Stafford Borough Nature Recovery Network Mapping


Radford Meadows © SWT

FINAL REPORT

Staffordshire Wildlife Trust 2019

Table of Contents

1. Executive Summary

Staffordshire Wildlife Trust were commissioned by Stafford Borough Council to carry out a strategic assessment of the borough's biodiversity and habitat networks. This document outlines the existing picture of the borough's nature network and describes key 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.

Existing data, previous biodiversity opportunity mapping, along with local, regional and national landscape designations and projects were taken into account 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 2.0 (beta test version) to carry out a strategic broad scale district/borough 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.

The results of the updated Nature Recovery Network closely reflect the existing biodiversity opportunity assessment of the Borough. 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 likely to emerge as outlined in the proposed Environment Bill (House of Commons, 2019).

2. National policy requirement for a Nature Recovery Network

Staffordshire Wildlife Trust were commissioned by Stafford Borough Council to carry out a strategic assessment of the Borough's 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. These elements will enable the borough to address the requirements articulated within para 170 and para 174 of the National Planning Policy Framework 2019 - To provide for the protection and support enhancements to the Borough's natural environment through the identification, mapping and safeguarding of the components and enabling connectivity, interpretation and integration of the natural resources to deliver overall net gain for biodiversity.

It must be noted that since previous opportunity mapping was carried out over 10 years ago, there have been huge changes both in the knowledge and practical assessment and planning of landscape ecology as well as more policy requirements for councils 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 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 proposed Environment Bill (2019).

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 recently published proposed Environment Bill.

The emerging Environment Bill 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 on 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 is coupled with the likely emergence of mandatory biodiversity net gain provision. The Biodiversity Metric 2.0 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 2.0 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 Stafford Borough (Appendix A) was reviewed in line with the creation of a new nature recovery network for the Borough. The existing biodiversity opportunity assessment was used as a benchmark to compare the results of the updated methods and models used in 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 then sense checked by Staffordshire Wildlife Trust by using available environmental data and synthesized into a combined opportunity map and report, defining spatial landscape areas and detailing 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, something which is crucially important to inform decision making on a broad scale.

It was concluded that whilst new methodologies can clearly provide a level of additional detail, that local expert knowledge as used in previous methodologies 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, but crucially the input from local experts and stakeholders continues to drive the mapping, providing 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.

Stafford Borough is a mainly rural area with a wide range of habitats that include many sites of local and national importance. This complex set of natural assets, which are found across the Borough, is summarised below:

- Three rivers, the Penk, Sow and Trent converge to the west of Stafford town;
- In the northwest of the Borough are the woodlands of Hanchurch and Bishop's Wood;
- To the southeast is the heathland of Cannock Chase which is nationally designated an Area of Outstanding Natural Beauty (AONB);
- In the west of the Borough, as part of the Meres and Mosses landscape, there are a variety of wetlands (e.g. Cop Mere, Loynton Moss and Aqualate Mere).
- To the east of Stafford town is Chartley Moss (Britain's largest example of a Floating Bog).
- On the southern border of the Borough is Mottey Meadows, one of the best-preserved floodplain meadows in the country.
- In total there are 15 nationally designated Sites of Special Scientific Interest (SSSI), two of which are National Nature Reserves;
- There are many locally designated Sites of Biological Importance (SBI) that are of county significance for their habitats and wildlife.
- Stafford Borough Council also owns and manages seven Local Nature Reserves across the Borough.

There are a number of sites in the Borough that are internationally designated. The "Natura 2000 network" consists of sites that are of exceptional importance for the protection of rare, endangered or vulnerable natural habitats and species within the European Community. These sites comprise of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)[*]. Guidance[†] also extends the protection to "Ramsar sites" of international importance for wetland habitats. Within Stafford Borough the international designations are:

- Special Areas of Conservation:
    - Cannock Chase,
    - Pasturefields Saltmarsh,
    - Mottey Meadows; and
    - Chartley Moss.
- Ramsar Sites
    - Chartley Moss
    - Cop Mere
    - Aqualate Mere

[*] https://sac.jncc.gov.uk/
[†] https://jncc.gov.uk/our-work/ramsar-convention/

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

Additionally, datasets held by Staffordshire Ecological Record (SER) were identified as being of importance for the mapping work.

Using the data held by Staffordshire Ecological Record (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. A breakdown of the datasets used can be found in Appendix C.

4.2 Phase 1 habitat mapping via aerial photography interpretation

When carrying out the review of available datasets above it was noticed that the Borough's habitat dataset was incomplete with just under half of the Borough mapped. Stafford Borough Council asked SWT to complete Phase 1 habitat mapping in areas where there was no existing Phase 1 habitat data available, i.e. white space.

Due to the size of the study area the Phase 1 mapping exercise was completed by staff experienced in both on the ground and desk based habitat mapping by using a desk based methodology, utilising other datasets such as Agricultural land classification data and CORINE Land Cover in Europe datasets in order to classify large areas of Phase 1 habitats very quickly. Carrying out desk based assessments in this way does present some accuracy

limitations however due to very short timescales this was seen as the most appropriate habitat assessment method in the circumstances (see section 4.5 for data limitations).

The completion of this mapping exercise has resulted in an almost complete* Phase 1 habitat dataset for the local authority area (Appendix N). This dataset is a composite of habitat data from a wide range of ages.

A breakdown of the extent of the Phase 1 habitats dataset can be found in appendix B

4.3 National Character Areas in Stafford Borough

Stafford Borough is 59,630 hectares (596.3 Square Kilometres) in size and is the second largest local authority area in Staffordshire after Staffordshire Moorlands. The Borough is rural and the land use is principally agricultural with much of the land use down to pasture, arable and soft fruit growing interspersed with small urban settlements. The overall character of the borough differs throughout its extent, in all the borough sits within 4 of Natural England's (NE) National Character Areas (NCA) (Appendix K), the bulk of the Borough is covered by the Shropshire, Cheshire and Staffordshire Plain NCA in the West, the Needwood and South Derbyshire Claylands NCA in the east, Cannock Chase and Cank Wood NCA in the south and a very small section of the Potteries and Churnet Valley NCA in the north.

Within each NCA a set of broad scale aims and opportunities for the enhancement of biodiversity have been identified by Natural England; these were used as a broad starting point from which to begin formulating further more refined opportunities on a much finer scale but still reflecting the opportunities associated with the relevant NCA.

In addition to the NCAs are the Staffordshire Ecosystem Action Plan Areas (EAPs) which were created as part of the Staffordshire Biodiversity Action Plan (SBAP). The objectives behind the EAPs are to provide a sustainable living and working environment that benefits both people and nature, by replacing conventional Habitat and Species Action Plans with 14 EAP areas across the county to prioritise conservation management at a landscape level and contribute to national, regional and local conservation targets. The EAPs were used alongside the NCAs to refine the creation of a detailed opportunities map and to make sure that priorities align at both local, county and national level.

4.4 Minerals Safeguarding Zones in Stafford Borough

Just less than 50% of the borough is within a mineral safeguarding zone which both presents challenges and opportunities in planning for nature conservation.

* There may be small gaps in habitat data arising from digitising error and difficulty of creating a seamless fit between existing data and newly created data, some areas such as large sections of man-made habitat (e.g. hardstanding, roads etc.) may have been excluded, along with areas where habitats are too difficult to distinguish from desk based methods.

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 and utilising the knowledge of experienced staff the decision was made to use a combined habitat map based on existing and newly generated data as a primary baseline and existing flora data to provide a further degree of scrutiny to the generated outputs. The datasets chosen represent the most complete coverage for the Borough and when used together form a robust baseline which 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 C.

A full inventory of available datasets has been collated (Appendix D) where each dataset was allocated a ‘confidence’ rating based on that particular datasets 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 higher 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 2.0 etc…). Taking this approach enables the application of methods to identify strategic habitat areas and habitat connectivity opportunity areas in relation to creating a robust nature recovery network for the Borough.

By utilising the knowledge of the county's 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 Borough's nature recovery network.

5.1 Habitat distinctiveness mapping

Habitat distinctiveness mapping is one of several elements included within the biodiversity metric 2.0 (Crosher et al. 2019) 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 heavily 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 2.0 Beta test (Crosher et al., 2019) which loosely defines what habitats are included within each distinctiveness band. These metrics as yet are not finalised and may be subject to change in future iterations of the metric.

Further detail of the habitat distinctiveness mapping and the breakdown of habitats included within each distinctiveness band can be found in Appendix E along with the habitat distinctiveness areas map for the borough (map 1).

Habitat distinctiveness mapping provides multiple uses outside of the biodiversity metric 2.0, including:

1. Identifying areas of high biodiversity value that 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 2.0. 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 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.

5.2 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.

5.3 Biodiversity metric 2.0*

The DEFRA Biodiversity metric 2.0 is designed to quantify biodiversity to inform and improve planning, design, land management and decision-making.

The metric can be used to both:

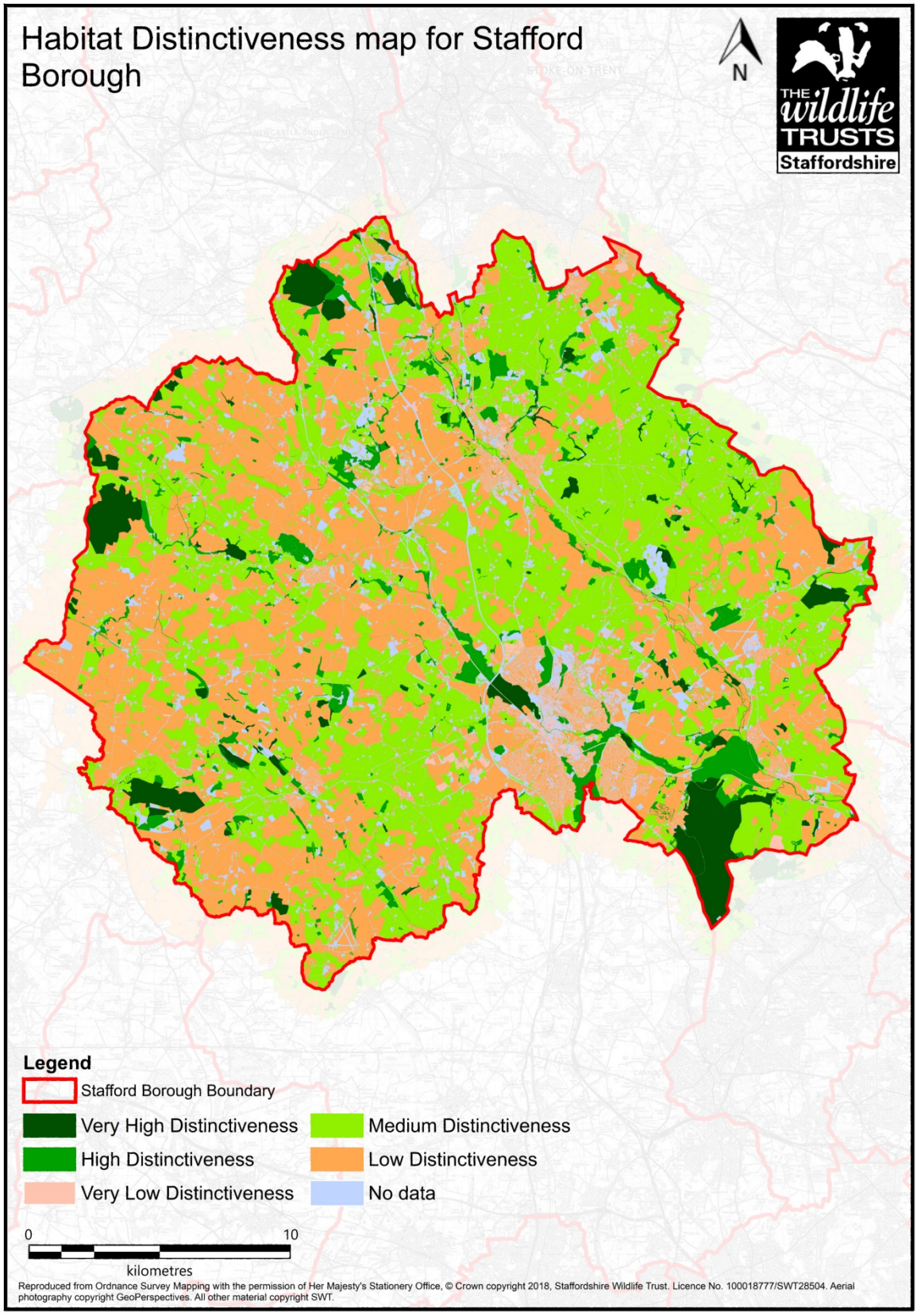
- Assess or audit **the biodiversity unit value** of an area of land and
- to **calculate the losses and gains** in biodiversity unit value from changes or actions which affect biodiversity, for example building houses or a change of use in a land holding.

The biodiversity metric 2.0 has 4 'quality 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 5.3).
- **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 (HCO) mapping (see sections 5.4 & 6-7).

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

* *The DEFRA Biodiversity metric 2.0 is currently in a beta testing period, the final metric may be different to the metric used in this report.*



Map 1 Habitat distinctiveness map for Stafford Borough (2019)

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 F.

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.

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).

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

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 11.2).

All strategic areas for each of the habitat types assessed are supplied as digital GIS appendices to this report.

5.5 Flora axiophyte analysis mapping

Axiophyte is a term used to describe plants with a strong association with habitats considered to be of high importance for nature conservation e.g. ancient woodlands or lowland meadows etc. The Botanical Society for the British Isles (BSBI) holds a checklist of axiophyte species for Staffordshire[*].

A list of habitat indicator species for the county was created by SWT in 2004 for use in creating and refining Staffordshire's Local Wildlife Site criteria, the evidence used for the creation of the list was based on analysis of the previous county flora surveys and local expert knowledge.

Each species was assessed on the strength of that particular species' association against a number of different habitats based on factors such as how regularly it is observed outside of a particular habitat. Each species was scored a value per habitat to reflecting the habitat indicator value of that species per habitat.

The axiophyte flora analysis carried out here relies on botanical survey data gathered between 1995 and 2011 for use in the flora of Staffordshire publication (Hawksford et al., 2011). This represents a complete dataset for the entire county based on a consistent exhaustive methodology looking at 2x2km Ordnance Survey grid squares (tetrads).

Flora axiophyte analysis was chosen as a method of reinforcing the strategic areas and habitat connectivity opportunity area analysis due to the fact that flora survey data is based on an exhaustive, consistent groundtruthed methodology, carried out by experienced and knowledgeable surveyors and crucially, covers the entire county. A full methodology for the flora analysis can be found in Appendix G.

[*] https://database.bsbi.org/object.php?objectid=2cd4p9h.c7ff58&class=ChecklistInstance

5.5.1 Limitations

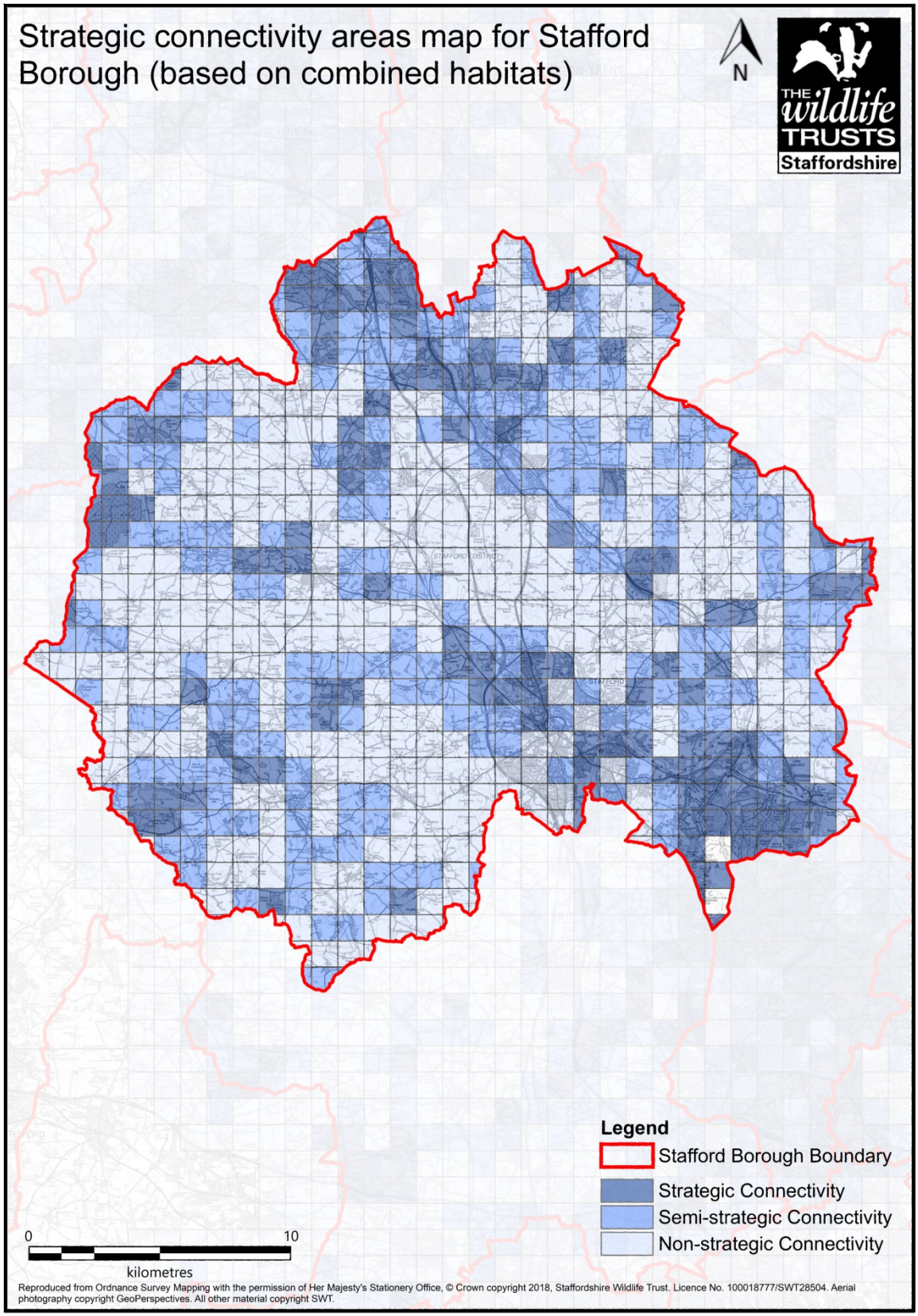
The data gathered through the flora surveys is only to tetrad level which is relatively coarse, for a district scale however on a full county level does work well and provides much needed cross boundary perspective.

There are no abundance values for the species surveyed, therefor species which have been seen multiple times in multiple locations within the tetrad (i.e. abundant or frequent on a DAFOR scale) have the same relative ‘value’ as a species which may have only been seen once throughout the entire survey of the tetrad.

5.5.2 Results

The results of the flora analysis closely reflect the results of the strategic habitat areas mapping and do identify the same core areas with a higher overall diversity value, particularly when defining a combined ‘general habitat’ connectivity/diversity assessment (Appendix H). By carrying out this additional analysis and the fact that the results of the mapping align in both methodologies it provides an extra level robustness to the strategic areas mapping, particularly in an absence of a complete field level habitat dataset.

The outputs of the flora axiophyte analysis are coarse in terms of a district or borough perspective owing to the fact that data is only available at a tetrad level, however there is still enough detail to define areas of high biodiversity in a local authority area. More importantly, this methodology can be consistently applied beyond a local authorities boundaries due to having a complete and consistent dataset for the entire county, increasing the ability to define and map a nature recovery network beyond political boundaries.



Map 2 Strategic areas map per 1km square based on combined habitats (Strategic areas represent squares with the most 'habitat' and vice versa for Non-strategic squares) (2019)

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

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 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 toward 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 M) 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 Borough 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 I). 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 Borough, to sense check what is produced by the models.

7. Results

7.1 Habitat Connectivity Opportunity Areas identified

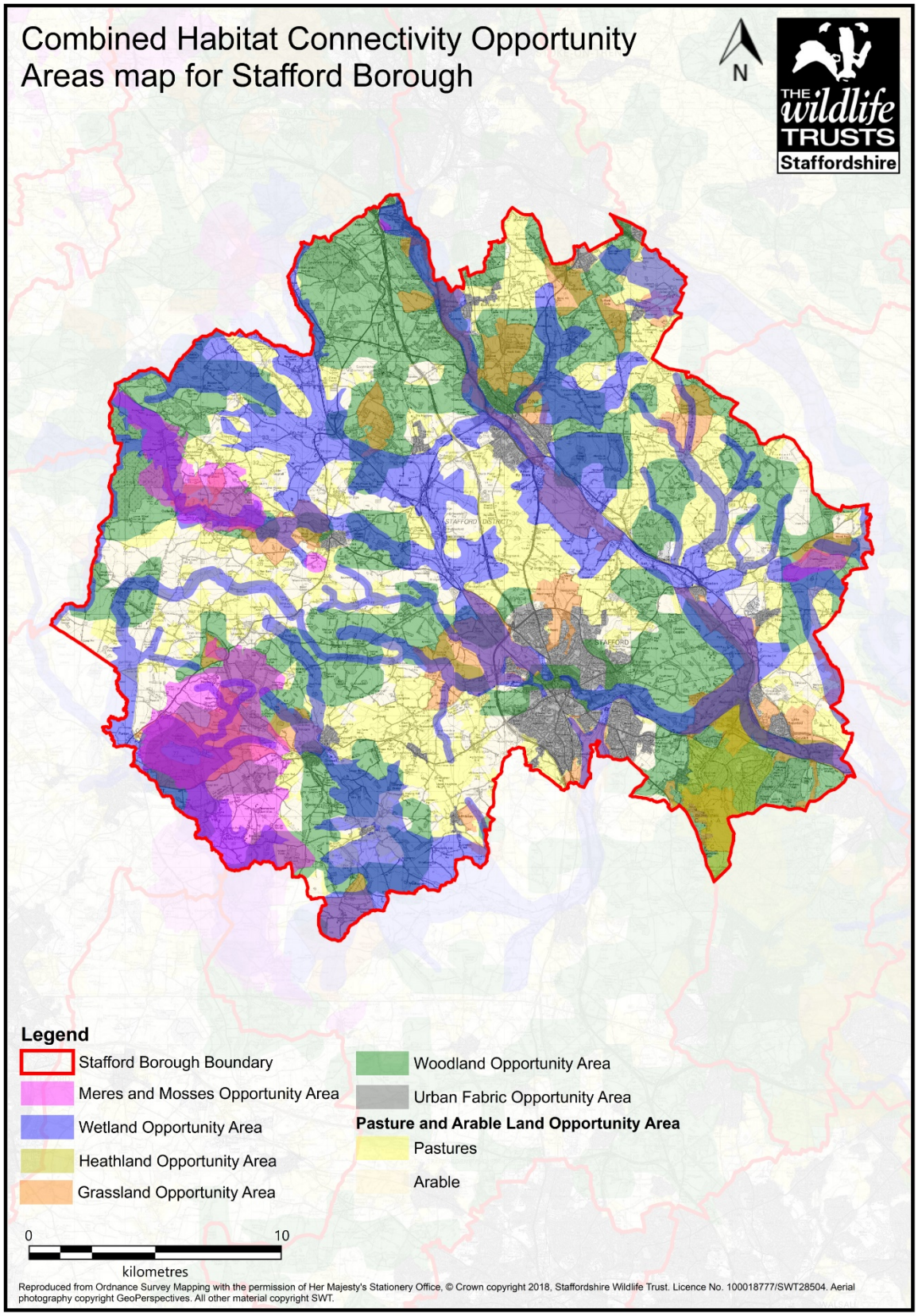
A total of 7 separate Habitat Connectivity Opportunity area types have been identified and mapped covering the entirety of Stafford Borough:

1. Woodland
2. Grassland
3. Heathland
4. Wetland
5. Meres and Mosses
6. Extensive pasture and arable land
7. Urban Fabric

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.

By incorporating the Habitat Connectivity Opportunity areas together it was possible to produce a combined HCO map for the Borough (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 Stafford Borough (2019) NB: some of the HCO areas overlap one another which can lead to the colouring of the map being distorted.

7.2 Woodland Opportunity Area

Small isolated pockets of both planted and semi-natural ancient woodland occupy the entire borough, interspersed amongst the predominantly agricultural landscape. Several larger semi-natural ancient and replanted woodland areas are present at the extremities of the Borough such as Bishops Wood and Hanchurch Woods to the north and Brocton Coppice and Cannock Chase to the south. A high proportion of the woodlands present in the Borough are of high quality either included on the ancient woodland inventory, designated as Local Wildlife Sites or in a lot of cases both. It is likely that in the past many of these woodlands would have been connected as part of a much larger woodland prior to expansion of agriculture.

7.2.1 Key Habitats	7.2.2 Key species
• Woodlands • Hedgerows • Scrub • Urban green spaces • Veteran trees	• Cuckoo • Bluebell
7.2.3 Threats	**7.2.4 Opportunities**
• Loss and fragmentation of irreplaceable woodland habitats (ancient woodland inventory sites). • Development. • Mis-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 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.	• 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 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 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.

7.2.5 Specific opportunities

- Seek to establish better woodland connectivity along the proposed route of HS2, facilitate species movement from sites which are likely to be either wholly or partly lost. By identifying the most appropriate opportunity areas for the creation/restoration of habitat it is possible through necessary habitat compensation measures to ensure that the creation/restoration of habitats is carried out in the locations which are likely to have the greatest benefits to wildlife in the Borough and county.

- Protect and facilitate connections between larger woodlands such as Bishops Wood, Swynnerton Old Park and Brocton Coppice/Cannock Chase Woodlands and smaller woodlands in the wider countryside by enhancing and creating new hedgerows and woodland pockets to enable the movement of species rare to the county both within the county and from neighbouring authorities and counties (e.g. Red Wood Ant, Hazel Dormouse, Pine Marten, Reptile species etc.).

- Safeguard the Borough's parkland and wood pasture sites for example estates such as Sandon, Charnes, Shugborough and Aqualate as these are important sites for both the natural heritage they possess as well as their biodiversity e.g. veteran trees and associated invertebrate population assemblages.

- Ensure that hedgerows are sufficiently protected and where impacted by developments are adequately mitigated for in terms of their compensation particularly in the west of the Borough in the vicinities of Woodseaves, Ranton, Norbury, Gnosall and Church Eaton as there are a high number of small diverse woodlands in this area which will benefit from the added connectivity of hedgerows.

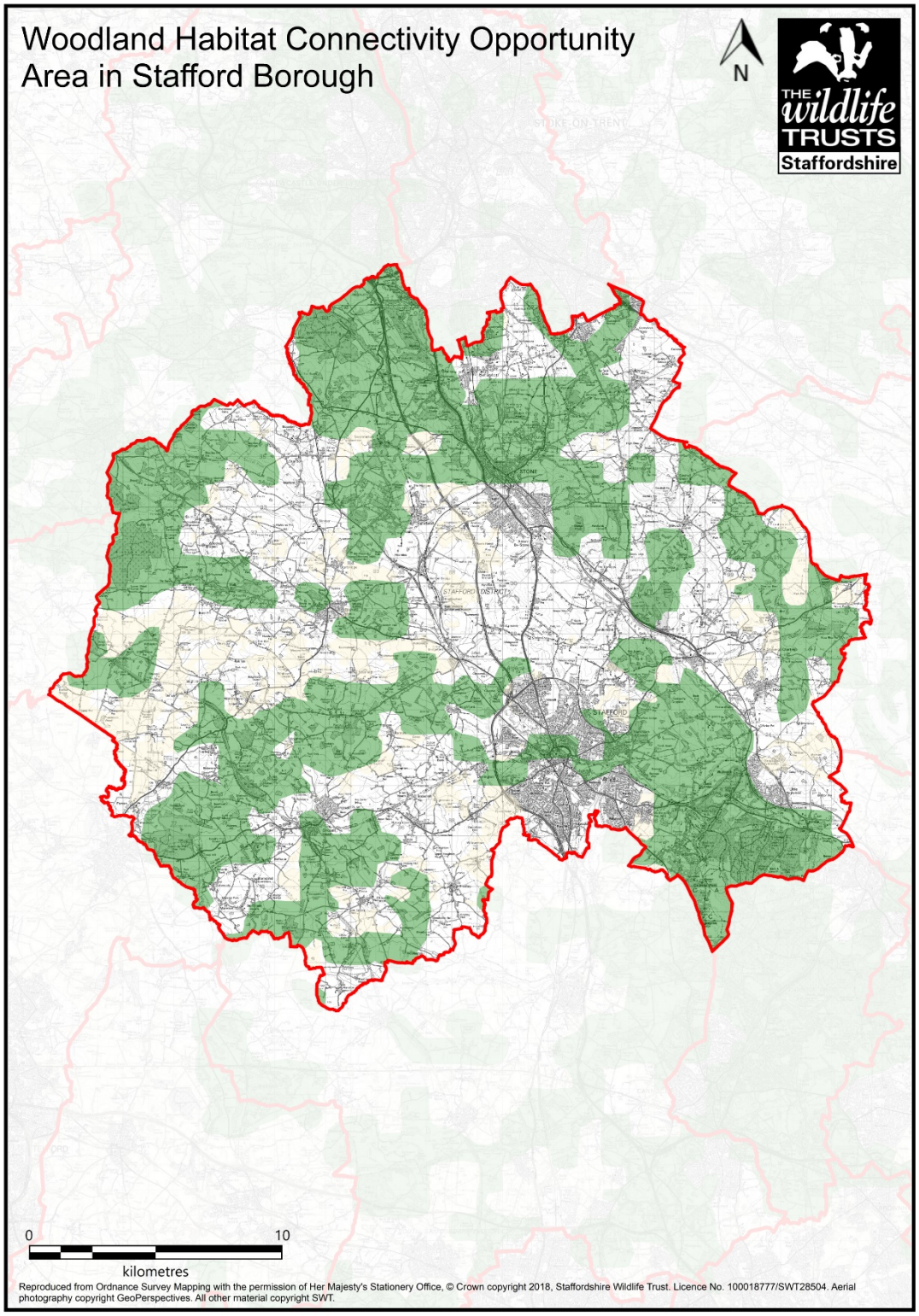
- Protect the diverse woodland and wet woodland in the steep sided valleys the east of Stone, particularly along the valley of the Scotch Brook.

- Ensure that woodland Local Wildlife Site surveys remain up-to-date and seek to survey any outstanding sites which are registered on the Ancient Woodland Inventory. This will provide suitable baseline and monitoring information for the boroughs most important woodland sites.

7.2.6 Opportunities to enhance other benefits

- Flood risk mitigation
- Carbon storage
- Recreation and aesthetic
- Cultural heritage
- Wood fuel, timber and fibre
- Foraging / wild food

7.2.7 Map of Woodland Opportunity Area



7.3 Grassland Opportunity Area

Areas of higher quality grassland both in the form of traditional Lowland Meadow as well as biodiverse pastures grazed by livestock are isolated within the borough, lacking connections of similar habitat between them. The relatively flat nature of the Borough means that most of the land is now intensively farmed and for the most part higher quality grasslands occur where sympathetic management and traditional practices remain. Generally, diverse grasslands in the borough are small in both overall size as well as field size, and often enclosed by species-rich diverse hedgerows.

Mottey Meadows, one of the best remaining examples of Lowland Floodplain Meadow in the country, lies on the boundary between Stafford Borough and South Staffordshire District and has a range of rare and scarce flora.

7.3.1 Key Habitats	7.3.2 Key Species
• Lowland meadows • Pastures • Hedgerows • Arable land • Open mosaic habitat on previously developed land	• Barn owl
7.3.3 Threats	**7.3.4 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 warming
 	
• Habitat loss and fragmentation
	• 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 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 LiDAR 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.

7.3.5 Specific Opportunities

- Protect the vitally important Lowland Floodplain Meadow habitats at Mottey Meadows NNR by engaging with surrounding landowners to facilitate sensitive management of adjacent land and watercourses.

- Stafford Common is managed by the Stafford Common Land Committee, to safeguard appropriate conservation management protecting the semi-improved grassland. Ensure that development pressures do not adversely affect The Common. Improve connectivity between this site and sites in the wider landscape.

- Connect the diverse grassland at Derrington Millennium Green with the wider landscape. Using the Doxey Brook and Stafford to Newport disused railway line as a vector to facilitate improved connectivity and species movement through additional habitat improvements.

- There is opportunity in the upper Sow area for the creation and restoration of wet grassland or species rich grazing pasture/Lowland Meadow for the benefit of habitat connectivity and strengthening an area which is already dense with diversity. The upper Sow contains a mosaic of grassland, woodland and wetland habitats and species rich grasslands tend to occur on the side of watercourses and are therefore normally marshy or wet.

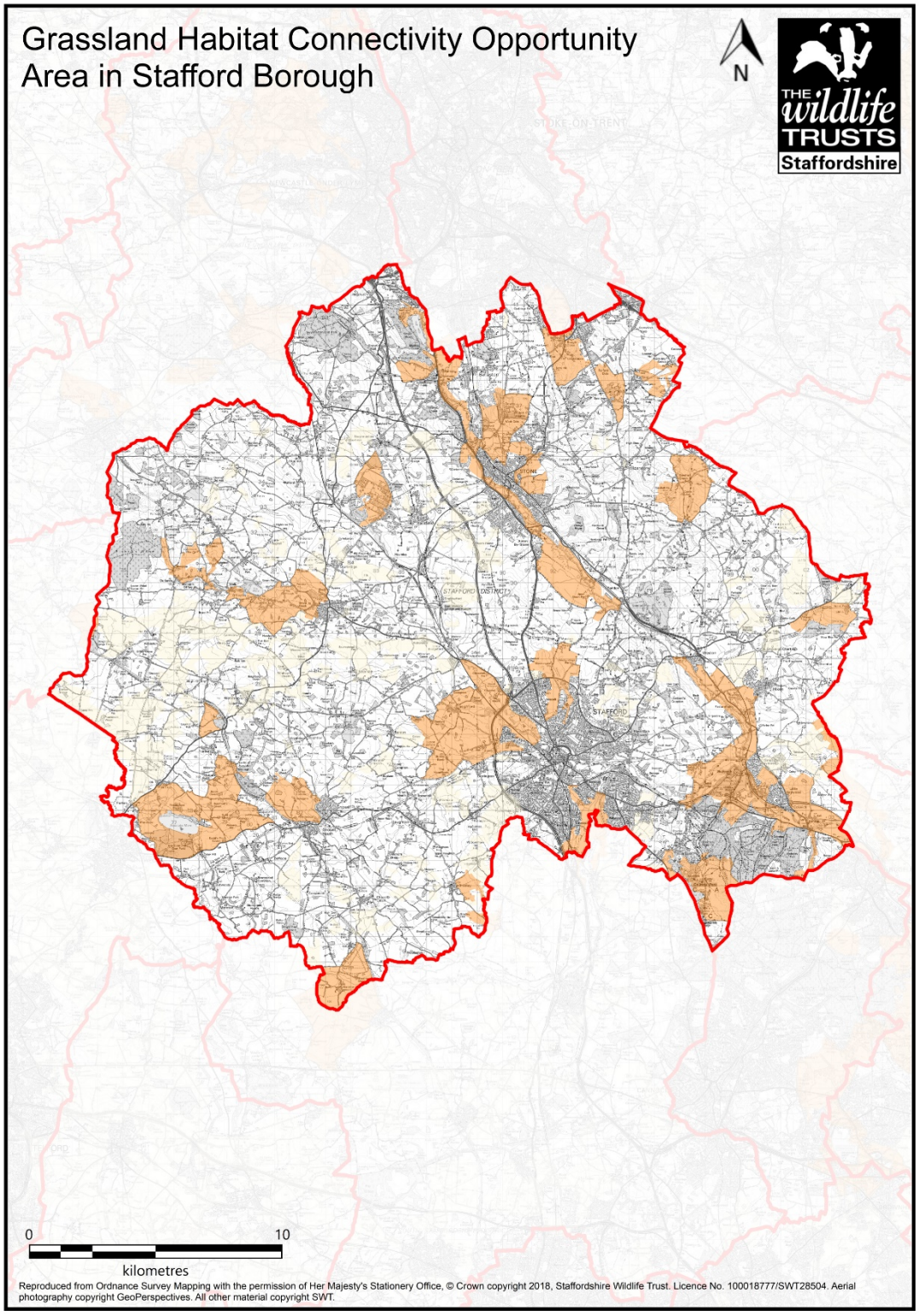
- Protect and enhance the grassland Local Nature Reserve sites throughout the centre of Stone (Crown and Stone Meadows).

- Work with landowners and managers to ensure that the grassland component of parkland sites are sympathetically managed. Potential to improve species diversity through hay strewing or wildflower seed application which would provide additional species diversity.

7.3.6 Opportunities to enhance other benefits

- Pollination
- Recreation and aesthetic
- Cultural heritage

7.3.7 Map of Grassland Opportunity Area



7.4 Heathland Opportunity Area

An extensive area of Lowland Heath at Cannock Chase exists in the south east of the borough in the Cannock Chase and Cank Wood National Character Area. This is the largest single area of Lowland Heath in the county and is a vitally important area for a wide range of species, particularly invertebrates, birds and reptiles. Other important heathland sites in the borough are Barlaston and Rough Close Commons, and the Downs Banks to the north-east of Stone.

Many of the Borough's woods are on former heaths, meaning that these woods have strong heathland character and often lack woodland indicator species. Examples include Swynnerton, Trentham and Tittensor Chase. It is probably undesirable to attempt to restore these sites to heathland as they are already species-rich, however sympathetic management to create rides and glades with a more open heathland character along with linking sites together through the creation of pockets of heathland would be beneficial.

Lowland heath is a nationally important habitat, the area around Cannock Chase is one of the most significant areas of Lowland Heath habitat in the Midlands and is a vital national stepping stone, between the lowland heaths in the south to the areas of moorland further to the north.

7.4.1 Key Habitats	7.4.2 Key Species
• Heathland • Woodland • Arable • Grassland • Open mosaic habitat on previously developed land • Wood pasture and veteran trees	• Nightjar • Heather • Fly agaric • Small Pearl-bordered Fritillary
7.4.3 Threats	**7.4.4 Opportunities**
• Pollution both from acute and diffuse sources leading to nutrient intensification - Nitrogen loading. • Lack of management or neglect leading to scrub encroachment. • 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 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 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.

7.4.5 Specific opportunities

- Protect the heathlands at Cannock Chase and ensure that they are safeguarded into the future, particularly in light of threats such as nitrogen deposition and visitor pressure as well as direct habitat loss. Expand the area of heathland through working with landowners and land managers to create new areas of habitat which connect into the wider landscape.

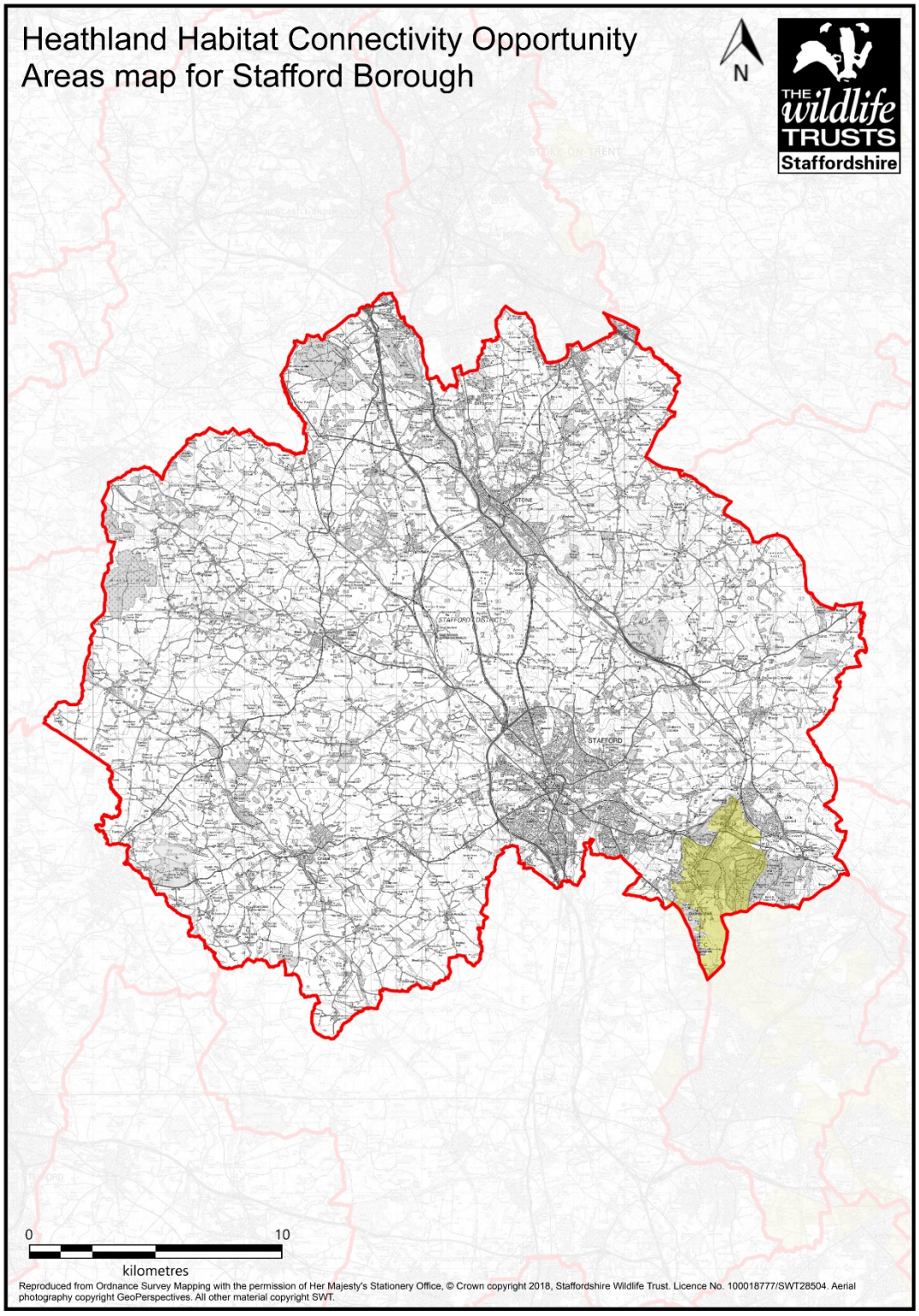
- Protection of other key heathland sites which are outside of the heathland strategic area for example Downs Banks and Barlaston Common. As heathland sites in the Borough outside of Cannock Chase are generally fragmented and isolated it is vital that sites such as this are safeguarded and connected through the creation of other habitat mosaics.

- Seek suitable sites in the area to the east of Stafford where conditions are suitable for the recreation of heathland or any remnant heathland exist for restoration and expansion to help improve habitat connectivity between the isolated pockets of heathland vegetation in Barlaston Common and Downs Banks and the larger heathland area of Cannock Chase to the south.

7.4.6 Opportunities to enhance other benefits

- Pollination
- Cultural Heritage
- Carbon Storage
- Flood risk mitigation
- Recreation and Aesthetic

7.4.7 Map of Heathland Opportunity Area



7.5 Wetland Opportunity Area

Stafford Borough is host to a number of important watercourses: The River Sow and its tributary the Meece Brook, the Church Eaton Brook, a short section of the river Penk before its confluence with the Sow to the east of Stafford and lastly the River Trent all flow through the Borough. The high number of watercourses and the relatively flat profile of the Borough is the driving force behind many of the areas of wetland habitat as water is readily retained, in particular along watercourses during times of high rainfall.

As well as the network of watercourses there are also a clusters of farm ponds, an extensive network of canals some sections of which are relatively natural and support several high quality habitats. Wetlands in the Borough are not exclusive to the wider countryside and both Stafford and Stone have extensive areas of wetland habitat such as Doxey, Astonfields, Kingsmead Marsh in Stafford and the River Trent and Scotch Brook in Stone extending well into the urban areas.

Another unique feature of the Borough is the presence of inland salt marshes as a result of natural brine upwelling from the underlying geology and years of brine extraction in the past. This natural upwelling of salt and mineral rich water means that certain areas of the Borough possess specific vegetation which is tolerant to the high levels of salt present (Halophytes) such as Pasturefields and areas to the north of Stafford Common.

7.5.1 Key Habitats	7.5.2 Key Species
• Woodland • Grassland • Pasture • Arable • Urban fabric/mosaic	• Otter • Snipe • Great Crested Newt • Lapwing
7.5.3 Threats	**7.5.4 Opportunities**
• 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. • 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. • Lack of understanding of the need to protect water throughout the catchment including areas where there	• 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 a Rural Sustainable Drainage Scheme. These sites should be buffered from any potential sources of damage both 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

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. ● Biosecurity / disease.	● 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 ● Effective mitigation for the loss Great Crested Newt (GCN) 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 GCN metapopulation data and modelling).

7.5.5 Specific opportunities

- The high number of watercourses which flow through the Borough clearly present a huge opportunity in terms of the protection, creation and enhancement of wetland habitats, as well as acting as a natural means of habitat and species connectivity.

- The River Trent and its floodplain already support a number of designated Local Wildlife Site habitats and present a variety of opportunities for both river and associated habitat improvements in the Borough

- The River Sow, in particular the upper sow from Blorepipe near its source through Jacksons Marsh and Eccleshall possesses a high number of designated Local Wildlife Sites and is therefore a key location in terms of protection of habitats. A further priority would be the creation and enhancement of further habitats and restoration of sections of the watercourse itself to improve the connectivity of the high density of sites in the upper Sow with sites further downstream in the catchment around Seighford and Doxey Marshes and through the urban area of Stafford.

- Several Local Wildlife Sites are present along the Doxey/Clanford/Hextall Brook and the Church Eaton Brook which present an ideal opportunity to improve the habitat connectivity of important nature conservation sites through improving both the riparian biodiversity between these sites as well as the geo-morphology of the

watercourses. This would not only provide further habitats but also improve factors such as flood resilience and the opportunity for aquatic species to inhabit the watercourses.

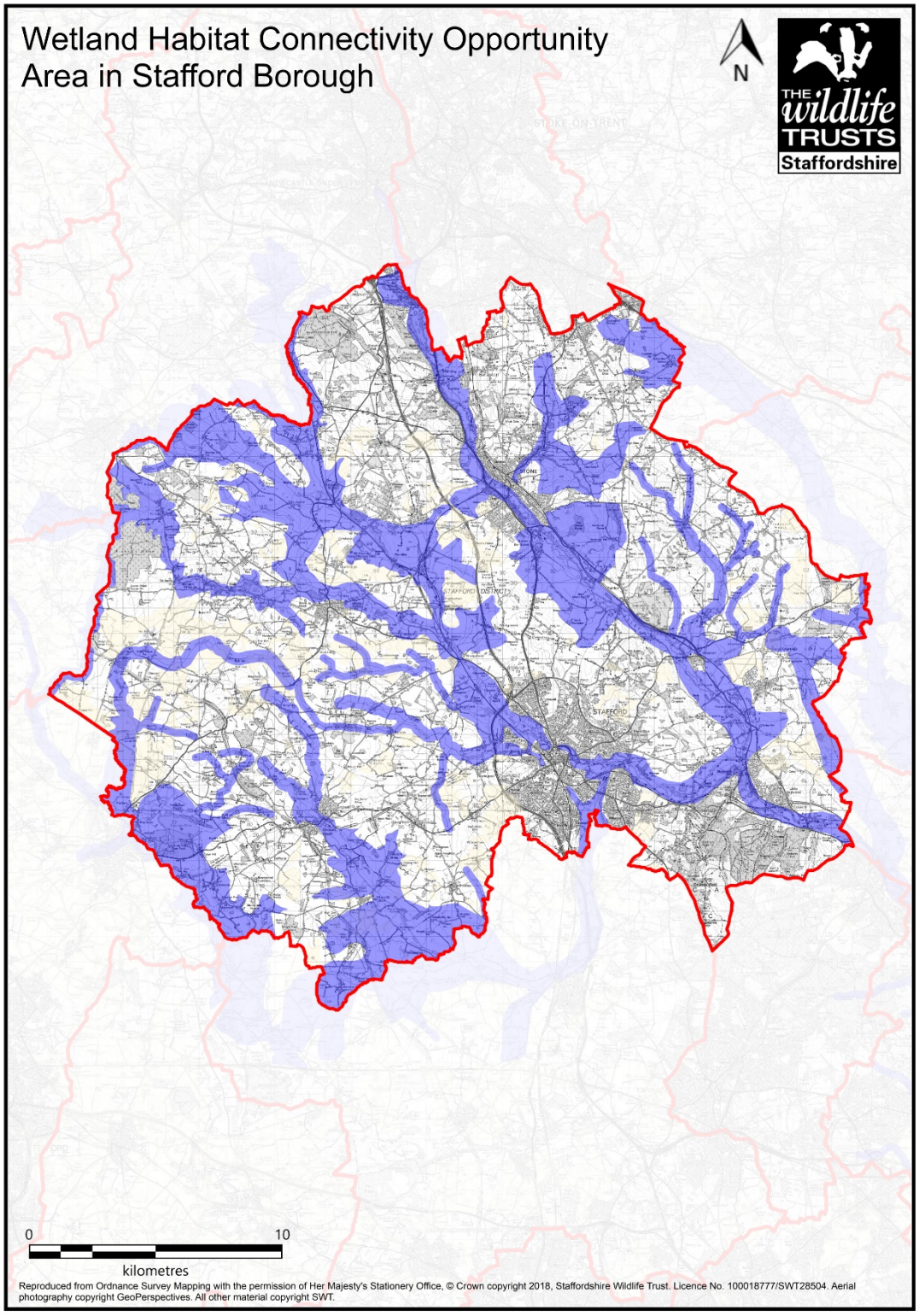
- Explore potential further sites for the implementation of Natural Flood Management techniques like those which have already been carried out in the Scotch Brook, key locations may be areas such as the headwaters of the Sow, Church Eaton Brook and the Doxey Brook.

- Work with the Sow and Penk Internal Drainage Board to identify key areas where watercourse management could be adjusted to benefit habitats and species.

7.5.6 Opportunities to enhance other benefits

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

7.5.7 Map of Wetland Opportunity Area



7.6 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. These sites exist mostly on the western edge of the borough with the exception of Chartley Moss in the east of the borough and form the easternmost edge of a larger network of associated sites which spread throughout the Shropshire, Staffordshire and Cheshire Plain National Character Area and were previously a focal point of the Meres and Mosses of the Marches Nature Improvement Area.

Whilst 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.

7.6.1 Key Habitats	7.6.2 Key Species
• Woodland • Grassland • Arable • Pastures	• Sundew species • Sphagnum moss • White-faced Darter dragonfly • Water Shrew
7.6.3 Threats	**7.6.4 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.
	• 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.

• 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
	• 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

- Priority sites are Aqualate, Chartley, Cop Mere and Loynton Moss as these have some statutory protection either through a national or international conservation site designation associated with them. The core area of these sites 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.

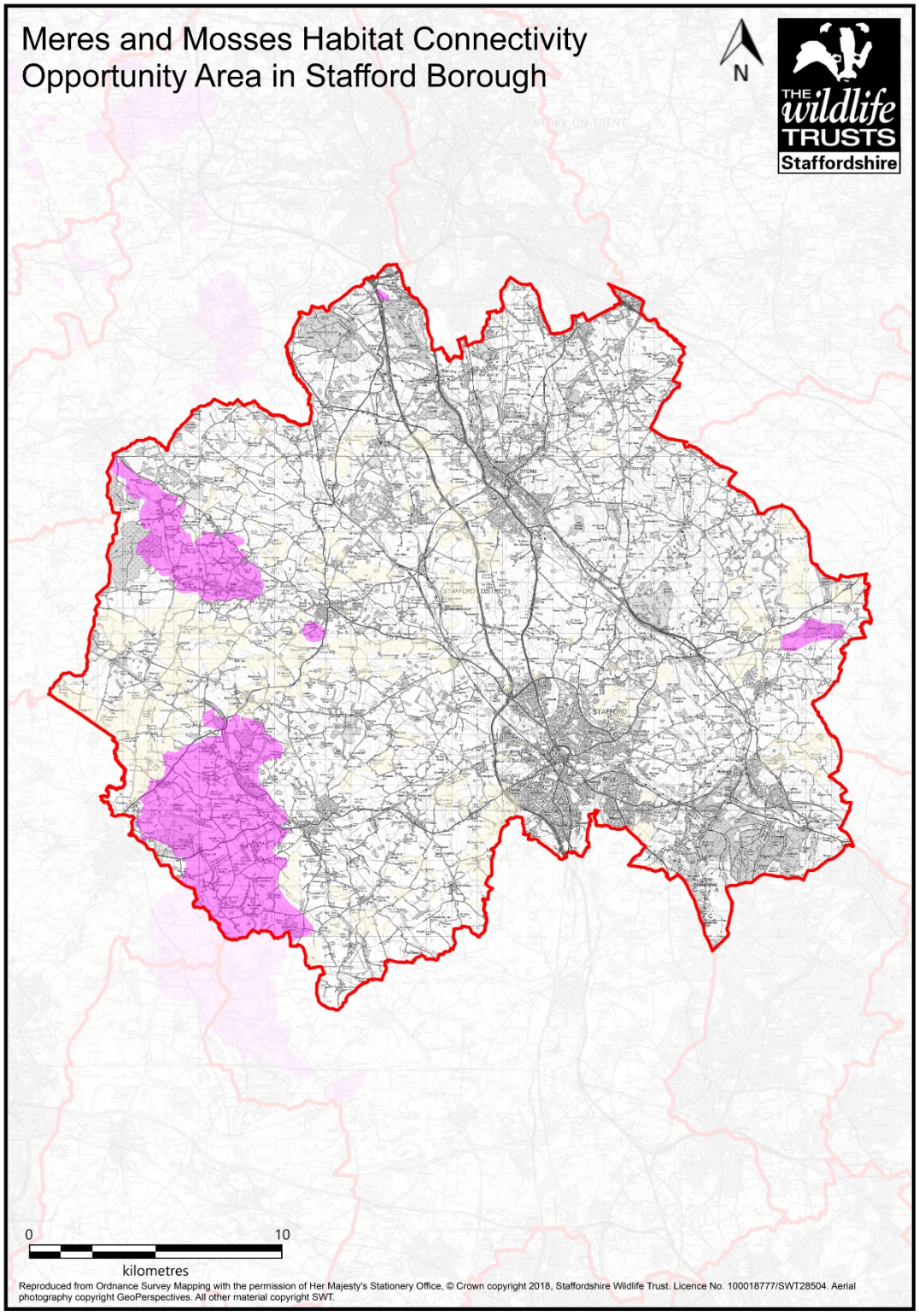
- Smaller Mosses and areas of peat such as those north of Bishops Wood, South of Eccleshall and Coneygreave which have no formal legal protection must be protected and where applicable seek to restore them through re-wetting.

- 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.

7.6.6 Opportunities to enhance other benefits

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

7.6.7 Map of Meres and Mosses Opportunity Area



7.7 Pasture and Arable Opportunity Area

Pasture and arable land are unquestionably 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, soft fruit and cereal growers, smaller units rearing sheep and cattle and small hobby farms and equestrian liveries.

Grazing pastures tend to be concentrated to the north east of the Borough in the Needwood and South Derbyshire Claylands National Character Area on the gently sloping hills around the tributaries of river Trent where land is less favourable for arable production.

Conversely, most of the arable production in the Borough is concentrated primarily in the central and western areas on the flatter land of the Shropshire, Cheshire and Staffordshire Plain National Character Area. Crop production is mixed, however cereals are generally the most common crops. Soft fruit is also produced fairly extensively in the borough and several localities have areas of seasonal polytunnels where fruits are grown under cover for several months of the year.

The extensive agricultural improvement resulting in extensive pasture and arable, in large field sizes bordered by hedgerows or fences.; as a result these areas generally tend to be fairly wildlife poor save for either highly generalist or highly specialist species which favour these habitats. There is ample opportunity within this area to enhance both the habitats themselves as well as ensuring that areas of higher quality habitat are suitably connected.

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. • Improper management.	• There are a spectrum of opportunities for general 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.
7.7.5 Specific opportunities	

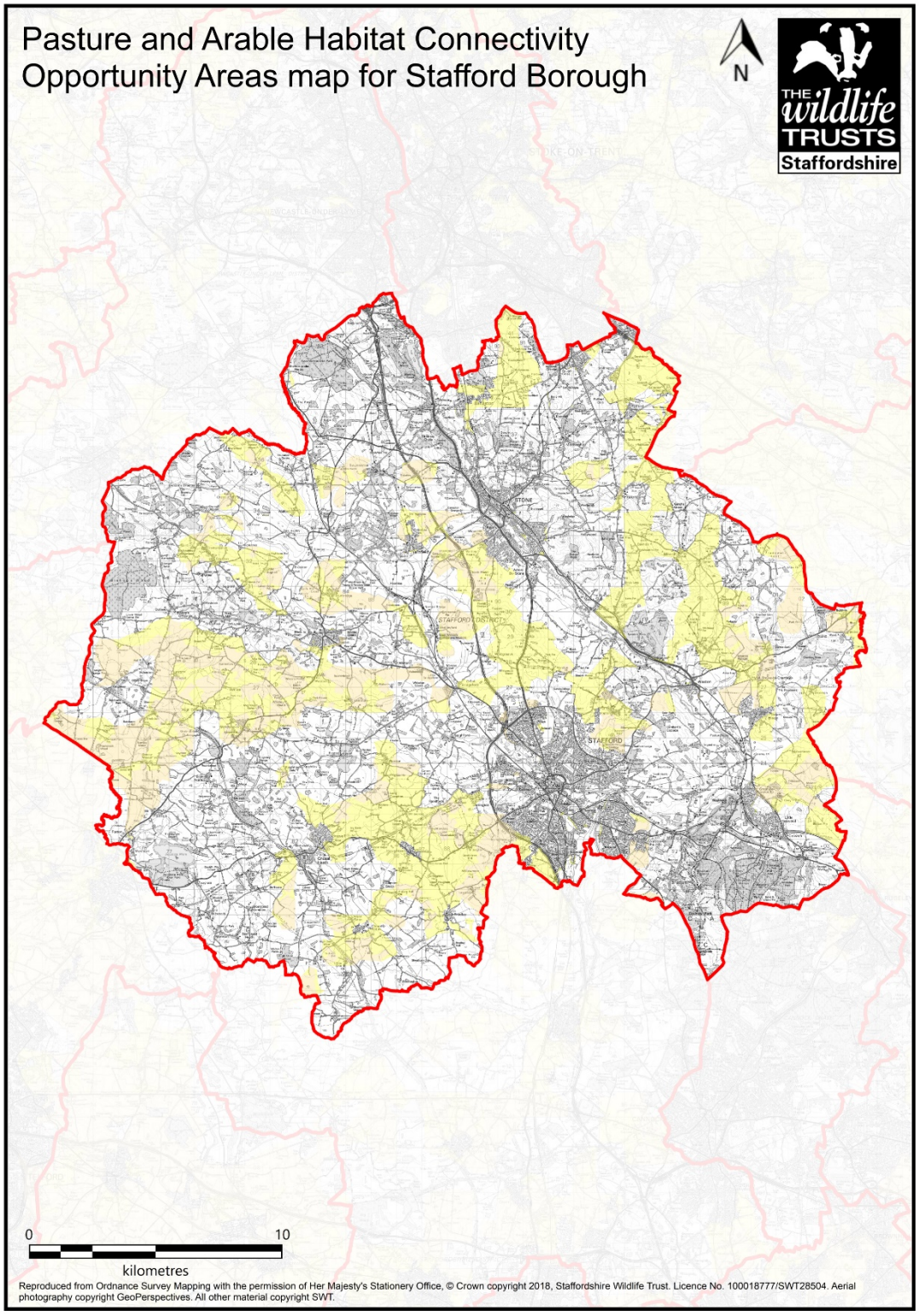
- Creation of swales, grasslands or permanent set aside habitats surrounding watercourses around soft fruit farms to slow down the flow of water, reduce flooding risk and improve water quality to allow sediment and soil run-off to filter out before reaching watercourses.

- Encourage the uptake of agri-environment schemes in areas surrounding designated nature conservation sites with options that are beneficial to both the protection and habitat connectivity of these sites. (Hedgerow restoration, buffer strips, species rich grassland creation etc.)

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

Urban fabric is the man-made built up land of the Borough's towns and villages including buildings, gardens, roads, artificial sports pitches and urban green spaces. Urban fabric only covers a relatively small proportion of the borough however it arguably has one of the biggest impacts not only directly on the amount of habitat present but also the impacts on the wider environment for instance through increased pollution levels or land pressures.

Whilst 'natural' habitats in urban areas are obviously far less prevalent than in the wider countryside there are still many opportunities to create, enhance and improve existing habitats to raise the connectivity between the urban environment with the wider countryside.

7.8.1 Key Habitats	7.8.2 Key Species
• Grassland • Woodland • Open Mosaic Habitat on Previously Developed Land • Wetland • Rivers and streams • Street trees	• Hedgehog • Great Crested Newt • Slow Worm • Invertebrates and pollinators • House Sparrow
7.8.3 Threats	**7.8.4 Opportunities**
• Habitat fragmentation through the loss of both sources of biodiversity as well as the '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 which are often important sites for a number of species in urban areas. • Intensive management of urban green spaces leading to: • Invasive species • Increased flood risk due to increased area of hard impermeable surfaces.	• 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 Sustainable Drainage System (SuDS) schemes. • Creation of new habitats particularly through new developments, make new developments as green as possible to bring high quality habitats and improve habitat connections in the urban environment. This may include for example green roofs/green walls, wildlife friendly SuDS schemes 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 - this may include relaxed mowing regimes to create and maintain 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.

7.8.5 Specific opportunities

Stafford

- Carry out habitat improvement works at Astonfields Local Nature Reserve, this can be in conjunction with improving the flood attenuation capabilities of the ponds. Particular attention should be made to halophytic (salt tolerant) plant communities which are a notable feature in this area, opportunities to allow these species to colonise and grow and be suitably managed in future, potentially strengthening connectivity to similar areas of habitat nearby.

- Improve the connectivity of high value habitats along the river Sow e.g. Doxey Marshes, Kingsmead Marsh, Victoria Park to link with areas of habitat to the east of Stafford around Baswich Meadows. Improving the in-channel

- Improve the species diversity of Kingston Pool Covert Local Nature Reserve through management, potential to carry out some re-naturalisation of the brook which runs through the centre of the site which would re-wet the site and create more features for a wider range of species.

- The area around the confluence of the Rivers Sow and Penk present a potential opportunity for habitat enhancement and flood risk attenuation.

- Ensure that Doxey Marshes is protected from adverse impacts of development pressure and that new developments do not deplete the levels of biodiversity of the site, particularly the sites habitats, wildfowl and wading birds.

- Ensure that Radford Meadows are protected from adverse impacts of development and that developments do not impact on the important populations of wildfowl and wading birds on site. Potential to improve the botanical diversity of the site which would facilitate improved habitat connectivity through this area of Stafford.

Stone

- Ensure that the course of the Filly Brook remains protected as a natural means of connectivity in and out of the town. Potential to enhance the habitats along the course of the brook.

- The River Trent runs directly through the centre of the town and obviously presents multiple opportunities such as bank re-profiling, creation of small scrapes and pools in the floodplain, grassland diversity enhancements etc. Crown Meadows and Stone Meadows Local Nature Reserves would be good sites for which to pioneer these approaches.

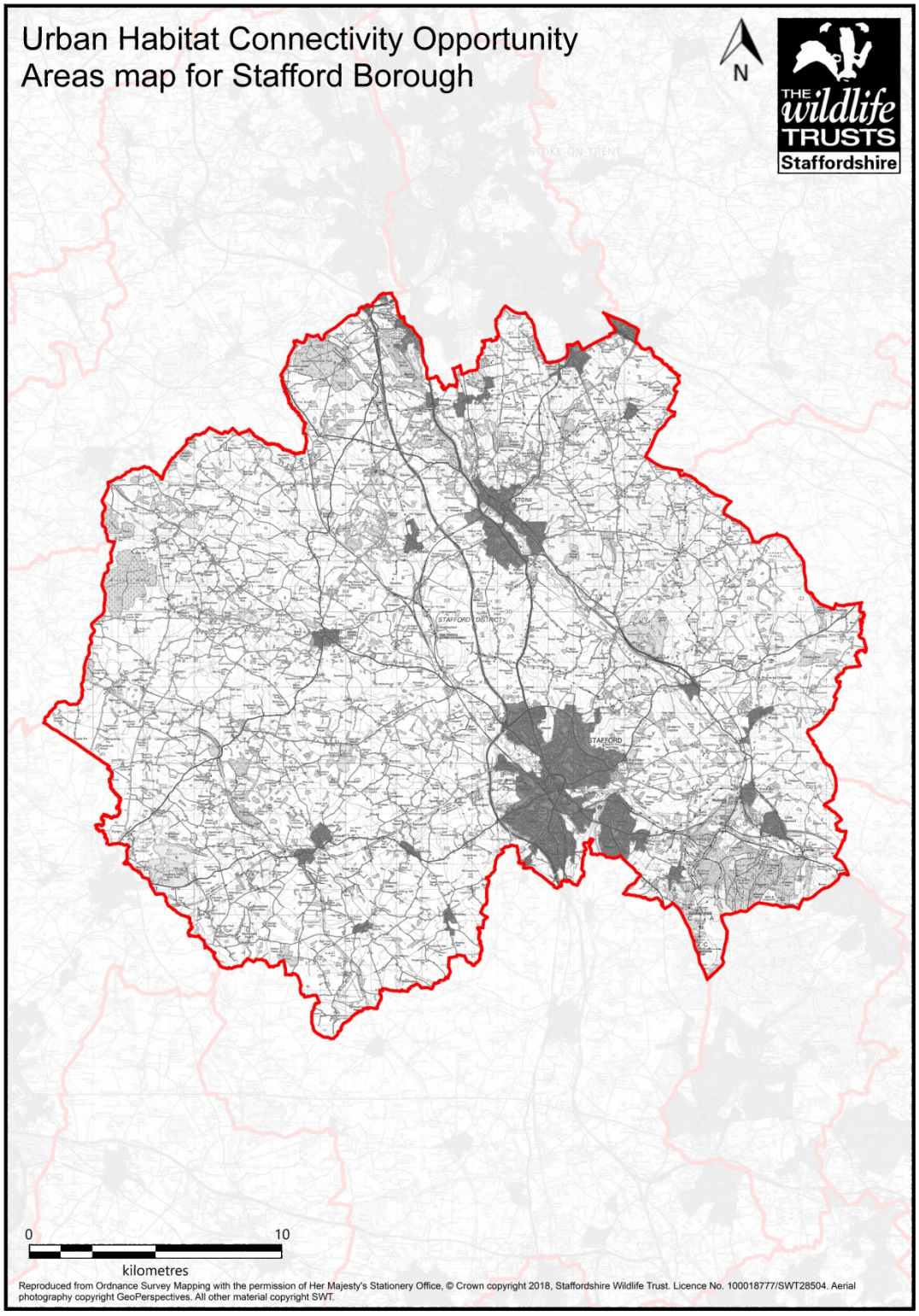
- Ensure that development pressures do not negatively impact the habitats at Common Plot to the North of Stone and seek to further connect these habitats to the wider landscape – hedgerow creation, grassland restoration etc.

- The Scotch Brook provides one of the best opportunities for habitat connectivity into and out of the town, there are already a number of sites and habitats of importance along its length which need to be safeguarded, along with other areas where habitat improvements could potentially be carried out.

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, 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 - tree planting, increased green space and green developments.
- 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

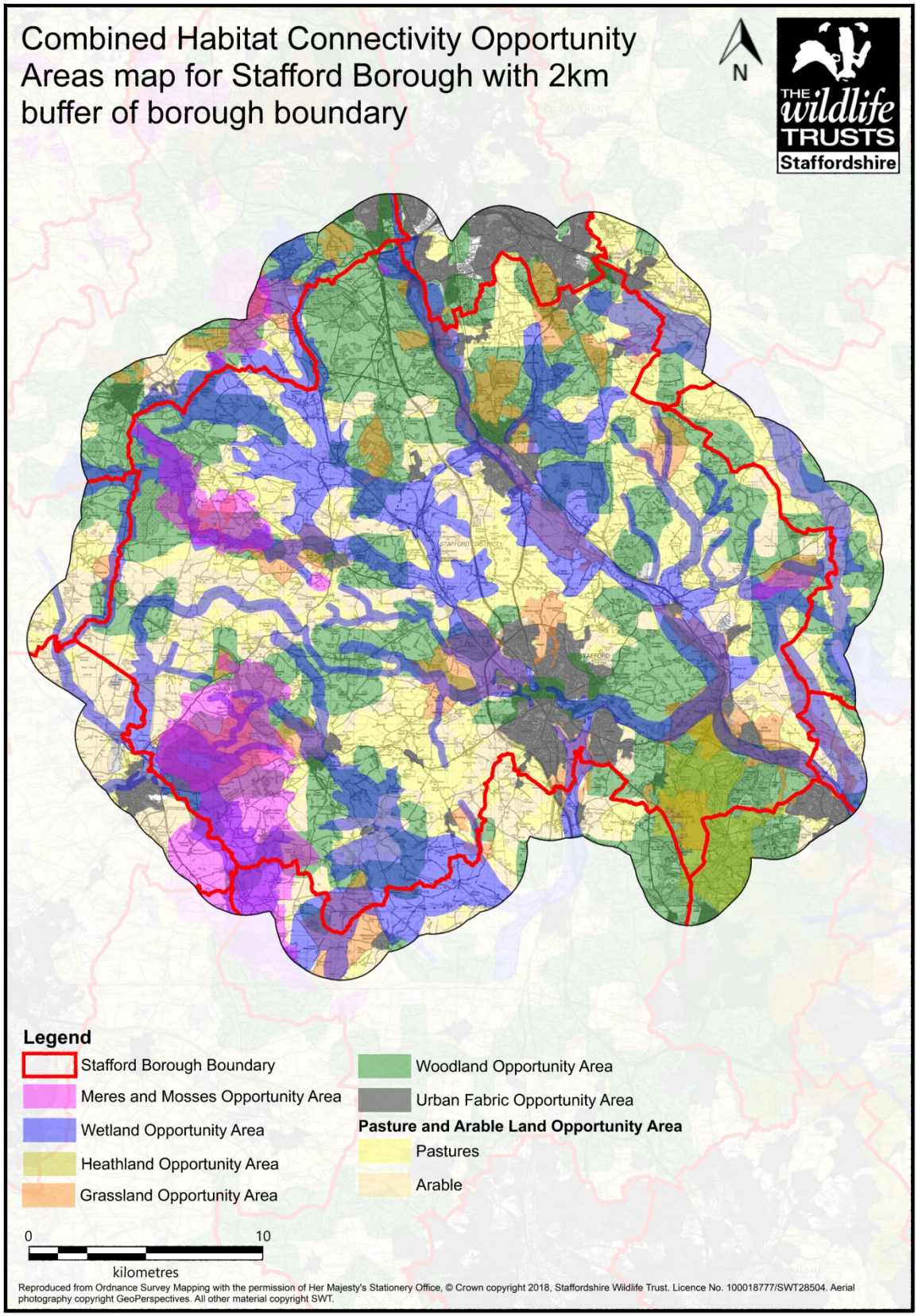


8. Cross boundary habitat connectivity

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 borough / district boundary despite there being suitable habitat

Map 4 illustrates this, showing the Habitat Connectivity Opportunity areas combined map including a 2km radius buffer around the Borough boundary. Despite the buffered radius falling outside of the Borough 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 borough 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 Stafford Borough including a 1 kilometre buffered radius of the district boundary (2019). 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 detailed are designed to be used in conjunction with the biodiversity metric 2.0, however the habitat connectivity opportunity areas and the bottleneck analysis can be used to both inform the metrics 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 J 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, specifically:

- Cannock Chase Area of Outstanding Natural Beauty (AONB) partnership
- Staffordshire Local Wildlife Site (LWS) Partnership
- Cannock Chase Special Area of Conservation (SAC) partnership
- Countryside Stewardship Facilitation Fund groups (x3)
- Trent-Sow Parklands and Cannock Chase AONB HS2 Group

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

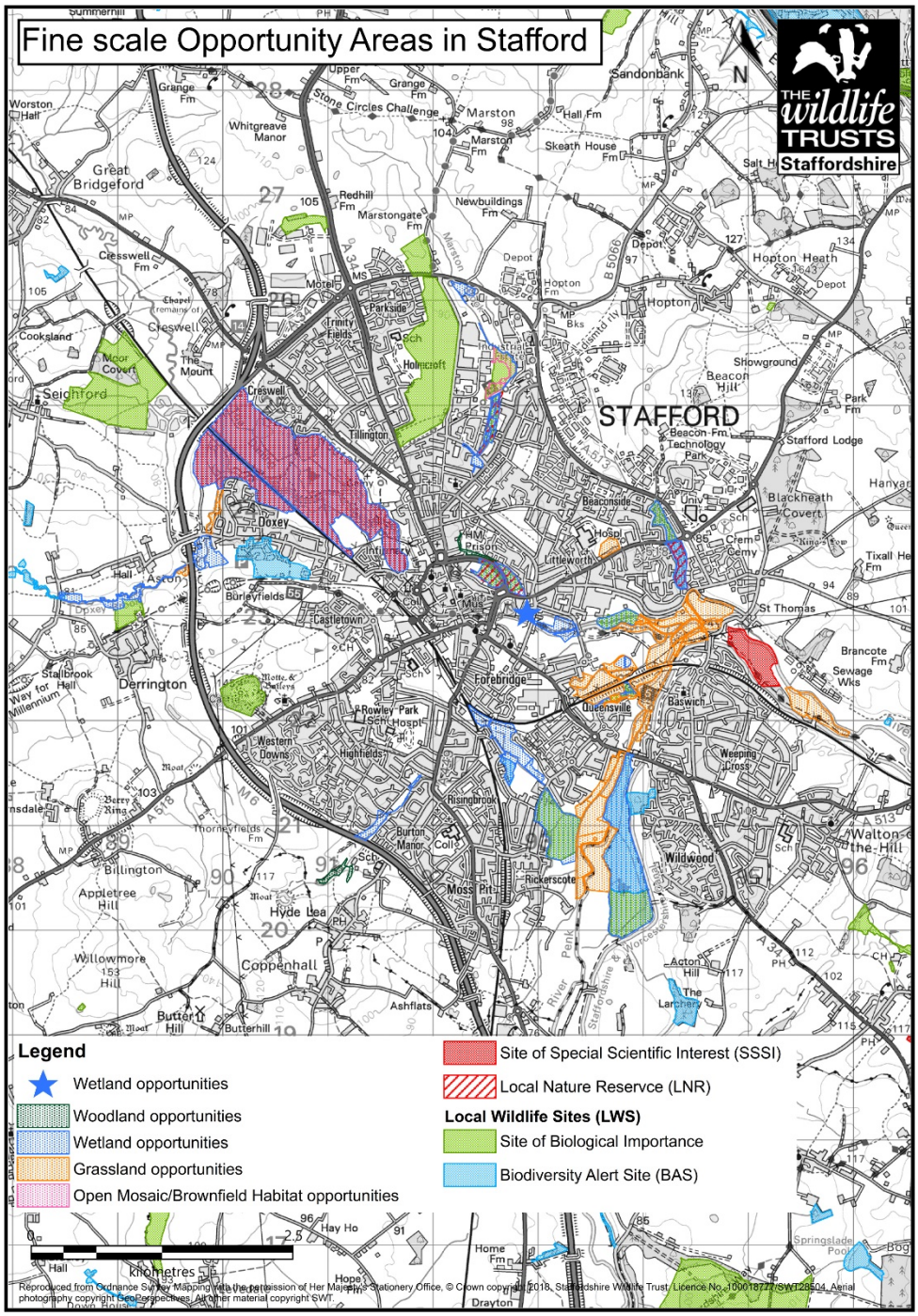
10. Fine scale Opportunity Areas for the targeting of potential future conservation projects in Stafford and Stone.

Within the urban and urban fringe areas of Stafford and Stone there are multiple opportunities for the enhancement of biodiversity and the benefits associated to enhancing biodiversity. Mapping has been carried out in finer detail in the Borough's core urban sites, Stafford and Stone to attempt to tease out very fine scale highly desirable potential project opportunities which would potentially see the greatest impact in terms of direct habitat provision as well as being highly beneficial to habitat connectivity within the urban/rural fringe.

Although potential projects ideas have been identified on a fine scale it must be made explicitly clear that they are purely aspirational and are not a guarantee of being physically delivered on the ground. Actual delivery of project aspirations will rely upon multiple factors including landowner consents, physical constraints on the ground, adequate groundtruthing and feasibility studies, statutory consent, public consultation etc.

10.1 Stafford:

Multiple opportunities have been identified, mapped and roughly costed within Stafford (Map 5) due to the proportionally high number of watercourses which converge in the town which provide natural connectivity into the wider landscape, however in many cases they are restricted to just their channel and disconnected from the surrounding areas. It is in these key areas where potential project ideas have been identified to enhance and restore habitats in the space available.



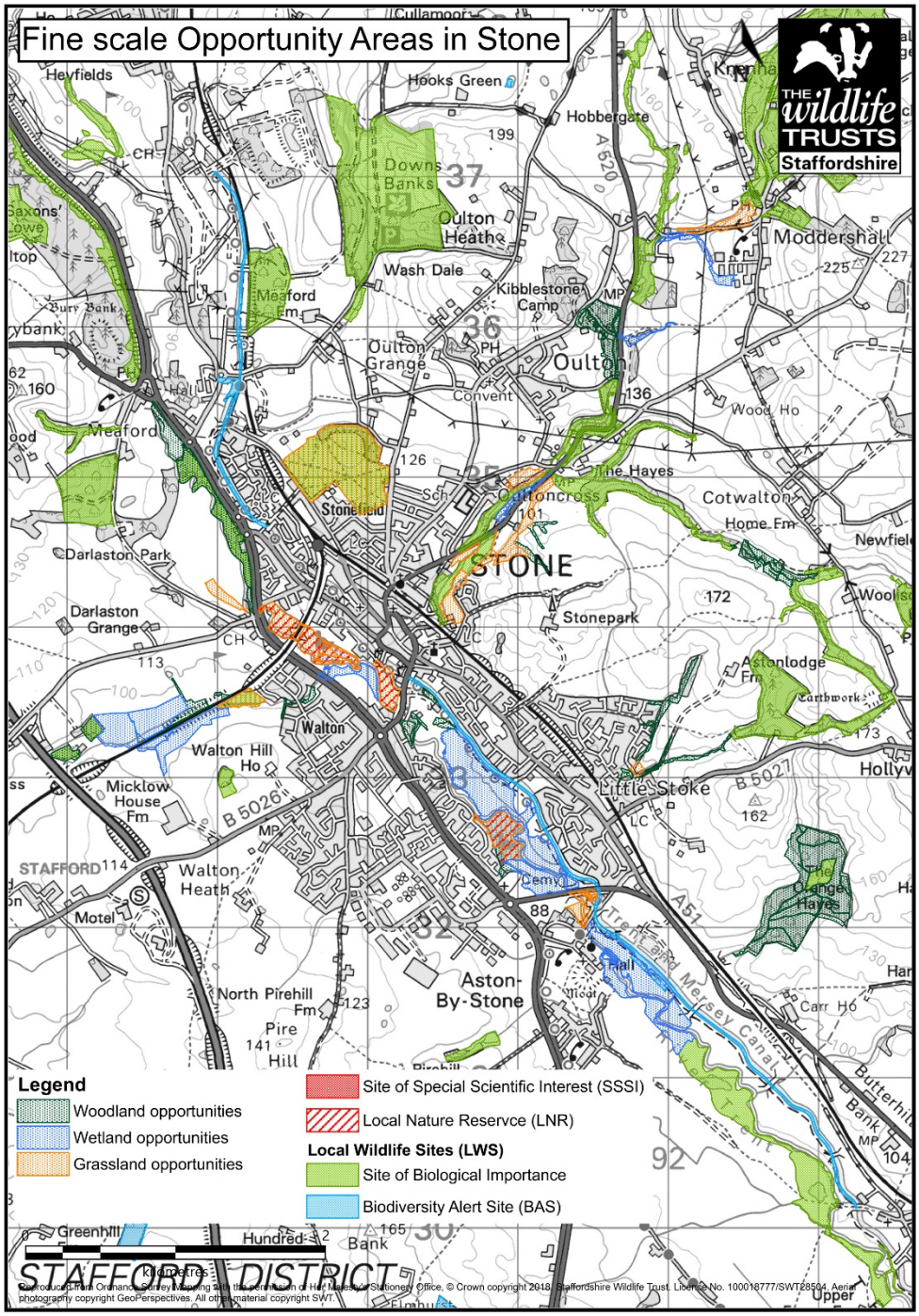
Map 5 Fine scale Opportunity Areas in Stafford

10.2 Stone:

A number of discrete project opportunities have been identified, mapped and roughly costed throughout the centre of Stone (map 6). The dominant feature of the town is the River Trent which flows directly through its centre dividing the town into two, this also acts as the focal point for a lot of the specific habitat improvement projects opportunities as it is a large area of accessible green space and already possesses areas of reasonable habitat. Project

opportunities identified along the Trent are of benefit a number of different habitats including woodlands, grassland and wetlands.

Further project opportunities expand into the wider landscape along existing natural corridors, with the aim of improving habitats which provide vital connectivity between the urban and rural environment and facilitate a greater ability for species to migrate through the urban environment.



Map 6 Fine scale Opportunity Areas in Stone

10.3 Wider Borough:

An analysis was carried out identifying concentrations of nature conservation sites (both LWS and SSSI), this was done by assessing the proportion of nature conservation sites within 1km squares in Stafford Borough (Appendix L). The higher the concentration of nature conservation sites within the 1km square the higher the potential for locating future nature conservation project opportunities to deliver the more, bigger better and joined objectives of Lawton et al. (2010).

11. Nature Recovery Network Next Steps

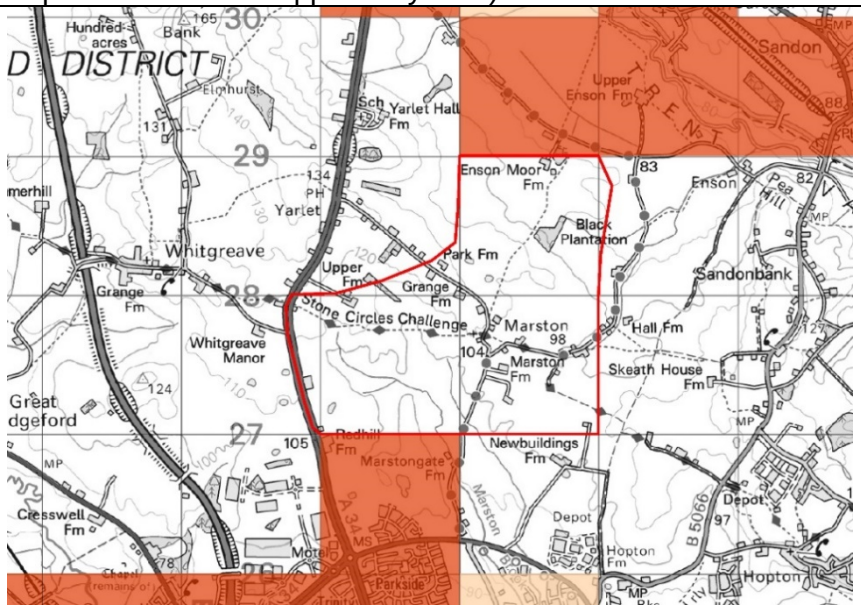
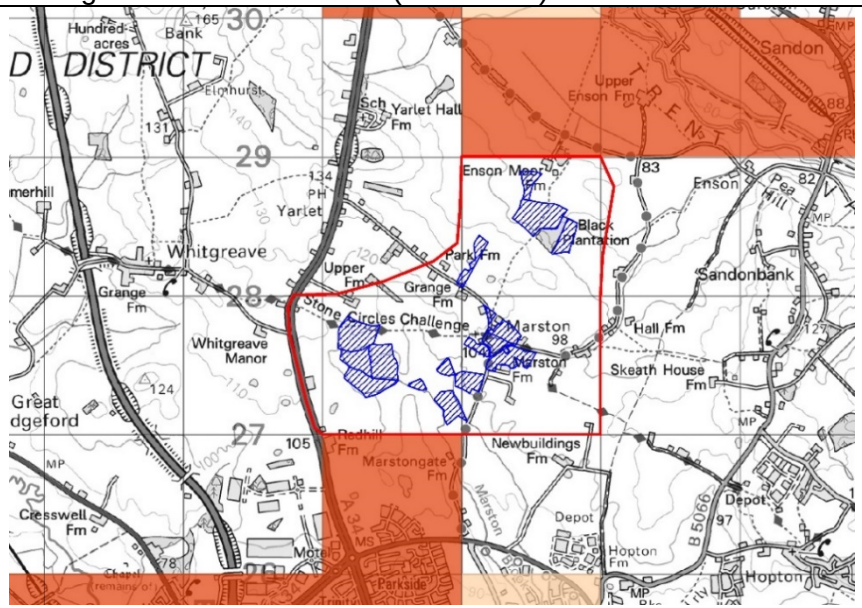
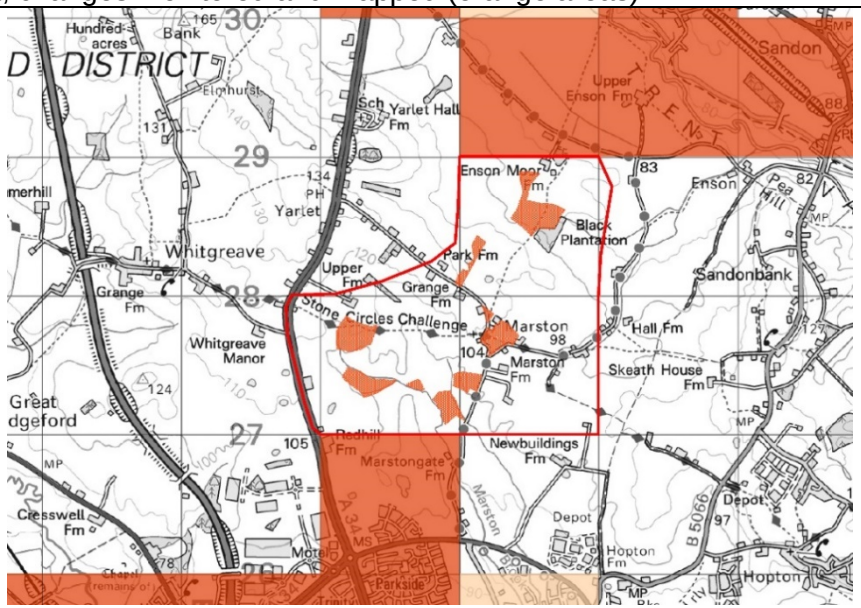
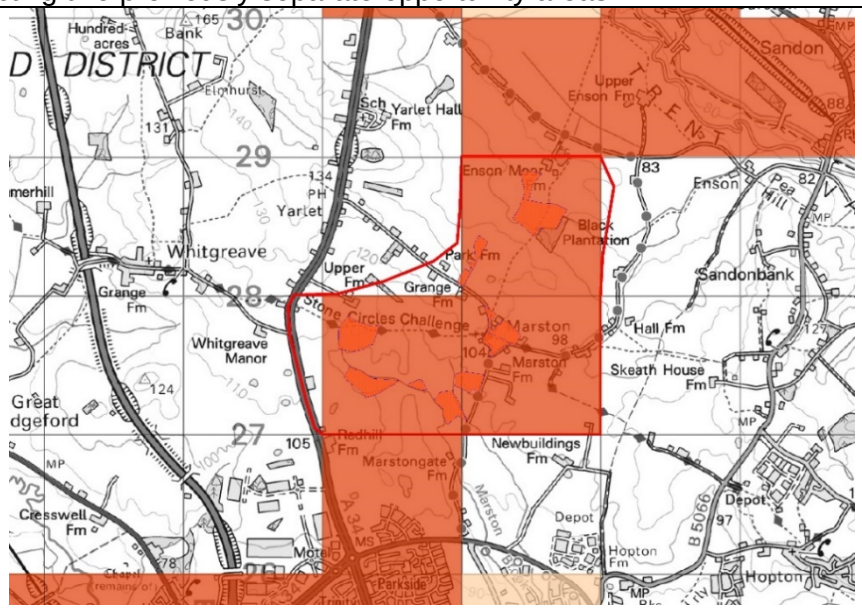
11.1 Habitat connectivity bottlenecks

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).

Bottlenecks can be used to determine the optimal locations to create and restore habitats to benefit connectivity and reduce ‘strain’ habitat connectivity. 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.

11.2 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.

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.
	

12. In Conclusion

The results of the updated Nature Recovery Network do closely reflect what was originally shown in the biodiversity opportunity assessment for the Borough. However, 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 likely to emerge as outlined in the proposed Environment Bill (House of Commons, 2019).

13. Spatially assessing the flow of benefits (the ecosystem services) and the relationship between supply and demand

13.1 What are ecosystem services?

Ecosystem services are the freely gained human benefits provided by natural capital assets and properly functioning ecosystems, these are generally grouped into 3 main categories: provisioning, regulating and cultural services. Specific services may include for example the provision of food and clean drinking water, flood prevention, local and global climate regulation, and recreational and educational value.

13.2 Spatial assessment of ecosystem services supply/demand

An examination of literature relating to the assessment of ecosystem services and their spatial supply and demand revealed several methodologies which could be applied to assess the relationship of ecosystem services in Stafford Borough. It was decided that a methodology developed by Burkhardt et al. (2014) for the assessment of Ecosystem Services based on European Environmental Agency (EEA) Coordinate Information on the Environment (CORINE) land classification types would be used as this can be spatially represented and adequately captures the relationship between service supply and demand within Stafford Borough. The methodology describes the principles of ecosystem service supply potential, demand and the relationship between these two factors (the flow) and whether there is a net supply or net demand for services. Full details of the spatial assessment of ecosystem services in the borough are described in Appendix Q.

The figures provided in the Burkhardt et al. (2014) describe an exemplary hypothetical European ‘normal’ landscape in summer directly before the harvest period (this is theoretically the point of the year when many services such as provisioning services have the highest potential).

Burkhardt et al. calculated the total supply and total demand of particular ecosystem services for each of the land use categories based on the EU CORINE land cover maps, attributing each ecosystem service a value from 0 to 5 with 0 having no supply or demand and 5 having a high supply or demand for each land use type. The flow/demand relationship was calculated by using these figures essentially subtracting the demand value from the supply value for example if a service has a supply value of 1 and a demand value of 5 for a particular site then demand outweighs supply for that particular service at that site.

By using available CORINE European land classification maps in Stafford Borough and assigning the land use values to the corresponding categories in the Ordnance Survey

MasterMap* it was possible to generate a fine scale ecosystem service supply/demand map for Stafford Borough (Appendix R).

*Some land use types and OS MasterMap definitions do not correspond exactly therefore the most appropriate matching type/definition was used in absence of a true like-for-like match.

13.3 Valuing the benefits

Hölzinger & Everard (2014) carried out an assessment of the ecosystem service provision in Staffordshire in 2014 describing the counties Biodiversity Action Plan (BAP) broad habitat types, estimating the financial value of a range of ecosystem services which are provided by these habitats.

The figures from Hölzinger & Everard (2014) were used provide an ecosystem service financial value breakdown to determine the value of 1ha of habitat per ecosystem service category (Appendix O), from this it is possible to then calculate a value for each ecosystem service category per habitat specifically within Stafford Borough (see Appendix P).

13.4 Limitations to the spatial assessment and valuation of ecosystem services

The concept of ecosystem services has become increasingly popular over the last few years and as such so has the demand for its quantification and spatial definition. This brings about major challenges as ecosystem services are provided by highly complex systems which are multi-faceted. A universal and easy to apply and understand method of assessing these services is very difficult.

It must be made explicitly clear that as of yet there is no single agreed methodology for the assessment of ecosystem services and how is best to qualify and quantify the supply, demand and benefits which they provide to humans. Different classification systems and varying degrees of understanding amongst experts have inhibited any universal practical applications. The methodology used for the assessment of ecosystem services in this instance was chosen as it provides an effective way of providing 100% cover of ecosystem service potential throughout the entire local authority area using a peer-reviewed methodology devised by European experts.

The same is true of the valuation of ecosystem services with no defined assessment or figures for the economic value provided by these services, and is an even more sensitive subject given that there are a number of issues when defining a ‘value’ to these services.

The financial value estimates are ‘best guess’, in most cases the true value of ecosystem services is likely to be significantly higher but currently too little is known about the relationship between their supply, demand and the relationship between the two. Changes in the economic climate inevitably leads to fluctuations in value of multiple goods and will also have a knock-on impact to ecosystem service value, particularly those such as food and

bioenergy provision or water quality regulation, therefore figures such as the ones provided are merely a snapshot in time and are likely to be subject to significant changes over time.

It must also be noted that the ecosystem service valuation for the Borough is based on available data and therefore may not represent the true extent or value of the borough's habitats and therefore can only be used as an indicative valuation until further detailed habitat survey and assessment has been carried out. Furthermore, the total ecosystem service values for certain habitat types, for example food production value by arable and horticulture is vastly more than the total for other habitat types which also have a high 'per hectare value' for example, wild species diversity within heathlands. The disparity between total values is due to the high value per hectare of food production in arable and horticulture (£1053 per hectare) as well as the very high presence of this habitat type in the borough (13,315ha) when compared to the value of wild species diversity in heathland (£527 per hectare) and a proportionally low presence of this habitat in the borough (2047ha). Based on this it would potentially be misleading to view a habitats total ecosystem service value in isolation and the per hectare 'unit' value must also be taken into account.

14. Glossary

Term	Definition
Axiophyte	A plant with a strong association with habitats considered to be of high importance for conservation, for example ancient woodlands, lowland meadows etc. Generally these species are not rare and are frequently observed within their respective habitats. The BSBI defines axiophytes as: • 90% restricted to a specific important habitat • Recorded in fewer than 25% of tetrads in the country
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 is 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 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.

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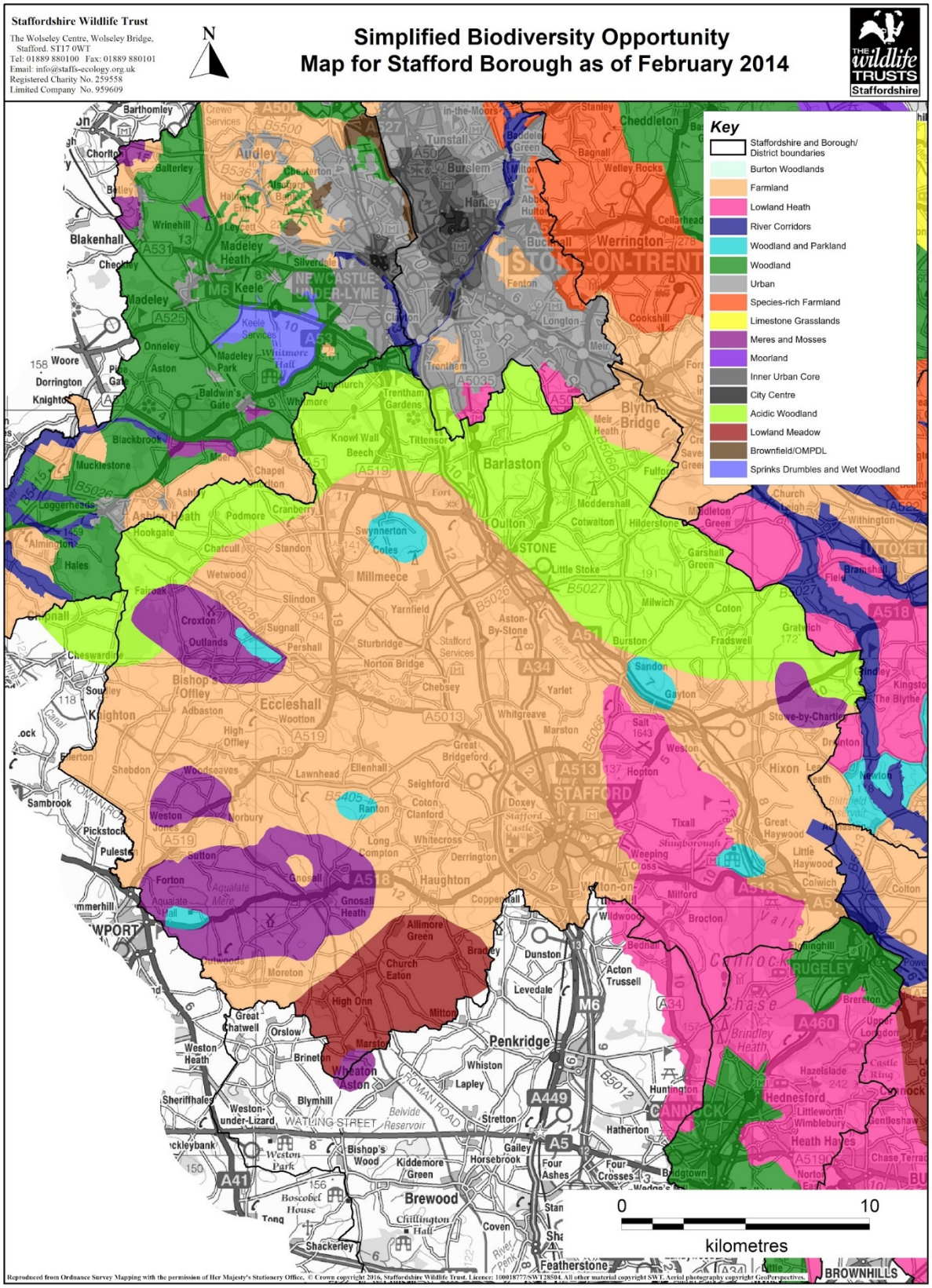
Appendices


Staffordshire Wildlife Trust
The Wolseley Centre, Wolseley Bridge, Stafford. ST17 0WT
Tel: 01889 880100 Fax: 01889 880101
Email: info@staffs-ecology.org.uk
Registered Charity No. 259558
Limited Company No. 959609
N
Simplified Biodiversity Opportunity Map for Stafford Borough as of February 2014
THE wildlife TRUSTS Staffordshire
Key
Staffordshire and Borough/ District boundaries
Burton Woodlands
Farmland
Lowland Heath
River Corridors
Woodland and Parkland
Woodland
Urban
Species-rich Farmland
Limestone Grasslands
Meres and Mosses
Moorland
Inner Urban Core
City Centre
Acidic Woodland
Lowland Meadow
Brownfield/OMPDL
Sprinks Drumbles and Wet Woodland
0
10
kilometres
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Appendix B – Breakdown of Habitat Composite Region GIS data supplied to the Local Authority.

Less than N years old	Data collection method	Cumulative Area (ha)	% of LA area
5 years	Desk Based	39389	66.1%
	Groundtruthed Survey	789	1.3%
	Total	**40178**	**67.4%**
10 years	Desk Based	40181	67.4%
	Groundtruthed Survey	1380	2.3%
	Total	**41561**	**69.7%**
15 years	Desk Based	40181	67.4%
	Groundtruthed Survey	4310	7.2%
	Total	**4310**	**7.2%**
20 years	Desk Based	57351	96.2%
	Groundtruthed Survey	8822	14.8%
	Total	**8822**	**14.8%**
25 years	Desk Based	57351	96.2%
	Groundtruthed Survey	9112	15.3%
	Total	**9112**	**15.3%**
40 years	Desk Based	57351	96.2%
	Groundtruthed Survey	9902	16.6%
	Total	**9902**	**16.6%**
unknown age	Desk Based	0	0.0%
	Groundtruthed Survey	0	0.0%
	Total	**0**	**0.0%**

Appendix C – GIS datasets used in the generation of the NRN mapping for Stafford Borough

Dataset	Used in	Justification	Limitations
Habitat Composite Region (including newly mapped areas)	Strategic areas mapping. Habitat distinctiveness mapping	Provides complete coverage of the district/borough	Wide range of ages and sources (See Appendix D) 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.
Corine Land Cover in Europe dataset	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	Strategic Areas mapping,	Identification of key habitat sites within the	

(SSSI, SAC, RAMSAR etc.)	Habitat distinctiveness mapping, Habitat Connectivity Opportunity mapping	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	Visual scrutiny of Condatis modelling output 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)	Habitat Connectivity Opportunity mapping	To ensure the identified network aligns with national priorities for species, habitats and landscape.	
Staffordshire Biodiversity Action Plan (SBAP) Ecosystem Action Plan Areas (EAPS)	Strategic Areas mapping, Habitat Connectivity Opportunity mapping	Ratification that the new Habitat Connectivity Opportunity areas align with what is identified as a priority within the SBAP.	
Staffordshire Flora data	Habitat Connectivity Opportunity mapping	Scrutiny of Condatis modelling outputs for the production of Habitat Connectivity Opportunity areas. Groundtruthed flora data used to ratify specific HCO areas based on the richness of 'axiophyte' indicator species of particular habitat types (Grassland, Woodland etc) per 1km square.	
Agricultural Land Classification dataset	Additional Phase 1 habitat mapping	Used in the creation of Phase 1 habitat assessment alongside Copernicus EU Land Use dataset to differentiate land parcels which fall within distinct agricultural land classes (parcels which fall in higher classes more likely to be of lower biodiversity value (e.g. Improved grassland or arable land) compared to those in lower classifications (e.g. poor semi-improved grassland or semi-improved grassland)).	

Appendix D – Evidence base confidence review (also supplied as a digital appendix)

Staffordshire Wildlife Trust (SWT)/Staffordshire Ecological Record (SER) hold and manage the a large quantity of the county's 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 E – 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/borough value ● Habitats known to support county and district/borough 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 LWS 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 (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 F1 – 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/MG10	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			

A list of habitat indicator species for the county was created by SWT in 2004 for use in creating and refining Staffordshire's Local Wildlife Site criteria, the evidence used for the creation of the list was based on analysis of the previous county flora surveys and local expert knowledge.

Each species was assessed on the strength of that particular species' association against a number of different habitats based on factors such as how regularly it is observed outside of a particular habitat. Each species was scored a value per habitat to reflecting the habitat indicator value of that species per habitat.
Scoring:

1 = A good indicator, i.e. a strong association with the habitat, sometimes almost confined to it

0.5 = A moderately reliable indicator, i.e. frequently occurs in the habitat, but association less strong and the species often occurs elsewhere

0/NA = Not Attributable, these are either so rare or such generalists that they are not attributable to any specific habitats, therefore they have not been scored.

Habitat Divisions:

1. Woodland
2. Wet Woodland
3. Still Water including canals (emergent vegetation), ponds and lakes
4. Running Water including rivers, streams and running ditches
5. Fen and swamp (i.e. calcareous and alkaline surface water)
6. Bog (i.e. acidic surface water)
7. Heathland
8. Grassland, neutral and calcareous
9. Grassland, acidic
10. Marsh/wet grassland
11. Ephemeral, tall herb, disturbed (i.e. field margins)
12. Rock exposures/walls

Some habitats have been grouped in this study to form a wider habitat classification:

1. **Woodland (all)** – Combination of 1 & 2 above
2. **Grassland (all)** – Combination of 8 & 9 above
3. **Wetland (all)** – Combination of 2, 3, 4, 5, 6 & 10 above
4. **Overall richness** – all habitat indicator species, not based on any of the groupings above to avoid double counting.

Axiophyte is a term used to describe plants with a strong association with habitats considered to be of high importance for nature conservation e.g. ancient woodlands or lowland meadows etc. The Botanical Society for the British Isles (BSBI) holds a checklist of axiophyte species for Staffordshire[*].

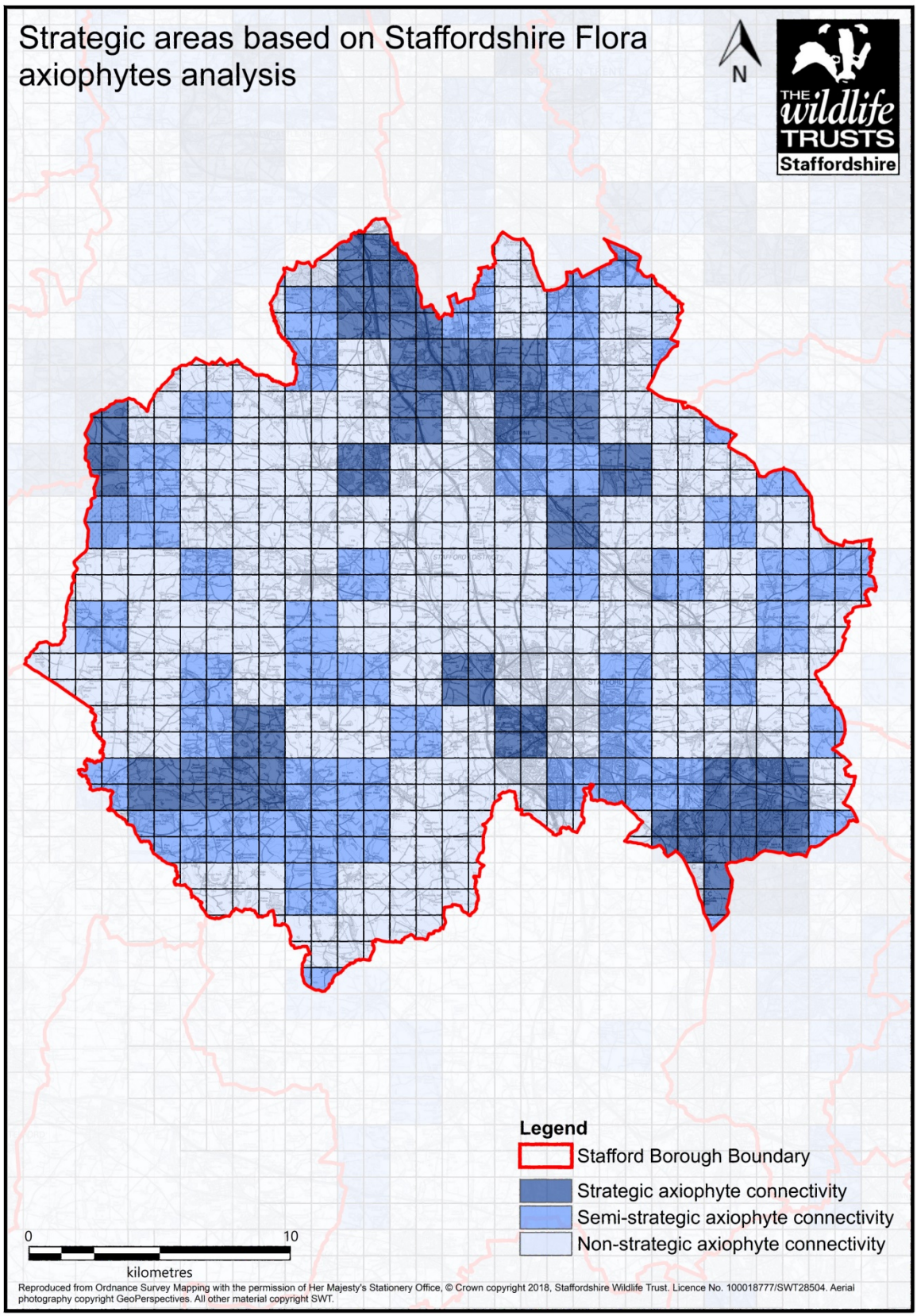
[*] https://database.bsbi.org/object.php?objectid=2cd4p9h.c7ff58&class=ChecklistInstance

The axiophyte flora analysis carried out here relies on botanical survey data gathered between 1995 and 2011 for use in the flora of Staffordshire publication (Hawksford et al., 2011). Surveys were carried out to tetrad level (2kmx2km square) representing a complete dataset for the entire county based on a robust exhaustive methodology. Each tetrad was subjected to equal survey effort by experienced surveyors meaning that the results of the survey remained consistent throughout the county. Surveyors looked for all flowering plants and ferns (not just axiophytes), in most cases no abundance values were recorded and only a presence or absence of the species was recorded in each tetrad.

The analysis was carried out firstly by creating a GIS table of axiophyte species recorded throughout the flora surveys using the BSBI checklist and inputting the habitat indicator values of that species per tetrad. From this it was possible to calculate a sum of axiophyte habitat scoring values to determine a richness indicator from multiple species, categorised by the habitats which they score as an axiophyte, this was carried out for each tetrad. Higher axiophyte richness indicator values in a tetrad mean that the habitat in question is likely to be either more species rich or there is a high proportion of that specific habitat or both within the tetrad, evidenced by a proportionally higher axiophyte richness indicator value.

Flora axiophyte analysis was chosen as a method of reinforcing the strategic areas and habitat connectivity opportunity area analysis due to the fact that flora survey data is based on an exhaustive, consistent groundtruthed methodology, carried out by experienced and knowledgeable surveyors and crucially, covers the entire county.

Appendix H – Flora axiophyte analysis map for Stafford Borough (2019)



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.

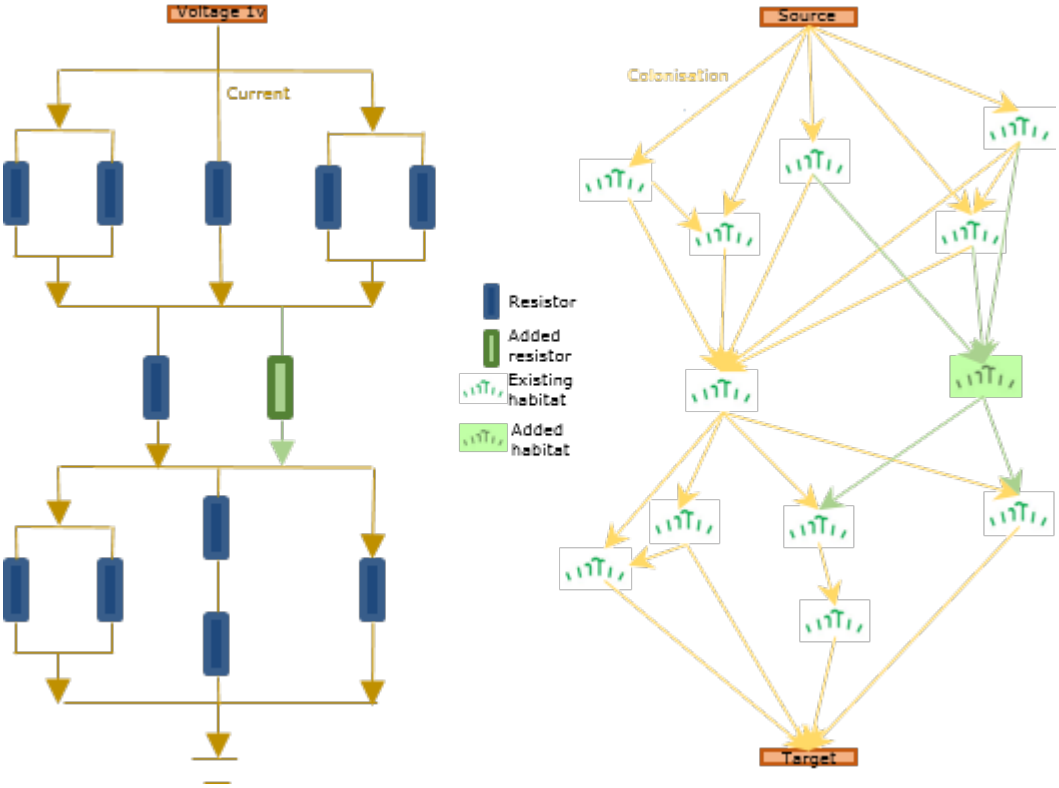


Image 1 Electrical circuit on the left and comparable stylised habitat map on the right. Green represents adding a resistor or additional habitat to each to increase the number of pathways available and therefore improve the flow. Image available at: http://wordpress.condatis.org.uk/

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.

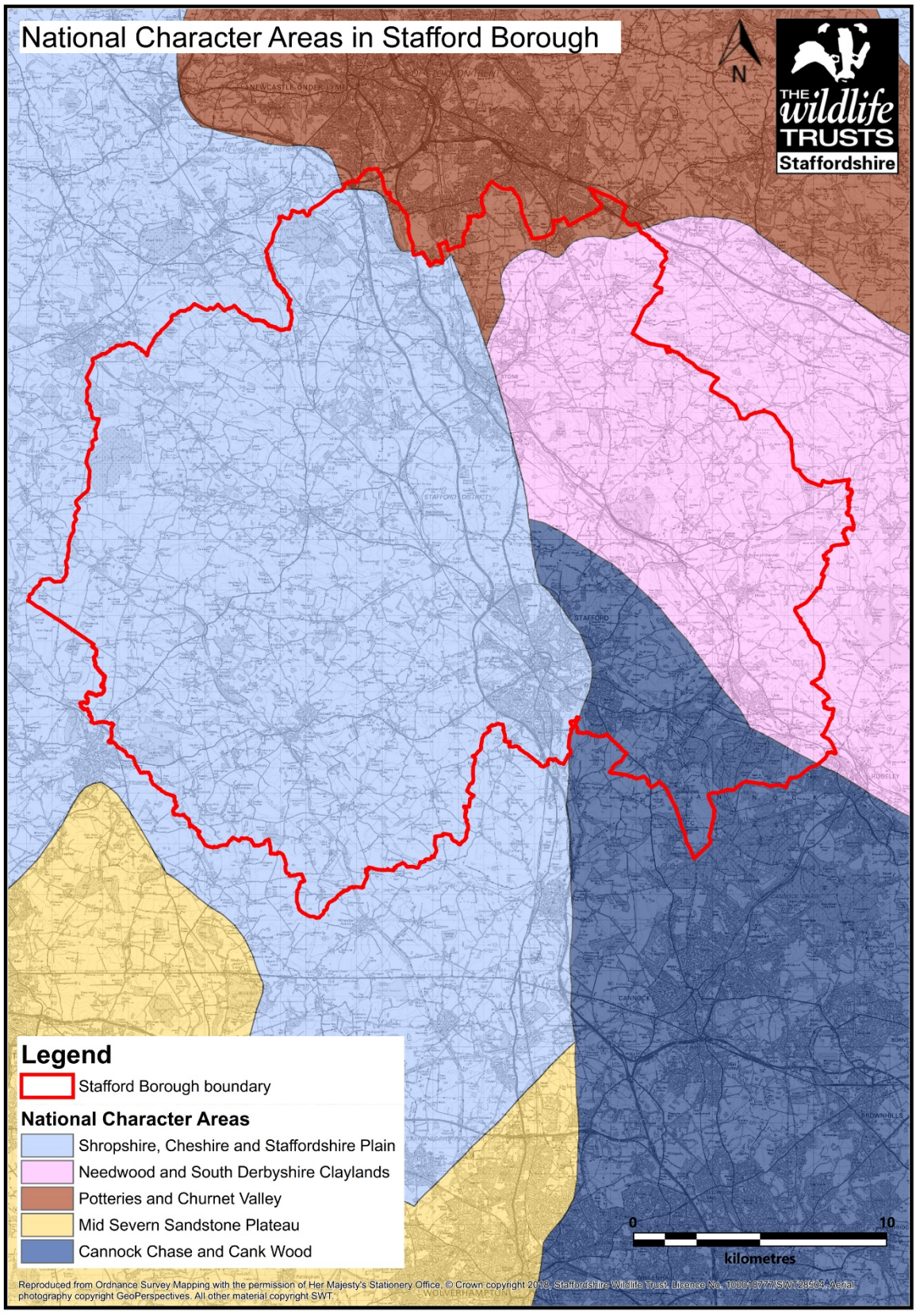
- The habitat connectivity opportunity areas were cross-referenced against previously mapped biodiversity opportunity zones in the Borough. The habitat connectivity opportunity areas are more refined than the previously mapped opportunity zones but do reflect similarities within the landscape.

- 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.

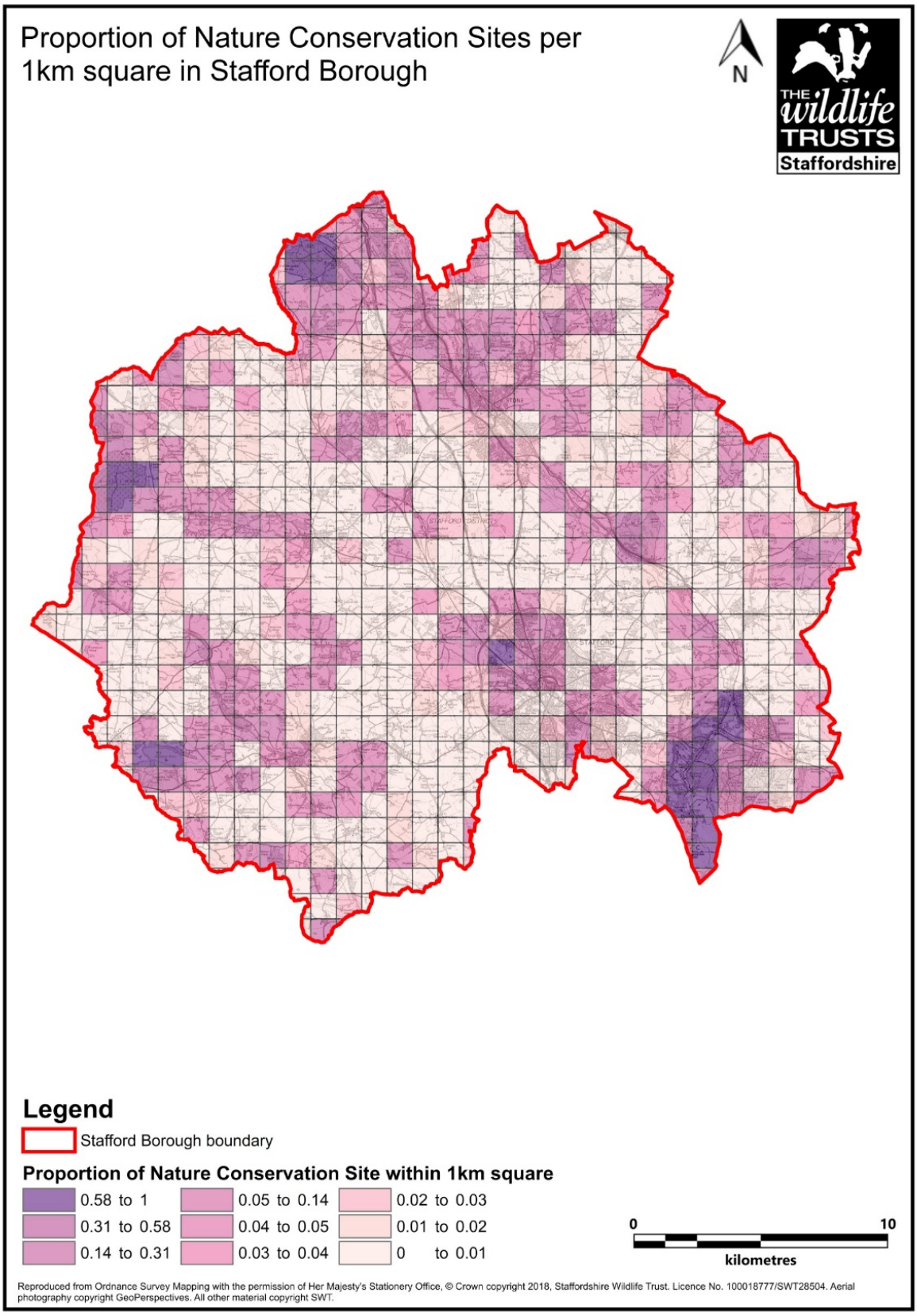
- Habitat creation or restoration may create opportunities too, for example screening unsightly features, creating geological exposures or helping conserve historic features.

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

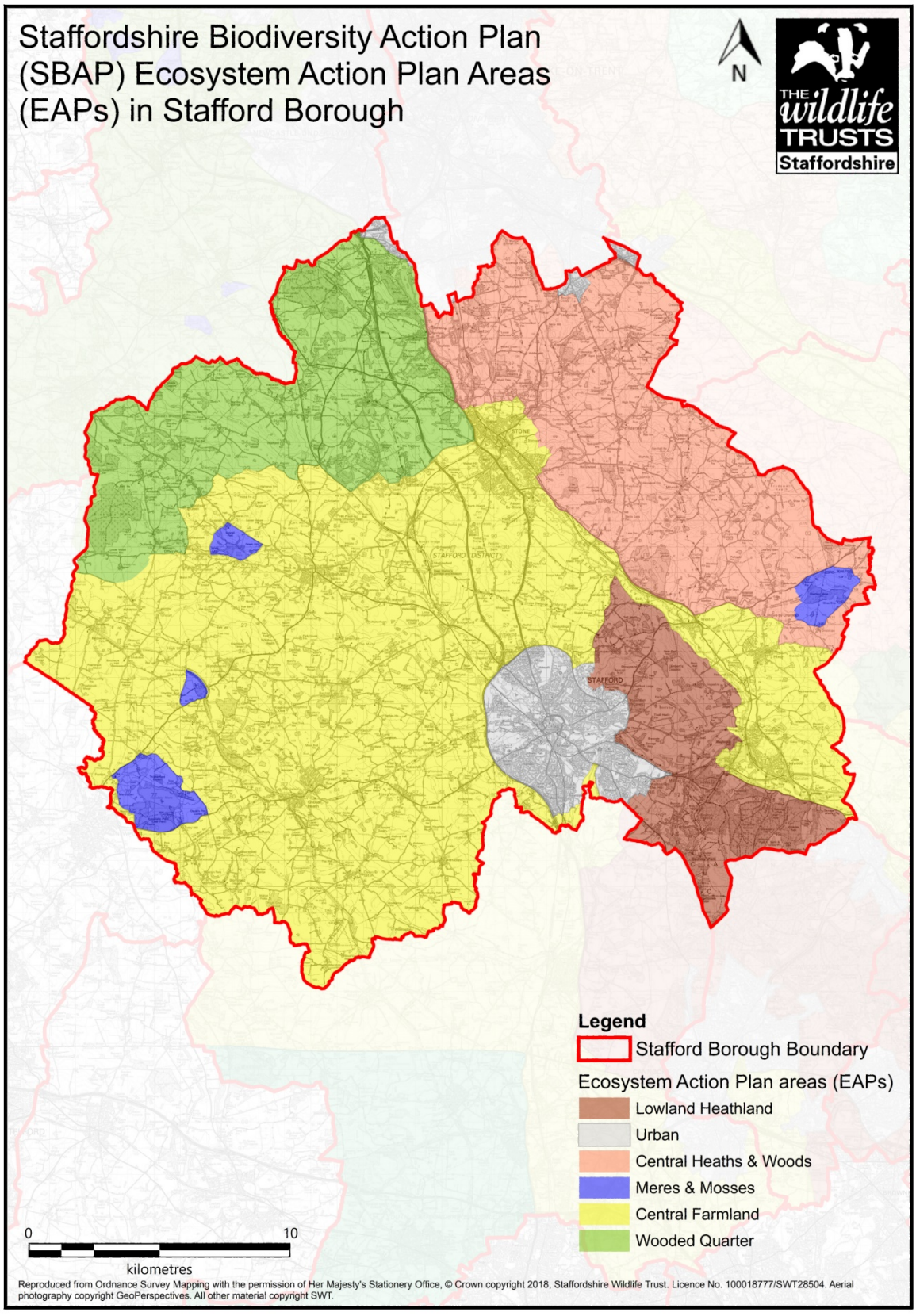
Appendix K – Map of Natural England National Character areas in Stafford Borough (2019)



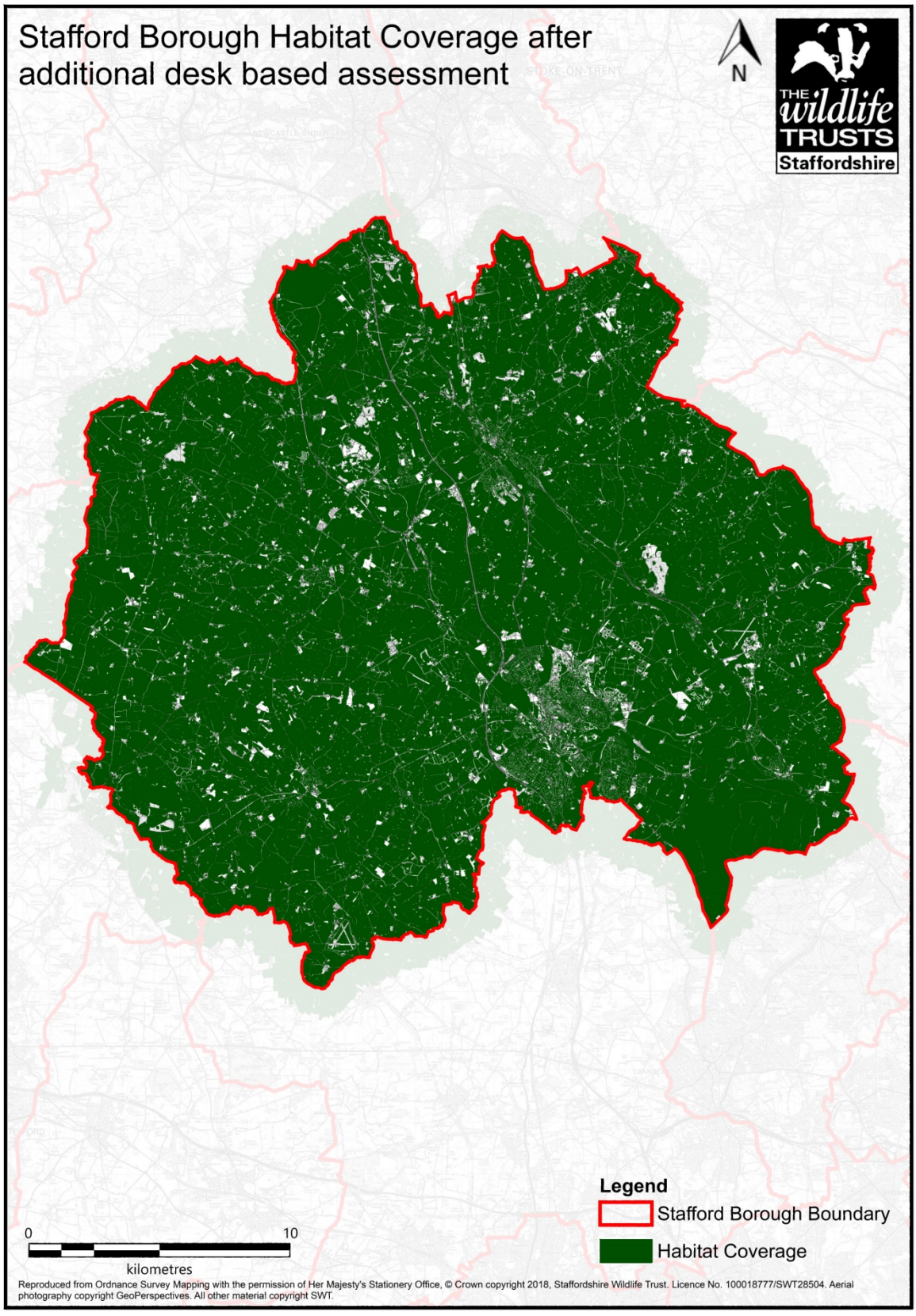
Appendix L – Map of concentrations of ‘nature conservation sites’ per 1km square in Stafford Borough (SWT, 2019).



Appendix M – Map of Staffordshire Biodiversity Action Plan (SBAP) Ecosystem Action Plan areas (EAPs) in Stafford Borough (2019)



Appendix N - Area of habitat mapped in Stafford Borough (2019) Data is from various sources including a mixture of desk based and ground truthed methods.



Appendix O - Value per hectare of ecosystem service per BAP broad habitat (Calculated from Hölzinger & Everard (2014))

		Ecosystem services best guess (BG) value (£) per 1 hectare									
Broad Habitat type	Area (ha) identified in Staffordshire by Hölzinger (2014)	Food and Bioengery provision	Timber and wood fuel	Wild food provision	Non-food products	Recreation	Recreational, Aesthetic & Biodiversity	Cultural	Wild species diversity benefits	Flood risk regulation benefits	Water quality regulation
Woodland	**24418.4**		**£53.03**	**£37.35**	**£44.47**	**£364.40**			**£121.14**	**£343.31**	
Broadleaved Woodland	15196.6			£44.62	£53.10				£124.24	£409.83	
Ancient Semi-Natural Woodland (ASNW)	*3028.3*			£55.48	£66.37				£209.36	£512.17	
Other	*12165.3*										
Coniferous woodland	5781								£62.27		
Mixed woodland	1137.7			£55.37	£66.80				£62.41	£512.44	
Shrub (Scrub?)	42.4			£47.17	£70.75					£518.87	
Young trees	1385.8										
New planted woodland (assumed)	878										
Wetland	**3732.9**			**£15.00**	**£1.61**		**£185.11**		**£434.25**	**£321.20**	**£260.39**
Inland Marsh	2903.7			£16.19	£0.69		£160.48		£443.23	£353.00	£286.19
Floodplain grazing marsh	*2432.7*			£17.68			£160.32		£519.18	£353.11	£286.10
Purple Moor-grass & Rush Pasture	*33.7*			£59.35	£29.67		£148.37		£415.43	£356.08	£296.74
Fens	*30.8*			£64.94	£32.47		£162.34		£324.68	£357.14	£292.21
Reedbeds	*1.9*								£526.32	£526.32	£526.32
Mire	*88.6*						£158.01			£349.89	£282.17
Swamp	*283.7*						£158.62			£352.49	£285.51
Other	*32.3*						£154.80			£340.56	£278.64
Peatbog	829.1			£10.86	£4.82		£272.58		£402.85	£209.87	£170.06
Blanket Bog	*781.9*			£11.51	£3.84		£272.41		£423.33	£209.75	£170.10
Fen	*8.9*			£112.36			£224.72		£337.08	£224.72	£224.72
Mire	*37.7*						£265.25			£212.20	£159.15
Moss	*0.7*										
Heathland	**2047**			**£6.84**	**£7.82**			**£339.52**	**£527.60**	**£314.61**	
Grassland	**33854.5**			**£0.18**	**£0.30**			**£85.28**	**£97.06**	**£122.82**	
Acid grassland***	108.2										
Calcareous grassland	16.6								£240.96		
Improved grassland	18134.3							£153.47	£170.45	£225.21	
Semi-improved grassland**	15047.1										
Neutral grassland	432.7										
Lowland meadows	*390.3*			£15.37	£23.06			£258.78	£479.12	£189.60	
*upland meadows**	*42.5*										
Amenity grassland	112.2										
Grassland (unspecified)**	3.4										
Hedgerows	**363.6**			**£500.55**	**£38.50**			**£500.55**	**£464.80**		
Arable & Horticulture	**57971**	**£1,053.65**		**£7.68**	**£20.41**				**£20.30**		
Horticulture	1255										
Arable fields	56716	£1,076.96									
Cereals	*44383*	£995.90									
*Vegetables****	*12333*	£1,368.69									
Other habitats**	**1862**										
Open mosaic on previously developed land**	266.2										
Parkland**	608.9										
Rock**	987.4										
Water	**2545.9**										
Open water**	1721.2										
Rivers**	617.2										
Canals**	207.6										
Ponds (number)**	242										

*) The assumption underlies that 1,072km hedgerows recorded as linear features are in average 1.5m wide.

**) These habitat types have not been included in the monetary assessment.

***) Acid grassland contains 11.7 ha and vegetables contain 8,049 ha which have not been evaluated in monetary terms.

Appendix P – Calculated value provided by a range of Ecosystem Services in Stafford Borough

Broad habitat type	Area (ha) of habitat mapped in Stafford Borough	Food and Bioenergy provision	Timber and wood fuel	Wild food provision	Non-food products	Recreation	Recreational, Aesthetic & Biodiversity	Cultural	Wild species diversity benefits	Flood risk regulation benefits	Water quality regulation
Woodland	**5144.06**	**£0.00**	**£272,808.94**	**£192,124.90**	**£228,780.31**	**£1,874,481.78**	**£0.00**	**£0.00**	**£623,141.95**	**£1,765,990.20**	**£0.00**
Broadleaved Woodland	2042.54	£0.00	£0.00	£91,128.42	£108,467.01	£0.00	£0.00	£0.00	£253,761.73	£837,091.13	£0.00
Ancient Semi-Natural Woodland (ASNW)		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Other		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Coniferous woodland	1587.36	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£98,849.61	£0.00	£0.00
Mixed woodland	633.08	£0.00	£0.00	£35,056.73	£42,290.66	£0.00	£0.00	£0.00	£39,508.38	£324,413.85	£0.00
Shrub (Scrub?)	74.78	£0.00	£0.00	£3,527.36	£5,291.04	£0.00	£0.00	£0.00	£0.00	£38,800.94	£0.00
Young trees		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
New planted woodland (assumed)		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Wetland	**1078.59**	**£0.00**	**£0.00**	**£16,180.73**	**£1,733.65**	**£0.00**	**£199,658.63**	**£0.00**	**£468,374.29**	**£346,440.95**	**£280,851.21**
Inland Marsh***		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Floodplain grazing marsh	*743.6*	£0.00	£0.00	£13,143.75	£0.00	£0.00	£119,210.75	£0.00	£386,059.44	£262,569.33	£212,745.34
*Purple Moor-grass & Rush Pasture****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
*Fens****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
*Reedbeds****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
*Mire****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
*Swamp****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
*Other****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Peatbog***		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
*Blanket Bog****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
*Fen****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
*Mire****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
*Moss****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Heathland	**435**	**£0.00**	**£0.00**	**£2,975.09**	**£3,400.10**	**£0.00**	**£0.00**	**£147,691.74**	**£229,506.60**	**£136,853.93**	**£0.00**
Grassland	**3127.12**	**£0.00**	**£0.00**	**£554.22**	**£923.69**	**£0.00**	**£0.00**	**£266,670.47**	**£303,525.86**	**£384,071.98**	**£0.00**
Acid grassland**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Calcareous grassland		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Improved grassland	1326.54	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£203,578.90	£226,109.37	£298,748.19	£0.00
Semi-improved grassland**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Neutral grassland	726.82	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Lowland meadows	*23.69*	£0.00	£0.00	£364.18	£546.27	£0.00	£0.00	£6,130.39	£11,350.32	£4,491.57	£0.00
*upland meadows**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Amenity grassland	233.9	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Grassland (unspecified)**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Hedgerows*		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Arable & Horticulture	**13315.53**	**£14,029,875.07**	**£0.00**	**£102,213.36**	**£271,726.76**	**£0.00**	**£0.00**	**£0.00**	**£270,348.60**	**£0.00**	**£0.00**
Horticulture***		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Arable fields***		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
*Cereals****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
*Vegetables****		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Other habitats**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Open mosaic on previously developed land**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Parkland**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Rock**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Water	**428.36**	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Open water**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Rivers**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Canals**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00
Ponds (number)**		£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00	£0.00

*) The assumption underlies that 1.872km hedgerows recorded as linear features are in average 1.5m wide.

**) These habitat types have not been included in the monetary assessment.

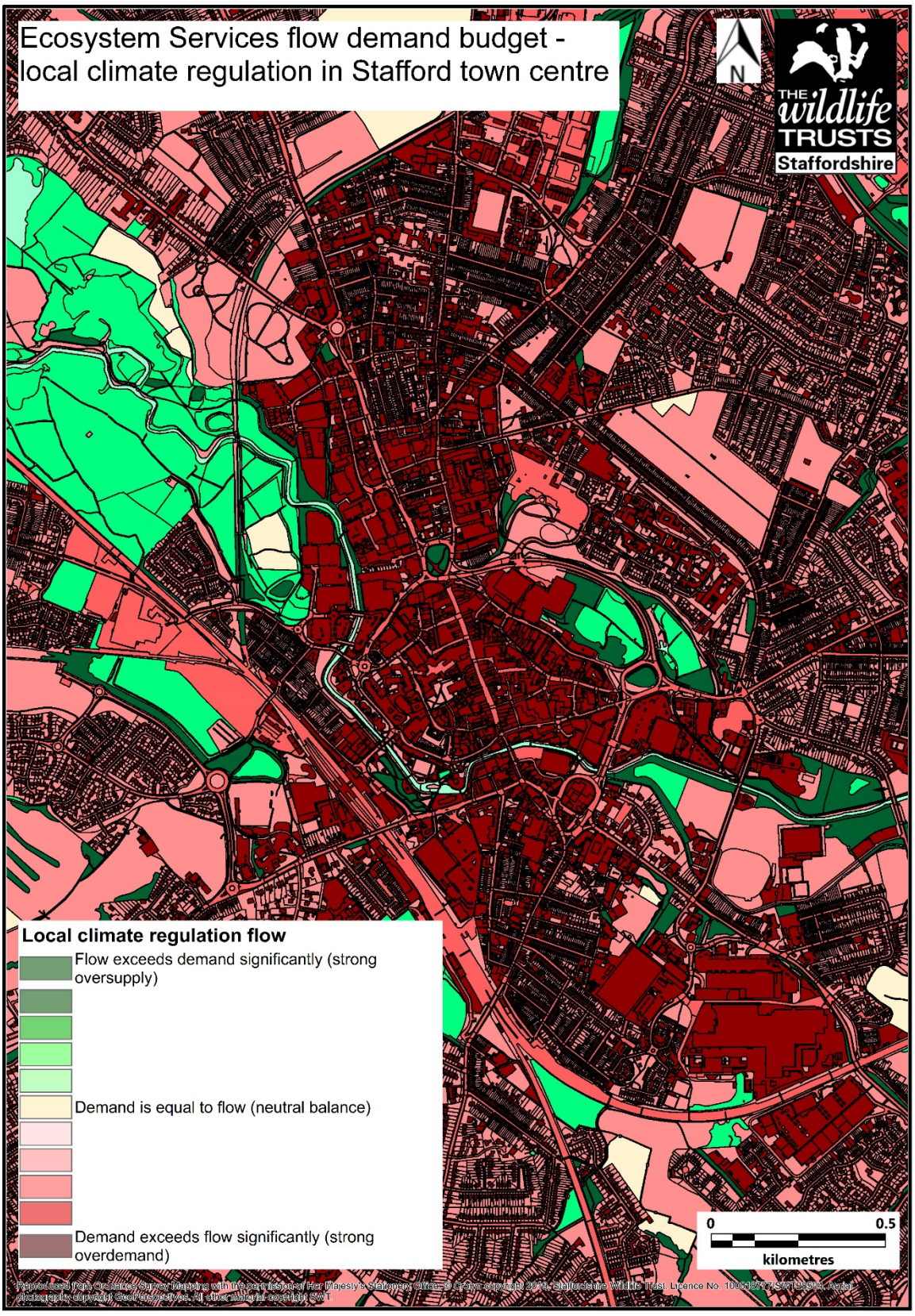
***) These habitat are included in the broad higher level category but could not be individually itemised.

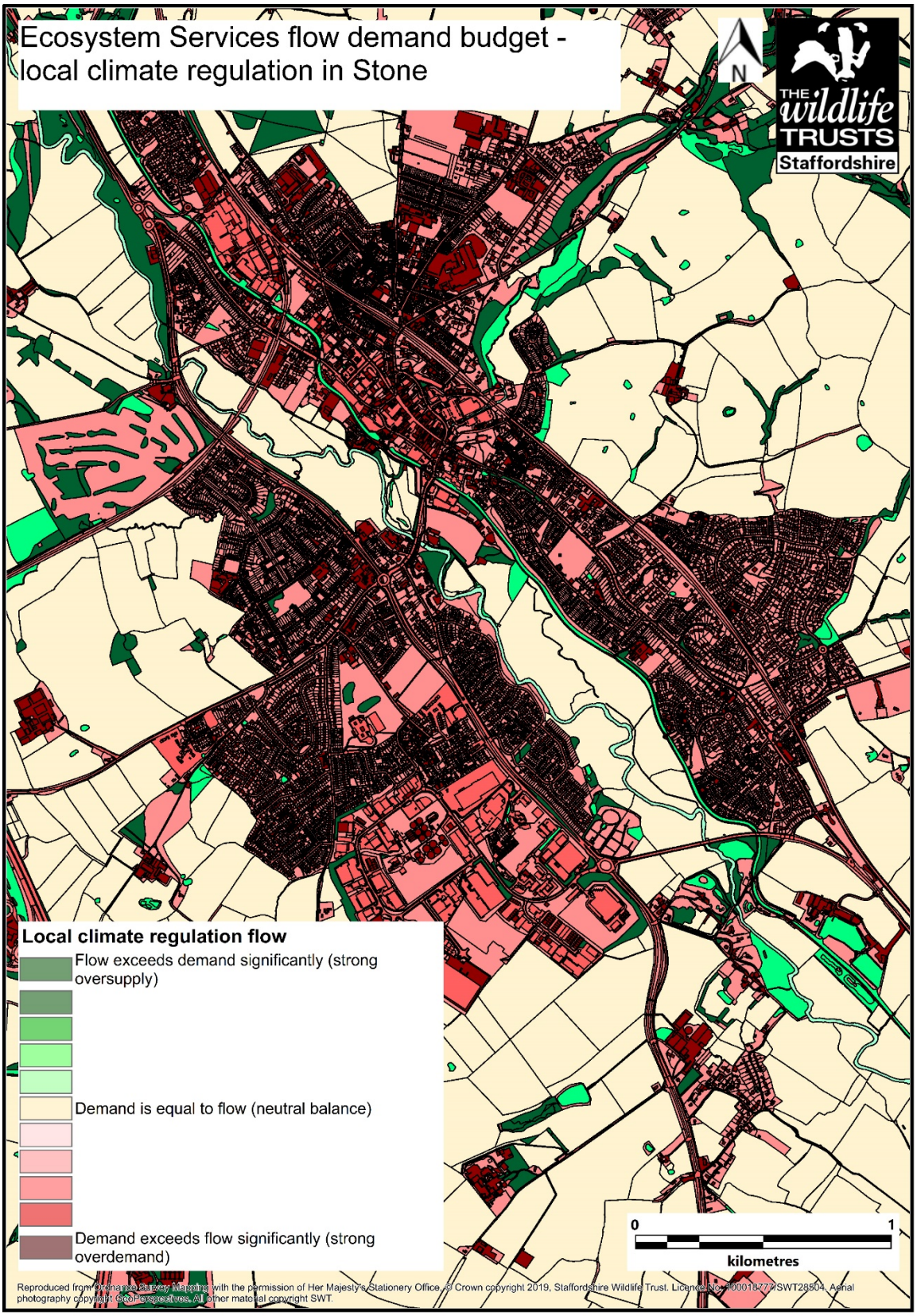
Appendix Q – Methodology for the spatial assessment of supply/demand of ecosystem services

The figures provided in the Burkhardt et al. (2014) describe an exemplary hypothetical European ‘normal’ landscape in summer directly before the harvest period (this is theoretically the point of the year when many services such as provisioning services have the highest potential).

Burkhardt et al. calculated the total supply and total demand of particular ecosystem services for each of the land use categories based on the EU CORINE land cover maps, attributing each ecosystem service a value from 0 to 5 with 0 having no supply or demand and 5 having a high supply or demand for each land use type. The flow/demand relationship was calculated by using these figures essentially subtracting the demand value from the supply value for example if a service has a supply value of 1 and a demand value of 5 for a particular site then demand outweighs supply for that particular service at that site.

Appendix R – Example flow/demand map of local climate regulation ecosystem service in Stafford Town Centre and Stone.




Ecosystem Services flow demand budget - local climate regulation in Stone
N
THE wildlife TRUSTS
Staffordshire
Local climate regulation flow
Flow exceeds demand significantly (strong oversupply)
Demand is equal to flow (neutral balance)
Demand exceeds flow significantly (strong overdemand)
0
1
kilometres
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