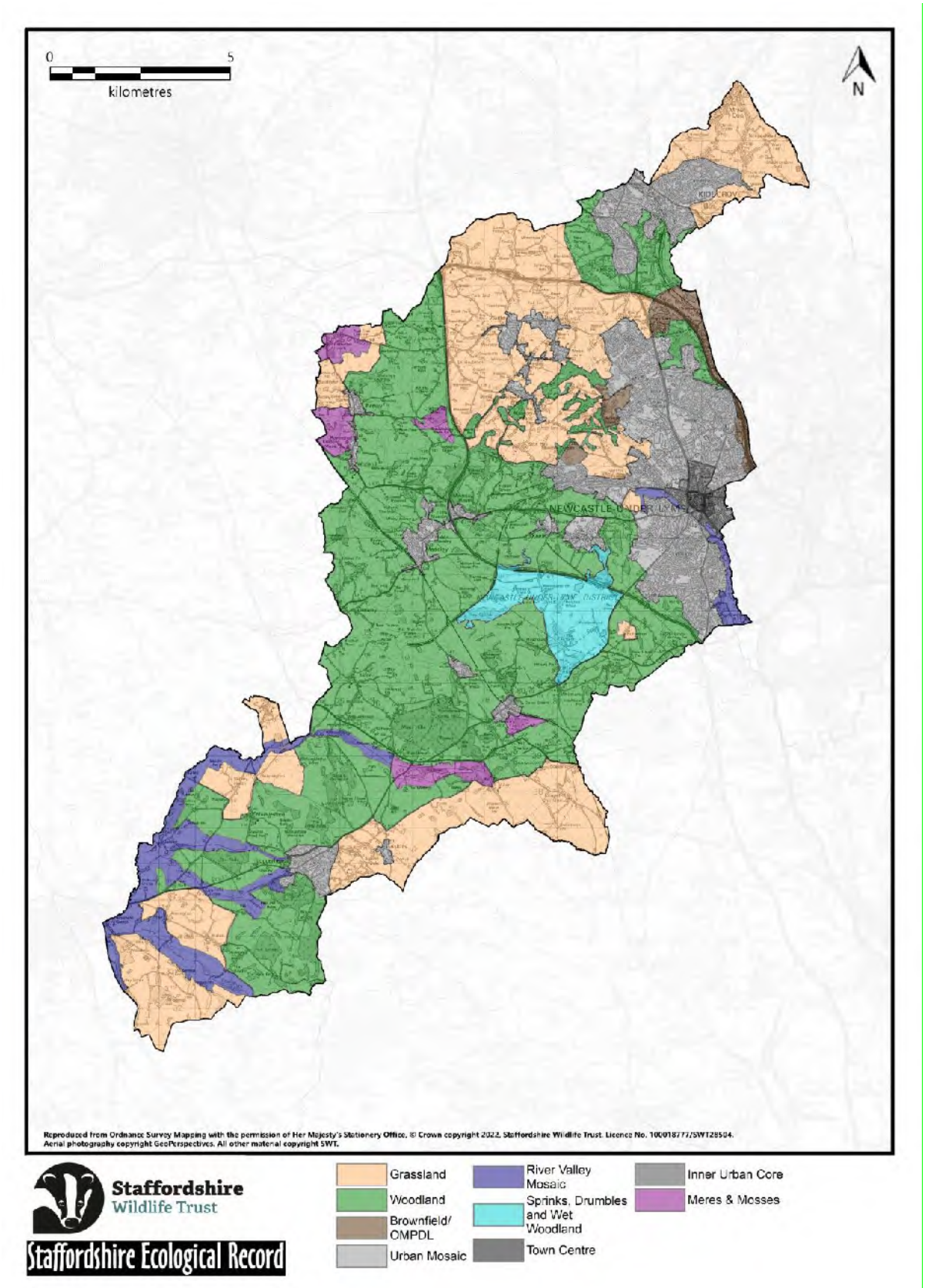
- The opportunity areas reflect and refine the work of the Staffordshire Biodiversity Action Plan Ecosystem Action Plan areas (appendix 11) by using finer detail data to pick out more targeted conservation areas.

- The habitat connectivity opportunity areas were cross-referenced against the previously mapped biodiversity opportunity zones detailed in LDCs Biodiversity & Development Supplementary Planning Document (2016). The habitat connectivity opportunity areas are more refined than the previously mapped opportunity zones but do reflect similarities within the landscape.

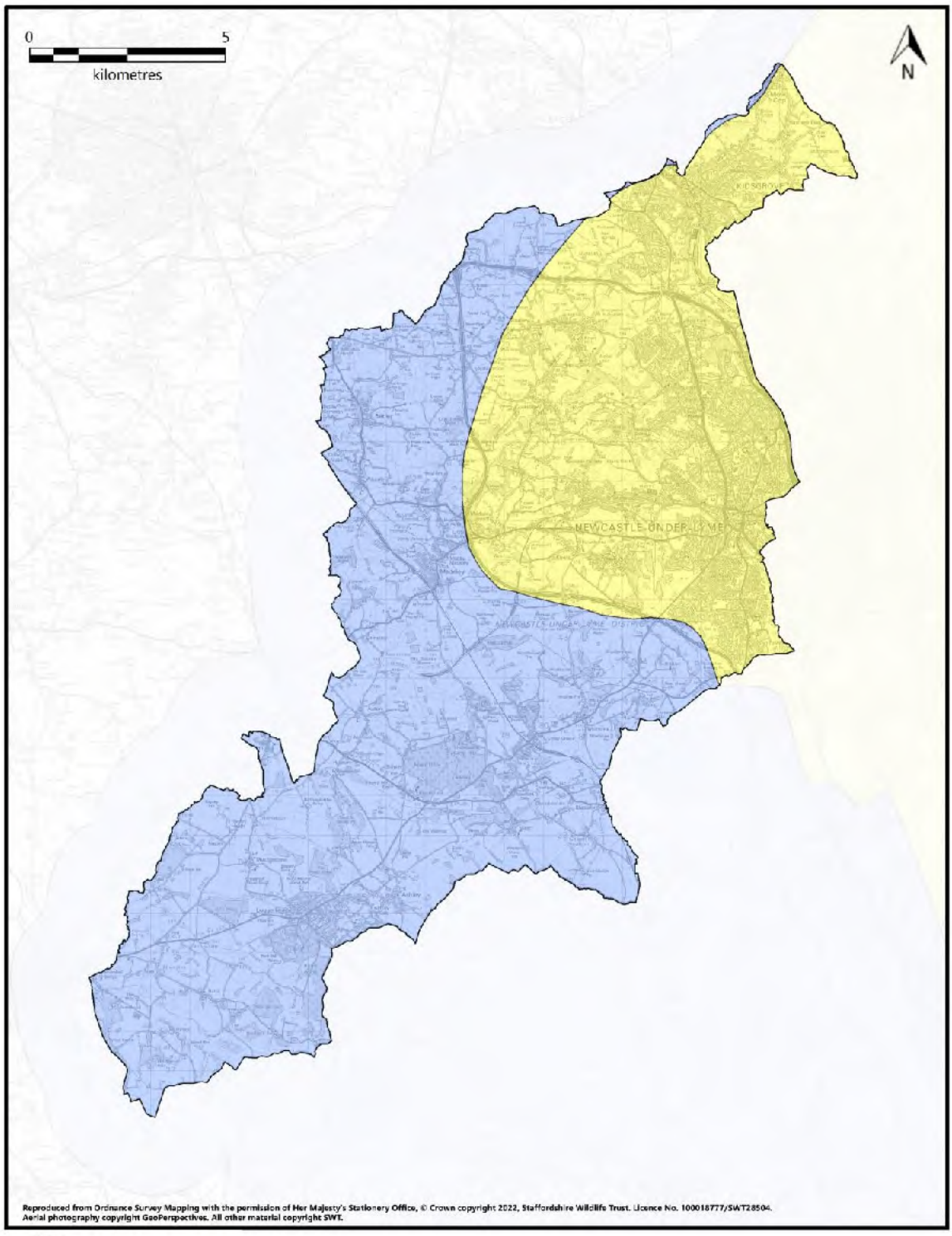
- Habitat creation and restoration should take into account landscape considerations, geology and the historic environment. Particular care will be required where intensive methods are required, such as topsoil stripping / deep ploughing, or where the effect, such as woodland planting is likely to be visible from settlements or rights of way.

- Habitat creation or restoration may create opportunities too, for example screening unsightly features, creating geological exposures or helping conserve historic features.

- Regular updates of the maps is required to reflect any changes in mapped habitats as a result of physical habitat changes on the ground.


0
5
kilometres
N
Reproduced from Ordnance Survey Mapping with the permission of Her Majesty's Stationery Office. © Crown copyright 2022. Staffordshire Wildlife Trust. Licence No. 100018772/SWT28504.
Aerial photography copyright GeoPerspectives. All other material copyright SWT.
Staffordshire
Wildlife Trust
Staffordshire Ecological Record
Grassland
Woodland
Brownfield/ OMPDL
Urban Mosaic
River Valley Mosaic
Sprinks, Drumbles and Wet Woodland
Town Centre
Inner Urban Core
Meres & Mosses

Appendix I – National Character Areas (NCA) in Newcastle Borough (NCA boundaries © Natural England)



Appendix J – Staffordshire Biodiversity Action Plan (SBAP) Ecosystem Action Plan Areas (EAPs) within Newcastle Borough (2008)