



Norwich Western Link

Environmental Statement

Chapter 10: Biodiversity

Appendix 10.17: Lichen Survey Report

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1 Introduction

- 1.1.1 WSP UK Ltd were commissioned by Norfolk County Council to carry out a lichen survey of the potential zone of influence of the Scheme alignment. The aim of the survey was to provide a nature conservation evaluation of the lichens in the potential zone of influence.
- 1.1.2 The approach to the lichen survey covered in this report is based on guidance published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018) where detailed scoping work, based on desk research and field work, was undertaken so as to identify what important lichen features are or might be present and the need for detailed lichen surveys.
- 1.1.3 The survey carried out for this report was based on two stages. The first stage was a Desk Study to identify areas with habitats that had the potential to support lichens of conservation interest. The second stage was a Field Survey of the areas and habitats identified by the Desk Study to survey the lichen species and communities. The Field Survey also included searching for lichen habitat not identified by the Desk Study.
- 1.1.4 The objectives of the Desk Study were to:
- Define the species of conservation importance to provide the basis for evaluating the lichen species in the Study Area (defined in Section 1.4);
 - Research the geology (bedrock and superficial) of the Study Area and its potential for lichen habitats;
 - Analyse the landscape and ecological history of the Study Area to identify habitats in the Area that could support lichen species of conservation interest;
 - Review and interpret historical records for lichens in and adjacent to the Study Area and use as potential guidance in the desk and field work; and



- Combine the results of the Desk Study to identify potential features that could support species of conservation interest and group these within targeted Survey Areas.

1.1.5 The objectives of the Field Survey were to:

- Visit the targeted Survey Areas to look at the potential features identified in the Desk Study (for example old trees on historic boundaries);
- Survey and/or assess historic and other relevant habitats in the Survey Areas for species of conservation interest; and
- Record a list of species indicative of the lichen flora of the Study Area and comment on the lichen communities present.

1.1.6 The output of the Desk Study and Field Survey was to:

- Present the results of the Desk Study and Field Survey;
- Interpret the results of the Desk Study and Field Survey to define the ecological importance of the lichens within the Study Area;
- Identify the need for additional targeted detailed survey work; and
- Present the results in a baseline report.

1.1.7 We have included a summary of key information shown in this document in an accessible format. However, some users may not be able to access all technical details. If you require this document in a more accessible format please contact norwichwesternlink@norfolk.gov.uk



Norfolk County Council

Norwich Western Link

Lichen Survey Report





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Lichen Survey Report

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1 Introduction

1.1 Project Background

- 1.1.1. The Norwich Western Link Road (NWL) is a highway scheme linking the A1270 Broadland Northway from its junction with the A1067 Fakenham Road to the A47 trunk road near Honingham.
- 1.1.2. The NWL, hereafter referred to as the Scheme, will comprise:
 - Dualling the A1067 Fakenham Road westwards from its existing junction with the A1270 to a new roundabout located approximately 400m to the north west.
 - Construction of a new roundabout.
 - Constructing a dual carriageway link from the new roundabout to a new junction with the A47 near Honingham.
- 1.1.3. As part of a separate planned scheme, National Highways proposes to realign and dual the A47 from the existing roundabout at Easton to join the existing dual carriageway section at North Tuddenham. If that scheme proceeds, it is expected that National Highways will construct the Honingham junction and the Norwich Western Link will connect to the north-eastern side of that junction.
- 1.1.4. The Scheme will cross the River Wensum and its flood plain by means of a viaduct. In addition, six other structures are proposed to cross minor roads and to provide habitat connectivity. The Scheme will include ancillary works such as provision for non-motorised users, necessary realignment of the local road network, including the stopping up of some minor roads, and the provision of environmental mitigation measures.

1.2 Ecological Background

- 1.2.1. A Phase 1 Habitat Survey (WSP UK Ltd., 2021) undertaken in 2020 identified the presence of habitats such as broad-leaved woodland, trees and hedgerows which have the potential to support lichen species protected under Schedule 8 of the Wildlife & Countryside Act 1981 (as amended). In addition, *Cladonia* and *Peltigera* lichens are noted in the citations of two County Wildlife Sites (CWS) situated within a 2km radius from the Scheme. A lichen survey was therefore undertaken to establish a sufficient baseline to inform impact assessment.

1.3 Brief and Objectives

- 1.3.1. WSP UK Ltd were commissioned by Norfolk County Council to carry out a lichen survey of the potential zone of influence of the Scheme alignment. The aim of the survey was to provide a nature conservation evaluation of the lichens in the potential zone of influence.
- 1.3.2. The approach to the lichen survey covered in this report is based on guidance published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018) where detailed scoping work, based on desk research and field work, was undertaken so as to identify what important lichen features are or might be present and the need for detailed lichen surveys.

- 1.3.3. The survey carried out for this report was based on two stages. The first stage was a Desk Study to identify areas with habitats that had the potential to support lichens of conservation interest. The second stage was a Field Survey of the areas and habitats identified by the Desk Study to survey the lichen species and communities. The Field Survey also included searching for lichen habitat not identified by the Desk Study.
- 1.3.4. The objectives of the Desk Study were to:
- Define the species of conservation importance to provide the basis for evaluating the lichen species in the Study Area (defined in Section 1.4);
 - Research the geology (bedrock and superficial) of the Study Area and its potential for lichen habitats;
 - Analyse the landscape and ecological history of the Study Area to identify habitats in the Area that could support lichen species of conservation interest;
 - Review and interpret historical records for lichens in and adjacent to the Study Area and use as potential guidance in the desk and field work; and
 - Combine the results of the Desk Study to identify potential features that could support species of conservation interest and group these within targeted Survey Areas.
- 1.3.5. The objectives of the Field Survey were to:
- Visit the targeted Survey Areas to look at the potential features identified in the Desk Study (for example old trees on historic boundaries);
 - Survey and/or assess historic and other relevant habitats in the Survey Areas for species of conservation interest; and
 - Record a list of species indicative of the lichen flora of the Study Area and comment on the lichen communities present.
- 1.3.6. The output of the Desk Study and Field Survey was to:
- Present the results of the Desk Study and Field Survey;
 - Interpret the results of the Desk Study and Field Survey to define the ecological importance of the lichens within the Study Area;
 - Identify the need for additional targeted detailed survey work; and
 - Present the results in a baseline report.

1.4 Study and Survey Areas

- 1.4.1. The zone of influence (i.e., the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities) for lichen was considered to extend up to 200m from the Scheme alignment to account for changes in air quality, which according to Highways England's Design Manual for Roads & Bridges (DMRB) LA 105, Highways England, 2019, LA 105 Air quality (Revision 0), can extend up to 200m from affected road networks. The Study Area for lichens therefore incorporated a 200m buffer from the Scheme alignment to account for potential air quality impacts as shown on the plan in Appendix A.



1.4.2. Not all of the Study Area has the potential to support lichens of conservation interest (for example arable fields, plantations and woodlands, improved grasslands etc.) and so the Desk Study identified habitats (for example old trees on historic boundaries, areas with potential for terricolous habitat) at specific locations within the Study Area for targeted field work. The Study Area is extensive and was sub-divided into four Survey Areas to assist planning the fieldwork and to ensure sufficient coverage of landscape/ecological historical features within the whole of the Study Area. The locations of the four Survey Areas are shown on the plan in Appendix A.

2 Relevant Legislation

2.1 Legal Compliance

2.1.1. The following legislation and policy was referred to for guidance on lichen species of conservation interest:

- Wildlife & Countryside Act 1981 (as amended);
- The NERC Act 2006; and
- The National Planning & Policy Framework.

Wildlife & Countryside Act 1981 (as amended)

2.1.2. The Wildlife & Countryside Act 1981 (as amended) provides guidance for the identification of for example, nationally important lichen species, lichen assemblages, and lichen habitats. Schedule 8 of the legislation also lists a number of lichen species that are protected against intentional picking, uprooting or destruction.

The National Environment and Rural Communities Act 2006

2.1.3. Section 41 of the NERC Act 2006 provides guidance for the identification of lichen species and habitats for lichens which are of principle importance for the conservation of biodiversity in England. The Act also includes the duty to conserve biodiversity.

The National Planning & Policy Framework.

2.1.4. This policy provides guidance on the protection of biodiversity within the context of planning. Of particular note for lichens is the aim to prevent damage to irreplaceable biodiversity – an example of how this might apply to lichens would be the need to avoid significant damage to species that are reliant on habitats of long ecological continuity.

3 Methods

3.1 Desk Study

- 3.1.1. The Desk Study was carried out by an experienced lichenologist who is a member of the British Lichen Society (BLS). The Desk Study researched the following topics:
- Listing the status/categories that define what a lichen species of conservation interest is;
 - The geology of the Study Area;
 - Landscape and ecological history;
 - Air quality information;
 - Historical records for lichens from the Study Area and adjacent land; and
 - Identification of areas with potential for lichens of conservation interest.
- 3.1.2. The conservation interest status/category is that given in the JNCC Conservation Designations for UK Taxa (JNCC, 2020). The category of International Responsibility is that listed in Woods and Coppins (2012) with additional information given in Sanderson et al., (2018).
- 3.1.3. Geological data is from the British Geological Survey and is based on their 1:50,000 maps which can be found on the BGS website (www.bgs.ac.uk).
- 3.1.4. The study of the landscape and ecological history is based on examining historic maps and aerial/satellite imagery available online from various sources (for example the British Library). The purpose of the research into the ecological history of an area is to identify habitats with long ecological continuity as these have high potential for supporting lichen species of conservation interest.
- 3.1.5. Data on the most recent modelled levels of nutrient nitrogen deposition and concentrations of ammonia in the Study Area were obtained from the Air Pollution Information System (APIS) which can be found on the APIS website (www.apis.ac.uk).
- 3.1.6. Historical lichen records are those held by the British Lichen Society (BLS) and the Norfolk Biodiversity Partnership (NBP).
- 3.1.7. Areas with the potential for habitats that could support lichens of conservation interest were identified using the results from the Desk Study.

3.2 Field Survey

- 3.2.1. Four Survey Areas identified from the Desk Study were surveyed to identify suitable features and habitat for lichen. Features (for example old oak pollards) at these locations were surveyed and assessed for lichens of conservation interest (lichens of conservation interest are those identified Section 4.1 below). In addition to searching/assessing features for lichens of conservation interest, records of other lichen species were made to provide information on the character of the lichen flora present in the landscape of the proposed development. The position of the locations visited were made with a GPS Garmin 62s receiver. Specimens of material not identified in the field were collected for identification in the office.
- 3.2.2. A list of lichen species was compiled, with the relative abundance of the lichens estimated subjectively and recorded using a DAFOR scale. The scientific names for lichen species follow Cannon et al. (2021) and Smith et al. (2009). The names of plant species follow those in the New Flora of the British Isles (Stace, 2019).

3.3 Dates of Survey and Personnel

- 3.3.1. The Field Survey carried out on 21 September 2021, as well as the interpretation and evaluation of the lichen species, was undertaken by an experienced lichenologist who is a member of the British Lichen Society (BLS).

3.4 Notes and Limitations

- 3.4.1. Access to all locations had been arranged and therefore there were no constraints in this regard. The weather was dry on the day of the field survey and there had been no significant rain for the days before and so there was no constraint to surveying lichens in the field.

4 Results

4.1 Desk Study

Defining Lichens of Conservation Interest

- 4.1.1. Lichens of conservation interest are species that are recorded in one or more of the following categories:
- National threat;
 - National rarity;
 - International responsibility;
 - Habitat quality and ecological continuity: Southern Oceanic Woodland Indicator species;
 - Species of Principal Importance for the Conservation of Biodiversity in England;
 - Species covered under the Wildlife & Countryside Act 1981 (as amended) - Section 13/Schedule 8; and
 - Lichens of potential conservation interest in Norfolk.
- 4.1.2. Additional information and definitions of these categories are listed below.

National Rarity

National Rarity covers two categories: Nationally Rare (NR) and Nationally Scarce (NS) and is based on the number of 10km grid squares in Britain in which the species is found. Species found in 1-15 10km squares are classed as Nationally Rare (NR), and those in 16-100 10 km squares as Nationally Scarce (NS). National Rarity status is that given in Woods & Coppins (2012), also listed on the Conservation Designations for UK Taxa (JNCC, 2020).

International Responsibility

The evaluation of the British Lichen list in Woods & Coppins (2012) includes a category for those species for which Britain supports 10% or more of the global or European population – these species are referred to as International Responsibility (IR) species. Additional details about the International Responsibility lichens are given in Sanderson et al. (2018).

Habitat Quality and Ecological Continuity: the Southern Oceanic Woodland Index

- 4.1.3. The Southern Oceanic Woodland Index (SOWI) is a list of species that can be used to identify the quality and ecological importance of woodlands in the southern part of Britain. The Index is described in the Guidelines for the Selection of Sites of Special Scientific Interest for lichens and lichenicolous fungi (Sanderson et al., 2018) and also on the British Lichen Society website (<https://www.britishlichensociety.org.uk/about-lichens/indices-ecological-continuity-woodland-epiphytic-lichen-habitats>).
- 4.1.4. The Study Area lies within a peripheral zone of where the Southern Oceanic Woodland Index should be used for woodlands though it is close to the boundary of an area of Britain where past pollution has been so extensive that there are insufficient surviving lichen species for habitat quality assessment using the SOWI to work.

- 4.1.5. The SOWI is a list of 85 species and the threshold for woodlands for consideration as a site of national importance in Norfolk is 20. There is no guidance on what the threshold number of SOWI species should be for a Site of importance in Norfolk.

S41: Species of Principal Importance for the Conservation of Biodiversity in England

Species of Principal Importance for the Conservation of Biodiversity in England are those species listed under Section 41 of the NERC Act 2006. S41 status is that listed on the Conservation Designations for UK Taxa (JNCC, 2020).

Wildlife & Countryside Act 1981 As Amended

- 4.1.6. The Wildlife & Countryside Act 1981 (as amended) makes two provisions for the protection of lichens; one is the creation of Sites of Special Scientific Interest (SSSI) for lichens and the other is protection of certain species as set out under Section 13 of the Wildlife and Countryside Act with the list of species given under Schedule 8 of the Act. Schedule 8 status is that listed on the Conservation Designations for UK Taxa (JNCC, 2020).

Lichens of Conservation Interest in Norfolk

- 4.1.7. The Norfolk Biodiversity Partnership lists two lichens under its Species Recovery Plan which can be found on the website (<https://www.norfolkbiodiversity.org/habitats-and-species/fungus-2/>):
- *Buellia asterella* (Starry Breck Lichen), a terricolous species of open vegetation on sandy/gravelly soil in the Brecks), and
 - *Caloplaca luteoalba*, a species typically epiphytic on Elm. Neither of these species occur, or could occur, within the Study Area.
- 4.1.8. The Norfolk Red Data Book Online lists one species: *Lecania coerulescens*. This species is known from one churchyard in the county and is found on a stone window ledge. This species could not occur in the Study Area.
- 4.1.9. An annotated lichen flora for Norfolk by Peter Lambley (Lambley, 1989) has been published in the Norfolk and Norwich Naturalists' Society. This list provides information on the Norfolk lichen flora and the then relative abundance of species. Much has changed since that flora was published, including habitat loss, decline in sulphur dioxide levels, increase in nutrient nitrogen, changes in habitat management etc.
- 4.1.10. There are no published guidance/criteria for evaluating the county importance of lichens in Norfolk or for the selection of Norfolk County Wildlife Sites for lichens.
- 4.1.11. The British Lichen Society publishes distribution maps for all the British species. These maps allow a reader to see and interpret the distribution of lichens at the national, county, and local levels.

Geology

- 4.1.12. The bedrock of the Study Area is Chalk though it is almost wholly overlain with superficial deposits. The higher ground on the southwestern end of the Study Area has the Lowestoft Formation Diamicton (Boulder Clay) overlying the chalk though this is a relatively small area of the Study Area. Most of the Study Area is on the Sheringham Formation (Ice age sands and gravels) on lower ground than the Boulder Clay. A narrow, shallow valley (alongside Ringland Lane) has Head deposits and local bedrock exposure. A slightly larger valley south of Foxburrow Plantation has alluvium in it.
- 4.1.13. The underlying bedrock has been exploited locally through the digging of marl pits and some of these are present in the Study Area. Marl pits tend to be old features (possibly medieval) though with changing agricultural practices and sourcing of material, abandoned and probably no longer dug from the early-mid 19th century (Williamson, T., 2002). The rims of these pits can have old trees suitable for lichens and, if well-lit, bedrock (here chalk) is present, could provide habitat for terricolous lichens.
- 4.1.14. The superficial sand/gravels of the Sheringham Formation have been locally dug out leaving gravel pits, with Gravel Pit Plantation appearing to be the main area. These pits when abandoned and remaining as open habitat can support terricolous lichens (derived, generally, from acidic heath/acid grassland habitats).

Landscape and Ecological History

- 4.1.15. A brief overview of landscape and ecological history of the Study Area is presented in Table 4-1 below.

Table 4-1 - Summary of landscape and ecological history of the landscape of the Study Area

Map/Aerial	Date	Comment
Faden, W. A Topographical Map of the County of Norfolk	Surveyed 1790-1794. Published 1797	Not easy to interpret this map but it shows an agricultural landscape with settlements, green, lanes though enclosed and unenclosed agricultural land. Woodlands are sparse. Honingham Park is shown.
Ordnance Survey drawing (OSD) 2" to the mile	1817	Charles Budgen Draughtsman. Shows a landscape of agricultural land before being substantially planted up between 1817 and 1838. Habitats present include lanes, farmsteads/settlements, anciently enclosed lanes, unenclosed lanes, breck farming (presumed shifting arable), and pastures/meadows.
1 inch to the mile OS	Published 1 st January 1838	Based on the OSD though published 21 years after the OSD. Substantial changes from the

Map/Aerial	Date	Comment
		<p>OSD and Blackbreck, Gravel Pit, and Limekiln Plantations (the latter in the approximate location of what is today 'Long Plantation' shown, all indicating certain (former) types of landuse – Breck farming, local gravel extraction and marl pits for excavation of chalk (presumably burnt for lime).</p> <p>Buildings, farmsteads, settlements, and lanes are shown. Some lanes now shown as straightened and with boundaries indicating local enclosure.</p>
<p>Ordnance Survey Maps 25 inches and 6 inches to the mile</p>	<p>County series Surveyed/published 1880/1882 and first revision Surveyed/published 1905/1907</p>	<p>Details from the County Series show that many of the older lanes and hedge boundaries are depicted with high numbers of mature trees.</p> <p>Rough pastures (derived from the Breck farming) are present - and some of these continue through to at least the 1930s.</p> <p>Marl Pits and Gravel pits are shown. Marl pits tend to be old features in a landscape and can support old trees around the rim. Bare, well-lit ground in gravel pits is a habitat for terricolous lichens such as Cladonia species.</p> <p>The first revision shows the creation of a parkland south of Morton Hall</p>
<p>Land Utilisation Survey (LUS)</p>	<p>Sheet 66 1935 Sheet 67 1934</p>	<p>The Study Area is shown mostly with arable, pastures, woodland farmsteads, and lanes. Parkland with scattered trees over pasture is shown south of Merton Hall. The LUS shows areas of 'Heath, Moorland, Commons and rough pasture' in the Telegraph Hill area, adjacent to Gravel Pit Plantation and what is now Long Plantation. This latter habitat is on sand/gravel superficial deposits and would probably have had some type of acid grassland vegetation.</p>
<p>Aerial/Satellite imagery</p>	<p>1999 to 2020</p>	<p>Shows the intensive modern agricultural landscape with mostly arable fields and woodlands (most plantations). There appears to be no surviving pasture in the former Breck farming areas. The Parkland south of Morton Hall has ceased to exist, and its pastures converted to arable.</p>

- 4.1.16. The results of the research into the landscape/ecological history of the Study Area were used to identify locations and features for the lichen survey. Cross-referencing old maps with modern aerial/satellite imagery shows that there are old trees on old boundary lines (especially on historic parish boundaries, old lanes, and old hedgerows), old pits, and, possibly, from the historic 'breck' landscape.
- 4.1.17. This cross-referencing also showed that none of the distinct areas of 'Heath, Common land, Rough grazing' still present in the 1930's appears to have survived into modern times. Most of those areas are now arable lands with the remainder having been planted up. If any of this habitat had survived, it would be along less intensively used boundaries or, possibly, in glades/woodland edges.
- 4.1.18. The same cross-referencing showed that the small, parkland created at the end of the 19th century south of Morton Hall was no longer present and that most of its former area was now arable. Two trees seen on the modern aerial imagery could be relict parkland trees.

Air Quality Data

Modern Air Quality

- 4.1.19. Air quality data from APIS for a 5km x 5km square centred in approximately the centre of the Study Area gave the following three-year (2017 to 2019) averages: 38.36 Kg N/ha/year (deposition) and 2.66 µg m⁻³ ammonia (concentration). Actual depositions and concentrations will vary within the 5km square and will change according to agricultural practice (e.g., arable, pasture, pig rearing, etc).

Historic Air Quality

- 4.1.20. The Study Area will have been subject to historic, extremely high levels of sulphur dioxide until these began to decline from the 1970s onwards. Annual emissions of sulphur dioxide in 1970 were six and a half thousand, thousand tonnes and were one hundred and sixty three thousand tonnes in 2019, a fall of c. 97% (UK Gov, 2021).
- 4.1.21. In general, the east of the country was downwind of most of the sources of sulphur dioxide, which led to extensive acidification of habitats leading to many lichen species being eradicated from the landscape or, where some shelter was present, reduced to small, relict populations. In addition to the loss of species, the acidification provided condition for an 'acid-loving' lichen flora to establish on the habitats changed by the sulphur dioxide. With the substantial decline in sulphur dioxide levels, 'acid-loving' lichen species have declined but the bark of old trees appears to have been left acidified.

Historic Lichen Records

Data held by the British Lichen Society

- 4.1.22. The British Lichen Society provided historic lichen records from the two 10km squares that the Scheme lies within: TG11 and TG01. Almost all of the Scheme is in TG11 with only the southwestern edge extending into TG01. All use of the records in this report is with the permission of the British Lichen Society.
- 4.1.23. The British Lichen Society database holds not lichen records from within the Study Area.
- 4.1.24. Species records from locations just beyond the Study Area were also examined and considered for their potential to occur in the Study Area. Of these, one location – the woodland at Honingham Hall (the wood at Hall Hills c. TG1112 surveyed in 1975 by an experienced lichenologist) had records for two species of conservation interest:
- *Lecanographa lyncea*, recorded on Oak *Quercus robur*, and
 - *Ramonia chrysophaea* recorded on Elm *Ulmus carpinifolia*.
- 4.1.25. *Lecanographa lyncea* is on the Southern Oceanic Woodland Index (SOWI) and is an International Responsibility species. It is a species typically of dry bark on ancient (generally over 300 years) Oaks. Though no habitat directly equivalent to that in Honingham Hall woods was identified in the desk research for the Study Area, this species, and its associated species, was searched for on old trees sampled in the four Survey Areas.
- 4.1.26. *Ramonia chrysophaea*, has the following conservation status categories: Near Threatened species in Britain, International Responsibility, Nationally Scarce, and listed on Section 41 of the NERC 2006. It has now not been recorded in Norfolk for more than 20 years. *Ramonia chrysophaea* is a species occurring on spongy, base-rich bark on old trees (mostly Elm *Ulmus* spp. but also on Ash *Fraxinus excelsior*, Oak and Willow *Salix* spp.) exposed when moss mats peel off.

Data held by the Norfolk Biodiversity Partnership

- 4.1.27. Returns from the Norfolk Biodiversity Partnership data search list two lichen genera in two County Wildlife Sites:
- 2306 – Aves Gap - *Cladonia* and *Peltigera* lichens
 - 2304 – Gravel pit Plantation - *Cladonia* lichens.
- 4.1.28. Neither of these records appear to be in the BLS database. Both these genera are, mostly, ground-living (terricolous) species on acid sandy/gravelly soils. Habitat that could support these was looked for in the targeted Survey Areas, in particular the edge of Gravel Pit Plantation where it occurs in the Study Area.

Lichen Survey Areas

4.1.29. The information obtained from the Desk Study was used to sub-divide the Study Area into four Survey Areas for the lichen survey. The purpose of sub-dividing the Study Area into four Survey Areas was to cover a range of landscape/ecological history features. A summary description of the Survey Areas is provided below in Table 4-2 shown on the plan in Appendix A.

Table 4-2 - Summary of the four main lichen Survey Areas

Main Lichen Survey Areas	Location within Study Area	Features/habitats of potential interest
Area 1	Between The Broadway and Old Covert.	The potential habitats that could support lichen species of conservation interest here were identified as; old trees of hedges, boundaries, and farmland; marl pit with old trees and bedrock chalk exposure.
Area 2	Encompassing the ancient section of Breck Road (from c. TG110139 northwest towards Weston Green) and the Telegraph Hill area.	The potential habitats that could support lichen species of conservation interest here were old trees on ancient lanes and sandy/gravelly ground in the former breck farming area for terricolous lichens.
Area 3	Encompassing ancient landscape at Weston Green (old Green and old/ancient Lanes) and the former breck farming landscape (as depicted on the Ordnance Survey drawing) since enclosed and modernised.	The potential habitats that could support lichen species of conservation interest here were identified as; old trees of hedges, boundaries, and farmland; sandy/gravelly ground in the former breck farming area for terricolous lichens; and gravel pits for terricolous lichens (the western edge of Gravel Pit Plantation).
Area 4	This Area extends from Long Row Lane to the Wensum Valley and the northern slopes of the Wensum valley.	The potential habitats that could support lichen species of conservation interest here were identified as; old trees on boundaries; an old marl pit with potential for old trees; and potential relicts of a short-lived, modern parkland area south of Morton Hall.

4.2 Field Survey

Survey Areas covered and Sample Locations

- 4.2.1. The four Survey Areas described in Table 4-2 above were visited on 21 September 2021. A total of 30 locations with one or more features/habitats of potential interest within the four areas were surveyed for lichen species of conservation interest. The four Survey Areas and target noted survey locations are shown in Appendix A.
- 4.2.2. Descriptions of the features surveyed/assessed are provided below, with full results presented in Appendix B. Target Note numbers provided below and in Appendix A and Appendix B are prefixed with 'L' to indicate that they are Target Notes for the lichen survey. Each Target Note is correlated, where possible, with the relevant Tree (T)/Tree Group (LG)/Woodland (W)/Hedgerow (H) numbers as given in the Arboriculture Report (WSP UK Ltd, 2020) for consistency.
- 4.2.3. The relative abundance of a lichen species on a tree is a subjective estimate made by the surveyor and recorded using DAFOR scale (described in Section 3.2).

Lichen Survey Areas

Area 1: between The Broadway and Old Covert

Ancient Parish Boundary on The Broadway

- 4.2.4. This feature is 'old trees on an ancient parish boundary bank' that forms the northern edge of The Broadway and is the boundary between the historic parishes of Honingham and Weston. Old Oaks and Hornbeams *Carpinus betula* (L1670/LG57) are present on the parish boundary bank (see Photograph 1, Appendix C), though none supported lichen species of conservation interest. The Oaks are somewhat shaded to the south by woodland and scrub. Ivy is locally abundant and shading a lot of the trunks and boles. The lichen *Lecanora expallens* was rare here, recorded on the north side on one of the boundary oaks.

Modern Boundary and Lane between The Broadway and Foxburrow Plantation

- 4.2.5. This feature is shown as Target Note L1666 in Appendix A and is a relatively modern hedge lined track between The Broadway and Foxburrow Plantation. A moderately old Field Maple *Acer campestre* (TG1059813484) on this boundary supported a lichen assemblage of high nutrient conditions on its twigs and larger branches. Species present included *Xanthoria parietina*, *Physcia tenella*, and *Punctelia subrudecta sensu stricto*.

Old trees on the southern edge of Foxburrow Plantation

- 4.2.6. Historic maps show a few trees were once present along the southern edge of Foxburrow Plantation. No old trees were seen on the survey and no trees were identified in the Plantation to survey for lichens of conservation interest.

Relicts of ancient features in the landscape between Foxburrow Plantation and Old Covert

- 4.2.7. The landscape between Foxburrow Plantation and Old Covert includes some ancient boundaries amongst more recent, straight boundaries.
- 4.2.8. Two trees with the potential to support lichens of conservation interest were surveyed here: one was an ancient, large Oak coppice stool at TG 10515 13361 (L1667/T49) and the other was an ancient Oak pollard at TG1047113249 (L1668/T45) on an ancient boundary line that no longer has a hedgerow, leaving the pollard as a field tree (see Photograph 2, Appendix C).
- 4.2.9. The oak stool, possibly the oldest tree seen on the survey, is either the last relict of a former area of coppice woodland or the last remains of an ancient boundary (see Barnes and Williamson, 2011 for information on coppicing in hedgerows) that has no other surviving features. The stool of this tree had sparse lichen cover though one of the most diverse noted on the survey though none were of conservation interest. Species here include: *Amandinea punctata* (Rare), *Lecidella elaechroma*, (Rare), *Diarthonis spadicea* (Rare), *Xanthoria parietina* (Rare), *Physcia cf tenella* (Frequent), *Parmotrema perlata* (Rare).
- 4.2.10. The large, old Oak pollard on the edge of the southern bank of the Foxburrow stream valley may be a relic of a boundary that once divided the valley to the north from the higher ground to the south. Lichen diversity on this tree was extremely low and those present are characteristic of nutrient enriched old bark: *Pachnolepia pruinata*, *Amandinea punctata* and *Diploica canescens*. The exposed lignum was searched for lichens though none were recorded.

Modern hedgerow with Hawthorn, Ash and Elder

- 4.2.11. Target Note L1669 (T30 and H32). A straight line, recent boundary with a Hawthorn *Crataegus monogyna* hedgerow that includes Ash and Elder *Sambucus nigra* with arable land use on both sides of the hedgerow. A well-lit Ash tree consisting of a coppiced stool with poles at c. TG1015213152) (see Photograph 3, Appendix C) had *Xanthoria parietina* (Abundant) and *Physcia tenella* (Abundant) indicative of high nutrient deposition. These species were also present and abundant on other species in the hedgerow, especially twigs and well-lit stems of Hawthorn. Other species recorded from this habitat were *Lecidella elaechroma* and *Lecanora chlorotera* on the Ash and a young, infertile *Ramalina* sp. (probably *Ramalina fastigiata*) on an Elder.

Old marl pit

- 4.2.12. The features at Target Note L1669a is old trees on the banks of an old marl pit (Grid reference at TG09971293) (see Photograph 4, Appendix C). The pit has old Ash, Maple, and Oak around its rim (which includes T21 and T22). The side of the trees facing the arable fields are exposed to nutrient pollution and the side of the trees facing into the pit are shaded. Lichens were sparse on these trees, and none supported any lichens of conservation interest.

Old Covert wood

- 4.2.13. The edge of Old Covert wood (W10) was checked (for example at TG099130) for old boundary trees though none were present. The interior of the woodland is mostly relatively young trees including Sweet Chestnut *Castanea sativa*. The area examined did not have habitat that would support lichens species of conservation interest.

Area 2: Breck Road and Telegraph Hill

An ancient lane – Breck Road

- 4.2.14. Breck Road between Weston Green and Windmill Hill has two quite different sections. The north-western section (from c. TG11041396 running c. northwest back to Weston Green) is a curving, sinuous old, probably ancient, lane with post-mature trees including old oak pollards. The south-eastern section (from c. TG11041396 southeast to Windmill Hill) is a modern straight line, enclosure lane and has no old trees.
- 4.2.15. Seven Oaks and one Ash were examined in the north-western section from Target Note L1671a to L1671d (the Ash). These trees are equivalent to Trees T62, T64, T68, T67 (the Ash), T73, G78 (two Oaks) and T80.
- 4.2.16. The old pollard Oaks on Breck Lane are mostly shaded by Ivy *Hedera helix* and/or dense lower growth leading to shade on the boles and limited space for lichens to grow (see Photograph 5, Appendix C). The adjacent land use is intensive arable leaving the old oaks exposed to high nutrient levels. Better lit areas of the boles of one of these Oaks (L1671c/T68) had *Diploica canescens*, a species of nutrient-enriched bark, and no other lichens recorded.

Breck Road (southeastern end) – former breck landscape

- 4.2.17. The plot of former open ground/pasture at the south-eastern end of Breck Road (Target Note 1671i - in parts of TG113137 and TG113136) was examined for the possibility of open, sandy, gravelly ground capable of supporting terricolous lichens (for example *Cladonia* and *Peltigera* species). Most of the former open ground/pasture in this area is now dense bracken *Pteridium aquilinum*, scrub and young trees with no suitable terricolous habitat present.

Area 3: Weston Lane to Gravel Pit Plantation

Old trees on ancient lane: Weston Lane

- 4.2.18. Four old oak pollards on the eastern bank of Weston Lane, an ancient lane on boulder clay. The trees here are at L1672/T108, L1673/T112 (see Photograph 6, Appendix C), L1673a/T114, and L1674/ T124 (see Photograph 7, Appendix C). The section of Weston Lane here is on Boulder Clay and trees here may have had a different land-use/ecological history compared to those on the Sheringham Formation (sandy/gravelly terrain) to the southeast.
- 4.2.19. Of these old oak trees, the Oak at L1673 is an exceptionally large ancient pollard. Most of the bole area on these trees has ivy or dense low growth. Lichens recorded here include *Pachnolepia pruinata* and *Diploica canescens*, both indicative of high nutrient levels. Though these are old trees, no species of conservation interest were recorded.

- 4.2.20. In a less unpolluted landscape (past and modern), trees such as these would have supported a range of lichens, possibly species of conservation interest, but now are devoid of them. These trees have been affected by historic sulphur dioxide pollution, probably ongoing acidified bark, modern high nutrient levels (land to the east of the boundary is modern arable) and the locally dominant, dense shade cast by ivy.
- 4.2.21. An ancient lane, no longer used for traffic, leading approximately east off the Green has old trees (for example an old oak at L1680/T127) on its boundary bank, though as with the trees described above, these have abundant ivy and have no lichens of conservation interest.

Straight-line Boundary with Hedge

- 4.2.22. This boundary is a bank and ditch, with a derelict hedgerow, extending northwest from Gravel Pit Plantation (centre of hedgerow at TG12081448). Most of the hedgerow is young hawthorn, though three older trees are present – an Ash stool (L1675/ T185) (see Photograph 8, Appendix C), an oak pollard (L1675a/LG191), and an Oak stub (L1676/T199) – a stub being a tree cut at a height between that of a coppice and a pollard (see Photograph 9, Appendix C). The boundary lies between arable fields and will be exposed to elevated levels of nutrient deposition, possibly also locally high concentrations of ammonia. The well-lit trees and twigs in this area support a lichen assemblage typical of high nutrient nitrogen deposition. No species of conservation interest recorded in this hedgerow habitat, including on the three older trees.

Former breck landscape and Gravel Pit Plantation

- 4.2.23. This area was part of the old breck farming landscape though has since been enclosed. The gravel pit (centre of pit at c. TG12211444) on the north-western side of Gravel Pit Plantation is under woodland (including young Sycamore and Oak) and there are no terricolous (e.g., *Cladonia* species) present here. A young Ash (L1678/G213) on the boundary had the lichen *Phlyctis argena*.
- 4.2.24. A large, old Oak pollard (L1677/T208) is present at TG 12166 14428. This tree may have been a field tree when this area was part of a breck farming system or on a boundary, now lost, in that landscape. As with others inspected elsewhere on this survey, few lichen species were present and those recorded – *Diploica canescens* (abundant at the base of the bole) and *Amandinea punctata* (occasional on bole) are indicative of high nutrient deposition and are not of conservation interest. A small amount of *Opegrapha cf vulgata* in poor condition was present on the southern side of the bole.

Area 4: from Ringland Lane to Rose Carr

Old lane with old pollard Oak

- 4.2.25. An ancient pollard oak (L1681/T230) on the south side of an old lane (see Photograph 10, Appendix C). The lane, leading to Morton Hall, is shown on Faden's 1797 Map of Norfolk but may be older as there has been a house at the Morton Hall location since the 1500s. As with all the other old, historic large boundary pollards in this landscape, the lichen flora on this tree is sparse. Species recorded here were *Pachnolepia pruinata*, *Amandinea punctata* and *Diploica canescens*, the nutrient rich assemblage on old dry bark. No species of conservation interest were recorded on this tree.

Former modern parkland area south of Morton Hall

- 4.2.26. An area of short-lived, modern parkland used to be present south of Morton Hall between Long Plantation and Spring Wood. Of this former parkland, nothing is left except two trees: one a Copper Beech *Fagus sylvatica* and the other a Common Lime *Tilia x europea* (L1682). Both are now within modern arable landscapes and neither supports any species of conservation interest.

Old boundary trees

- 4.2.27. A relatively young oak stub (L1683) was recorded at TG 13224 15373 on a bank (a possible lynchet) offset a short distance from the eastern tip of Spring Hill wood (see Photograph 11, Appendix C). This tree has a sparse lichen flora with occasional *Pachnolepia pruinata* and *Diploica canescens* and a small patch of *Pertusaria hymenea*.

Old boundary trees in Marl Pit and Rose Carr

- 4.2.28. An old Marl pit (at c. TG13291540) on the northern edge of Rose Carr was examined for old tree habitat and lichens of conservation interest. The marl pit is now woodland and scrub and mostly a shaded habitat. An old Walnut *Juglans regia* (L1684) on the western bank of the pit had *Opegrapha vulgata* locally abundant on the bark where ivy was absent. No lichens of conservation interest were recorded in the marl pit.
- 4.2.29. The upper slopes of Rose Carr support a dry woodland with mostly young growth and a high forest structure. No habitats with lichens of conservation interest were noted.

Boundary Oak tree in Spring Wood

- 4.2.30. A maiden Oak (L1685) of moderate age occurs on the southern side of a woodland track in Spring Wood. This oak is older than the surrounding woodland though it is in shade, as are almost all the trees in this woodland, and supported no lichen species of conservation interest.

Lichen Species Recorded in Survey Areas 1 to 4

4.2.31. A total of 22 lichen species were recorded across the four Survey Areas. All species were recorded on the bark of trees and shrubs, with no terricolous species recorded. The list of lichen species recorded is given in Table 4-3 below.

Table 4-3 - Lichen Species Recorded from the Four Survey Areas.

Lichen Species	Relative abundance (DAFOR scale)	Tree and shrub species lichen recorded on
<i>Amandinea punctata</i>	Occasional – a few individuals	Pedunculate Oak <i>Quercus robur</i>
<i>Cladonia coniocraea</i>	Rare – one or two individuals	Pedunculate Oak <i>Quercus robur</i>
<i>Diarthonis spadicea</i>	Rare – one or two individuals	Pedunculate Oak <i>Quercus robur</i>
<i>Diploica canescens</i>	Frequent – scattered individuals	Pedunculate Oak <i>Quercus robur</i> Ash <i>Fraxinus excelsior</i>
<i>Lecanora chlarotera</i>	Rare – one or two individuals	Ash <i>Fraxinus excelsior</i>
<i>Lecanora expallens</i>	Rare – one or two individuals	Pedunculate Oak <i>Quercus robur</i>
<i>Lecidella elaeochroma</i>	Occasional – a few individuals	Ash <i>Fraxinus excelsior</i> Pedunculate Oak <i>Quercus robur</i> Hawthorn <i>Crataegus monogyna</i>
<i>Lepraria sp.</i>	Rare – one or two individuals	Pedunculate Oak <i>Quercus robur</i>
<i>Melanelixia glabratula</i>	Rare – one or two individuals	Maple <i>Acer campestre</i>
<i>Opegrapha vulgata</i>	Rare – one or two individuals	Pedunculate Oak <i>Quercus robur</i> Walnut <i>Juglans regia</i>
<i>Pachnolepia pruinata</i>	Abundent – many individuals	Pedunculate Oak <i>Quercus robur</i>
<i>Parmelia perlata</i>	Rare – one or two individuals	Pedunculate Oak <i>Quercus robur</i> Maple <i>Acer campestre</i>
<i>Parmelia sulcata</i>	Rare – one or two individuals	Maple <i>Acer campestre</i>
<i>Pertusaria hymenea</i>	Rare – one or two individuals	Pedunculate Oak <i>Quercus robur</i>
<i>Phlyctis argena</i>	Rare – one or two individuals	Ash <i>Fraxinus excelsior</i>
<i>Physcia adscendens</i>	Frequent – scattered individuals Abundent – many individuals	Ash <i>Fraxinus excelsior</i> Maple <i>Acer campestre</i>
<i>Physcia tenella</i>	Frequent – scattered individuals Abundent – many individuals	Pedunculate Oak <i>Quercus robur</i> Pedunculate Oak <i>Quercus robur</i> Maple <i>Acer campestre</i> Hawthorn <i>Crataegus monogyna</i> Elder <i>Sambucus nigra</i>

Lichen Species	Relative abundance (DAFOR scale)	Tree and shrub species lichen recorded on
<i>Physconia grisea</i>	Rare – one or two individuals	Ash <i>Fraxinus excelsior</i>
<i>Punctelia subrudecta</i> s. str.	Occasional – a few individuals	Ash <i>Fraxinus excelsior</i> Maple <i>Acer campestre</i>
<i>Ramalina cf fastigiata</i>	Rare – one or two individuals	Elder <i>Sambucus nigra</i>
<i>Scolociosporum chlorococcum</i>	Occasional – a few individuals	Maple <i>Acer campestre</i>
<i>Xanthoria parietina</i>	Abundent – many individuals	Ash <i>Fraxinus excelsior</i> Maple <i>Acer campestre</i>

Lichen Species of Conservation Interest in Survey Areas 1 to 4

4.2.32. The survey carried out for this report was based on sampling lichen habitats (ranging, for example, from ancient oak pollards on ancient boundaries through to young Elder in a modern hedgerow) at 30 locations in four Survey Areas. No lichen species of conservation interest were found. It is therefore considered very unlikely that the Study Area supports any lichen species of conservation importance. A summary of the results for the various conservation interest status/categories is provided in

Table 4-4 - Summary of Results of Survey for lichen species of Conservation Interest in the Four Targeted Survey Areas.

Conservation Interest Category	Comment
Red List Threat for Britain	No Red List species were recorded
Nationally Rare/Scarce	No NR/NS species were recorded
International Responsibility Species	No IR species were recorded
Habitat Quality Species: SOWI	No Habitat Quality Indicator species were recorded
NERC Act 2006 Section 41 Species of principle importance for the conservation of biodiversity in England	No Section 41 species were recorded
Schedule 8 of the Wildlife & Countryside Act 1981 as amended	No Schedule 8 species were recorded

Lichen Communities

4.2.33. Two lichen communities (based on descriptions in James et al., 1977) were identified subjectively in the field based on the observations of the lichen species recorded on trees and shrubs.

4.2.34. One of the communities is a species-poor community dominated by *Xanthoria parietina* and *Physcia* species on well-lit, nutrient-enriched, or hyper-trophicated bark. This community is part of the ***Xanthorion parietinae*** Association (James et al., 1977).

- 4.2.35. The other community, also a species-poor community, typically is on the dry bark of older Oaks and has *Amandinea punctata* and *Pachnolepia pruinata*, with *Diploica canescens* locally prominent. This community appears here to be a very species poor variant of the ***Arthonietum impolitae*** association and is indicative of high nutrient levels.
- 4.2.36. Neither of these lichen communities as they occur in the Study Area are of significant conservation interest.

4.3 Evaluation of Lichen Flora within the Study Area

Review of Lichen Habitats and Factors Affecting Lichens

- 4.3.1. The most important habitat that could have supported lichens of conservation interest in the four Survey Areas are the old oak trees, most notably the old oak pollards and stubs. These trees, based on their size and historic management as pollards and stubs, are likely to be remnants of an early modern (i.e., pre-1800) landscape (see for example Barnes and Williamson, 2011). Almost all are associated with old, mostly ancient, boundaries, with one possibly an old breck field tree. None of the old trees appear to be relicts of pasture woodland habitat.
- 4.3.2. All the old oaks will have been exposed to the increasing acidification from sulphur dioxide associated with industrial development until its high point in the 1970s. This sustained exposure to sulphur dioxide will have eradicated most of their lichen species. Sulphur dioxide levels have fallen c. 97% since the 1970s and the associated acidification almost eliminated. Though levels have fallen, the consequence of the historic acidification has, however, left a habitat (oak trees) with few lichen species and with what appears to be acidified bark.
- 4.3.3. In the time that the decline in acidification from sulphur dioxide has taken place, there has been an increase in nutrient nitrogen in the Study Areas to levels and concentrations high enough to have some effect on what species recolonise and occupy this landscape. Many of the species returning to the landscape are those that can tolerate and/or thrive on high nutrient levels, and these species are, in general, not of conservation significance.
- 4.3.4. Two other noticeable aspects of this landscape have, or are having, a negative impact on the lichen flora in this area; one is the historical loss of Elm, which removed a tree species that could support lichen species of conservation interest, and the other is the ever-increasing abundance of ivy *Hedera helix*, which grows over lichen habitats on the trunk and shades the trunk. Lichens cannot grow or thrive under the shade of the ivy and abundant ivy on a tree can shade out all lichens.

Species of Conservation Interest

- 4.3.5. Given the historic extremely high levels of acidification from sulphur dioxide, the modern high levels of nutrient nitrogen, the absence of habitats with ecological continuity, and the limited range of habitats (here it is only field and boundary trees in an agricultural landscape) with the potential to support lichen species of conservation importance, it is very unlikely that any significant lichen species of conservation importance are present in the four Survey Areas.

Other Lichen Species

- 4.3.6. The 22 lichen species recorded in the four Survey Areas are all species that have no formal national conservation status.
- 4.3.7. None of the 22 lichen species recorded have a formal lichen conservation status in Norfolk. All, with the exception of *Pertusaria hymenea*, discussed below, are common and widespread in Norfolk.
- 4.3.8. A small thallus of *Pertusaria hymenea* was recorded on one Oak just east of Spring Hills wood (L1683) in what was otherwise a very species-poor lichen community/assemblage. Other species recorded were *Pachnolepia pruinata* and *Diploica canescens*, typical of dry bark and nutrient enriched habitat. *Pertusaria hymenea* is a species that has a restricted distribution in Norfolk. The presence here of a small thallus indicates that this may be a recent colonisation rather than an individual that has survived the worst of the sulphur dioxide acidification in the 1970s. The presence here is probably of significance within the Study Area of the proposed scheme.
- 4.3.9. Further, detailed, field work would certainly find other lichen species, though these would most likely be common and widespread species or those recolonising this landscape.

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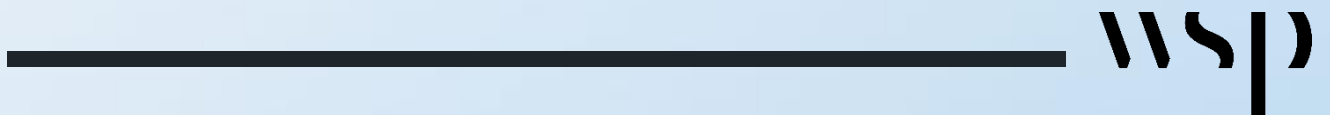
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Appendix A

Lichen Survey Areas and Sampling Locations



Appendix B

Survey Results

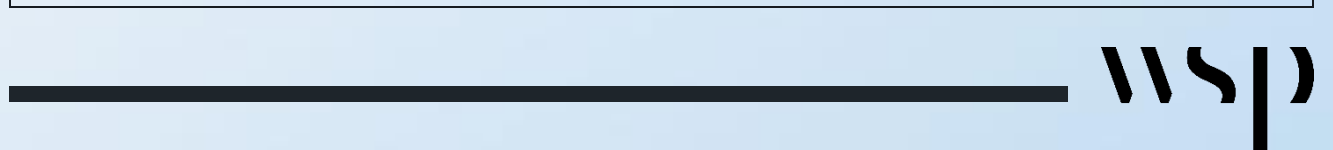


Table B-1 - Survey Results

Lichen Target Note No.	Tree No.	Survey Area	Landscape Feature	Tree	Lichen Survey Note
1666	Not listed	1	Hedgerow/Boundary trees	Old field maple on straightline (not ancient) boundary.	Nutrient enriched with <i>Xanthoria parietina</i> , <i>Physcia tenella</i> , <i>P. adscendens</i> , <i>Punctelia subrudecta</i> s.str. and <i>Parmelia sulcata</i> .
1667	T49	1	Field trees in old landscape pattern	Ancient oak stool	In herb-poor permanent pasture. Locally high nitrogen levels. A few lichens present though locally shaded by Bramble
1668	T45	1	Field trees in old landscape pattern	Ancient pollard Oak	Nutrient enriched. <i>Diploica canescens</i> and possibly some poor material of <i>Lecanora expallens</i>
1669	T30 (and H32)	1	Modern hedgerows/ boundaries	Twigs and trunks of young Ash stool, Hawthorn and Elder.	Nutrient-enriched community with <i>Xanthoria</i> and <i>Physcia tenella</i> abundant on well-lit trunks and twigs. Also present on Ash: <i>Lecanora chlorotera</i> and <i>Lecidella elaechroma</i> . A small, stunted piece of <i>Ramalina</i> - infertile, not sorediate with relatively broad thalli - is cf <i>fastigiata</i> was recorded on Elder.
1669a	Includes T21 (Oak), T22 (Oak) (and part of LG25)	1	Marl pit: old landscape feature with trees on bank and rim	Oaks and Ash.	Shaded habitat and few lichens present on Oak, Ash and Maple trees around rim. Small amounts of <i>Phlyctis argena</i> and <i>Opegrapha vulgata</i> recorded on one Ash.
1670	Part of LG57 (Oak and Hornbeam)	1	Ancient boundary (historic parish boundary)	Old Oak and Hornbeam trees on boundary bank.	Oak and Hornbeam present. Nutrient enriched landscape. Shaded on southern side. Ivy locally abundant to dominant on trees. <i>Lecanora expallens</i> on Oak.

Lichen Target Note No.	Tree No.	Survey Area	Landscape Feature	Tree	Lichen Survey Note
1671a	T62	2	Old Trees on ancient lane.	Old pollard Oak. Crown die-back	Abundant ivy and lower growth. No lichens
1671b	T64	2	Old Trees on ancient lane.	Old pollard Oak	Abundant ivy and lower growth. No lichens
1671c	T68	2	Old Trees on ancient lane.	Old pollard Oak	Adjacent to arable and nutrient enriched. Ivy abundant and dominant. <i>Diploica canescens</i> at base of Oak at TG 10940 14031
1671d	T67	2	Old Trees on ancient lane.	Ash within dense Ivy and Honeysuckle. Form and age of tree unknown	Abundant ivy and lower growth. No lichens
1671e	T73	2	Old Trees on ancient lane.	Old pollard Oak	Abundant ivy and lower growth. No lichens
1671f	G78	2	Old Trees on ancient lane.	Old pollard Oak	Abundant ivy and lower growth. No lichens
1671g	G78	2	Old Trees on ancient lane.	Old pollard Oak	Abundant ivy and lower growth. No lichens
1671h	T80	2	Old Trees on ancient lane.	Old pollard Oak	Abundant ivy and lower growth. No lichens
1671i	Area adjacent/east of W100	2	Former breck field/rough grazing	n/a	Now is woodland with locally dense bracken, or arable. No terricolous lichens present
1672	T108	3	Old Trees on ancient lane.	Old Oak pollard	<i>Pachnolepia pruinata</i> on trunk
1673	T112	3	Old Trees on ancient lane.	Huge, ancient oak pollard	Ivy dominant in lower part. <i>Diploica canescens</i> locally abundant at base of tree.

Lichen Target Note No.	Tree No.	Survey Area	Landscape Feature	Tree	Lichen Survey Note
1673a	T114	3	Old Trees on ancient lane.	Old Oak pollard	Covered in Ivy. No lichens noted.
1674	T124	3	Old Trees on ancient lane.	Post-mature Oak pollard	Covered in Ivy. No lichens noted.
1675	T185	3	Boundary hedgerow trees	Ash – old coppice stool	Adjacent to arable. High nutrient status. <i>Xanthoria parietina</i> is dominant on the raised stool and <i>Physconia grisea</i> is rare.
1675a	LG191	Survey Area 3	Boundary hedgerow trees	Pollard Oak	Adjacent to arable. No lichens.
1676	T199	Survey Area 3	Boundary. hedgerow trees	Post-mature Oak stub	<i>Diploica canescens</i> rare at base.
1677	T206	Survey Area 3	Gravel Pit landscape	Large, old pollard Oak.	Lichen cover sparse on the bole of the tree where <i>Diploica canescens</i> is locally abundant at the base and <i>Amandinea punctata</i> is occasional higher up the bole. <i>Opegrapha cf vulgata</i> is occasional on the southern side but in poor condition
1678	Part of G213	Survey Area 3	Gravel Pit landscape	Plantation and self-sown young trees.	No terricolous habitat present in old gravel pit. A young Ash on the northern edge of the pit had occasional <i>Phlyctis</i> .
1680	T127	Survey Area 3	Ancient Lane trees	Post-mature boundary Oak	Old oak on ancient lane. Dense Ivy
1681	T230	Survey Area 4	Ancient Lane trees	Ancient Oak pollard	Lichens recorded: <i>Pachnolepia pruinata</i> F, <i>Diploica canescens</i> A, <i>Amandinea punctata</i> O, <i>Opegrapha cf vulgata</i> R

Lichen Target Note No.	Tree No.	Survey Area	Landscape Feature	Tree	Lichen Survey Note
1682	Not Listed	Survey Area 4	Modern parkland tree	European Lime	No lichens present.
1683.	Not listed	Survey Area 4	Old Boundary	Pollard Oak	Lichens recorded: <i>Pachnolepia pruinata</i> F, <i>Diploica canescens</i> A and a small patch of <i>Pertusaria hymenea</i>
1684	Not listed	Survey Area 4	Marl Pit	Walnut	Old walnut on the rim of the pit. Shaded by surrounding woodland and with locally dominant ivy on the tree. Bare trunk area with <i>Opegrapha vulgata</i> .
1685	Not listed	4	Woodland	Oak	Maiden Oak by track. Shaded. No lichens of conservation importance and only <i>Lepraria</i> sp. noted

Table B-2 – Correlation between lichen survey Target Note locations, reference number and WSP arboriculture report

Lichen Survey Grid Ref	Lichen Survey Target Note Ref	WSP Arboriculture Report Tree Number	Landscape Feature
TG 10598 13484	L1666	Not listed	Hedgerow/Boundary trees
TG 10515 13361	L1667	T49	Field trees in old landscape pattern
TG 10471 13249	L1668	T45	Field trees in old landscape pattern
TG 10152 13152	L1669	T30 (and H32)	Modern hedgerows/boundaries
TG 09970 12920	L1669a	Includes T21 (Oak), T22 (Oak) (and part of LG25)	Old landscape feature.
TG 10816 13798	L1670	Part of LG57 (Oak and Hornbeam)	Ancient boundary (historic parish boundary)



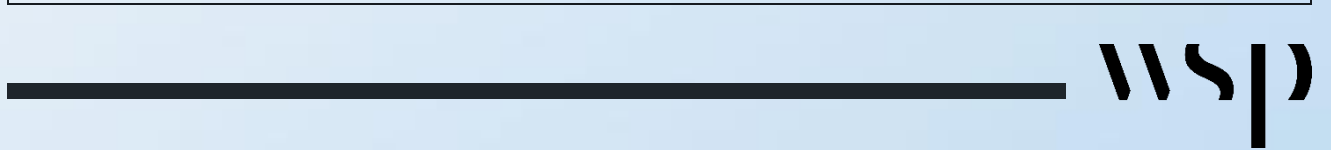
Lichen Survey Grid Ref	Lichen Survey Target Note Ref	WSP Arboriculture Report Tree Number	Landscape Feature
TG 10900 14057	L1671a	T62	Old Trees on ancient lane.
TG 10917 14042	L1671b	T64	Old Trees on ancient lane.
TG 10940 14071	L1671c	T68	Old Trees on ancient lane.
TG 10949 14022	L1671d	T67	Old Trees on ancient lane.
TG 10972 13998	L1671e	T73	Old Trees on ancient lane.
TG 11000 13978	L1671f	G78	Old Trees on ancient lane.
TG 11009 13974	L1671g	G78	Old Trees on ancient lane.
TG 11039 13958	L1671h	T80	Old Trees on ancient lane.
TG 11381 13690	L1671i	Area adjacent/east of W100	Terricolous habitat/former Breck
TG 11521 14581	L1672	T108	Old Trees on ancient lane.
TG 11527 14562	L1673	T112	Old Trees on ancient lane.
TG 11538 14536	L1673a	T114	Old Trees on ancient lane.
TG 11567 14475	L1674	T124	Old Trees on ancient lane.
TG 11982 14565	L1675	T185	Hedgerow trees and shrubs
TG 12021 14541	L1675a	LG191	Hedgerow trees and shrubs
TG 12114 14473	L1676	T199	Hedgerow trees and shrubs
TG 12166 14428	L1677	T206	Field/old boundary tree



Lichen Survey Grid Ref	Lichen Survey Target Note Ref	WSP Arboriculture Report Tree Number	Landscape Feature
TG 12189 14465	L1678	Part of G213	Gravel Pit landscape. Woodland/Plantation
TG 11580 14616	L1680	T127	Ancient Lane trees
TG 12402 15286	L1681	T230	Ancient Lane trees
TG 12836 15339	L1682	Not Listed	Modern parkland tree
TG 13224 15373	L1683	Not listed	Boundary bank/possible lynchet
TG13281540	L1684	Not listed	Marl Pit. Bankside trees
TG 12978 15422	L1685	Not listed	Mature maiden oak in woodland

Appendix C

Photographs



Photograph 1: L1670 (LG57) Oak tree (c.TG 1081 1379) on the historic parish boundary along the northern edge of The Broadway. The lichen cover on these trees was sparse. *Lecanora expallens* was the only lichen present on the bole of the oak on the right side of the photo.



Photograph 2: Ancient pollard Oak at TG 10471 13249 (L1668/T45). Extremely poor in lichen species with those present on the bole being characteristic of old, dry bark in nutrient enriched conditions: *Pachnolepia pruinata*, *Amandinea punctata* and *Diploica canescens*.



Photograph 3: Ash at Target Note L1669/WSPT30 (Grid reference c. TG 10152 13152) in recent boundary line hedgerow. The well-lit poles support abundant *Xanthoria parietina* (yellow lichen) indicating high nitrogen levels.



Photograph 4: Target Note L1669a. An old Ash on the bank of the old marl pit. Most trees here have few lichens and probably is too shady for mobile colonisers such as *Xanthoria parietina*. The old Ash in the centre right of the image had a few small thalli of *Phlyctis argena*.



Photograph 5: Old trees on Breck Road. Nearest tree on the right of the road is an old pollard Oak (L1671b/T64), the further tree on the right of the road is also an old pollard oak (L1671c/T68). The tree to the left of L1671c is an ash covered in ivy (L1671d/T67). The photo is looking southeast from approximately TG10911405. The boles of these old pollards have abundant ivy, which covers the bark and creates too much shade for lichens to grow. The lichen *Diploica canescens* is present, indicating high nutrient levels from adjacent arable land use.



Photograph 6: Ancient oak pollard (L1673/T112) on the eastern bank of Weston Lane. The bole of the tree is covered in ivy thereby shading out lichens.



Photograph 7: large, old pollard oak (L173a/T114) on Weston Lane, with L1674/T124 in the far distance. No lichens are present on this tree largely because of the dense shade cast by the Ivy as well as the shade from the ground vegetation/scrub.



Photograph 8: Ash stool (L1675/T185) in hedgerow. The well-lit poles and stool support abundant *Xanthoria parietina* (yellow lichen) indicative of high nutrient nitrogen levels. A few other species are present here that either thrive in high nutrient levels, for example *Physcia* spp. or tolerate them, for example *Lecidella elaeochroma*.



Photograph 9: old Oak stub (L1676/T199) in hedgerow between two arable fields. The bark habitat here is being affected by high nutrient levels and shade from the ivy. *Diploica canescens*, a species characteristic of high nitrogen levels is the only lichen present on this tree.



Photograph 10: Large, historic old Oak pollard (L1681/T230) on the south side of an old lane leading to Morton Hall. Despite its age and size – it has a girth of nearly six metres (5.84m) - this tree supports a sparse lichen flora, with the most prominent being *Pachnolepia pruinata*, *Amandinea punctata* and *Diploica canescens* – characteristic of old, dry bark in high nutrient conditions.



Photograph 11: Boundary oak stub (L1683) at TG 13224 15373. This tree has a sparse lichen flora with *Pachnolepia pruinata* and *Diploica canescens* occasional and a small patch of *Pertusaria hymenea*.



Appendix A - Lichen Survey Areas and Sampling Locations





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