Guildford Borough Council: Tyting Farm

Biodiversity Net Gain – Baseline Report and Feasibility Study

On behalf of **Guildford Borough Council**

Project Ref: 322511267 | Rev: A | Date: October 2022

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Executive Summary

Stantec was commissioned by Guildford Borough Council (GBC) to determine the baseline biodiversity value of the 45.9ha GBC-owned Tyting Farm ('Site') and to provide a feasibility study with respect to the opportunities available for uplift in biodiversity value of the Site. The uplift in value has the potential to be used as a 'Mitigation Bank' for proposed development projects within Guildford Borough. This study has been undertaken in anticipation of future Biodiversity Net Gain off-set requirements, under forthcoming national and local policy and legislative frameworks for Biodiversity Net Gain delivery through development.

This report confirms the baseline ecological value of the Site, determined through a desk study, soil sampling and analysis, and ecological survey. The baseline biodiversity value of the Site was calculated using Defra's Biodiversity Metric 3.1 tool (Panks *et al*., 2022). The feasibility of habitat creation and enhancement was determined using this baseline, informed by practical management considerations, site context in relation to linkages to surrounding habitats, and current site management.

The proposed habitat creation and enhancements determined feasible for the Site sought to 'dove-tail' with the wider strategic nature recovery context at the Parish, County and wider levels (Biodiversity Opportunity Area ND02: North Downs Scarp & Dip; Guildford to the Mole Gap, Surrey Nature Partnership, 2019). This includes, in the case of the Site, consideration of linkages with nearby sites such as St Martha's Hill and Newlands Corner, as well as consideration of the landscape character and heritage of the area.

The potential Biodiversity Units that would be delivered by the proposed habitat creation and enhancement changes described in this report were calculated using the Biodiversity Metric 3.1 tool, based on a 30-year timeframe, to match the anticipated timeframe for a Biodiversity Net Gain Plan for the Site. The proposed target habitat type and condition have also been set in the Biodiversity Metric 3.1 calculation for the Site, taking account of this timeframe and a precautionary approach to setting target habitat condition, especially for habitats of higher distinctiveness.

The Biodiversity Metric outcome determined that, based on the proposals for habitat creation and enhancement, the Site has the potential to provide an uplift of 47.32% in Habitat Units and 108.56% in Hedgerow Units, equating to a 'Mitigation Bank' of 141.3 Habitat Units and 29.04 Hedgerow Units.

A long-term commitment must ringfence the resources required for practical management on the Site over the 30-year timescale that is required to deliver Biodiversity Net Gain. An adaptive approach to management of the Site must be responsive to best practice, scientific developments in nature recovery techniques and monitoring outcomes, to secure the best outcomes for Biodiversity Net Gain. This is best achieved through a costed Biodiversity Net Gain Plan that includes ongoing monitoring against targets and baseline conditions (Stantec, 2022a).

Any proposed development seeking to deliver an off-site off-set via Tyting Farm, or any other 'Mitigation Bank' must first confirm how the proposed development meets with BNG Key Rules and Principals, especially with regard to the application of the Mitigation Hierarchy.

As Tyting Farm will be managed "in perpetuity" for SANG purposes, it is anticipated that beyond the 30-year timeframe for the current Biodiversity Net Gain Plan, a new Biodiversity Net Gain Plan could be set for the following 30-year timeframe, with the potential to further enhance the biodiversity value of the Site beyond the target habitat conditions set out within this report. This has the potential to deliver additional Habitat Units, providing the prescribed monitoring of the Biodiversity Net Gain Plan confirms the anticipated outcomes.

1 Introduction

1.1 Background: Biodiversity Net Gain Policy and Legislation

1.1.1 There has been clear global and national evidence for a biodiversity crisis, with biodiversity declining globally at rates unprecedented in human history and the rate of species extinctions accelerating (IPBES, 2019). There has also been clear evidence presented of the intrinsic link between climate change and biodiversity loss and, conversely, how action to support biodiversity can also contribute towards action against climate change (Portner *et al.* 2021). The value of nature for wellbeing is also demonstrated at the individual and community level (Aerts *et al.,* 2018; Romanelli *et al.,* 2015).

National Context

1.1.2 The UK Government's Natural Environment White Paper: 'The Natural Choice: securing the value of nature' (HM Government, 2011) introduced several policies to conserve the environment. One policy included the system of accounting, termed 'biodiversity offsetting.'

1.1.3 In England, the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021) sets out a broad framework of policies for the planning system in England and how they should be applied. Underpinning the framework is the principal aim of 'Sustainable Development' which is to be pursued through the fulfilment of interdependent economic, social and environmental objectives.

1.1.4 Chapter 15 of the NPPF details core policy principles with respect to conserving and enhancing the natural environment. Securing 'net gains' for biodiversity, in accordance with the Government's 'A Green Future; Our 25 Year Plan to Improve the Environment' paper is a key theme running through the Chapter, whereby planning decisions are required to contribute to and enhance the natural environment by "minimising impacts on and providing net gains for biodiversity". Chapter 15 of the NPPF also states that plans should "identify and pursue opportunities for securing measurable net gains for biodiversity". The Chapter also places planning decisions in the context of the mitigation hierarchy where, if impacts on biodiversity cannot be avoided, mitigated, or as a last resort compensated for, then planning permission should be refused.

1.1.5 The Environment Act 2021 received Royal Assent on 9th November 2021 and includes provision for a new mandatory requirement for proposed developments (which meet certain requirements) to provide 10% Biodiversity Net Gain(BNG). This requirement is not yet mandatory, but it is anticipated that the 10% BNG (and requirement to measure this using the Biodiversity Metric 3.1, or its successor) will come into force when the Secretary of State makes a Regulation to do so; likely following a two year 'transition period' after the Environment Act came into force, i.e., from November 2023.

1.1.6 In addition, Section 40 of the Natural Environment and Rural Communities (NERC) Act 2006 places duties on public bodies to have regard to the conservation of biodiversity in the exercise of their normal functions. Section 41 of the Act defines Habitats and Species of Principal Importance (HoPI or SoPI) to nature conservation in England which should be considered by all public bodies, including LPAs, when carrying out their Section 40 duties. 'Planning Practice Guidance for the Natural Environment' (Planning Portal 2014) and the British Standard for Biodiversity in Planning (BS 42020:2013) both recommend the system of biodiversity offsetting as an appropriate mechanism of delivering biodiversity compensation.

Local Context

1.1.7 The Guildford Borough Local Plan: Development Management Policies Submission Local Plan (June, 2022) sets out clearly the local biodiversity context, identifying Surrey as a

comparatively biodiverse county and Guildford as one of its most biodiverse districts. The Local Plan also identifies that the decline in local biodiversity is even more pronounced than the national decline. Surrey has historically suffered a high degree of habitat loss and fragmentation; the Surrey Nature Partnership's (SyNP) report, "The State of Surrey's Nature" estimates that 12% of the County's species have been lost, 21% are in decline and heading for local extinction, 15% are rare but stable and only 3% of rare species are recovering (Surrey Nature Partnership, 2019). This information is presented as a context to a new Policy for Guildford Borough Council, as presented in the Guildford Borough Local Plan: Development Management Policies Submission Local Plan (June, 2022): Policy P6/P7: Biodiversity in New Developments which includes a proposed requirement for development applications meeting certain criteria to deliver 20% BNG. The proposed wording for Policy P6/P7 is provided at Appendix A.

1.1.8 The Regulation 19 consultation and the List of Matters and Questions provided by the Inspector for the Guildford Development Management Policies Examination includes questions around demonstrating the viability of Policy P6/P7; specifically, what would be the implications of a 20% BNG policy on development viability and whether Policy P6/P7 is consistent with both national policy and the Local Plan: Strategy and Sites.

1.1.9 Guildford Borough Council have commissioned Stantec to provide a series of reports demonstrating the application of the Biodiversity Metric 3.1 (Panks *et al.*) to "real world" examples in the Borough, to provide additional evidence for the Guildford Development Management Policies Examination. The studies are:.

- Guildford Borough Council - Tyting Farm – Biodiversity Net Gain Baseline Report and Feasibility Study (this report)
- Guildford Borough Council - Tyting Farm – Biodiversity Net Gain Plan (Stantec, 2022a); and)
- Guildford Borough Council: Biodiversity Net Gain. Evidence Base for Policy Development – Biodiversity Net Gain Study for Approved Developments (Stantec 2022b).

1.2 Description of the Site

1.2.1 Tyting Farm (the Site) is owned and managed as a SANG[1] by GBC. The Change of Use Application for use of Tyting Farm as public open space was approved by GBC in April 2018. The Site comprises 45.9 ha of farmland and woodland approximately 2 miles south-east of Guildford (OS Grid Reference TQ 02758 48747).

1.2.2 Varied bedrock and soils, from acid character to the south to shallow soils over chalk to the north gives rise to a range of flora and fauna. A primary influence on the grassland habitat that dominates the Site is intensive agricultural management in the 20th Century which has led to depauperate swards dominated by grasses; a network of hedgerows also has substantial scope for enhancement. A 2.3ha woodland to the east has ancient woodland indicators and a diverse flora and structure, as well as good levels of deadwood. Historical farmstead and parkland influences are reflected in planted treelines and non-native species in woodland to the south-west of the Site, grading into acid character woodland. Areas of land not under the management control of Guildford Borough Council were excluded from the study area. These

[1] Suitable Alternative Natural Greenspace areas are designated greenspaces which are provided within Guildford Borough as an attractive alternative to the Thames Basin Heaths Special Protection Area (SPA). The Thames Basin Heaths SPAs are internationally important heathland sites that support rare birds such as the Dartford warbler and Nightjar that who are highly sensitive to disturbance from recreation, especially dog-walking. SANGs are therefore provided to encourage recreational use, to reduce pressure on the SPA and are provided as part of a package of mitigation for residential development within the Borough. GBC have a strong track-record in successful provision and ongoing management of SANG.

comprised residential developments to the west of the Site and private land and properties to the north of the Site.

1.3 Biodiversity Metric

1.3.1 The Biodiversity Metric 3.1 (Panks *et al.,* 2022b) provides developers, planners and land managers with a tool to measure the biodiversity value of a site. The metric uses habitat features as a proxy measure for biodiversity which can be used to measure the “baseline” and “post-development” biodiversity value of a site through a numerical change in "Biodiversity Units" pre and post development, or habitat creation and management[2]. The metric enables developers, site managers and stakeholders to see how they might be able to design a site or habitat creation/enhancement in a way that increases its biodiversity value over time.

1.3.2 A Biodiversity Net Gain Assessment using a Biodiversity Metric can be used to demonstrate predicted biodiversity change by establishing the difference in the value of habitats present within a site before and after any development, or proposed habitat creation/management. In this way the application of the Biodiversity Metric supports positive biodiversity change.

1.4 Biodiversity Net Gain Key Principles and Rules

1.4.1 The approach taken to delivering net biodiversity gain at Tyting Farm takes into account the Key Principles, Mitigation Hierarchy and Rules for Biodiversity Net Gain as detailed within the Biodiversity Metric Version 3.1 User Guide (Panks *et al.* 2022a).

1.4.2 BNG Key Principles as set out in the User Guide are:

- Principle 1: The metric does not change the protection afforded to biodiversity.
- Principle 2: Biodiversity metric calculations can inform decision-making where application of the mitigation hierarchy and good practice principles conclude that compensation for habitat losses is justified.
- Principle 3: The metric’s biodiversity units are only a proxy for biodiversity and should be treated as relative values.
- Principle 4: The metric focuses on typical habitats and widespread species; important or protected habitats and features should be given broader consideration.
- Principle 5: The metric design aims to encourage enhancement, not transformation, of the natural environment. Proper consideration should be given to the habitats being lost in favour of higher-scoring habitats, and whether the retention of less distinctive but well-established habitats may sometimes be a better option for local biodiversity.
- Principle 6: The metric is designed to inform decisions, not to override expert opinion. Management interventions should be guided by appropriate expert ecological advice and not just the biodiversity unit outputs of the metric. Ecological principles still need to be applied to ensure that what is being proposed is realistic and deliverable based on local

[2] Biodiversity Units are calculated using the size of a parcel of habitat and its quality. The metric uses habitat area (measured in hectares) as its core measurement, except for linear habitats (hedgerows, lines of trees, rivers and streams) where habitat length (measured in kilometres) is used. To assess the quality of a habitat, the biodiversity metric 3.1 scores each habitat parcel against their relative distinctiveness and condition. Furthermore, the metric also accounts for whether or not the habitat is sited in an area identified, typically in a relevant local strategy or plan, as being of strategic significance for nature. The biodiversity units are calculated by the Metric in the same way for both the baseline and post-development habitats. However, as new habitat is created, or existing habitat is enhanced in the post-development scenario, the difficulty and associated risks of doing so are considered by biodiversity metric 3.1 (Panks *et al.,* 2022).

conditions such as geology, hydrology, nutrient levels, etc. and the complexity of future management requirements.

- Principle 7: Compensation habitats should seek, where practical, to be local to the impact.
- Principle 8: The metric does not enforce a mandatory minimum 1:1 habitat size ratio for losses and compensation but consideration should be given to maintaining habitat extent and habitat parcels of sufficient size for ecological function.

1.4.3 To fulfil the Key Principles it will be essential for any developments relying on Tyting Farm for off-set biodiversity units to first demonstrate that they have adopted the Mitigation Hierarchy and reduced impacts on wildlife from their proposal as far as practicable. This must be a key part of planning obligations for each development. The sequential Mitigation Hierarchy aims to:

- **Avoid** habitat damage/loss where possible;
- **Minimise** habitat damage/loss where possible;
- **Remediate** (restore) habitat damage/loss where possible; and
- **Compensate** for habitat loss/damage where possible as a last resort.

1.4.4 By applying the sequential Mitigation Hierarchy approach, this means aiming to retain habitats in situ, i.e., avoiding and minimising habitat damage/loss as much as possible before restoring habitat loss/damage, then finally compensating for habitat damage/loss through habitat creation and/or enhancement.

1.4.5 The application of the Mitigation hierarchy is supported and reinforced through the Biodiversity Metric as it allows overall biodiversity gains to be achieved through the avoidance of on-site habitat damage/loss rather than relying on just the compensation of habitat loss/creation through creating new habitats. The metric applies multipliers which are based on the risks of creating/restoring habitat which are not applicable when impacts on the existing habitat are avoided. The support that the Biodiversity Metric 3.1 provides to the Mitigation Hierarchy approach is demonstrated by the Biodiversity Net Gain Study (Stantec, 2022b)

1.4.6 The application of the Biodiversity Net Gain Key Rules to the feasibility study for Tyting Farm is described in **Section 4.6** below.

1.5 Additionality of Environmental and Other Services

1.5.1 The recent Department of Environment Food and Rural Affairs (Defra) consultation on Biodiversity Net Gain Regulations and Implementation (Defra, January 2022) discussed stacking of payments for environmental services The consultation paper acknowledged that the market for Biodiversity Units will need to work alongside other environmental markets, such as nature-based carbon and nutrient trading and established markets for provisioning services, such as agricultural and forestry products, as well as UK Government-funded programmes such as the new schemes to reward environmental land management.

1.5.2 The consultation paper stated that the government were minded to allow landowners and managers to combine payments for biodiversity units with other payments for environmental services from the same parcel of land, provided they are paying for distinct, additional outcomes (for example, carbon sequestration and biodiversity benefits other than net gain).

1.5.3 By services the consultation paper stated that this meant distinct environmental services (including supporting and regulating services) or benefits such as carbon sequestration,

pollution mitigation, biodiversity, or recreation. Agreements must be compatible, pay for different or additional outcomes and must not pay for the same outcome twice. Such considerations are taken into account in this Report, with proposals for habitat creation and enhancement set out in this Report being over-and-above those measures required for SANG purposes described in the Landscape and Biodiversity Enhancement Management Plan (LBEMP) produced for Tyting Farm SANG (Guildford Borough Council, 2019).

1.6 Objectives of Study

1.6.1 To provide part of an Evidence Base for Guildford Borough Council's Policy P6/7, this study seeks to understand the potential for Council-owned land at Tyting Farm to be used as a mitigation bank, to allow biodiversity credits to be sold to developers, where BNG is not achievable within a proposed development site. Specifically, this study seeks to:

- Set out the methods used for determining the baseline biodiversity value for Tyting Farm including desk study, habitat survey and soil sampling.
- Describe the local biodiversity context, heritage and landscape considerations relevant to determining potential suitable habitat enhancements for Tyting Farm.
- Describe the baseline habitats and confirm the baseline biodiversity value in Habitat and Hedgerow Units using the Biodiversity Metric 3.1 tool (Panks et al., 2022b).
- Set out the feasibility of uplift in biodiversity value through proposed habitat management, enhancement and/or creation with reference to baseline context.
- Confirm the biodiversity uplift value, in Habitat and Hedgerow Units, for Tyting Farm based on the proposed habitat enhancement and creation using the Biodiversity Metric 3.1.
- Confirm the consideration of the BNG Key Rules to the proposed habitat creation and enhancement.
- Confirm approaches to securing delivery of BNG and the potential for additional environmental service delivery from Tyting Farm.

1.6.2 It should be noted that a parallel study is being undertaken for Tyting Farm, which should be read in conjunction with this report, a Biodiversity Net Gain Plan for Tyting Farm Stantec (2022a) This BNG plan sets out the costed management plan that would be required to achieve the uplift in biodiversity value proposed for Tyting Farm, as described in this report. Furthermore, an additional study is also being undertaken which seeks to understand whether BNG would have been achieved by three previously approved developments within Guildford Borough Council's jurisdiction and if so, whether 20% BNG would have been achievable and, if not, how many Biodiversity Units would have been required for the development to meet that target (Stantec, 2022b).

2 Methods

2.1 Personnel

2.1.1 The fieldwork survey lead was Mrs Kate Jeffreys MCIEEM CEnv, an ecologist with over 20 years' experience and a FISC 4 certificate in botanical survey and identification. Her assistant was Mrs Anna Coles, a farmer and conservation livestock specialist with over 15 years' experience in practical land management for wildlife and agricultural production.

2.2 Desk Study

2.2.1 The desktop study considered nearby designated sites for ecology (statutory and non-statutory), priority habitats as defined under the NERC Act 2006, and other biodiversity information available from previous reports relating to the Site including a Preliminary Ecological Assessment and Biodiversity and Landscape Management Plan (MAGIC, 2022; The Ecology Consultancy, 2017; Guildford Borough Council, 2019).

2.2.2 Landscape context included consideration of objectives of the North Downs National Landscape Character Area (Natural England, 2013), and emerging policies and approaches to Nature Recovery in the area undertaken by Surrey Nature Partnership (Surrey Nature Partnership, 2019).

2.2.3 Geology and soils were considered using baseline maps to target sampling (BGS, 2001), with parameters for enhancement options checked against data presented in Blakesley & Buckley (2016) and Dicks et al (2020).

2.2.4 Historical maps and sources, including online maps and site management information were checked for the context and continuity of existing habitats, as well as being used to inform habitat change and enhancements. Options to achieve the complementary delivery of biodiversity, recreation and heritage benefits were sought as well as checks for any potential conflicts (GBC, pers. comm. 2022; MAGIC, 2022; Geckoella and Historic England, 2021). This included review of the Landscape and Biodiversity Enhancement Management Plan (LBEMP) for Tyting Farm (Guildford Borough Council, 2019) which sets out current management arrangements as well as the required management actions to provide Suitable Alternative Natural Greenspace (SANG) within the Site. BNG recommendations in this report were informed by the aspirational options for enhancement of the Site for biodiversity set out within the LBEMP (additional to the measures required to make the Site suitable for SANG), as well as discussions with GBC Officers.

2.2.5 The evaluation of the Site for protected and notable species was beyond the scope of the study. However, the Biodiversity Net Gain Plan for Tyting Farm (Stantec, 2022a) takes into account the findings of protected species reports for the Tyting Farm Site, provided by GBC.

2.3 Soil Field Sampling and Analysis

2.3.1 Soil samples were taken from the Site on 31st August 2022 in accordance with the methodology set out in Natural England Technical Information Note (TIN035, NE, 2008a) and as described in Appendix D.

2.3.2 Five samples represented different bedrock geology, soil and slope conditions across the Site, obtained using a pot corer and taken to a depth of 0-7.5cm; sub sample points were taken at approximately regular intervals in a 'W'-shaped pattern. Laboratory analysis was carried out into the soil sample's physical and chemical characteristics with reference to parameters for options for target habitats for the Site. The detailed methods and findings are set out in Appendix D.

2.4 Habitat Field Survey

2.4.1 The fieldwork comprised a survey of the Site, with habitats ascribed to the UKHab classification to the highest level practicable using species composition and other character indications (Butcher *et al.,* 2020). Where species number per m^2 is an indicator of a habitat, an average score across the area surveyed was determined.

2.4.2 Habitats and features were also described in relation to priority habitats as listed under Section 41 of the NERC Act 2006; woodland was assessed as to whether it was likely to comprise ancient woodland, that is, continuously wooded areas since 1600 including against online information (MAGIC, 2022). Hedgerows were assessed according to the likelihood of meeting the criteria for important hedgerows under the Hedgerow Regulations 1997.

2.4.3 The condition of habitats and linear features on the Site were assessed according to the Biodiversity Metric 3.1 Condition Assessment sheets (Panks *et al.,* 2022c).

2.5 Baseline Habitat Description, Evaluation and Metric Input

2.5.1 The results of the desktop and fieldwork were combined to describe the baseline habitat type, quality and condition of Tyting Farm habitats as appropriate for consideration within the Biodiversity Metric 3.1 (Panks *et al.,* 2022b). In order to have confidence in uplift calculations, a precautionary approach to the classification and condition assessment of baseline habitats was adopted, such that in 'borderline' cases the habitat type and condition was ascribed to the higher available category.

2.5.2 The likelihood of features comprising Section 41 Priority Habitats as listed in accordance with the NERC Act 2006[3] was also considered as well as their connectivity to nearby areas of wildlife value including statutory and non-statutory designated sites. The context of the Site in terms of connectivity to the local nature network at the local and wider geographical scales are important in the effectively delivery of biodiversity recovery (Lawton *et al.,* 2010)

2.5.3 The baseline habitat mapping results were mapped in QGIS and are described in Section 3 and Appendix B. These results were inputted to the Biodiversity Metric 3.1 using the QGIS import tool (Natural England, 2022a, 2022b) to determine baseline habitat values (Biodiversity Units) for the Site.

2.6 Approach to Determining Options for Proposed Habitat Creation and Enhancement

2.6.1 Proposed habitat creation and enhancement described within this feasibility study was based upon the potential for biodiversity gain from the Site, considering the following factors:

- Practical limitations relating to baseline habitats, slope, climate and soils;
- Practicalities for Site management including existing public use and availability of stock, skills and equipment;
- Strategic location of the Site with regard to nature recovery and connectivity to nearby sites of wildlife importance;
- The requirement to adhere to the rules and key principles associated with the delivery of Biodiversity Net Gain (see Section 1.5); and

[3] List of priority habitats and species in England ('Section 41 habitats and species') are for public bodies, landowners and funders to use for biodiversity conservation. https://www.gov.uk/government/publications/habitats-and-species-of-principal-importance-in-england

- Consideration of potential additional environmental and other services to be gained from the Site, including recreation and landscape.

2.6.2 The gains in terms of Biodiversity Units available from future management and enhancement were explored through the use of the Biodiversity Metric 3.1 as a decision support tool, alongside spatial analysis through mapping in QGIS and the use of the QGIS import tool. Where practicable, 'win-wins' were sought for complementary environmental services, for example relating to heritage and wildlife benefits; both arising from proposed hedgerow and orchard restoration (see Section 4).

2.6.3 The recommendations and suggested options for BNG Delivery presented in this report have been developed into a costed management plan (Tyting Farm Biodiversity Net Gain Plan, Stantec, 2022a). The principle of additionality was adhered to so that, if enhancements presented in the Biodiversity Net Gain Plan are already accounted for (wholly or partially) in the Landscape and Biodiversity Enhancement Management Plan (LBEMP) for Tyting Farm SANG (Guildford Borough Council, 2019), this is clearly identified and discounted from the costing for the BNG Plan, to avoid "double-accounting".

2.7 Assumptions and Constraints

2.7.1 The time of year of survey (late August 2022) represented a constraint to botanical field survey due to some characteristic species potentially being absent, or not as well represented within the sward as during the optimum periods. However, the findings of the field survey were broadly in line with previous Phase 1 survey (The Ecology Consultancy, 2017) and also reflected the observations of the site managers in terms of variation of species-richness in different areas (GBC SANG Officer, *pers. comm*). The findings presented here take into account the time of year of survey and the constraint is not considered significant in terms of the objective of the study.

2.7.2 Small errors in areas may arise from rounding and from discrepancies between base mapping for different purposes between desk studies and fieldwork and GIS analysis. This must be taken into account in the development of any contractual or planning agreements relating to the use of Habitat Units from the Site.

2.7.3 There is uncertainty with regard to biodiversity enhancement and creation, both in relation to site-specific issues that could impact on success, and in relation to the developing science and monitoring around techniques for ecological enhancement. However, this uncertainty is taken into account within the Biodiversity Metric 3.1 (Panks *et al.,* 2022b), as well as in the developed recommendations and options presented in this study, where a precautionary approach is adopted, such that this is not considered a significant constraint.

2.7.4 It is assumed that the Mitigation Hierarchy and other principles and rules for BNG (see Section 1.4) will be applied to any future developments or projects seeking delivery at Tyting Farm, in the delivery of their planning, or other obligations.

2.7.5 It is assumed that additionality will be achievable, should environmental services over and above BNG as relevant to the Biodiversity Metric be required to be delivered by Tyting Farm; the findings presented here are based upon current approaches and best practice. However, this is in part governed by interpretation and may be subject to future developments in this dynamic policy area.

3 Baseline Conditions

3.1 Context, Heritage and Landscape

3.1.1 The Site is located in the Surrey Hills Area of Outstanding Natural Beauty (AONB) and the North Downs National Landscape Character Area.

3.1.2 The strategic significance of potential enhancements to habitats within Tyting Farm is reflected by inclusion of the Site within Biodiversity Opportunity Area ND02: North Downs Scarp & Dip; Guildford to the Mole Gap by Surrey Nature Partnership (Surrey Nature Partnership, 2019). This means that all habitats and linear features on the Site, current and proposed, are 'formally identified in the local strategy' and scored as such within the Biodiversity Metric 3.1.

3.1.3 There are no designated statutory or non-statutory sites for biodiversity value within the Site. However, the southern boundary of the Site is contiguous with extensive semi-natural woodland and grassland habitats including St. Martha's Hill nature reserve and locally designated Site of Nature Conservation Importance (SNCI); there is considerable scope for habitat enhancement in Tyting Farm to complement and extend this area. Other nearby designated sites include Colyers Hanger Site of Special Scientific Interest (SSSI) which lies adjacent to the south-eastern corner of the Site. The SSSI is an area of ancient woodland situated on a south facing slope of the Lower Greensand ridge. It is of particular interest for the diversity of woodland types present, including ash/maple woodland over light sandy soil rich in bases and base-rich spring line alderwood, both of which are nationally rare. Newlands Corner Local Nature Reserve, across the road, to the north east of the Site. Newlands Corner comprises part of Merrow to Clandon Downs SNCI; a relatively extensive tract of semi-natural habitat along the North Downs escarpment. including unimproved chalk grassland, ancient woodland and scrub. The SNCI has considerable ecological interest supporting several nationally rare and scarce plant species, county scarce invertebrates and breeding birds (The Ecology Consultancy, 2017).

3.1.4 The heritage and landscape of the Site includes farmland and farmstead habitats, comprising a pastoral context with hedgerows, with some parkland character associated with the previous large house that was located to the south-west of the Site reflected in planted standards within treelines and woodland along the track and south of the residences (Surrey Hills AONB, 2018; GBC SANG Officer *pers comm*).

3.1.5 This context of nearby connected existing sites of nature conservation value further enhances the potential biodiversity benefits associated with the potential future habitat creation and management within the Site and was considered, along with complementary benefits arising from heritage and landscape, in the development of the feasibility of biodiversity enhancements for the Site.

3.2 Current Management

3.2.1 The current management regime of the Site was confirmed through review of the existing LBEMP for the Tyting Farm SANG (Guildford Borough Council, 2019) and through discussion with GBC staff responsible for coordinating the management at the Site (GBC SANG Officer *pers. comm*). The SANG provides Suitable Alternative Natural Greenspace as part of a series of sites within Guildford Borough Council which are provided for recreation, as an attractive alternative to the Thames Basin Heaths SPA. Tyting Farm habitats in their current condition would fulfil the SANG requirements for a "semi-natural feel". The LBEMP acknowledges the potential for additional biodiversity enhancements, in addition to the measures required for SANG delivery within the Site. The biodiversity enhancements proposed in this Report are additional and complementary to the SANG provision.

3.2.2 Currently, some of the grassland fields are grazed by cattle but the grazing regime is not directly targeted for conservation purposes. The cattle are moved to the Site from Commons and Nature Reserves elsewhere, once the grazing in those areas is complete. There are therefore variable numbers of cattle present across the Site across the year and within the fields. It is understood that only the western and central fields have been grazed in recent years, with the north eastern fields not being subject to any current management (GBC SANG Officer *pers. comm.*). The August 2022 survey noted uneven grazing across the Site. In addition to the grazing, the only other management of the grassland has been some focussed intervention management (cutting/spraying) for localised issues such as dense thistles.

3.2.3 Woodland and treeline habitats are generally subject to non-intervention management. However, there has been targeted work undertaken to reduce the impact and extent of invasive rhododendron and cherry laurel in acid woodland in the southwest part of the Site, in addition to targeted works on treelines associated with trees affected by Ash dieback.

3.2.4 Hedgerows are subject in places to enhancement works including laying; it is understood that some of this work is completed by volunteers with a group from the Surrey Wildlife Trust. Some sections of hedge have also been professionally laid, where the age of the growth requires a more experienced practitioner to successfully lay the hedge. Lastly, point features have been provided for wildlife across the Site, for example barn owl *Tyto alba* boxes.

3.3 Geology and Soils

3.3.1 Soils and geology within the Site are described in detail in Appendix D. Although the bedrock geology and soils varied considerably across the Site, from shallow soils over chalk to acid grassland and woodland, key parameters regarding soil nutrients relevant to grassland restoration, particularly phosphorus, were remarkably similar within the samples.

3.3.2 Based on the results of the analysis of the soil samples, phosphorus is considered to be the most important nutrient influencing sward diversity. Where the main objective is the development of botanical diversity, the soils should have a low soil P index of 0 (for semi-natural, species-rich grassland) or 1 (Natural England 2008b). Soil phosphorus levels at Tyting Farm varied from high to very high across the site (Index 3 and above), including on the shallow chalk soils on steep slopes, indicating that all sampled areas have received high inputs of inorganic fertilisers or manures in the past. The implications of these findings for future management options are described in Section 4.3 and taken into account in the feasibility for biodiversity enhancement within the Site.

3.4 Habitats

3.4.1 The baseline habitats for Tyting Farm are shown in **Figure 1**, as at August 2022; Table 3.1 below summarises the habitat types shown on **Figure 1** and photographs of the various habitats within the Site are provided at **Figure 7**. The areas are described using the UKHab Classification, with reference to Priority Habitats as listed under Section 41 of the NERC Act 2006. The habitat condition is described with reference to Biodiversity Metric 3.1 Condition Assessment (Panks *et al.,* 2022c) (see **Figure 3**). The habitats found reflect the underlying geology and previous management history; significant opportunities for enhancement for biodiversity were identified.

3.4.2 There was one area of ancient woodland in the east of the Site. The canopy tree species included pendunculate oak *Quercus robur*, sycamore *Acer pseudoplatanus* and ash *Fraxinus excelsior*. Much of the understory included coppiced hazel *Corylus avellana* with holly *Ilex aquifolium* and hawthorn *Crataegus monogyna* as well as crab apple *Malus sylvestris* sens. str. Ancient woodland indicators included woodruff *Galium odoratum* and the diverse ground flora included violets *Viola* sp., wood meadow-grass *Poa nemoralis* and redcurrant *Ribes rubrum*. There were good levels of deadwood and the woodland is generally in good condition,

and already of value for nature conservation. However, connectivity with other woodland areas to the south and north of the Site could be improved.

3.4.3 Other areas of woodland within the Site were found to the southwest. This complex area included developing acid woodland with oak *Quercus robur*, silver birch *Betula pendula* and established planted standards behind the existing residences including non-native pines, as well as patches of invasive bracken *Pteridium aquilinum* and rhododendron *ponticum.*

3.4.4 Lowland calcareous grassland was present within a 'green lane' leading from White Lane to the south of the Site. This area was amongst the most species-rich found on Site including salad burnet *Sanguisorba minor* and wild basil *Clinopodium vulgare*. However, it was in poor condition due to scrub encroachment to the south and at the edges from adjacent hedgerows, and was impacted by the dumping of garden waste (including invasive species).

3.4.5 Grassland with calcareous influence was also found on steep slopes over chalk in fields to the north east of the Site. The habitat included extensive patches of g2a lowland calcareous grassland, with calcareous indicators such as wild basil and wild marjoram *Origanum vulgare* frequent on the steeper slopes and associated with ant hills and patches of shorter rabbit-grazed turf; species such as common bird's-foot trefoil *Lotus corniculatus* and red bartsia *Odontites vernus* contributed further to species diversity. However, this community was a poor-quality example of calcareous grassland and was also in poor condition. Tussocky grasses such as false oat-grass *Arrhenatherum elatius*, tor-grass *Brachypodium pinnatum* s. l. and cock's-foot *Dactylis glomerata* often dominated across the sward. The sward did not therefore meet the species-richness or classic calcareous character required to be described as community g2a5 (Dry grasslands and scrub on chalk or limestone).

3.4.6 Species-rich grassland was also patchily found on the north west slopes of the Site, with wild carrot *Daucus carota*, black knapweed *Centaurea nigra* and ox-eye daisy *Leucanthemum vulgare* present. Grazing in these areas had diversified sward structure as compared to other south-facing slopes, and in patches species-diversity reached scores of up to 9 per m^2. However, even taking into account seasonal constraints to survey, the sward in the north western fields of the Site lacked many classic indicators of calcareous grassland (despite underlying chalk bedrock) and had a relatively high grass to forb ratio generally (50% or more). The most species-rich areas also tended to be smaller in size than the minimum mappable area of 5x5m required by UKHab (Butcher *et al.,* 2020). The best UKHab classification 'fit' on balance for these grassland fields was therefore 'other neutral grassland'.

3.4.7 Grazed neutral grassland was found at the base of the slopes, through the central part of the Site and was generally very species poor, with cock's-foot and false oat-grass dominating the grasses and the forbs including creeping buttercup *Ranunculus repens* and occasional dense stands of creeping thistle *Cirsium arvense*. Occasional other herbs such as germander speedwell *Veronica chamaedrys* were present. The species-poor character meant that this community most closely matched the UKHab g4 modified grassland community.

3.4.8 An ungrazed field adjacent to the woodland had neutral character and a broader range of herbs present including black knapweed *Centaurea nigra* and agrimony *Agrimonia eupatoria*; poor condition was however characterised by abundant tussocky grasses (false oat-grass and cock's-foot). The relative abundance of Yorkshire-fog *Holcus lanatus* within the sward, together with occasional rushes such as compact rush *Juncus conglomeratus* lent weak affinity to the UKHab g3c8 Holcus-Juncus neutral grassland community.

3.4.9 Acid grassland was found to the southwest of the Site, adjacent to residences. The best quality patches included wavy hair-grass *Avenella flexuosa* and sheep's sorrel *Acetosa acetosella* as well as red fescue *Festuca rubra* and common ragwort *Senecio jacobaea.* These areas were bounded by bracken that in turn graded to oak and birch woodland to the south of the site and beyond into the wider countryside. A patch of depauperate and atypical acid grassland sward was also found on elevated land within pasture at OS grid ref TQ 02740 48658. This sward was dominated by common stork's-bill *Erodium cicutarium* agg.

3.4.10 Patches of dense bracken (UKHab community g1c) dominated areas of the south-west of the Site and appeared to be increasing in area (cf. The Ecology Consultancy, 2017). Whilst comprising a typical habitat of acid communities, bracken monocultures are species-poor and invasive in character, impacting on acid grassland and acid woodland habitats and control is recommended to maintain species diversity.

3.4.11 A shaded, steep-sided pond was present to the west (UKHab community r1a6 Other eutrophic standing waters). It lacked aquatic flora, was fringed and shaded by mature crack willow *Salix fragilis*. It did not meet the criteria for priority habitat and was in moderate condition.

3.4.12 A ruderal, floristically-rich community (Open Mosaic Habitats on Previous Developed Land (OMHPDL)) was associated with disturbed ground where farm buildings had been removed and included scarlet pimpernel *Anagallis arvensis*, white campion *Silene latifolia* and dark mullein *Verbascum nigrum*. The community is declining in extent as compared to 2017 as bramble scrub encroaches (cf. The Ecology Consultancy, 2017).

3.4.13 Dense bramble and blackthorn *Prunus spinosa* scrub dominate other areas that were previously a farmstead area to the west of the Site. Within the dense scrub, over-mature apple *Malus domestica* trees indicate the previous presence of an orchard.

3.4.14 Table 3.1 below presents the BNG Habitat Unit values for each of the Broad Habitat types within the Site, as determined by Biodiversity Metric 3.1, taking account of the specific habitat type within each broad habitat type, and its condition. Condition Assessment sheets for all of the specific habitat types are provided in Appendix B.

Table 3.1 Baseline Summary – Habitats

Broad Habitat Type	Area (Ha)*	Existing Value: Habitat Units*	Notes
Grassland	37.84	190.91	Includes neutral, calcareous and modified grassland, generally species-poor.
Woodland	6.65	103.15	Includes priority habitats ancient woodland, and mixed on acid soils
Scrub	0.41	2.88	Associated with previous farmstead (demolished)
Urban	0.97	1.30	Associated with previous farmstead (demolished)
Pond	0.04	0.40	Shaded pond
Total	**45.92**	**298.63***	

*rounded to two decimal places.

3.5 Linear Features

3.5.1 The hedgerows within the Site are shown on **Figure 2**; Condition Assessment for the hedgerows is shown on **Figure 3**. All intact hedgerows on Site comprise priority habitat under Section 41 of the NERC Act 2006. None however qualify as important under the Hedgerow Regulations 1997.

3.5.2 A planted roadside hedge to the west is species-rich. A hedge to the east grades into roadside scrub and treeline habitat to the east, associated with a footpath. A hedgerow bordering gardens to the north of the Site varies in quality and composition, but includes frequent gaps and non-native species (including an extensive stand of the invasive species Russian-vine *Fallopia baldschuanica*).

3.5.3 Hedges within the main Site vary but are frequently both species-poor and in poor condition, with defunct lengths meeting UKHab criteria for 'tree-line'. Some however boast excellent mature pendunculate oak standards.

3.5.4 The previous parkland character of the Site is reflected in the presence of mature scots pine *Pinus sylvestris* and Turkey oak *Quercus cerris* in tree-lines along the trackway that follows the base of the valley. Table 3.2 below presents the BNG Habitat Unit values for each of the Hedgerow types within the Site, as determined by Biodiversity Metric 3.1, taking account of the each hedgerow's condition. The Condition Assessment sheets for all of the hedgerows is provided in Appendix B.

Table 3.2 Baseline Summary – Hedgerows

Hedgerow type	Length (km)	Existing Value: Hedgerow Units*	Notes
Native Species Rich Hedgerow	0.12	1.66	Priority habitat
Native Hedgerow with Trees	0.62	7.74	Variable quality standards, some mature with veteran features
Native Hedgerow	3.96	15.25	Often species-poor, sometimes poor condition
Line of Trees	0.63	2.10	Line of trees
Total	**5.32**	**26.75**	

*rounded to two decimal places.

3.6 Invasive and Non-native Species

3.6.1 The presence of invasive species has implications for BNG calculations, as the presence of invasive species affects the Condition Assessment for certain habitats. Targeted removal of invasive species provides an opportunity for habitat enhancement, but commitment to removal does have implications for additional ongoing costs of management.

3.6.2 Invasive non-native species on Site include a small stand of Japanese knotweed *Fallopia japonica* in tall herb close to the western pond, marks on stems indicated ongoing efforts to control this stand (confirmed by GBC SANG Officer *pers. comm.*).

3.6.3 Non-native species are frequent along garden boundaries, including Russian vine which is entwined within some of the garden hedge trees on the northern boundary and *Buddleja davidii* and other garden plants encroaching on species-rich calcareous grassland along the green lane to the north of the Site. Liaison with the adjacent landowners will be required on an ongoing basis to help enable this area of the Site to be brought back into favourable management.

3.6.4 Work is ongoing by GBC to remove invasive cherry laurel *Prunus laurocerasus* and rhododendron *Rhododendron ponticum* within oak-birch woodland to the southwest of the Site (GBC SANG Officer, *pers. comm.*).

3.6.5 Bracken is a native species with invasive characteristics and dense stands reduce habitat and community diversity on shallow acid soils to the southwest of the Site. Clearance and management of bracken in this area provides an opportunity for a change to acid grassland and woodland habitat.

4 Feasibility of Biodiversity Net Gain

4.1 Context, Heritage and Landscape

4.1.1 The proposals for biodiversity enhancement thorough additional habitat creation and management within the Site are described in Sections 4.4. (Habitats) and 4.5 (Linear Features) below.

4.1.2 In developing these proposals the context and landscape position of the Site in relation to other biodiverse sites and habitats and the Site's position within the Biodiversity Opportunity Area (BOA) ND02: North Downs Scarp & Dip; Guildford to the Mole Gap, as described in Section 3.1, was taken into account. The priorities for the BOA include the creation or restoration of chalk grassland, the restoration and better active management of woodland and creation or rejuvenation of hedgerows. The proposals described in Section 4.4 and 4.5 deliver against these priorities, contributing to biodiversity priorities within Guildford and Surrey.

4.1.3 The proposals for biodiversity enhancement also seek to complement and acknowledge the heritage of the Site, including the enhancement and reinstatement of the hedgerow network across the Site, and the inclusion of an orchard in a location reflecting previous 'kitchen garden' and farmstead features.

4.2 Management Changes and Habitat Creation Opportunities.

4.2.1 The existing management regime for the Site is described in Section 3.2. The existing management at Tyting Farm has the potential to be changed to accommodate measures for biodiversity habitat creation and enhancement, that are compatible with the existing and planned future uses of the Site.

4.2.2 The grassland management regime is proposed to be changed through proposed rotation topping and removal of arisings, and a change in grazing regime to achieve changes to sward height and structure, whilst works to control invasive species have the potential to be extended and adapted to improve acid grassland and woodland diversity. The existing hedgerow enhancement programme ais proposed to be extended to restore historical hedgerow lines, as well as taking on new challenges such as woodland habitat management. More substantive works likely requiring plant include the potential for creating terraced and shallow edges around the edge of the large and shaded pond to the west of the Site.

4.2.3 The enhancement proposals were informed by the Biodiversity Metric 3.1, with careful attention paid to trading rules and maximising wildlife benefit. In many cases, this results in an enhancement being favoured over a change from one habitat to another.

4.3 Geology and Soils – Implications for Biodiversity Net Gain

4.3.1 The baseline section on geology and soils (3.3) confirmed the Site included varying underlying geology from chalk to acid. However, key parameters regarding soil nutrients, particularly phosphorus, were remarkably similar across the Site.

4.3.2 Soil Phosphorus is a particularly important consideration when considering the restoration of species-rich grassland. It is an important plant nutrient and has a major influence on grass growth favouring grasses over broad-leaved species. It is considered to be the most important nutrient influencing sward diversity and where the main objective is the development of botanical diversity, the Site should have a low soil P index of 0 (for semi-natural, species-rich grassland) or 1 (Natural England 2008b). Levels at Tyting Farm were all index 3 or above, including on shallow, soils over steep chalk slopes, and over Folkestone Formation acid sands.

4.3.3 The underlying geology presents an opportunity for Tyting Farm to deliver a variety of habitat types within the Site; information on the geology and its influence on the habitats within the Site could form part of the Environmental Education and Outreach information presented to the public about the Site.

4.3.4 The Biodiversity Net Gain uplift proposals considered for each area of the Site have been checked against reasonable soil parameters for compatibility and likely success of management for each part of the Site. The results are summarised in Table 4.1 below.

Table 4.1 Physical Constraints for Intervention Options

Site Area	Soil Type	Bedrock Geology	Physical and / or Chemical constraints and parameters (P, K, N) Implications for Potential Habitat Creation and Enhancement
Grassland slopes in northern part of site (calcareous influence)	Shallow, well drained, calcareous silt soils over chalk slopes. Andover 1 Association.	Chalk	Although the soils are shallow, high phosphorous levels in particular makes successful restoration of species-rich calcareous grassland unlikely within a reasonable timeframe unless substantial intervention is undertaken in the form of soil stripping etc. Small-scale trials are recommended to test the cost-effectiveness of such intervention. Until the results of these trials are available then calculated BNG units available are assumed to be relevant to enhancement of the grassland habitat to a less species-rich sward through a combined mowing (removal of arisings) and conservation grazing regime.
Grassland fields in valley base (neutral grassland)	Mixed lime-rich and acidic (ie. neutral) sandy loams near slope base.	Upper Greensand, Gault Clay, Folkestone Formation	High nutrient levels make the successful restoration of species-rich grassland in the valley base areas unlikely to be cost-effective. Instead, a focus on increasing habitat and structural diversity is recommended.
Grassland areas in southern and south-western part of site (acidic influence)	Acid sandy loams, Shirrell Heath 1 or 2 Associations.	Folkestone Formation	A small area on higher ground to the south of the Site that has some acid grassland indicators is suggested as an option for potential BNG uplift. Soil samples collected from areas nearby indicate nutrient enrichment from agricultural fertiliser application. This potentially limits the likelihood of acid grassland of high biodiversity value developing within a reasonable timescale. A precautionary approach has been applied with regard to calculated potential uplift, pending review and results of monitoring. An area of poor-quality and condition acid grassland grading into woodland to the south-west of the site is less likely to have been subject to agricultural improvements; here, control of invasives (bracken, cherry-laurel) are the main limitations to uplift and biodiversity uplift seems more likely to be a success.
Existing grassland fields in SE of Site between existing woodland parcels	Acid sandy and loamy soils assignable to either the Shirrell Heath 1 or 2 Associations	Folkestone Formation	Soil samples and habitat data from Site indicates that conditions are modified by management and slope-base context. The conditions here are neutral, and so grassland/wood pasture options are within the appropriate parameters for BNG enhancement.
Ponds and water features – valley base	Sandy loam, weakly lime-rich soils. Andover 1 Association	Gault Clay	The impervious nature of Gault Clay tends to give rise to less permeable soils, pH may vary from weakly acidic to weakly calcareous; other soil types at Tyting are much more permeable, free draining and unsuitable for water retention

Site Area	Soil Type	Bedrock Geology	Physical and / or Chemical constraints and parameters (P, K, N) Implications for Potential Habitat Creation and Enhancement
Hedgerows with standards– northern slopes	Shallow, well drained, calcareous silt soils over chalk slopes. Andover 1 Association.	Chalk	Shallow soils on steep chalk slopes to the north may limit the speed of growth of new hedgerows – calcicolous species are recommended. Standards within hedgerows are likely to be subject to windthrow; establishment is more likely to be successful once a hedgerow has established and modified the local conditions to the extent that water is retained and soil depth is sufficient to support a larger shrub or tree. Existing hedgerows currently lacking larger specimens could have potential future standards identified and allowed to grow above the rest of the hedgerow; however, careful monitoring would be required, including consideration of the impacts of shading on adjacent hedgerow shrubs.
Hedgerows with standards –valley base	Mixed lime-rich and acidic (ie. neutral) sandy loams near slope base.	Upper Greensand, Gault Clay, Folkestone Formation	Neutral soils are suitable for enhancement of hedgerows and the addition of standards.

4.4 Habitats

4.4.1 The key habitat creation and enhancement measures identified for Tyting Farm, based on the baseline conditions of the site (**Sections 4.1-4.3**) includes the following:

- Enhancement of grassland habitats (calcareous, neutral and acid). This site is of particular interest due to the underlying geology which presents the opportunity to enhance all three types of grassland. This presents a unique opportunity to deliver diverse types of grassland habitats in a relatively small space.
- Enhancement of woodland habitats and provision of additional woodland (parkland) to support and enhance woodland connectivity.
- Creation of orchard habitat reflecting and restoring historic farmstead production.
- Pond enhancement
- Enhancement and creation of hedgerows (see Linear Features – Section 4.5 below).

4.4.2 Proposed habitats for the Site are shown in **Figure 4**. With proposed Condition for those habitats in **Figure 6**.

Grassland

4.4.3 Lowland calcareous grassland present in the 'green lane' leading from White Lane to the south of the Site is the most diverse and species-rich grassland present on Site and would benefit from removal of scrub encroachment and garden waste dumped in the lane, to avoid this calcareous grassland developing into scrub habitats.

4.4.4 The poor calcareous grassland in the north-east of the site is not currently in any active management. The lack of management in these fields has resulted in the development of a dense sward of tussocky grasses. The 'other neutral grassland' present in the north-western most slopes of the Site but underlying geology would suggest movement towards calcareous nature is possible. The biodiversity value uplift potential of these grassland areas is constrained by the existing soil nutrient levels, notably including high levels of Phosphorous. These excess nutrients with time and conservation management will leach out, especially from the steeper slopes. However, the seedbank may also be depauperate, adding to the time that will be required to reach the high levels of species diversity required to fulfil criteria for more species-rich grassland.

4.4.5 Nonetheless the steeper slopes over chalk remain a priority area for investment in biodiversity enhancement, with shallow soils over chalk with existing calcicolous species to the east of the Site more likely to achieve good quality species-rich swards given the thinner soils. Restorative management including seasonal cutting and removal of arisings and a conservation grazing regime is proposed.

4.4.6 A trial area of soil stripping using plant is recommended (e.g. 5 x 5m) on the steeper chalk slopes to the north of the Site, to investigate whether this would help to restore the grassland to a diverse and high-quality sward quicker than would otherwise be the case through ongoing grazing management. This trial could inform potential future management recommendations.

4.4.7 Neutral and modified grassland at the base of the slopes at Tyting Farm also has biodiversity value uplift potential, with improvements in sward structure representing a potential gain for biodiversity enhancement. Due to the position of the grassland, the potential to reduce soil fertility to levels conducive to high species-richness are less likely; as such, a focus on improvements in habitat structure and diversity are proposed.

4.4.8 Acid grassland is by its nature relatively species-poor, and the uplift potential would be related to observing a shift in sward composition to species more characteristic of acid conditions. This would yield most benefits in the area to the west of the Site, particularly targeting areas subject to bracken invasion.

Woodland and Scrub

4.4.9 Wood pasture/parkland habitat is proposed to be planted in the eastern-most modified grassland field in the Site. This habitat is intended to provide a habitat linkage between the neutral ancient woodland at the base of the slopes within the Site, to extensive areas of acid-character woodland to the south of the Site, including St Martha's Hill. Woodland habitat enhancement proposals include ongoing control of invasive species including rhododendron which would improve the condition of the woodland habitat, as well as a long-term strategy to maintain and enhance woodland structure and to replace non-native trees.

Orchard

4.4.10 The proposed habitat creation includes the creation of a Traditional Orchard to the west of the Site. There are remnant apple trees *Malus domestica* embedded in nearby dense scrub suggesting that an orchard was present in the area previously. Photographs and historical maps also suggest the presence of kitchen garden features amongst the previous farm buildings. Therefore the creation of this habitat type contributes to maintenance of the historic management of the Site, in addition to providing the biodiversity value inherent in traditionally-managed orchards which would also have the potential to provide community value.

4.4.11 The Biodiversity Metric identifies a "trading error" in the area proposed for traditional orchard creation. This because whilst the majority of this area comprises existing hardstanding (from clearance of farm buildings and scrub, Open Mosaic Habitats on Previous Developed Land (OMHPDL) were identified in a strip around the interface between the hardstanding and the scrub. Although the OMHPDL is relatively floristically rich, and comprises a valuable nectar source and addition to habitat complexity for the Site (The Ecology Consultancy, 2017), the OMHPDL in context is in fact a transitional early successional habitat, arising from works including the removal of previous farmstead buildings in the area. The habitat is now dwindling in size and extent when compared to 2017 (TEC, 2017), and will succeed in any case to scrub without substantive intervention management. The choice of orchard habitat over OMHPDL is therefore considered to be ecologically and historically appropriate for the Site.

4.4.12 This is an example of where the BNG Metric spreadsheet automatically 'flags' a potential issue with a habitat change through highlighting a 'trading issue', whilst the Site-specific context offers good reason to make that change. It is important therefore that the BNG metric is always considered 'guidance' rather than 'dogma' when choosing the best management options for a site.

Pond

4.4.13 The existing large and shaded pond in the west of the Site would benefit from further woodland clearance around the edge, as well as, ideally, reprofiling to provide some shallow edges; both measures would encourage macrophyte growth and diversification of the pond.

4.5 Linear Features

4.5.1 **Figure 5** shows the proposed hedgerows, with proposed Condition in **Figure 6**. Existing species-rich hedgerows in good condition will be maintained and enhanced. Tree lines are similarly limited in their scope for enhancement.

4.5.2 There is substantial scope to enhance species-poor hedgerows through improved management, reducing the proportion of gaps and adding tree standards. In some places, the original hedge is defunct to the extent that a new hedge is required to be created.

4.5.3 The importance of linear and other features to the conservation and enhancement of priority and protected species is outwith the scope of this study. However, the value of linear features to species such as dormouse offers the potential for additional biodiversity benefits to be delivered over and above those reflected within BNG unit calculations alone.

4.6 Application of BNG Key Rules and Principles to Tyting Farm Habitat Creation and Enhancement Proposals

4.6.1 The Biodiversity Net Gain Plan (Stantec, 2022a) determines the costs for the proposed enhancements described in this feasibility report.

4.6.2 Table 4.2 below details the BNG Key Rules (Panks *et al.,* 2022a) and how the proposals for BNG at Tyting Farm would meet them.

Table 4.2: BNG Version 3.1 Key Rules as applicable to Tyting Farm

Key Rules (Version 3.1)	Application of the Rules to Tyting Farm
Rule 1: Where the metric is used to measure change, biodiversity unit values need to be calculated prior to the intervention and post-intervention for all parcels of land / linear features affected.	All land parcels/linear features to be affected have been included in the calculation for both pre and post intervention.
Rule 2: Compensation for habitat losses can be provided by creating new habitats, or by restoring or enhancing existing habitats.	There are no habitat losses to development. Some changes in habitat types proposed are reflected in the Metric 3.1 calculation and are shown as “losses”.
Rule 3: ‘Trading down’ must be avoided. Losses of habitat are to be compensated for on a “like for like” or “like for better” basis. New or restored habitats should aim to achieve a higher distinctiveness and/or condition than those lost.	The trading summary cannot be met for this Site due to the loss of Open Mosaic Habitats on Previously Developed Land (OMHPDL) that cannot be mitigated or compensated for on a like for like or like for better habitat area basis. According to the strict rules of the metric, the loss of priority habitats OMHPDL cannot be exchanged, even for a traditional orchard. The Metric also identifies loss of scrub; again, this would mainly be due to the proposed orchard. The OMHPDL, although relatively floristically rich at the site scale, comprises early successional species colonising bare earth after the relatively recent removal of farmstead buildings from the Site. The habitat lacks the specialist long-term conditions (often post-industrial), that characterise the best examples of this habitat regionally and nationally. The OMHPDL habitat present on Site is also rapidly succeeding to bramble scrub as compared to the area covered in 2017 (The Ecology Consultancy, 2017) and is likely to be lost without complex and costly ongoing management with little certainty of long-term success. There is also the context of the likely loss of traditional orchard and other kitchen garden features caused by the creation of OMHPDL and ongoing scrub development (there are two apple trees and a walnut tree embedded in the scrub). Given this context, including the heritage value and landscape context, then reversion to and extension of the valuable habitat Traditional Orchard that was likely present before the

Key Rules (Version 3.1)	Application of the Rules to Tyting Farm
	OMHPDL and scrub is considered of greater conservation value in the long term. In this way, although the Biodiversity Metric 3.1 trading rules have not been strictly fulfilled, the ecological sense of the enhancement is valid[4].
Rule 4: Biodiversity unit values generated by biodiversity metric 3.1 are unique to this metric and cannot be compared to unit outputs from version 3.0, the original Defra metric or any other biodiversity metric.	No comparison to other metrics has been or is intended to be undertaken.
Rule 5: It is not the area/length of habitat created that determines whether ecological equivalence or better has been achieved but the net change in biodiversity units. Risks associated with creating or enhancing habitats mean that it may be necessary to create or enhance a larger area of habitat than that lost, to fully compensate for impacts on biodiversity.	Ecological equivalence is calculated in terms of net change in biodiversity units as set out in the Biodiversity Metric. This takes into account the risks associated with habitat change and enhancement.
Rule 6: Deviations from the published methodology of biodiversity metric 3.1 need to be ecologically justified and agreed with relevant decision makers. While the methodology is expected to be suitable in the majority of circumstances it is recognised that there may be exceptions. Any local or project-specific adaptations of the metric must be transparent and fully justified.	The only deviation is set out above in relation to trading rules, given the specific example of the loss of early successional floristically rich habitat (OMHPDL) in exchange for reinstatement and extension of the previous traditional orchard habitat.

4.7 Biodiversity Metric Outcomes: Habitats and Linear Features

4.7.1 The Biodiversity Metric 3.1 builds in considerations of risk to the calculations within it, to take account of the uncertainties and risk of failure of any action to create or improve the Biodiversity Unit value of a habitat (or linear feature). This is built into the Biodiversity Metric 3.1 through the use of multipliers to account for the risk associated with habitat creation and enhancement (Panks *et al.,* 2022a). The three types of risk that are considered within the Biodiversity Metric 3.1 are:

- Difficulty of habitat creation or enhancement
- Time to target condition (i.e. for the habitat created to reach its target condition)
- Spatial risk – a risk factor is applied to off-site off-sets which are delivered outside of the area local to the site of impact.

4.7.2 The risk associated with the difficulty of delivery of habitat creation or enhancement, is applied to represent the uncertainty in the effectiveness of management techniques used to restore or create habitat. The level of risk differs between habitat types because of ecological factors (e.g. the different challenges posed by creating different habitat types) and due to the availability of techniques or knowledge of how to create habitats in a realistic timeframe (Panks *et al.,*2022). A habitat specific difficulty multiplier is associated to each habitat type; one for habitat creation and another for enhancement.

[4] This approach is supported by guidance in the Biodiversity Metric 3.1 User Guide (Panks *et al.,* 2022) which reminds the reader that the metric and its outputs should be interpreted, alongside ecological expertise and common sense, as an element of the evidence that informs plans and decisions.

4.7.3 The “time to target condition” multiplier within the Biodiversity Metric 3.1 takes account of the temporal risk of habitat creation and/or enhancement i.e. the time taken for habitat to mature and reach its anticipated target habitat condition. The time to target condition has a ‘discounting rate’ applied to generate the multiplier value which is used in Biodiversity Metric 3.1. ‘Discounting’ over time is an economic technique used to compare costs and benefits that occur in different time periods based around the principle that, generally, people prefer to receive goods and services now rather than later (Panks *et al.,* 2022a). The metric sets a multiplier limit to take account of temporal risk. This equates to a period of 30 years, which is the maximum time frame that most projects and plans can realistically plan-ahead.

4.7.4 The spatial risk multiplier is applied to reflect the proximity of off-site Biodiversity Net Gain delivery to the project site, where the biodiversity loss is occurring (Panks *et al.,* 2022a). This is only relevant where the off-site habitat delivery is outside the local planning area where the impact is happening.

4.7.5 The application of these risks in the Biodiversity Metric 3.1 is relevant to the considerations in this report and the anticipated timeframes for delivery of the habitat creation and enhancement within Tyting Farm. They affect the Biodiversity Metric outcomes and considerations for future management. The multipliers are built into the Biodiversity Metric 3.1 and are therefore not subject to change for this report.

4.7.6 Given the risks described above, the post-habitat enhancement and creation outcomes are set and entered into the metric within a 30 year timeframe for Tyting Farm, to match the anticipated timeframe for the Biodiversity Net Gain Plan for Tyting Farm (Stantec, 2022a). The proposed target habitat type and condition have also been set in the Biodiversity Metric 3.1 for Tyting Farm taking account of this timeframe and a precautionary approach to setting target habitat condition, especially for habitats of higher distinctiveness[5].

4.7.7 As Tyting Farm will be managed “in perpetuity” for SANG purposes, it is anticipated that beyond the 30-year timeframe for the current Biodiversity Net Gain Plan (which includes monitoring and adaptive management), a new Biodiversity Net Gain Plan could be determined for the following 30-year timeframe, with the potential to further enhance the biodiversity value of the Site beyond the target habitat conditions set out within this report. This has the potential to provide for additional Habitat Units, providing the prescribed monitoring of the outcomes of the Biodiversity Net Gain Plan confirm the anticipated outcomes.

4.7.8 Tables 4.2 -4.4 present the Metric outcomes for habitats and linear features (hedgerows) based on the habitat creation and enhancements proposed for the Site, as described in Sections 4.4 and 4.5. Note that the biggest changes come from the proposed enhancement of grassland value, with further small positive changes from woodland creation and enhancement and pond creation. The Metric also identifies negative changes in scrub and urban Broad Habitat Types, as a result of the proposed habitat creation and enhancement proposals. These changes are considered and justified in Section 4.6 against the BNG Key Rules.

[5] Distinctiveness refers to the relative scarcity of a habitat and its importance for nature conservation.

Table 4.2 Summary – Proposed Habitat Creation and Enhancement: Metric Outcomes by Broad Habitat Type.

Proposed Broad Habitat type	Proposed Area	Proposed Value: Habitat Units	Area Change	Habitat Unit Change
Grassland	37.80	323.51	-0.05	+132.60
Woodland	7.54	115.91	0.89	+12.76
Scrub	0	0	-0.41	-2.88
Urban	0.54	0	-0.43	-1.30
Pond	0.04	0.52	0	+0.12
Total	**45.9**	**437.89**	**0**	**139.26**

*rounded to 2 decimal places

Table 1.3 Summary – Proposed Hedgerow Creation and Enhancement: Metric Outcomes by Hedgerow Type.

Proposed Hedgerow Type	Proposed Length	Proposed Value: Hedgerow Units	Length Change	Hedgerow Unit Change
Native Species Rich Hedgerow with trees	0.81	8.18	0.81	8.18
Native Species Rich Hedgerow	0.25	2.78	0.13	1.12
Native Hedgerow with Trees	3.44	39.08	2.82	31.34
Native Hedgerow	1.13	5.38	-2.82	-9.87
Line of Trees	0.05	0.36	-0.58	-1.74
Total	**5.67**	**55.78**	**0.35**	**29.04**

*rounded to 2 decimal places

Table 4.4 Summary Predicted Net Changes in Habitat Units and Hedgerow Units Arising from Proposals for Tyting Farm

Habitat type UKHAB	Unit change	% change
Habitats	141.30	47.32%
Linear features (Hedgerows)	29.04	108.56%

*rounded to two decimal points

4.8 Securing Delivery

4.8.1 An adaptive approach to management at Tyting Farm must be responsive to best practice, monitoring and scientific developments as well as an improving understanding of nature recovery techniques and application to achieve the best outcomes for Biodiversity Net Gain. Policy changes may also occur in relation to wider topics such as additionality of environmental services that could influence management options. On the other hand, a long-

term approach is often required to achieve the continuity of favourable conditions conducive to the development of species-rich and important communities (Blakesley and Buckley, 2016). The required balance between adaptability and consistency of approach is best achieved through the costed Biodiversity Net Gain Plan that includes ongoing monitoring against targets and baseline conditions (Stantec, 2022a).

4.8.2 In relation to technical changes to the Biodiversity Metric, it will be important that future versions, that follow v.3.1, consider the implications of legacy commitments and arrangements. This will enable an adaptive response and incorporation of improvements to the BNG process at Tyting Farm, as well as effective monitoring of progress against the 2022 biodiversity baseline presented in this report.

4.8.3 A long-term commitment must ringfence the resources required for practical management on the Site over the 30-year timescale that is required to deliver Biodiversity Net Gain. Sites earmarked for the delivery of Biodiversity Units must be subject to long-term contractual and budget obligations, as well as secure policies at the site, local and wider levels in order to have confidence in delivery. Where Tyting Farm is to be proposed as an off-set location for proposed development elsewhere within Guildford Borough Council, a minimum number of Biodiversity Units must be agreed for delivery. If circumstances change such that the original proposals for BNG uplift cannot be achieved or bettered, then alternative means of delivery of the contracted Biodiversity Units must be secured.

4.9 Additional Environmental Services from Tyting Farm

4.9.1 Tyting Farm is owned and managed by Guildford Borough Council. There is the potential for Guildford Borough Council to support delivery of other Environmental Services available from Tyting Farm, in addition to Biodiversity Net Gain and SANG delivery. Such Environmental Services opportunities could include contribution to carbon markets and mitigation provision for protected species.

4.9.2 Carbon sequestration is potentially deliverable in addition to Biodiversity Net Gain on Tyting Farm as a distinct environmental service (Surrey Connects, 2014). Although the market and means to achieve carbon sequestration is not at this time well-developed it is recommended that opportunities to do so are explored in the future.

4.9.3 Mitigation provision for protected species is another additional benefit that Tyting Farm could potentially deliver, over and above Biodiversity Net Gain. It is understood that Guildford Borough Council are minded to explore the opportunities for delivery of mitigation habitat for Great Crested Newt at Tyting Farm under the District Licensing regime. The principle of additionality would require there to be exclusive and separate benefits calculated and delivered by Tyting Farm under each scheme.

5 Conclusion

5.1.1 This study demonstrated an approach to biodiversity uplift including calculation of the potential habitat units realistically available from management and enhancement of a 45.9ha farmland site in Surrey (Tyting Farm).

5.1.2 The baseline biodiversity value was calculated with reference to Biodiversity Metric 3.1, with current and proposed habitat type and condition determined though desk study, soil analysis and habitat survey (ref. 3.1). Feasible options for habitat enhancements were developed and informed by practical management considerations, site conditions including current habitats and soils, and context in relation to linkages to surrounding habitats and sites.

5.1.3 Recommended enhancements at Tyting Farm sought to 'dove-tail' with the wider strategic nature recovery context at the Parish, County and wider levels (Biodiversity Opportunity Area ND02: North Downs Scarp & Dip; Guildford to the Mole Gap, Surrey Nature Partnership (2019). This includes in the case of Tyting Farm consideration of linkages with nearby sites such as St Martha's Hill and Newlands Corner, as well as consideration of the landscape character and heritage of the area.

5.1.4 There is considerable potential for enhancing the wildlife of Tyting Farm through encouraging species-rich grassland, restoring hedgerow features, improving wetland habitat, restoring and extending remnant an orchard, and enhancing strategic linkages between woodlands. The potential habitat units arising from these proposed changes were then calculated using the Biodiversity Metric 3.1 spreadsheet.

5.1.5 The Biodiversity Metric outcome determined that based on the proposals, the Site has the potential to provide an uplift of 47.32% in Habitat Units and 108.56% Uplift in Hedgerow Units, equating to a 'Mitigation Bank' of 141.3 Habitat Units and 29.04 Hedgerow Units.

5.1.6 Benefits arose from habitat changes from species-poor 'other' neutral grassland to woodpasture habitat, and from the restoration and enhancement of historic hedgerow lines, including standards and enhancing shrub diversity. A change from OMHPDL to Orchard habitat was flagged within the Biodiversity Metric 3.1 tool as a potential loss of a biodiverse feature, but when viewed in the context of the past, as well as current and potential future wildlife features, the wildlife gains and justification for this proposed change are clear and demonstrable.

5.1.7 Options for uplift were constrained by practical considerations, primarily high nutrient levels in soils (in particular, phosphorus), as well as site-specific management issues. This illustrates the importance of soil assessments and discussions with site managers as an integral part of the development of BNG uplift plans for a site.

5.1.8 A long-term commitment must ringfence the resources required for practical management on the Site over the 30-year timescale that is required to deliver Biodiversity Net Gain. An adaptive approach to management of the Site must be responsive to best practice, scientific developments in nature recovery techniques and monitoring outcomes, to secure the best outcomes for Biodiversity Net Gain. This is best achieved through a costed Biodiversity Net Gain Plan that includes ongoing monitoring against targets and baseline conditions (Stantec, 2022a).

5.1.9 Any proposed development seeking to deliver an off-site off-set must first confirm how the proposed development meets with BNG Key Rules and Principals, especially with regard to the application of the Mitigation Hierarchy.

5.1.10 As Tyting Farm will be managed "in perpetuity" for SANG purposes, it is anticipated that beyond the 30-year timeframe for the current Biodiversity Net Gain Plan, a new Biodiversity

Net Gain Plan could be set for the following 30-year timeframe, with the potential to further enhance the biodiversity value of the Site beyond the target habitat conditions set out within this report. This has the potential to provide for additional Habitat Units, providing the prescribed monitoring of the outcomes of the Biodiversity Net Gain Plan confirm the anticipated outcomes.

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7 Figures

Legend

Habitats Baseline

- g1d - other lowland acid grassland
- g1c - bracken
- g2 - calcareous grassland, poor
- g2a - lowland calcareous grassland
- g3c - other neutral grassland
- g3c6 - ungrazed, neutral grassland
- g4 - modified grassland
- w1f* - ancient woodland
- w1f - lowland mixed deciduous woodland
- w1g - other woodland-broadleaved
- w1g6 - line of trees
- h3 - dense scrub
- u1a - floristically rich, early successional
- u1b - building
- u1c - tracks, hard standing
- r1a - pond

Stantec

Client: For Guildford Borough Council

Tyting Farm Baseline Habitats

0 200 400 m

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Drawn: KJ	Checked: HE
Figure 1	Rev B

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h2NE5
h2NE5
h2NE5
h2NE5
h2NE2
h2NE5
w1g6NE2
h2NE5
w1g6NE2 h2NE5
h2NE5
w1g6NE2
h2NE4
h2NE4
h2NE4
h2NE5
h2NE5
h2NE4
h2NE5
h2NE5
h2NE5
h2NE5
h2NE5

Legend

Linear features

- Line of Trees (w1g6NE2)
- Native Hedgerow (h2NE5)
- Native Hedgerow with trees (h2NE4)
- Native Species Rich Hedgerow (h2NE2)

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Client

For Guildford Borough Council

Tyting Farm Baseline Linear Features

0 200 400 m

[OS Mastermap License Number]

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Figure 2	Rev B

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N

g2a
g3c
g3c
g3c
g2
w1g
g2
g2
w1g
g4
g4
w1g6
g3c6
w1f*
u1c
g1d
g4
g4
g4
w1g
r1a
u1a
u1c
h3
h3
u1a
u1b
w1g6
g1d
g1c
g4
g1c
w1f

Legend

HEDGEROWS

Proposed Hedgerow Condition

- Good
- Moderate
- Poor

HABITATS

Proposed Habitat Condition

- Good
- Moderate
- Poor
- N/A

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Tyting Farm Proposed Condition

0 200 400 m

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Figure 3 | Rev B

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Habitats Proposed

- g1d - other lowland acid grassland
- g2 - calcareous grassland
- g2a - lowland calcareous grassland
- g3c - other neutral grassland
- g4 - modified grassland
- w1f* - ancient woodland
- w1f - lowland mixed deciduous woodland
- w1g - other woodland-broadleaved
- w1g6 - line of trees
- u1b - building
- u1c - tracks, hard standing
- r1a - pond
- g920 - traditional orchards
- g20 - wood-pasture

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Tyting Farm Proposed Habitats

0 200 400 m

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Figure 4 | Rev B

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N

h2NE5
h2NE5
h2NE4
h2NE4
h2NE2
h2NE1
h2NE2
h2NE4
h2NE4
h2NE4
h2NE4
h2NE4
h2NE4
h2NE4
h2NE4
h2NE4
h2NE4
h2NE4
h2NE4
h2NE1
h2NE1
h2NE1
h2NE4

Legend

Linear Features

Proposed

- Line of Trees (w1g6NE2)
- Native Hedgerow (h2NE5)
- Native Hedgerow with trees (h2NE4)
- Native Species Rich Hedgerow (h2NE2)
- Native Species Rich Hedgerow with trees (h2NE1)

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Client

For Guildford Borough Council

Tyting Farm Proposed Linear Features

0 200 400 m

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Figure 5	Rev B

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Legend

Linear Features

Proposed Hedgerow Condition

- Good
- Moderate

Proposed Habitats Condition

- Good
- Moderate
- N/A - Other

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For Guildford Borough Council

Tyting Farm Proposed Condition

0 200 400 m

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Figure 6	Rev B

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Figure 7. Photos from the Site

Fig 7a. Pastoral landscape with woodland to the south. Neutral grassland (with some calcareous character), defunct hedgerows

Fig 7b. Ungrazed calcareous grassland in poor condition

Fig 7c. Grazed neutral grassland, bordered by species-poor hedgerows and trackside treelines

Fig 7d. Ungrazed neutral grassland, ancient woodland in background

Fig 7e. Acid grassland, encroached by bracken

Fig 7f. Mixed woodland on acid soils

	
Fig 7g. Species-poor, gappy hedgerows	Fig 7h. Native hedgerow with standards

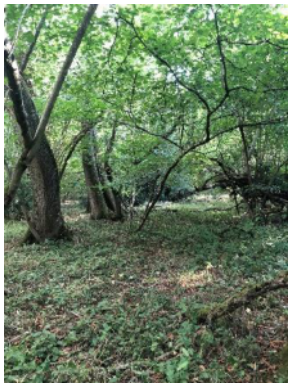
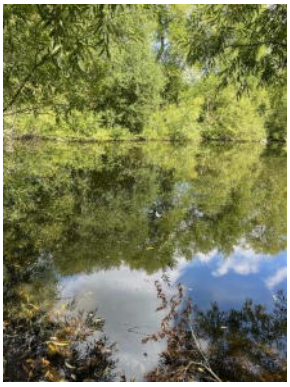



Fig 7i. Ancient woodland	Fig. 7j. Early successional and scrub communities on cleared farmstead location
	
Fig 7k. Rabbit hole, showing thin soils over chalk bedrock on northern slopes	Fig 7l. Pond - shaded

Appendix A Guildford Borough Local Plan: Development Management Policies. Submission Local Plan

Policy P6/P7: Biodiversity in New Developments.

General principles

1) Development proposals, including those exempt from minimum biodiversity net gain standards, are required to seek maximum biodiversity gain and to follow the mitigation hierarchy.

2) Development proposals within or adjacent to a Biodiversity Opportunity Area (BOA) are required to: a) contribute towards the achievement of the objectives of the BOA as set out in the relevant BOA policy statement (and its successor revision documents); b) protect and enhance designated and priority habitats and species within the BOA; and c) improve habitat connectivity across and/or into the BOA.

3) In addition to the BOAs, biodiversity measures are required to align with and deliver the Local Nature Recovery Strategy (to be prepared) and take account of other national, regional and local biodiversity strategies.

4) Major development proposals are required to set out plans for long term management and maintenance of on-site biodiversity. Planting schemes, landscaping and water management

5) Planting and landscaping schemes, open spaces, Sustainable Drainage Systems (SuDS) and Natural Flood Management measures are expected to incorporate species, habitats and management regimes that provide best biodiversity benefit as set out in BOA policy statements and other strategies.

6) Tree canopies are expected to be retained and new tree planting is expected to focus on the creation of new connected tree canopies and/or the extension of existing canopies, unless doing so would adversely impact on sensitive species or habitats. Tree planting schemes are expected to provide resilience in terms of climate, disease and ageing, incorporating large species with long lifespans where opportunities arise.

7) Planting schemes are expected to use UK sourced, native species, unless imported strains of native species would offer greater resilience and are free from disease. Measures on building structures

8) Development proposals are required to include appropriate features in or on building structures that support nature, will last for the lifetime of the development and will cater for appropriate species and habitats.

Site design

9) Development proposals are expected to be designed to create areas of new habitat and provide appropriate links and corridors between new and existing habitats, avoiding and reversing fragmentation and species isolation. Development sites and built features are expected to be permeable for wildlife.

10) In areas where invasive species are present, site design should not facilitate their spread. Where invasive species are present on development sites, they should be eradicated, or controlled where eradication is not possible. Planting schemes must not include invasive plants.

11) Major development proposals are expected, and minor development proposals are encouraged, to deliver measures that promote a sense of community ownership of green spaces and habitats.

Biodiversity Net Gain

12) Qualifying development proposals are required to achieve a biodiversity net gain of at least 20 per cent, or the advised national minimum amount, whichever is greater, measured using the national biodiversity net gain calculation methodology.

13) Biodiversity net gain is not a requirement on previously developed land, unless it supports at least one protected or priority species population or habitat, or an assemblage of species with an otherwise demonstrably high biodiversity value. Where these are present, a measurable net gain for those features is required.

14) Biodiversity gains are required to be delivered in a manner that is consistent with the biodiversity policies in this plan and LPSS 2019 Policy ID4: Green and Blue Infrastructure so that measures are focused on local priorities and will provide the best biodiversity value.

15) New habitats and habitat improvements that contribute towards the achievement of biodiversity net gain are required to be secured and maintained for at least 30 years, or a period of time set out in national policy or legislation if this is greater.

16) Where the applicant is unable to provide the gains on-site, provide the gains off-site or fund gains off-site on third-party sites, a justified and proportionate financial contribution to fund off-site measures will be secured.

17) Development proposals for the creation of biodiversity sites will be supported where these are well located and will be appropriately managed in order to align with local, regional and national strategies and provide best biodiversity value.

Appendix B Biodiversity Baseline Value – Condition Assessment Sheets

B.1 Biodiversity Baseline for BNG calculations

B.1.1 The Condition Assessment sheets, which are the tool Natural England published with the Biodiversity Metric 3.1, in order to determine Condition Assessments for baseline habitats is provided in the excel sheet (Tyting BNG CA_v19Oct22). These provide justifications for the baseline habitat condition entered into the Biodiversity Metric 3.1.

Appendix C Biodiversity Metric Calculations

C.1 BNG Calculations and Outputs

C.1.1 The appended excel sheet (Tyting BNG Metric_v19Oct22) details baseline habitats and linear features using the relevant baseline description, and shows relevant gains and losses as defined by the Biodiversity Metric 3.1. Note that the Site figures are not repeated through embedding in the Metric itself, as these are provided in this Report.

Appendix D Soils and Geology – Detailed Results

D.1 Methodology

D.1.1 The following references were used for desk study and to inform the interpretation:

- Geology: British Geological Survey [BGS] 2001; BGS GeoIndex (onshore) Map Viewer; BGS Lexicon of Named Rock Units; Ellison et al, 2002.
- Soils: Cranfield University Soilscapes; Jarvis et al, 1984; Natural England, Technical Information Notes TIN035, TIN036 and TIN037; UK Soil Observatory Soilscapes.

D.1.2 Laboratory analysis was carried out by Geckoella. Individual sampling point cores from each of the sampled locations (Gecko1 – Gecko 5) were bulked together to give a single soil sample for analysis of between 500g - 1kg in weight. Samples supplied for chemical analysis weighed 400 - 450g per location. Soil texture and chemical analyses were undertaken in accordance with the guidance and methodologies set out in Natural England Technical Information Notes (TIN035 and TIN037). All samples were retained in a cool box / refrigerated condition prior to being analysed.

D.2 Results

Geology

D.2.1 The desk study confirmed that the bedrock geology of the Tyting Farm site strikes east-west (Figure D.1) and comprises a northern, moderately steeply inclined ridge of Upper Cretaceous chalk (assigned to the Holywell Nodular Chalk and Lewes Nodular Chalk formations) which overlies a lower band of Upper Greensand Formation calcareous sandstones and siltstones. Beyond the slope base, a band of relatively impervious, blue-grey clays and mudstones (the Gault Formation) marks the topographically lowest part of the site. The southern part of the area is underlain by the Folkestone Formation which comprises cross-bedded and weakly cemented sandstones (sometimes iron-rich) and forms the wooded slopes that rise up to St Martha's Hill. A North-South cross-section of the geological sequence is provided in Figure D.2.

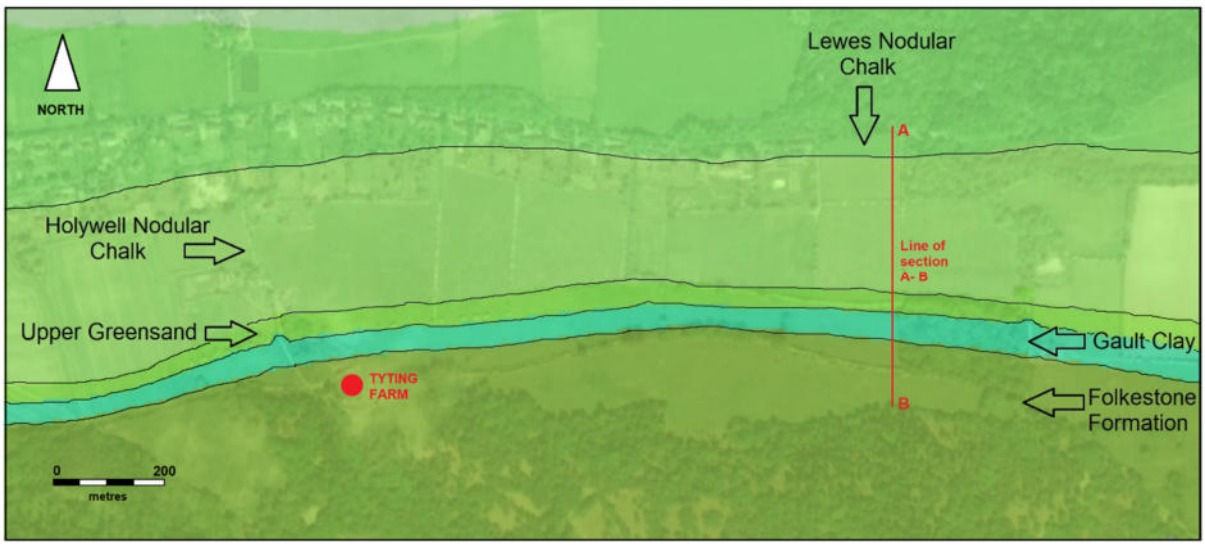


Figure D.1. Bedrock geology map of the Tyting Farm area, showing line of section A-B (data from BGS GeoIndex Map Viewer)

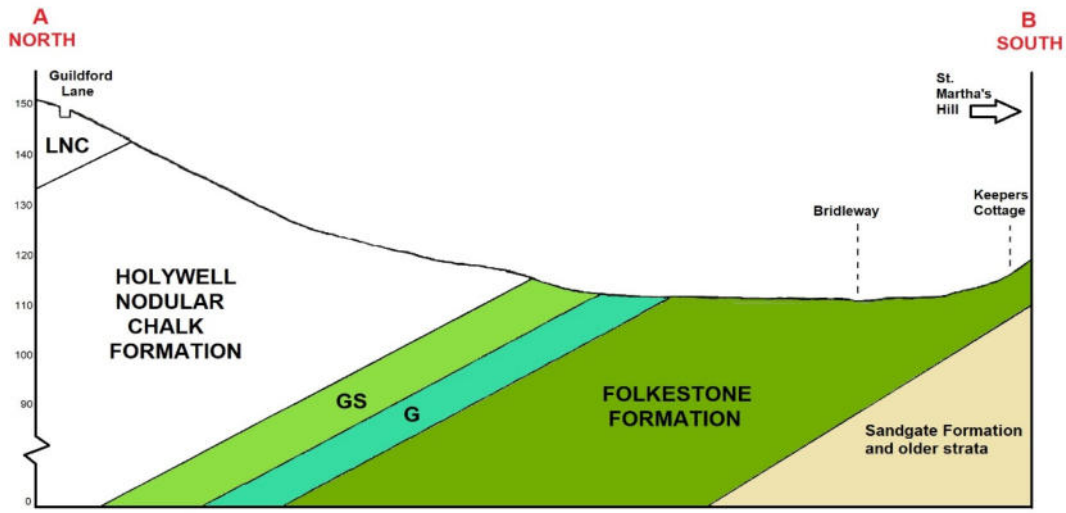


Figure D.2. Geological cross-section (North-South) of Tyting Farm area

(data interpreted from BGS GeoIndex Map Viewer and Ellison et al, 2022). Chalk shown coloured white. LNC = Lewes Nodular Chalk Formation, GS = Upper Greensand Formation, G = Gault Formation. Vertical scale exaggerated).

Soils

D.2.2 Based on the desk study, soils of the Tyting Farm site can broadly be divided into two main types (Figure D.3) which display a close correlation to the underlying bedrock:

- Soil cover of the northern part of the site comprises shallow, well drained, calcareous silt soils over chalk slopes. These are assigned to the Andover 1 Association.
- Soil cover in the southern part of the site comprises (very) acid sandy and loamy soils assignable to either the Shirrell Heath 1 or Shirrell Heath 2 Associations.

D.2.3 There are areas at slope base that are influenced by both these soil types, including through leaching from upper slopes as well as patchy localised soil distribution. These are mixed lime-rich and acidic (ie. neutral) sandy loams.

D.2.4 A third soil type, free draining slightly acid loamy soil, is present at the northernmost margin of the Tyting Farm site adjoining Guildford Lane. However, this has a very limited extent within the study area and is considered to be of negligible influence.

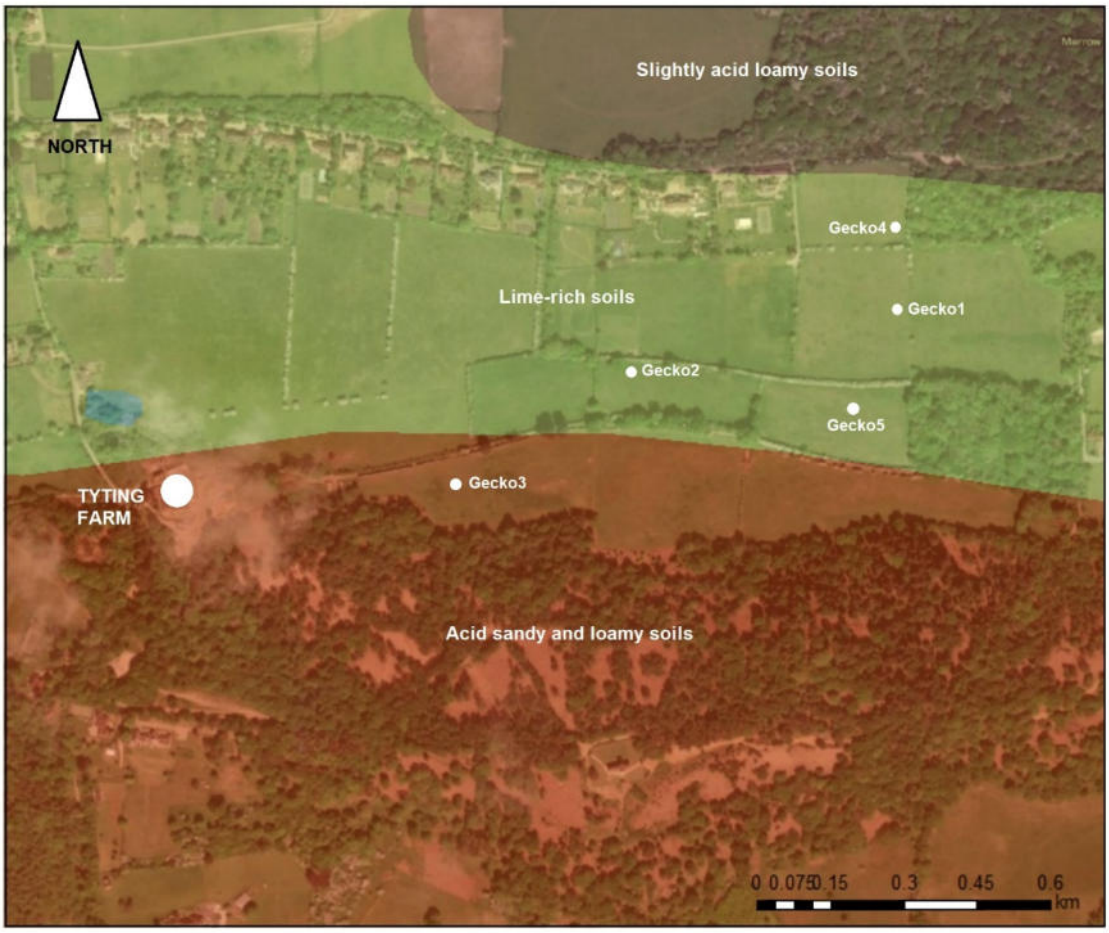


Figure D.3. Map showing the main soil types of the Tyting Farm area

(data from Cranfield University Soilscapes) and centrad location of five soil samples Gecko1 – Gecko 5 collected. (Table D.1 provides the NGR centrads of the five sample locations)).

D2.3 Results of laboratory analysis of soil samples are provided in tables below:

Table D.1. Physical and textural characteristics of the soil samples (analysis by Geckoella)

Soil sample	Centrad Grid Reference	Underlying geology[1]	Soil type[2]	Colour	General notes, texture and sedimentary composition
Gecko1	TQ 0316 4888	Chalk [Holywell Nodular Chalk Formation]	Sandy loam	Medium to Dark brown	Finely to very finely grained sandy texture, very fine to fine subangular to angular quartz particles, 65-250 µm. Occasional small carbonate (chalk) grains, up to 0.5 mm. Strong reaction with 10% HCl acid
Gecko2	TQ 0282 4881	Greensand [Upper Greensand Formation]	Sandy loam	Medium brown	Finely granular sandy texture, fine subangular to angular quartz particles, mainly 125-250 µm, some rootlets. No reaction with 10% HCl acid
Gecko3	TQ 0259 4865	Folkestone Sands [Folkestone Formation]	Sandy loam	Dark brown	Finely granular sandy texture, abundant fine subangular to angular quartz particles, mainly 125-250 µm comprising 60-70% of sample. Some rootlets. No reaction with 10% HCl acid
Gecko4	TQ 0316 4899	Chalk [Lewes Nodular Chalk and Holywell Nodular Chalk formations]	Sandy loam	Medium brown	Finely to very finely grained sandy texture, very fine to fine subangular to angular quartz particles, 65-250 µm, some rootlets. Occasional small carbonate (chalk) grains or rhombs of calcite (0.5 to 1mm). Strong reaction with 10% HCl acid
Gecko5	TQ 0310 4877	Gault Clay [Gault Formation]	Sandy loam	Pale medium brown	Finely granular sandy texture, fine subangular to angular quartz particles, mainly 125-250 µm, common rootlets. No reaction with 10% HCl acid

[1] British Geological Survey Lexicon of Named Rock Units (https://www.bgs.ac.uk/technologies/the-bgs-lexicon-of-named-rock-units, accessed 27 Sept 2022)
[2] Hand soil texture. Classification of Soil Survey of England and Wales & Natural England Technical Information Note (TIN037)

Table D.2. Chemical analysis of Tyting Farm soil samples (analysis by Hill Court Farm Research Ltd, Gloucestershire. Results obtained 16/09/2022)

Soil sample	Lab ref	pH[1]	Phosphorus[2] P (mg/litre)	Potassium[3] K (mg/litre)	Magnesium[3] Mg (mg/litre)	Total Nitrogen[4] N (%)	Total Soil Mineral Nitrogen[5] (kg/ha)	Total Organic Matter[6] (%)
Gecko1	2209564	7.59	92 (Index 5)	138 (Index 2-)	35 (Index 1)	0.550 (High)	10.9	9.56
Gecko2	2209565	6.30	49 (Index 4)	253 (Index 3)	193 (Index 3)	0.338 (Medium)	27.8	7.15
Gecko3	2209566	6.45	61 (Index 4)	268 (Index 3)	86 (Index 2)	0.244 (Low)	30.0	4.34
Gecko4	2209567	7.90	46 (Index 3/4)	132 (Index 2-)	78 (Index 2)	0.499 (Medium)	17.4	13.4
Gecko5	2209568	6.53	33 (Index 3)	170 (Index 2-)	92 (Index 2)	0.217 (Low)	27.9	4.83

[1] Measured in deionised H20
[2] Available P, extraction in 0.5M $NaHCO_3$, pH 8.5 for 30 mins (Olsen method)
[3] Available K and Mg, extraction in 1M NH_4NO_3 for 30 mins
[4] Dry combustion (Dumas method)
[5] SMN (Nitrate N and Ammonium N), extraction in 1M KCl for 1 hour
[6] Loss on ignition

D.3 Interpretation and Implications for Biodiversity Net Gain

Chemical analysis

Soil phosphorous (P)

D.3.1 Overall, the soil analysis of the Tyting Farm samples yields high P levels (Index 3 and above) across the site indicating that it has received high inputs of inorganic fertilisers or manures. The highest P level recorded was in soil sample Gecko1 (obtained from semi-improved grassland overlying chalk in the lower slopes) which yielded very high levels (92 mg/litre) sufficient to be classified as a 'potential environmental risk' (Hill Court Farm Research, September, 2022).

Soil potassium (K)

D.3.2 Soil K is essential to plant growth and is derived naturally from the weathering of clay-rich minerals. Species-rich swards exhibit a wider range of soil K than soil P, and K levels are generally accepted as being a less important soil nutrient when considering the suitability of sites for habitat recreation or restoration (Natural England, 2008b).

D.3.3 Intensive grassland and arable soils are normally Index 2 or above; on grassland where K levels are Index 0, low herbage yields are likely. The lowest K levels (Index 2-) from the Tyting Farm soil samples were not unexpectedly recorded from Gecko1 and Gecko4 – i.e. from soils overlying chalk bedrock. Higher K levels recorded from other soil samples (approximately 170-270 mg/litre) are likely due to both the weathering of clay minerals and/or fertiliser application.

Soil nitrogen (N)

D.3.4 Nitrogen is the dominant nutrient controlling plant growth and the majority of N in the soil is bound up in organic matter. Under old grasslands, total soil N levels may exceed 1% since lack of cultivation allows the accumulation of plant material and manures. Following long-term arable cropping and grass leys, N content will be lower.

D.3.5 The moderate and high total soil N levels recorded from the Tyting Farm site (especially in combination with high P levels) suggest that it has received either significant inputs of animal manures or its history of cultivation is relatively short. Tyting Farm is thought to have been intensively grazed in areas for a considerable period of time.

D.3.6 On land which is being considered for the re-creation of species-rich grassland, the status of both extractable P and total N are important to consider. When sites with low N and moderate/high P are reverted to grassland, there is a high chance of white clover *Trifolium repens* growing vigorously. White clover seeds are often present in soil even after many years of arable cropping. Nitrogen fixation by clover also allows grasses to grow vigorously, and may present a higher risk of perennial weeds such as creeping thistle *Cirsium arv*ense, broad-leaved dock *Rumex obtusifolius* and nettles *Urtica dioica* thriving. Such conditions make it very difficult for wildflowers and less competitive grass species to survive (Natural England, 2008b).

The Andover 1 Association

D.3.7 Andover 1 Association soils occur on chalk crests or slopes and may be associated with deeper calcareous and non-calcareous fine silty soils (Coombe soils) in adjoining valley bottoms. Andover 1 soils are permeable and well drained, they dry rapidly after rain. Although shallow, crops can extract sufficient water from the underlying chalk, especially where chalk subsoil is shattered. The presence of flint bands within the chalk at the surface outcrop can make cultivation difficult. At Tyting Farm, the Andover 1 Association occurs in the northern part of the site.

D.3.8 By way of potential and comparison, there are four National Nature Reserves on this association and several key sites in southern England which may be used to illustrate the range of chalkland habitats and species that can occur. Of these, Castle Hill, Sussex has typical herb-rich *Festuca ovina - F. rubra* grassland. Chalk heathland, with both acidophilous and calcicolous species, occurs notably at Martin Down and Lullington Heath, where ling *Calluna vulgaris*, bell-heather *Erica cinerea* and *Festuca ovina - F. rubra* grassland occur in close association on Andover soils with acid surface horizons. Yew woodland is extensive at Kingley Vale along with herb-rich grassland and some chalk heath, and Yew *Taxus baccata* is associated with Juniper *Juniperus communis* and mixed scrub at Stockbridge Down, Hampshire. A varied complex of scrub with an old stand of Juniper is found at Rushmoor Down, Hampshire. Aston Upthorpe Down in Oxfordshire also contains extensive Juniper along with *Festuca ovina* grassland and mixed scrub (Jarvis et al, 1984; Cranfield University, 2022).

D.3.9 In terms of tree species that may be associated with Andover 1 Association soils, Ash and Field maple Acer campestre are typical of the semi-natural woodlands usually with coppiced hazel, although pedunculate oak and beech have been widely planted. Wych elm occurs on footslopes and with beech and ash on steeper slopes. Common calcicolous shrub species that can occur on soils of those association include Spindle *Euonymus europaeus*, Guelder rose *Viburnum opulus*, Wayfaring tree *V. lantana*, Dogwood *Cornus sanguinea* and Privet *Ligustrum vulgare*. Dog's mercury *Mercurialis perennis* often dominates the herb layer and can conceal *Moschatel Adoxa moschatellina*, Goldilocks *Ranunculus auricomus* and Pignut *Conopodium majus* (Jarvis et al, 1984; Cranfield University, 2022).

The Shirrell Heath 1 / Shirrell Heath 2 Associations

D.3.10 The Shirrel Heath Soil Associations are well drained soils often associated with coniferous or deciduous woodland and lowland heath habitats. Where land is not wooded, the open country ranges from dry heathland to valley mire and exhibits a wide range of groundwater conditions.At Tyting Farm, the Shirrell Heath Soil Association occurs in the southern part of the site.

D.3.11 Shirrell Heath soils typically have pans or bedrock at shallow depth which restrict root penetration, and small water holding capacity makes them particularly droughty. These limitations and the low reserves of Ca, K, P and N and general acidity can restrict the options for future habitats; growth of oak tends to be poor (Jarvis *et al*, 1984; Cranfield University, 2022).

D.4 Soil and Geology References

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