



Infrastructure: Technical Guidance Note 04/2020

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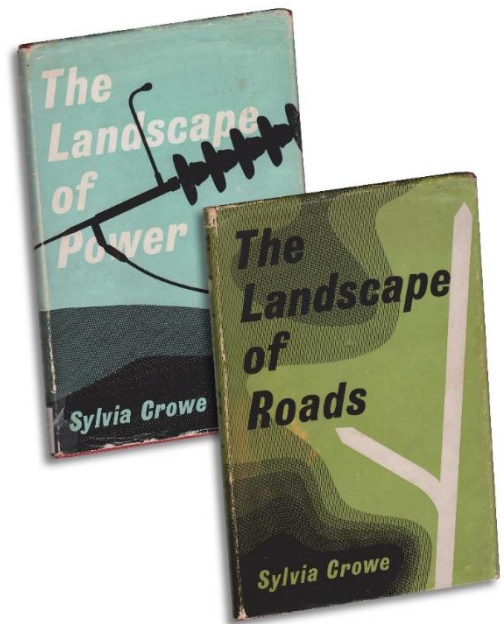
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This Technical Guidance Note explains the role of the Landscape Professional in the planning, design and management of infrastructure projects. It also provides a summary of existing technical guidance. It was prepared with the support of Landscape Professionals working in the UK's leading infrastructure organisations and private practice.

1. Foreword

- 1.1 *“Infrastructure – energy, transport, utilities and digital communication – is the backbone of a successful modern economy”* (Institute of Government, 2020). Yet a significant proportion of the infrastructure that we rely on in the UK today was constructed during the 19th and 20th centuries; that is, it was built for a different time. Infrastructure has become an integral part of our towns and cities, the countryside, and coastal and marine environments. Some is now regarded as iconic and contributes positively to local landscape character and in some cases our national identity. However, the needs of the 21st century are changing rapidly and our infrastructure must adapt. Globalisation, driven by advances in technology, has changed the way we live and work and has exacerbated a decline in some industries and economic regions. The Covid-19 pandemic and global protests in response to climate change have made people think differently and are further accelerating these changes. This will inevitably result in further pressures on the landscape, and the response will need to be guided by professionals to minimise adverse impacts and maximise opportunities for environmental gain.
- 1.2 The Landscape Institute, along with many other organisations, has declared a climate and biodiversity emergency, recognising the important contribution that landscape architecture can play in addressing the issues and effects of the global heating crisis. This is driving many organisations to make commitments to address their impacts on the environment, to achieve net zero carbon emissions and deliver biodiversity net gain. **Science based targets** and the UK Government’s recently published **Enabling a Natural Capital Approach** and Defra’s **Biodiversity Metric 2.0** have merged in response give us the tools to help meet these commitments.
- 1.3 At the same time, the UK is on the cusp of significant changes in policy and investment as a result of Brexit. This is likely to result in further growth and development with the added requirement to decarbonise the economy. The government announced a comprehensive spending review in March 2019, with the aim of levelling up the UK economy by investing in infrastructure, innovation and people. This includes a review of **“The Green Book”**, which informs investment decisions on infrastructure projects. The UK government’s recent White Paper on **proposals for reform on the planning system in England** also sets the direction of travel for planning for infrastructure and connected places. This includes wide ranging changes to the plan-making process with more focus on design and the introduction of a new national Infrastructure Levy. The **Environment Bill**, which is currently progressing through parliament, will also introduce in law requirements to conserve and enhance biodiversity for development to deliver biodiversity gain.
- 1.4 The planning, design and management of infrastructure will have to respond directly respond to the challenges and opportunities these issues and policy changes present. For example, new forms of energy generation will emerge and the means of managing rising water levels and more frequent extreme weather events will require new and innovative engineering and environmental solutions. The investment required will be significant but can be the catalyst for a whole range of programmes and projects which interface with it.
- 1.5 The **Fourth Industrial Revolution** raises further challenges and opportunities. This will see technologies in the physical, digital and biological spheres fuse (World Economic Forum, 2016) and in the coming years new forms of infrastructure will emerge. By example Artificial Intelligence will fuel the data-driven economy and will make such things as autonomous vehicles a reality, dramatically changing travel patterns and influencing the way transport infrastructure is planned, designed and managed.

- 1.6 Landscape Architecture is a multi-skilled profession that has historically had a significant role in the planning and design of new infrastructure. Landscape Professionals are trained to think at scale and respond to context, helping to understand the relationship between different elements and how people relate to place. They therefore have the skills necessary to integrate major infrastructure projects successfully into the landscape.
- 1.7 The importance of a landscape-led approach to infrastructure design was recognised by the pioneers of modern landscape architecture from the early post-war period. As the country sought to rapidly rebuild the broken fabric of its towns and cities and to capitalise on the quantum leaps made in technology through the war, there was a huge drive for modernisation and growth. Landscape Professionals, such as Sir Geoffrey Jellicoe, Dame Sylvia Crowe DBE and Brenda Colvin, were influential during this time and championed the importance of landscape and of the role of the landscape profession in delivering good design. Together with leading planners, such as Patrick Abercrombie, and architectural critics, such as Iain Nairn, they led the discourse and made an enormous contribution to the planning and design of much of the post war infrastructure we still rely on today.
- 1.8 The solutions to the challenges we face will come through broad collaboration and a genuinely joined up approach to the planning, design and management of infrastructure. Landscape Professionals will continue help to guide change, by applying their unique understanding of the art and science of landscape to positively address constraints and maximise place-making opportunities for the benefit of people and the environment. This will ensure new infrastructure makes a positive contribution to its immediate and wider environmental context and that this generation leaves a fitting legacy for the future.



2. Introduction

- 2.1 This Technical Guidance Note provides information to members of the Landscape Institute, other professionals, clients, decision makers and stakeholders on the planning, design and management of infrastructure. It has been prepared by a group of landscape and other professionals working within the public and private sectors, supporting the delivery of major infrastructure projects in the UK. Details of the working group are provided at the end of the document.
- 2.2 The document is split into two main parts:
- **Part 1** explains what infrastructure is, the role of the Landscape Professional and the planning and design process in a major infrastructure project.
 - **Part 2** provides technical guidance and resources, introducing documents of relevance to different infrastructure types.
- 2.3 A comprehensive bibliography is provided at the end of the document.
- 2.4 The principal objectives of this guidance are to:
- Highlight the valuable role Landscape Professionals can have in infrastructure projects;
 - Emphasise the importance of an understanding of context to good design and place making; and
 - Provide a resource for practitioners, decision makers and stakeholders by bringing together key references in one place.

Part 1: Context and guiding principles

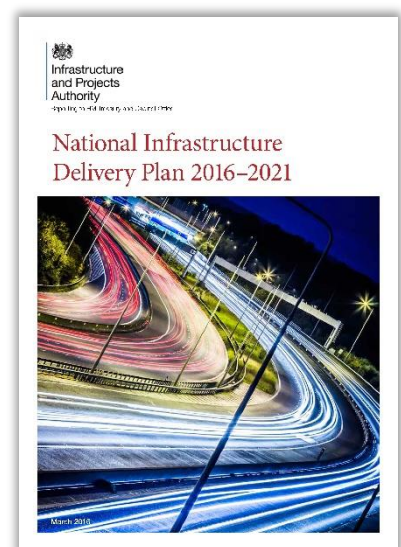


3. What is infrastructure and how is it planned for?

- 3.1 Infrastructure can be defined as “the basic physical and organizational structures and facilities (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise” (OED, 2019). Thus, infrastructure underpins effective and efficient communications and trade, which are essential to a functioning economy and the health and wellbeing of communities.
- 3.2 Despite its importance, infrastructure can be taken for granted, forming part of our everyday lives. However, well-designed and integrated infrastructure which responds to and enhances its surroundings can come to be celebrated for its contribution to the landscape. For example, the historic bridges of Brunel are now often regarded as iconic architectural statements. Similarly, Bazalgette’s Thames Embankment in central London seamlessly and elegantly integrates wastewater and transport infrastructure while providing an attractive riverside public realm.
- 3.3 Infrastructure projects vary significantly in scale and the levels of disturbance that they can cause. Some infrastructure, for example, is predominantly underground, potentially limiting the effects it can cause during operation. Other elements can be large and permanent features protruding above the landscape, resulting in potentially widespread effects to the environment and communities.
- 3.4 The construction, upgrading and decommissioning of infrastructure can also be disruptive, often requiring a significant amount of land in addition to that needed for operation. In very large and complex projects, construction activity may extend over several years and in some instances require temporary infrastructure, such as access roads or wharves. In this context, the renewal and re-purposing of existing infrastructure for future needs is also important. Examples include the conversion of existing motorways to Smart Motorways and the expansion of ports and airports to accommodate greater volumes of traffic and larger ships and aeroplanes.
- 3.5 The issue of integration and multifunctionality is nothing new but has become ever more important as pressure on space and project finances increases. For example, linear infrastructure such as new roads or railways can present an opportunity to deliver new telecommunications infrastructure or contribute to Nature Recovery Networks by linking habitats at the landscape scale.

Policy context

- 3.6 Policy and strategic planning of infrastructure in the UK is under constant review, building on and integrating with existing networks. However, the benefits of investment in delivering sustainable economic growth may not be fully realised for a generation or more and so a long-term view is needed. The **National Infrastructure Delivery Plan 2016-2021** sets out the governments ambitions to invest over £480 billion in infrastructure and is underpinned by a new organisational framework (HM Treasury, 2016). This will be followed by a 30-year infrastructure strategy for the UK, which is now expected in autumn 2020. The National Planning Policy Framework in England, and the equivalent documents in other jurisdictions, provide the policy context for how the changes brought about by infrastructure projects will be managed. They are supported by National Planning Statements (NPS) for different types of infrastructure. Further information on these documents is provided in section 6.



- 3.7 The **National Infrastructure Commission (NIC)** was established by the government in 2015. It enables long-term strategic decisions to be taken on future infrastructure needs. It provides expert, impartial advice to the government on infrastructure, engaging with industry, interest groups and other stakeholders to gather views on future infrastructure needs and solutions (NIC, 2019) and is also a champion for high quality, multi-functional design. The NIC published **Design Principles for National Infrastructure** in early 2020, which are explained in detail in Section 6 of this document (NIC, 2020).
- 3.8** The **Infrastructure and Projects Authority** was formed in 2016 and is tasked with improving the delivery of major government projects. It supports the successful delivery of all types of infrastructure and major projects ranging from railways, schools, hospitals and housing, to defence, IT and major transformation programmes (Infrastructure and Projects Authority, 2019).

4. The role of Landscape Professionals in infrastructure projects

- 4.1 The impact of infrastructure projects can be extensive and wide ranging. Without a clear vision, design can often resolve to mitigating adverse effects within the narrow confines of the land left over within scheme, but this ignores broader opportunities. Achieving good design which works with the landscape and delivers valuable green infrastructure therefore needs a joined up, collaborative approach, where all planning and design elements of the project are integrated. This requires a common vision and purpose and a culture of openness to new ideas and perspectives.
- 4.2 Landscape Professionals make an important contribution to collaborative working. This is because they understand and help to coordinate and assimilate the work of other professionals such as civil engineers, architects, ecologists, noise consultants, archaeologists and community engagement specialists. These aspects need to be identified early and drawn together to respond positively to the opportunities presented for the benefit of people and nature and create or reinforce sense of place.
- 4.3 By applying design creativity and an understanding place Landscape Professionals can inform and influence all scales of planning and design, from optioneering and strategic masterplanning down to the detailed design and specification of soft and hard landscape works. This means looking beyond the narrow corridor or immediate context of the development to identify the wider opportunities, for example to enhance natural capital and ecosystem services to deliver net gain.
- 4.4 The role of a Landscape Professional in the delivery of an infrastructure project can therefore include:

- Assessing and describing the landscape and visual context. This should include the elements and features of particular value that should be conserved, enhanced and protected. This may require undertaking baseline character assessments or interpreting and ground-truthing published character assessments or landscape sensitivity and capacity studies. An assessment of the effects during construction, operation, once decommissioned and at night are often a requirement of the consenting process.
- Advising project teams on the issues, legislation and policies related to landscape and views, including National Parks, Areas of Outstanding Natural Beauty, Ancient Woodland or local landscape designations.
- Contributing to the vision and design principles to guide the planning and design of infrastructure.
- Championing a landscape-scale approach to design, which delivers net environmental gain. Working with other professionals and stakeholders to use the results of landscape and visual impact assessments (LVIA), ecological appraisals and Ecosystem Services Assessment to inform early design progression, optioneering, consideration of alternatives and masterplanning and to mitigate adverse effects.
- Engaging in consultation with statutory and non-statutory organisations and the public and prepare reports and presentations to communicate and engage on specific technical issues.
- Working closely with project engineers and architects to guide and/or lead the design and integration of civils works including ground modelling, flood management, utilities and transport infrastructure. This includes guidance on detailed matters related to the visual appearance of the proposals, such as the appropriate use of colour.
- Developing landscape design materials and specifications necessary to support planning consents, construction and future management.

- Preparing visualisations as part of optioneering or to test proposals during the iterative design process and to illustrate the final proposed development.
- Preparing management plans to explain the actions that need to be taken during operation of the scheme to realise the vision and objectives of the design.
- Undertaking a specific design quality role, for example as a member of a design review panel or overseeing work during the construction, operational and decommissioning stages of the project.

- 4.5 To maximise the value that Landscape Professionals can bring to infrastructure projects, it is important that they are appointed at an early stage in the project lifecycle and that their brief is made clear to the whole team. This includes those with responsibilities for advising stakeholders and decision makers on design and future management.
- 4.6 It is often necessary to draw together the work of several professional disciplines, such as ecology and cultural heritage, to establish a comprehensive understanding of the environmental context of a project. This can help deliver multifunctional and innovative design solutions that mitigate adverse effects for several types of receptor and conserve and enhance local characteristics.
- 4.7 There are roles in the public sector, for example within infrastructure delivery organisations and local planning authorities and for a wide range and scale of landscape practices in infrastructure projects. Larger practices, including those within multi-disciplinary organisations, often have the resources necessary to service demanding projects over a long period. Smaller landscape practices also have opportunities, for example by providing specialist inputs, working with larger practices as part of supply chains or in representing stakeholders including Local Planning Authorities. When appointing Landscape Professionals clients are often keen to see evidence of experience, but local knowledge can also be a major consideration.
- 4.8 Landscape Professionals are also increasingly sought to join expert panels and committees related to the improving the quality of design, delivery and management of infrastructure. For example, several members of the Highways England Design Review Panel and the Design Council's panels are Landscape Professionals. Members are encouraged to share their experience and expertise by joining such groups, supporting the Landscape Institute and through contributions to publications, academic research and events. Such roles demonstrate the benefits and raise the profile and understanding of the profession amongst peers in other professions and government.

5. The planning process for major infrastructure projects

- 5.1 The need for major infrastructure projects is likely to be established at the national or regional scale. At the more local scale, infrastructure requirements are established through the Local Plan process in an accompanying Infrastructure Delivery Plan (IDP). This sets out what infrastructure is required to support planned growth identified over the plan period. There is often a role for Landscape Professionals in feeding into the IDP or through the **Strategic Environmental Assessment (SEA)** process, which considers the likely significant effects of plans and policies on the environment.
- 5.2 There are several ways by which consent can be secured for major infrastructure projects. This includes through statutory powers, such as schemes delivered under the Highway Act 1980, Hybrid Bill or Transport and Works Act Orders. This section focusses on Nationally Significant Infrastructure Projects (NSIPs), which fall under the legislation set out in the Planning Act 2008 (as amended) (PA2008) for a range of major infrastructure projects, in England and Wales. Whilst there may be procedural differences between the different planning routes, the general principles are common. Reference to other planning routes is given in Part 2 of this document where relevant.

Nationally Significant Infrastructure Projects (NSIP)

- 5.3 Until the Planning Act 2008 (PA2008) introduced a new process to streamline the decision-making process in England and Wales, major infrastructure projects could take many years to come to fruition. This Act introduced the definition of NSIPs, which are large-scale developments relating to energy, transport, water, or waste, which meet certain thresholds as set out in PA2008. It was subsequently amended by the Localism Act 2011. An extension of the regime in 2013 now also allows certain business and commercial projects to opt into this process.
- 5.4 In the case of an NSIP the promoter of the scheme will prepare material in order to apply for a Development Consent Order (DCO) from the relevant Secretary of State. In the case of offshore wind proposals, there may also be a need for **Deemed Marine Licenses** (DML). If granted, the DCO will remove the need to seek most of the consents separately that would otherwise have been sought from a Local Planning Authority and other regulatory bodies. It is therefore designed to be a much quicker process because the legislation sets out fixed timescales for Examination, reporting and decision making. Over 80 major infrastructure projects, including the Thames Tideway Tunnel and Hinkley Point C Nuclear Power Station have been decided through this planning route.
- 5.5 There is a lot to learn from major infrastructure projects of the past and present. A review of the relevant documentation can provide a useful starting point for defining the scope and approach to challenges presented by infrastructure schemes. The National Infrastructure Planning pages of the Planning Inspectorate are a useful resource as they provide links to all DCOs which have been decided, including libraries of documents. The Planning Inspectorate provides a **Register of Applications for NSIPs**, which provides links to project related documentation (The Planning Inspectorate, 2019a). There are also various **guidance** and **advice notes** available on the Planning Inspectorate website, which can be helpful.

National Policy Statements (NPS)

- 5.6 Applications for DCOs are decided in accordance with designated National Policy Statements (NPS), if one exists for that specific type of infrastructure, or through national and local policy if one does not. NPS are formally “designated” by the Government after a process of public consultation and Parliamentary scrutiny. NPS fall under the categories of hazardous waste, waste water, energy, national networks, aviation, ports and geological disposal infrastructure (The Planning Inspectorate, 2019b). Landscape is a key consideration, in most NPS, for example, the current NPS for National Networks stresses the importance of understanding

and responding to landscape character. Draft NPS can also carry some weight for decision-makers in the development consent process. This will depend on how far along the process the NPS is at and how much consultation has taken place.

Development Consent Order process

- 5.7 The Landscape Professional should play a key role as part of a multi-disciplinary team in the development of a DCO application. The process is overseen by the National Infrastructure Planning Unit of the Planning Inspectorate, working under authority delegated by the relevant Secretary of State. The timetable following acceptance is clearly set out in PA2008, with six months for the Examination, three months for The Planning Inspectorate to prepare a recommendation to the relevant Secretary of State and three months for the Secretary of State to decide. Whilst the DCO process is focussed on determining consent, it is important to understand that the design is developed in parallel. Detailed design considerations are subject to future approvals by relevant local planning authorities and other bodies post-DCO consent.
- 5.8 The process is front-loaded and examined in accordance with a statutory timetable. Prior to submitting an application, the process is driven by the applicant, engaging stakeholders through consultation much earlier than might be expected in other types of planning consent. It is therefore important to understand the different stages and the inputs that are required at each stage. Once accepted for Examination an Examining Authority (ExA) is appointed by the relevant Secretary of State and then it is the ExA which drives the process. The ExA recommends approval or refusal, but the final decision on granting a DCO rests with relevant Secretary of State. The key stages are shown in the diagram below and a useful video which explains the process is provided on the [Planning Inspectorate website](#).



Pre-application

- 5.9 This phase encompasses the baseline, assessment and design work and consultation with affected parties and statutory bodies up to the point of submission of the DCO documents. It is therefore likely to be the longest phase in the DCO process and can take many months. It is a statutory requirement and is led by the applicant. Where the type of the proposed development is subject to an NPS, that NPS sets out the assessment criteria and the aspects to be considered in decision-making for a range of topics including landscape and visual.

Scoping

- 5.10 As all DCO schemes are very likely to fall within the thresholds of the Environmental Impact Assessment (EIA) Regulations, a scoping report is likely to be required. The format of the scoping report will be determined by the EIA coordinator for the project, but it will be the responsibility of the Landscape Professional to define the scope, method, receptors and forms of presentation for the LVIA and to describe how this will be used to inform and influence the design process. Early engagement with stakeholders, such as Local Planning Authorities, and other relevant Statutory Consultees will be important in defining the scope of the LVIA, including the extent of the study area, the relevance of existing baseline studies and the location of receptors and viewpoints to inform the assessment.
- 5.11 The Secretary of State's Scoping Response will set out key matters which will need to be addressed in the LVIA, and often relate to design matters and inter-dependencies with other environmental topics, including biodiversity, amenity and recreation, heritage and noise.

Preliminary Environmental Information Report (PEIR)

- 5.12 The PEIR is unique to DCO schemes, falling between the issue of the scoping report and the Environmental Statement (ES). It is intended to provide statutory consultees, other interested parties and communities with a summary of the baseline, initial assessment findings and further work planned in preparation of the ES. It is usually published by the applicant to precede Statutory Consultation, which may include formal public consultation events, such as public exhibitions. There is no set format for the PEIR and it therefore varies between projects, but it can be expected to be a comprehensive document which presents sufficient detail reflecting a level of understanding and assessment appropriate to the point at which the scheme has been developed.

Consultation

- 5.13 There must be evidence that adequate consultation has been carried out for the Planning Inspectorate to accept the DCO application. It is therefore fundamental the consultation is properly planned, and the results are well documented. **Advice Note 3: EIA Notification and Consultation** (The Planning Inspectorate, 2013) and **Planning Act 2008: Guidance on the pre-application process** (DCLG, 2015), provides useful information on consultation.
- 5.14 Engagement should not end at the scoping stage and dialogue should continue between the applicant's team, Local Planning Authorities, statutory consultees (such as Natural England or Natural Resources Wales) and other interested parties (such as AONBs, the National Trust, town and parish councils, and wildlife trusts), including lobby groups and local residents. This may include refining the landscape mitigation and enhancement strategy in response to the evolving assessment and design. The requirements for landscape mitigation are likely to be discussed through meetings and workshops and documented through correspondence that can inform Statements of Common Ground (SoCG), which are documents agreed between the Applicant and other parties to set out areas of agreement and disagreement, and which are updated through the Examination.
- 5.15 The Landscape Professional's understanding of the project and the interrelationships between different environmental and design aspects means that they can play an important role in explaining the scheme to the stakeholders and the public. They should therefore expect to be involved in consultation throughout the DCO process, which may include:
- Preparing written and illustrative materials, such as masterplans, illustrations and visualisations;
 - Meetings and correspondence with local planning authorities and statutory consultees;
 - Attendance and presentations at community forums, such as parish council meetings;
 - Attendance at consultation events, such as public exhibitions and roadshows.
- 5.16 It is common for major infrastructure projects to employ teams of public liaison and communications specialists in the planning and implementation phases. They coordinate and manage the stakeholder engagement process, developing systems to plan and record the feedback received. Consultation is likely to involve a mixture of informal discussions and formal exhibitions where published materials for a particular design stage are presented. The method and results of the consultation are recorded in the 'Statement of Community Consultation' (SoCC), which the Landscape Professional may contribute to by reviewing and responding to comments specific to landscape and visual matters.

DCO application documents

- 5.17 Many documents will form part of the DCO submission, with each being made available via the Planning Inspectorate website for public access and reference during the Examination process.
- 5.18 The ES is likely to include a chapter comprising the LVIA, which sets out the significant landscape and visual effects and mitigation proposed. This will build upon the information set out in the PEIR, including additional supporting tables, figures and visualisations. As these can be very large and complex assessments, it is advisable to present the detail in appendices so that the main chapter can be focussed on summarising the key points to inform decision makers and consultees. This is likely to include consideration of construction, operational and inter-project and cumulative effects, and may also consider other aspects such as night time effects and decommissioning. The EIA Coordinator will agree the format of the ES and review the technical chapters, including the LVIA, to make sure they are consistent.
- 5.19 The Landscape Professional may also be involved in the production of other supporting documents such as a Design and Access Statement, an Environmental or Landscape Masterplan, General Arrangement drawings, Outline Environmental Management Plan (OEMP) and Outline Landscape and Ecology Management Plan (OLEMP). The OEMP (or equivalent) is a key document in conveying the design principles, should the DCO application be consented, to guide the future approvals. When approved by the local planning authority it will be the mechanism for securing and enforcing the design. The Landscape Professional may also be involved in the drafting of requirements in the DCO which relate to landscape matters.

Acceptance

- 5.20 The Planning Inspectorate will consider whether an applicant has complied with the acceptance procedure and will have sought the views of all affected Local Planning Authorities (formally referred to as Adequacy of Consultation Representations) before accepting the DCO application. It will only be accepted if it is deemed satisfactory for Examination against set criteria set

Examination

- 5.21 The Examination commences the day after its preliminary meeting. At this meeting, a draft Examination timetable which has been published beforehand will be discussed. Once the timetable is confirmed an Examination Library document is published, which is updated after every deadline with unique references for all documents submitted.
- 5.22 The Examination process provides the opportunity for the ExA (a single examining inspector or a panel of up to five depending on the complexity of the proposed development) to test the evidence presented in the DCO submission. Examination is undertaken mainly as a written process, with hearings used where matters need further resolution. There are three types of hearings; issue specific hearings, where the ExA leads questioning, open floor hearings where local people and those representing local people are invited to give their evidence and compulsory acquisition hearings, which relate to acquisition and/or temporary possession of land.
- 5.23 The Examination is often an intense period of work for Landscape Professionals, consisting of several related workstreams. Near the start of the Examination, the ExA will publish written questions for the Applicant and other Interested Parties to answer via written responses. These are likely to include questions on design matters, the LVIA and OEMP as well as matters of detail in the DCO. PA2008 sets out the timescales and processes for the asking of written questions, responses and then opportunities for Interested Parties to respond to the responses.

- 5.24 The Landscape Professional will have a defined period in which to respond to these questions, so that they can be reviewed and either closed out or additional questions raised. Therefore, during the Examination period, it is likely that there will be rounds of written questions (usually two) requiring a significant investment in time and resources.
- 5.25 It is common practice for the ExA to make unaccompanied site visits to familiarise itself with the proposed development area, viewpoints etc. During the Examination there is also likely to be accompanied site visit(s) for the ExA and Interested Parties, which can be led by the Landscape Professional. The purpose of the site visit is to point out key features and matters of relevance to the ExA. It is not an opportunity to present evidence or make oral representations.
- 5.26 Throughout the DCO Examination, the Applicant continues to liaise with many Interested Parties including those with which it has set out a Statement of Common Ground (SoCG), particularly where matters may remain ‘under discussion’ or are ‘not agreed’. Regular updates on the SoCG are submitted during the Examination to enable the ExA to keep up to date with relevant matters, with the written questions and hearings most likely to focus on those matters which are not agreed. The Applicant will also continue to update negotiations with landowners (Affected Persons).
- 5.27 It may be necessary for the Landscape Professional to attend several hearings, to answer specific questions on the LVIA or support the multi-disciplinary team on design matters or related topics, including the OEMP or equivalent. The ExA issues an agenda in advance of the hearings to lead the discussion and all responses are generally submitted into the Examination via a written submission. Unlike a public inquiry, the DCO Examination is an inquisitorial process. If there are matters which cannot be answered during the hearing, the Applicant, if requested by the ExA can provide a response to the Examination via written submissions (often called a Post Hearing Note).
- 5.28 Landscape Professionals may also represent other Interested Parties, such as local planning authorities, landowners and objectors at the Examination. Further information on this is provided in **Advice Note 8.2 How to register to participate in an Examination** (The Planning Inspectorate, 2016).

Post Examination

- 5.29 The ExA must prepare a report and recommendation on the application to the relevant Secretary of State within three months of the close of the Examination. The Secretary of State then has three months to make the decision on whether to grant or refuse development consent, although there are cases when the SoS has taken longer, which requires Parliamentary consent. There is no route for appeal, but the decision can be challenged in the High Court through a judicial review.
- 5.30 Once the Examination is closed, the Landscape Professional is likely to be involved in the preparation of tender documents and the subsequent tender review process and design work required to be approved by the relevant local planning authorities and other bodies before the construction phase can commence. There may be a change in design team at this stage and if so a transition or handover process may be required.
- 5.31 The relevant local planning authority is usually responsible for approving and enforcing the Requirements set out in the DCO. Secondary consents and licences may also be needed.

Department for Transport business case

- 5.32 Aside from the planning requirements, it may also be necessary for the Landscape Professional to carry out work to support the development of the business case for infrastructure projects. This process may be

linked to the planning and design process and is likely to start early in the development of the scheme process and may be revisited at several points as the proposals develop.

- 5.33 The Department for Transport (DfT) is responsible for the delivery of major new transport infrastructure in the UK and for ensuring public resources are invested to provide the greatest benefits to society, in the most efficient way. Value for money is therefore a key consideration from the earliest stages of planning for major new transport infrastructure and DfT has defined a process for this (Department for Transport, 2015). The **DfT Value for Money Framework** (VfM), which is informed by the economic models defined by Her Majesty's Treasury, sits alongside **WebTAG** (Department for Transport, 2019) and **WelTAG** in Wales) (Welsh Government, 2017) and explains how to use the appraisal results to provide value for money advice for our decision makers. In Scotland, it is necessary to refer to **Scottish Transport Appraisal Guidance (STAG) – Section 7: Environment** (Transport for Scotland, 2014a).
- 5.34 The DfT VfM framework recognises that major transport schemes are likely to have an impact on the landscape. **Value for Money: Supplementary Guidance on Landscape** (DfT, 2016) provides guidance on undertaking an approach to indicatively monetising the landscape impacts of a transport proposal. This document sets out a seven-step procedure as follows:

1. Identify landscape features - uses information from the WebTAG landscape worksheet and an environmental constraints map (identify moderate or large landscape impacts). This step comprises the WebTAG non-monetised assessment.

2. Segment the scheme – Divide the scheme into segments where landscape impacts vary significantly.

3. Determine Land Type – From information or other sources (environmental constraints map/google maps) determine the appropriate (mix of) land type.

4. Determine landscape 'footprint' - Determine the size of the area affected by the landscape changes.

5. Mitigation – Identify any current mitigation structures or measures proposed to reduce impacts on the landscape.

6. Landscape impact valuation - Use the landscape values recommended in this guidance to assess the landscape impact.

6. The landscape design process for infrastructure

Introduction

- 6.1 This section explains the general process and key design considerations for major infrastructure projects. It is not intended to be prescriptive and should be adapted to address the scope, programme and needs of the client and stakeholders on a project-by-project basis.
- 6.2 Communication is a common theme, which is referred to throughout this document. Landscape connects people, place and nature, which are often amongst the highest concerns of the public and stakeholders in infrastructure projects. How the design is developed and communicated is therefore very important as it can affect how it is received and understood. It will be necessary to apply various techniques at different stages of the project, for example through face-to-face meetings, presentations, illustrations and visualisations. This should be established at the beginning of the project and reviewed regularly throughout.

Vision

- 6.3 All infrastructure projects should start with a clearly defined and described design vision. The Landscape Professional can play a key role in this process by articulating the interrelationships between the environment and design at the landscape scale.
- 6.4 The design vision should be developed with the broadest range of input to maximise its impact in challenging, motivating and inspiring the design team. The vision could be developed through separate visioning workshops or competitions, for example, informed by initial baseline assessments to identify opportunities and constraints. The results should be articulated as an aspirational statement which guides the goals and objectives of the delivery organisation and the design team, informs the design principles.

Landscape design

Introduction

- 6.5 Infrastructure projects by their nature can transform the character of large tracts of landscape and therefore the design response needs to be strategic and landscape-scale. The design vision can inform the development of a Landscape Design Strategy for the scheme which delivers multiple benefits to people, place and nature, including through green infrastructure. This should set out the key constraints and opportunities, objectives and design principles which will provide the framework for the design and delivery of the vision. It should include a detailed study of the existing landscape, including a landscape character assessment and be informed by other studies such as habitat studies and Ecosystem Services Assessments. This should identify features or characteristics which should be preserved, conserved, enhanced or replaced. It can also provide guidance on how mitigation should be designed, as new interventions should seek to follow guidelines included in LCAs.
- 6.6 It is important that the landscape design process is not carried out in isolation integrated with the wider engineering and environmental design. This will help maximise opportunities to deliver biodiversity net gain and minimise embodied carbon. The Landscape Design Strategy should therefore be developed with input from other environmental and design disciplines. This should cover all aspects of the scheme, including the construction phase, options for retaining important or valued assets, opportunities for advanced planting and phasing of restoration, for example. It could be presented as a masterplan, supported by annotated photographs, sketches, sections and written details. Computer generated 3D images and video fly-throughs viewed on a screen or in virtual reality can also be helpful in presenting the design in an accessible format. It is recommended that the strategy is initially shared as a face-to-face presentation, with the document provided electronically to the whole design team at the earliest opportunity within the project.

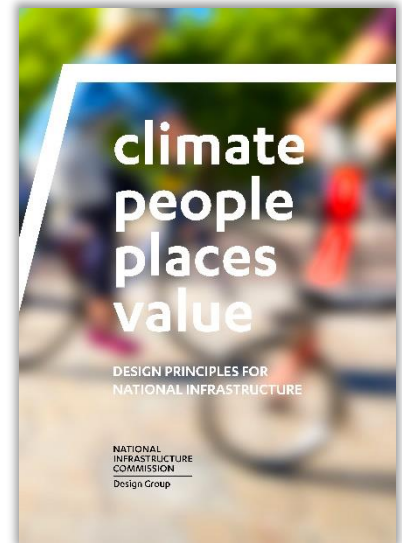
- 6.7 Some infrastructure organisations, such as Highways England and the Environment Agency, have their own landscape design processes and deliverables. If they do not, reference should be made to the **LI Digital Plan of Works for Landscape** (Landscape Institute, 2017). This presents information from the LI Scopes of Service (2013) combined with information in the RIBA template tasks in the Government-funded and publicly available NBS Building Information Modelling (BIM) Toolkit (NBS, 2015).

Design principles

- 6.8 Major infrastructure projects are complex, often affecting a range of different landscape types. Design principles are short statements, which help to guide designers to achieve the design vision by creating a common approach.

- 6.9 The NIC established a National Infrastructure Design Group to ensure quality design in future major infrastructure. This led in February 2020 to the publication of **Design Principles for National Infrastructure** (NIC, 2020), which established four key principles, which can be applied to any infrastructure project:

- **Climate** - Mitigate greenhouse gas emissions and adapt to climate change;
- **People** - Reflect what society wants and share benefits widely;
- **Places** - Provide a sense of identity and improve our environment; and
- **Value** - Achieve multiple benefits and solve problems well.



- 6.10 In applying these principles, the document calls for design champions and challenges everyone involved in an infrastructure project to:

- appreciate the wider context;
- engage meaningfully; and
- continually measure and improve

- 6.11 CABE researched and published as the Design Council **“A design led approach to infrastructure”** which promotes ten design principles (Design Council, 2012). It is intended to help applicants of NSIPs to meet the criteria for good design set out in the NPS available online (see section 5 for further information). The ten design principles can be summarised as follows:

Setting the scene - design thinking should be part of creating the vision and designing the brief for a new project.

Multi-disciplinary teamwork – collaborations between stakeholders must begin early and be sustained.

The bigger picture – holistic thinking is required to ensure that projects are part of an integrated

Landscape design - Intelligent landscape design mitigates the impact of an infrastructure installation and can enhance its setting

Design approach - In a good design, such choices will seem compelling and inevitable, clearly expressing what the project is about and working well with its setting.

process that fits into bigger strategies such as regional or sub-regional planning.

Site masterplan - Good design will do much to reconcile the infrastructure project with its environment by creating a facility that responds to its context.

Landscape and visual impact assessment – LVIA should be used as a design tool to inform location, orientation, composition and height.

Materials and detailing - High quality materials and careful detailing will limit the need for maintenance and allow schemes to weather and age well.

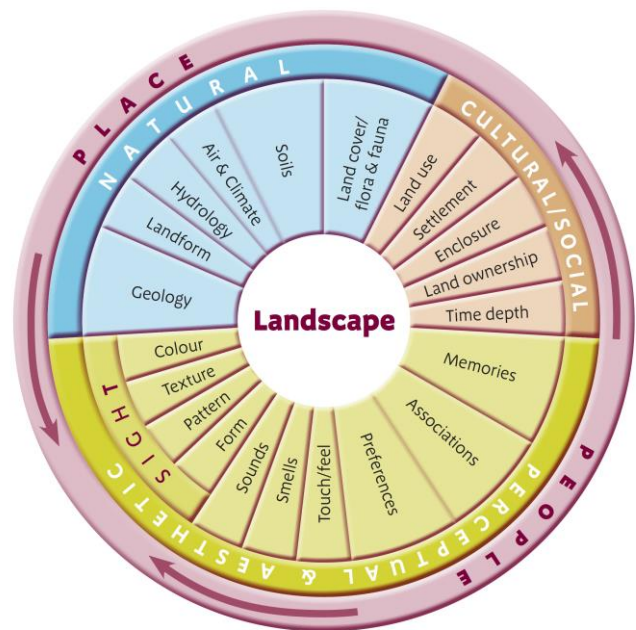
Sustainability - Given the complexity of infrastructure projects, sustainability must be integral to the design from the very beginning.

Visitor centre – promotes the provision of a visitor centre, which can provide a compelling insight into the need for the infrastructure and an appreciation of its size and scale.

- 6.12 It will be important for Landscape Professionals to understand and interpret these principles in preparing a set of landscape design principles specific to the scheme. These principles can then be used to inform the design, and engagement with clients and other project stakeholders (NIC, 2018).

Responding to context and sense of place

- 6.13 Ensuring that major infrastructure projects respond to context and sense of place is perhaps the most important of all the roles of the Landscape Professional. This general principle applies to all types of infrastructure project and Landscape Professionals will understand its general premise and the importance of carrying out a Landscape Character Assessment to inform the design (Natural England, 2014). The starting point for this should be a review of existing, published character assessments and discussion and agreement with Local Planning Authorities and other stakeholders on its adequacy for the assessment of the proposed scheme. A character assessment is important because it can help to identify valued or other features to conserve, enhance and understand the scale and grain of the landscape and how it has evolved over time. Guidelines within character assessments, including Statements of Environmental Opportunity in National Character Area profiles, can inform how land should be managed to reinforce or enhance character. Landscape sensitivity and capacity studies can also be important reference documents where undertaken. Other relevant guidance includes:



- **An Approach to Seascape Character Assessment NECR105** (Natural England, 2012);
- **Landscape Character Assessment: Technical Information Note 08/2015** (Landscape Institute, 2016);
- **Townscape Character Assessment: Technical Information Note 05/2017** (Landscape Institute, 2017); and

- **An approach to landscape sensitivity assessment – to inform spatial planning and land management** (Natural England, 2019).

6.14 There are specific considerations for linear infrastructure, because the character of the landscape through which it passes is likely to vary. If the route is to become part of the landscape, the landscape design must respond to the character of the landscape in each location. Landscape and visual considerations are likely to be important in informing optioneering and design for all forms of infrastructure, including for example, subterranean pipes and tunnels, offshore windfarms and telecommunications apparatus. This might include the siting of construction facilities to minimise visual impact or the sustainable placement of arisings to create new areas of habitat or green infrastructure.

Designing to enhance green infrastructure and ecosystem services and deliver net gain for biodiversity

6.15 Particular attention should be given to how the scheme will integrate with and, wherever possible, enhance existing nature networks and green infrastructure. As a starting point, this should include a review of the objectives and opportunities defined within regional, county and district Green Infrastructure and landscape strategies, Biodiversity Action Plans or equivalent. This could include, for example, taking the opportunity to connect the landscape within the scheme boundary to isolated pieces of habitat, reinforcing or creating ecological corridors and improving access through the provision of new or alternative walking or cycling routes.

6.16 Natural Capital accounts and Ecosystem Services Assessments can also provide a useful baseline against which to judge the benefits of different design approaches. A good example of where such an approach has successfully been applied is the Norwich Northern Distributor Road, designed by Mott MacDonald and applying research by Cranfield University (Zawadzka, J.E, et al, 2017). The Government published its new “**Enabling a Natural Capital Approach**” (ENCA) in January 2020, which provides natural capital evidence, tools and resources used in government to inform policy and decision making. The templates and databooks for assets and services can be used as a guide for capturing baseline information to inform the design process. The **Landscape Institute Ecosystem Services Technical Information Note 02/16** is also a useful resource (Landscape Institute, 2016a).

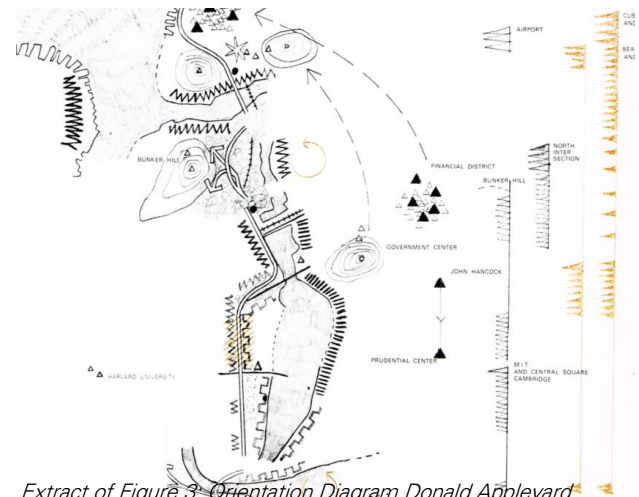
6.17 The revised **National Planning Policy Framework** (NPPF) (February 2019) states a requirement that planning policies and decisions should not only minimise impacts on biodiversity but also provide net gain. Whilst delivering Biodiversity Net Gain is not currently mandatory and is out of scope for NSIPs, clients may expect these aims to be applied. Landscape Professionals need to understand the principles behind this and work closely with professional ecologists to guide the iterative process of design to integrate new and existing habitats into the scheme. (Further resources relating to Biodiversity Net Gain will be published on the Landscape Institute website).

Views and Visual Amenity

6.18 The initial design response to major infrastructure projects may be to attempt to conceal them from the surrounding landscape to mitigate impacts on people’s views. However, this ignores the opportunity to enhance or positively change the existing character of the landscape, improving visual experience and amenity. As referred to earlier, infrastructure can, where appropriate, provide opportunities to make a statement in the landscape, for example through the elegant design of bridges, buildings, cooling towers etc, and through careful selection of materials, finishes and colour.

6.19 Views from linear infrastructure are also important and are nowadays one of the most common ways for people to see and experience the landscape. For transport infrastructure, this was recognised as early as the 1960's by Kevin Lynch, Donald Appleyard and John R. Myer in **The View from the Road** (MIT Press, 1965). They summarised three principal, interrelated objectives in shaping the visual experience of people travelling along linear routes:

- Present the viewer with a rich, coherent sequential form, a form that has continuity, rhythm, and development, and that provides contrasts, well-joined transitions, and a moving balance;



Extract of Figure 3: Orientation Diagram Donald Appleyard, Kevin Lynch and John Myer, *The view from the Road*, (Cambridge: Massachusetts M.I.T Press, 1965), 52.

- Clarify and strengthen the traveller's image of the environment, to give them a picture that is well-structured, distinct, and as far-ranging as possible. They should be able to locate themselves, the road, and the major features of the landscape, to recognize those features with surety, and to sense how they are moving by or approaching them;
- Deepen the observer's grasp of the meaning of their environment-to give them an understanding of the use, history, nature, or symbolism of the route and its surrounding landscape. The soft estate should be a fascinating book to read on the run.

6.20 It is the skill of the Landscape Professional to develop designs which deliver against these objectives. Lynch's work is still a valuable resource and has influenced many subsequent studies, including recently a passenger experience study for HS2. This used GIS mapping to illustrate the visibility of points of interest in the landscape along the route using Zones of Theoretical Visibility (ZTV). The study applied the principles of motion parallax, which refers to the relative position of elements in a moving scene, such as viewed from a train or car window. The further the object from the moving vehicle, the longer the viewer is likely to have to perceive and understand it.

6.21 Design speed (a tool used to determine the speed at which vehicles will travel) for linear transport infrastructure is also a factor. The distance at which it is possible to perceive elements increases as the speed of the route increases, such that for motorways or high-speed rail objects close to the route would flash by in a blur. The eye can only rest on distant objects when travelling at speed, therefore a view consisting only of foreground is bound to become tiresome (Crowe, 1960). The design response must therefore consider a balance between much longer elements within the corridor that can be read at high speeds and longer gaps to allow views out to more distant landmarks, taking care to ensure the view is not monotonous. Slower routes allow designers to apply a finer grain of detail within the corridor, such as smaller groups of trees.

6.22 In summary, the prime consideration of the design should be in responding to and reinforcing or enhancing landscape character. For linear infrastructure, a balance is needed between concealing the route to mitigate significant effects and creating or highlighting important landscape features, such as landmarks or the approach to a settlement. The design should allow for selective views in and attractive views out to enhance the passenger experience.

Optimising resources

- 6.23 One way that Landscape Professionals can help address the broader environmental and social impacts of infrastructure projects is through the selection, specification and management of materials. Embedding the principles of the circular economy can deliver significant benefits beyond simply cost, including the drive towards zero carbon. This concept has its roots in industrial ecology, whereby the bi-product or waste of a process can be the primary resource for another system. So, for example, working with engineers and contractors to achieve a cut/fill balance may extend to working with other nearby schemes to help them achieve the same. Designers should consider this at an early stage, identifying opportunities to make use of surplus material where it arises, for example to enhance landscape integration and biodiversity. Defra's **Construction Code of Practice for the Sustainable Use of Soils on Construction Sites** (Defra, 2009) is a useful starting point. Other examples may include recycling materials on site from the demolition of existing roads or structures to form the base of new development. It is important that projects sign up to these principles from the earliest stage. Early contractor involvement is common in modern major infrastructure projects and creates the best opportunity for this. Organisations such as **Contaminated Land: Applications in Real Environments (CL:AIRE)** can help facilitate exchanges of surplus material between projects, reducing environmental impacts and cost. Advice is also available from organisations such as International Synergies, the Ellen MacArthur Foundation and the Major Infrastructure Resources Optimisation Group (MI-ROG).

Digital Practice and BIM

- 6.24 BIM (Building Information Modelling) is a process for creating and managing information on a construction project across the project lifecycle. Whilst the process is similar for building and infrastructure projects, the software environments used may be different to those packages familiar to Landscape Professionals. It is therefore important to establish which platforms will be used for the project early and to determine if training is required.
- 6.25 Although references to BIM levels are being superseded, BIM Level 2 may still be a requirement for major infrastructure projects delivered in the UK. This establishes collaborative working and processes to coordinate the exchange of information between systems and designers. There are many ways in which BIM compliance can be achieved and each organisation is likely to implement its own systems and protocols for managing this exchange of information. The Landscape Institute already provides detailed guidance on this, including the **BIM for Landscape book** (Landscape Institute, 2016b) and **online technical resources** (Landscape Institute, 2019).
- 6.26 3D design and GIS software can also be used to inform the design and consultation process. For example, they make it possible to drape existing vegetation, buildings and other elements over a model of the topography and interrogate this in real time. These models can be a powerful communication tool in explaining to the wider design team and stakeholders why alignment which respects existing contours and landscape features is so important to responding to context and sense of place.

Design elements

- 6.27 There are some elements that are unique or are delivered or managed in a particular way that needs a specific response. This section considers these design elements and provides advice on how the design might be approached, with reference to existing guidance, such as the HS2 Landscape Design Approach (HS2, 2016), the Road to Good Design (Highways England, 2018) and LA 117 Landscape Design (Highways England, 2019).

Siting, alignment and pattern

- 6.28 Infrastructure should be sited or aligned to respond positively and elegantly to the context, with mitigation deployed to address ancillary clutter and detracting elements, such as plant or vehicles. The Landscape Professional can advise the project team on this, with reference to desk study and fieldwork and the landscape character assessment.
- 6.29 The successful integration of infrastructure projects with the landscape is one of the most important ways of reducing adverse effects.. Siting or alignment that uses existing landform and reflects natural slopes can minimise impacts on landform and sensitive landscapes while providing an aesthetic setting within a local context. This principle applies to all types of infrastructure, for example the extent and alignment of solar panels in an energy farm or an interconnector station on the coast. Some design solutions, such as the A3 Hindhead Tunnel, allow older infrastructure to be removed, removing lines of severance and restoring the natural contours of the land. It is important therefore that issues and opportunities are addressed as early as possible in the design process, informed by a detailed study of topography and landscape patterns.
- 6.30 In the *Landscape of Roads*, Dame Sylvia Crowe draws parallels with linear infrastructure and rivers, which create lines of severance in the landscape, but where the character is continuous from one side to the other or creating a natural divide between two landscape types. Green bridges are one way of addressing issues of severance and increasing connectivity in the landscape, particularly where routes are in cutting. The Landscape Institute's **Green Bridges Technical Guidance Note 09/2015** (Landscape Institute, 2015) and **Natural England's Green Bridges Literature Review NECR181** (Natural England, 2015) are useful resources. Crowe also advocates for creating space between the carriageways of roads, which allows for a smaller scale of design and overcoming the issue of parallel lines in the landscape (Crowe, 1960). This is a challenge for modern infrastructure schemes in the UK, where space is limited, maintenance can be costly and safety standards often demand concrete safety barriers. It is often necessary to clearly demonstrate the need to acquire land as essential mitigation for significant effects. Advice from the Landscape Professional on future maintenance will be important in such situations. There are however some good case studies to point to which demonstrate where wide, green central reservations assist in integrating the roads into the landscape. Examples include the M6 at Tebay in Cumbria, and sections of the Taconic State Parkway in New York State, USA.
- 6.31 Design speed for linear transport infrastructure is also a consideration for alignment and pattern. It is important to apply appropriate standards and principles based on the character of the route being created. Country lanes which need to be realigned, for example, should be designed as country lanes and the design response should be at an appropriate scale, avoiding large roundabouts. The interface between major infrastructure and the settlement edge also requires careful consideration, where the design speed slows and correspondingly the scale reduces to define a gateway.

Earthworks

- 6.32 The earthworks design can be fundamental to successfully integrating new infrastructure into the landscape and responding to sense of place. One traditional engineering approach is focused on achieving a cut/fill balance and angles of repose based on the load bearing properties of materials. This often leads to designs which are out of context and draw attention to the scheme, particularly for linear infrastructure. Working collaboratively with engineers and with the existing, natural landform or existing manmade earthworks such as flooded quarry pits can help minimise landscape and also carbon impacts. This can help achieve better integration and, where appropriate, showcase architectural or engineering elements.

6.33 Landscape Professionals are trained to understand and interpret the natural contours of the landscape and to understand soils and their input in the earthworks design is of great value. In her book *The Landscape of Roads*, Sylvia Crowe described how *“the inflection of the road to the surrounding contours and the smoothness of the transition from one to the other is formed by the slopes of the cuttings and embankments whose shape is one of the greatest factors in achieving unity of road and landscape.”* There are several ways in which this can be achieved, including:

- Choose routes which follow the natural contours of the land. Ensure there is space beneath bridges and viaducts for wildlife corridors and promote green bridges across cuttings to maintain landscape connectivity;
- Where earthworks cannot be avoided, design them so that, as far as practicable within the limits of land acquired, they are graded out to integrate sympathetically with the surrounding landform;
- Split the carriageways of major roads which traverse slopes to create space between for planting;
- Where possible and appropriate, feather out the toe of embankment slopes so that the land can be returned to agriculture on completion;
- The use of bunds should be carefully considered in the context of the surrounding landscape as attempts to screen infrastructure may result in substantial, incongruous earthworks which are out of character. Where bunds or false cuttings are needed, for example for noise or visual mitigation, steepen slopes on the inside and slacken slopes on the outside, ensuring that the transition between the slopes is smooth and flowing;
- Expand the footprint of structures, such as bridge abutments, so that earthworks can be feathered out to blend sympathetically with the surrounding contours;
- Where surplus sub-soil is exposed or generated by the scheme, identify additional areas this could be left in-situ or spread to support new habitats, such as species rich grassland and meadows. This needs careful consideration and planning to manage the soil resource, including prior top-soil stripping. The document **Managing grassland road verges: a best practice guide** is a helpful resource (Plantlife, 2019);
- There may also be opportunities to introduce sculptural landforms which make a new contribution to the landscape, such as has been achieved at Northala Fields in west London; and
- Avoid planting on slopes greater than 1:3 to reduce health and safety risks associated with future maintenance.

6.34 Soil quality and health are important considerations, particularly where soil may need to be stored on site for several years. The Landscape Professional can advise on this with reference to the relevant British Standards and the support of soil scientists, facilitating soil testing and specifying appropriate management of temporary storage and spreading depths. The **Construction Code of Practice for the Sustainable Use of Soils on Construction Sites** is a useful resource (Defra, 2009) as is the **Landscape Institute’s Technical Information Note on Soils and Soil-forming material**.

Buildings and structures

6.35 Infrastructure projects may introduce a wide variety of different types of buildings or structures into the landscape, both above and below ground. A new power station, for example, could require tall buildings to accommodate turbine halls and chimney stacks or flues which may vent plumes of gases, transforming the sky. Linear infrastructure such as roads, rivers and railway lines need overbridges and flyovers and may

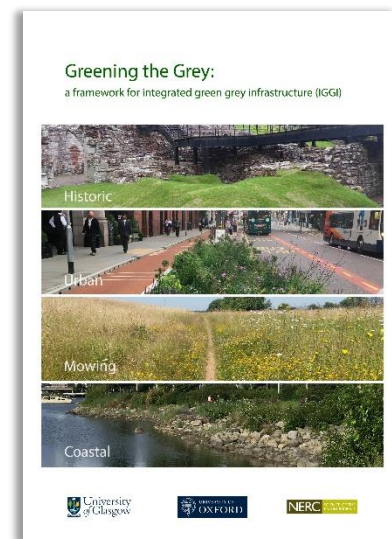
require signage or signalling. Such buildings and structures can be utilitarian in appearance and out of context, particularly in rural areas. The Landscape Professional can positively influence the design and integration of these elements in several ways, as set out below.

- 6.36 The successful integration of buildings and structures, like linear infrastructure, requires a detailed understanding of the character of the site as landscape. Modern techniques, such as ZTV analysis, volumetrics and computer-generated visualisations can be applied as part of the optioneering process to iteratively test and establish parameters for placement, mass, scale and height. Different models can be generated quickly to identify how changes in one or more parameters could affect the success of integration.
- 6.37 Buildings and structures related to infrastructure can form landmarks in their own right. Examples in the UK include the Forth Bridge in Scotland (which is a UNESCO World Heritage Site), the Ribbleshead Viaduct in North Yorkshire, the Clifton Suspension Bridge in Bristol and Lake Vyrnwy in Wales. The opportunity to create a legacy in this way should be considered where appropriate, driven by a high-quality design response. The Landscape Professional's role is likely to include providing evidence on character and context and advising on an appropriate design response, including soft and hard landscape treatments.
- 6.38 The technical requirements and standards which relate to buildings and structures for infrastructure projects can have limited flexibility. Attention to the appearance is therefore another way that Landscape Professionals can inform the design. For example, it could include advice on detailing, materials and surface finishes. This should be informed by studies, which could include visual analysis and **Environmental Colour Assessment**, which helps to identify key colours common in the local environment (Landscape Institute, 2018) and can help inform the selection of materials and surface finishes.

Water

- 6.39 This section focusses on the key design principles of water as a design element within an infrastructure scheme. Further guidance on water related projects, such as reservoirs, coastal protection and flood alleviation schemes is provided in Part 2.
- 6.40 The hydrology of the site and the area surrounding a major infrastructure scheme are often key constraints to the design but can also create opportunities. Water specialists undertake complex modelling to understand how water flows and is stored in the landscape to form the baseline. This informs the requirement for new elements such as dams, ditches, flood compensation areas, attenuation ponds and SuDS. Landscape Professionals should work closely with other members of the design team to integrate these features into the landscape. Particular consideration should be given to positioning in relation to existing landscape features, avoiding or reducing severance, maximising connectivity with other landscape elements and achieving natural edge and bank profiles and planting.

- 6.41 Safety and security can also be an issue, particularly as design safety audits are often not carried out until late in the design process. The consequence of this may be the late introduction of sometimes incongruous fencing and gates around waterbodies. It is important to raise these issues with the design team early and agree principles of how such measures will be designed to achieve the best landscape integration.
- 6.42 Water related features such as attenuation features and SuDS can also be of value to nature. Nature based solutions, such as swales and rain gardens, can provide opportunities to deliver biodiversity enhancements through the introduction of new or enhanced habitats and habitat connections which support a wider range of species. This must often be balanced against the operational requirements of the scheme and requires early and ongoing engagement. **Greening the Grey: a framework for integrated green grey infrastructure** provides some good design solutions for urban and rural contexts (University of Glasgow, 2017). The M40 Wheatley Services are an example of where SuDs have successfully been applied in an infrastructure scheme (SusDrain, 2020).



Plant selection and handling

- 6.43 There are many factors which may influence the selection of plants for infrastructure schemes, for example:
- Geology and soils;
 - Climate;
 - Latitude;
 - Altitude;
 - Availability of irrigation;
 - Function – e.g., woodland creation, visual screening, public realm enhancement;
 - Prevalence of pest and diseases in the environment, for example oak processionary moth;
 - Commercial availability;
 - Management arrangements; and
 - Budget.
- 6.44 Climate change resilience and biosecurity, including the control of Invasive Non-Native Species (INNS), should always be considerations in the specification, implementation and management of landscape schemes. The Landscape Professional should establish the standards required with reference to Government requirements and best practice. In addition to best practice and relevant British Standards, the specification for major infrastructure projects may need to consider:
- **Forest Reproductive Material Regulations** (Great Britain) (HMSO, 2002);
 - **UK Forestry Standard** (Forestry Commission, 2017);

- **Ecological Site Classification for Forestry in Great Britain** – a tool to help select ecologically suited species to specific sites (Forest Research, 2019a); and
- **Plant Health and Biosecurity: The Landscape Consultant's Toolkit**, (Landscape Institute, 2019)

6.45 There are number of guidance documents which can be useful in selecting appropriate species for major infrastructure schemes:

- **Tree Species Selection for Green Infrastructure: A Guide for Specifiers** (TDAG, 2018);
- **Trees in hard landscapes: A guide for delivery** (TDAG, 2014);
- **The Right Trees for Changing Climate Database** (Forest Research, 2019b); and
- **Urban Tree Manual** (Forest Research, 2018).

6.46 Major infrastructure schemes often require very large quantities of nursery stock to be procured, perhaps over several years. This presents challenges and opportunities, particularly in the case of linear infrastructure schemes which may cross a range of landscape and habitat types. Native species are likely to make up the larger proportion of a planting mix. This is because the longer a tree species has been present in the British Isles the wider the range of other species it can support, maximising biodiversity. However, current thinking is to broaden the range of species to maximise resilience to climate change and biosecurity risks, by applying the rule that no single species should account for more than between 5-10% of any single population. If non-native species are to be included in the mix, the **Non-native Species Information Portal** can be helpful in understanding the taxonomy, distribution and habit of non-native species and their control (NNSS, 2019). These principles should also be applied in the annual beat-up, to secure the successful establishment of planting to meet its aims for, for example screening or landscape integration.

6.47 The Government also provides advice on compliance with the Forest Reproductive Materials (FRM) Regulations, which can apply to major infrastructure projects (Forestry Commission, 2019). This covers the collection and supply of FRM, including relevant inspections, certification and governance (Forestry Commission, 2019).

6.48 Direct seeding or natural colonisation in place of planting may be an option on some sites and can lead to successful establishment. The success of such an approach is closely related to the quality and preparation of the soil and the implementation of a management plan, which includes the removal of undesirable species in the early years until a canopy has established.

Contract growing

6.49 Contract growing is a means of securing the supply of plants when they are needed and can provide a higher degree of control over quality, cost and biosecurity. The longer lead in times of major infrastructure projects can increase the viability of this approach, but there are also potential downsides. There must be an early commitment from all parties and close working between the client, designer, supplier and contractor. A breakdown in this chain increases the risk of surplus stock because of programme delays.

6.50 Unlike other nursery crops, trees and shrubs are often grown from seed collected from the environment. Growing plants under contract gives designers more freedom to specify seed from a wider range of provenance zones. Whilst contract growing is less common than it once was, modern procurement methods, such as Early Contractor Involvement and Collaborative Delivery Frameworks make it an increasingly viable and attractive option. **JCLI Practice Note 11** (JCLI, 2014), sets out the benefits in detail and provides guidance on how to establish Contract Growing agreements.

Plant protection

- 6.51 The costs of providing protection to establishing plants at the scale of a major infrastructure project can be high and will differ depending on the method and need to be considered against the risk of damage. Field surveys carried out by the Landscape Professional should note any damage to existing plants from grazing animals, such as deer, rabbits and squirrels as this is often not picked up in ecology surveys. These surveys are best carried out in winter, when the damage is most likely to occur and be prominent.
- 6.52 Fencing planting plots to protect against rabbit damage was common in the late 20th century, but is expensive to install, difficult and costly to maintain and remove at the end of establishment and can appear unsightly. This should be avoided as far as possible and confined to areas where there is a high risk of frequent damage. Individual plant protection can appear incongruous on mass in the early stages of establishment but is likely to weather and be more cost effective to install. There are several proprietary solutions available, including products which are made from natural materials. The method and cost of removal and recycling at the end of establishment should be agreed at the design stage.

Implementation

- 6.53 The Landscape Professional should play several crucial roles during the implementation phase of an infrastructure project to support successful delivery. This can include acting as a clerk of works or contract administrator, to monitor the implementation of the landscape design against the specification and other contract requirements including the programme.
- 6.54 A particularly important role is overseeing the condition and quality of the plants and planting as this has a direct impact on the success of establishment. For this reason, it is advisable for the Landscape Professional to inspect the plants at the nursery and on delivery to site. This requires an understanding of horticultural practice and biosecurity principles, which is part of a Landscape Professional's training.
- 6.55 The National Highway Sector Scheme 18 sets out requirements for the application of ISO 9001:2015 for the natural environment and landscape including ecology for infrastructure (UKAS, 2018). The Landscape Institute is not a member of the scheme; however, several UK infrastructure organisations are. Members of the Landscape Institute may be required to monitor and report on the adherence to the standard specified in the implementation and maintenance of landscape and ecology areas.

Management

- 6.56 The assurance role that Landscape Professionals provide during implementation should be extended to oversee the management of the soft estate created as part of the scheme. This should include determining the requirements for establishment and long-term management in an Environmental Management Plan and Code of Construction Practice. This is likely to be delivered in accordance with the management plan in two phases:
- an initial establishment phase, where the level of maintenance is more intense. The Landscape Professional may be required to monitor and report on the health and vigour of plants regularly and advise of the need for beat-up at the end of each growing season. This is generally at least five years for major infrastructure projects; and
 - if responsibility for long-term stewardship of the land within the scheme is not handed back to the landowner or another third party, overseeing the delivery of the management plan, including reporting against objectives and actions.

Part 2: Technical guidance and resources



7. Case studies

- 7.1 There are many good examples of how major infrastructure projects can be successfully integrated into the landscape.
- 7.2 The **Landscape Institute Case Studies Library** provides a searchable database of projects. The summaries of these case studies explain how particular issues were addressed or opportunities to enhance the landscape were maximised. The database is regularly updated and members are encouraged to share their experience by uploading new case studies.

8. Existing guidance

- 8.1 This section provides a summary of some of the most relevant existing guidance to the delivery of infrastructure projects in the UK. It is not exhaustive and serves as a starter for additional research. Whilst it is divided into different types of infrastructure for ease of reference, much of the guidance is transferrable to other types of infrastructure. Some technical guidance and standards, which Landscape Professionals may be expected to follow, are internal documents to particular infrastructure providers. This is made clear in this guidance where relevant.

Highways



Introduction

- 8.2 Guidance on the assessment, design and management of the landscape in relation to roads is extensive and long established. It started in the UK with the 1925 Roads Improvement Act. Poor implementation of the act led to the establishment of the Roads Beautifying Association by the Minister of Transport in 1928, which ran until 1950. Its aim was to increase the publicly maintainable biophysical environment around the new roads, particularly trunk roads and motorways (Turner, 2017). It published **Roadside Planting** in 1930 (Roads Beautifying Association, 1930) and its legacy is reflected in more recent technical guidance. Sylvia Crowe's **The Landscape of Roads** (Crowe, 1960) and Kevin Lynch's **The View from the Road** (Lynch, 1964) build on these concepts, establishing key landscape appraisal and design principles, which have stood the test of time.
- 8.3 The Government published its **Roads Investment Strategy** (RIS1) in 2014, which covered the period 2015-2020 (DfT, 2014) and is supported by **Highways England's Environment Strategy** (Highways England, 2017). This was followed in 2018 by **RIS2**, (DfT, 2018a) which was published in March 2020 and covers the period **2020 to 2025** (DfT, 2020). This document seeks to shape the future use of the network to support the Government's wider policy aims of promoting the importance of place; achieving net gains for the environment and contributing to a wider climate change strategy; and being at the forefront of technological change. It establishes a new vision to 2050, which includes an ambition to establish a greener network, established through the use of "*environmentally and visually sensitive 'green infrastructure', and management of the verges and open spaces, good design will minimise the air, light, noise, and visual impacts of the Strategic Road Network (SRN). Enhancements to the SRN will meet high standards of design, responding to a local sense of place, and working wherever possible in harmony with the natural, built and historic environments.*"
- 8.4 The Campaign for Better Transport has published a paper setting out its expectations in in the document **Roads and the environment Putting an innovative approach at the heart of RIS2** (Campaign for Better Transport, 2018). This is a comprehensive and detailed document which includes many useful case studies and guidance notes in relation to landscape.
- 8.5 Highways England's strategy objectives have been encapsulated in the document, **The Road to Good Design** (Highways England, 2018) This document reflects the evolution of principles to be followed in the development of a project. Each of the ten principles of good road design is relevant to landscape, but the section on "Connecting Places" is particularly pertinent. This is focussed on demonstrating sensitivity to the landscape heritage and local community, and seeking to enhance the place (Principle 4: "fits in context"), responding positively and elegantly to the context and allowing for expression of character and identity (Principle 5: "is restrained") and contributes to achieving environmental net gain by being multi-functional, resilient and sustainable (Principle 6: "is environmentally sustainable").



Standards for Highways

- 8.6 The principal source of guidance and Standards for Highways in the UK are available through the **Standards for Highways website** (TSO, 2019). The Standards for Highways currently comprise:
- Design Manual for Roads and Bridges (DMRB);

- Manual of Contract Documents for Highway works (MCHW); and
 - Interim Advice Notes (IANs).
- 8.7 The DMRB applies to all UK jurisdictions. It was introduced in 1992 in England and Wales and following that in Scotland and Northern Ireland.
- 8.8 The documents which have formed the DMRB since its introduction, including IANs, have been removed or replaced with new documents. The recent DMRB changes mandate requirements (“must” and “shall”) and advice (“should” and “may”) relevant to undertaking works on motorways and all-purpose trunk roads. The reliance is on *“competent practitioners, typically qualified professionals”* expected to apply their own skill and judgement in their field. Changes to Volume 10 and 11 follow on from the Road to Good Design and Environment Strategy to influence and mandate requirements to deliver better designs. Maintenance, management requirements and specifications previously within the DMRB will form part of the MCHW suite of documents currently in the process of being updated. Some standards and specifications have annexes specific to each devolved administration and it is therefore important to check with the relevant authority before starting work to confirm which of these apply:
- England – Highways England (Gov.uk, 2019);
 - Scotland – (Transport for Scotland, 2019 and the Scottish Road Research Board (Transport for Scotland, 2019a);
 - Wales – Welsh Government, (Welsh Government, 2018a); and
 - Northern Ireland – Department for Infrastructure, 2019.
- 8.9 The DMRB is split into volumes, sections and parts. The key volumes of the DMRB of most relevance to landscape are explained further below.

Volume 10: Environmental Design

- 8.10 The sections on Environmental Design in Volume 10 have been consolidated in the 2019 review. Of particular relevance to landscape is Section 0, Part 3, LA 117 Landscape Design (Highways England, 2019a). This supersedes most of Section 1: New Roads guidance, Section 2, Improving Existing Roads, Section 3 Landscape Management. It should be noted that this document is expected to be *“implemented forthwith on all schemes involving design on the Overseeing Organisations’ motorway and all-purpose trunk roads”*.
- 8.11 This document represents a significant shift from the guidance that it replaces. The new document is more strategic, establishing principles which will guide the landscape design process. Paragraph 1.3 within the Scope section states that LA 117 *“shall be used to identify the appropriate codes for masterplans to illustrate environmental mitigation and enhancement measures.”*
- 8.12 LA 117 is set in the context of the European Landscape Convention and GG 103: Introduction and general requirements for sustainable development and design (Highways England, 2019b), which itself refers to the Road to Good Design (Highways England, 2018). It covers landscape design matters with respect to new roads and improvements to existing roads. The expectations raised by this document look to take the design beyond mitigation and include many references to enhancing and improving the landscape character and quality. If land take goes beyond that required for essential mitigation, this will need the agreement of the Overseeing Organisation.
- 8.13 The document establishes the need for a Design Strategy and, as part of this, a Landscape Strategy. Paragraph 2.5.1 states that *“A project’s landscape strategy (design vision) and/or a set of defined landscape*

objectives should encourage excellence and greater design quality that is sensitive to and integrates the road into the local context acknowledging cost and whole-life cost.” The Design Strategy is dealt within in detail in Section 3 of the document.

- 8.14 Paragraph 2.7 establishes the need for a project’s design to “*address the Overseeing’s Organisations specific project requirements,*” to demonstrate collaborative working in design development, encourage landscape quality and incorporate the “*defined landscape objectives*” into the design. Importance here is attached for this to be undertaken in accordance with Appendix A and Appendix B and the early involvement of “*a suitably qualified Landscape Architect.*” (Landscape Architect is defined in LA 107: Landscape and visual effects, ‘Terms and definitions’, as a competent expert – a CMLI or “*member of a recognised equivalent Landscape Professional body*”.)
- 8.15 Paragraph 3.6 establishes a need to demonstrate that the design has accounted for opportunities that enhance integration with the surrounding landscape. It will be important to draw these requirements to the attention of the whole design team at the earliest opportunity as they could affect the alignment, extent of earthworks and position of structures etc.
- 8.16 LA 117 refers to other documents and should be read alongside relevant DMRB documents, in particular:
- GD 304: Designing health and safety into maintenance;
 - GG 103: Introduction and general requirements for sustainable development and design; and
 - LA 119: Roadside environmental mitigation and enhancement.

Volume 11: Environmental Assessment

- 8.17 LA 107: Landscape and Visual Effects, was published in September 2019 and replaces DMRB Volume 11, Section 3, Part 5 and Interim Advice Note (IAN) 135/10 (Highways England, 2019c).
- 8.18 LA 107 is intended to bring the approach to the assessment of landscape and visual effects broadly in line with the Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3) (Landscape Institute and the Institute of Environmental Management and Assessment, 2013). It also refers to other relevant Landscape Institute Technical Information Notes and Technical Guidance Notes. LA 107 should be read alongside:
- GG 103: Introduction and general requirements for sustainable development and design;
 - LA 101 – Introduction to Environmental Assessment;
 - LA 102 – Screening projects for Environmental Impact Assessment;
 - LA 103 – Scoping projects for Environmental Assessment;
 - LA 104 – Environmental Assessment and Monitoring; and
 - LA 120 – Environmental management plans

Other DMRB volumes

- 8.19 It is also important to be familiar with the structure and contents of the other volumes as some of these may specify constraints or opportunities for landscape design. For example, TD 19/06 specifies the situations where trees, either existing or planted and of a certain girth closer than specified, will require a

hazard risk assessment that determines the need for safety barriers to be installed or not. (Highways England, 2006).

Manual of Contract Documents for Highway works (MCHW)

8.20 The MCHW is currently under review to align it with the recent changes to the DMRB. It provides a framework for preparing contracts for highways works. The volumes which are of most relevance to landscape are:

- Volume 1: Specification for Highway Works; and
- Volume 3: Highway Construction Details

8.21 The Specification for Highways Works is split into several sections. Those of most relevance to landscape are:

- Series 0200: Site Clearance;
- Series 0300: Fencing;
- Series 0600: Earthworks; and
- Series 3000: Landscape and Ecology.

8.22 Each series comprises a set of standards, detailed specification clauses. These are generally transcribed into a new document which forms the specification for the contract. Where no change is proposed to the standard clause, it is usual to state “shall apply”. Changes can be made to the standard clauses where relevant to the particular scheme or contract, but these should be agreed with the Overseeing Organisation. The Series 3000 specification is generally written by the Landscape Professional as it relates closely to the landscape design and landscape management plan. It also includes a set of standard forms, for example for recording seed provenance. Volume 2 of the MCHW comprises a set of guidance notes for each of the specification series. These assist in interpreting the standard clauses.

8.23 Volume 3 contains a series of standard highway design details. This includes, for example, a section on drainage (F Series) fences, stiles and gates (H Series) and, under miscellaneous (K Series), tree anchoring.

8.24 The Transport Research Laboratory (TRL) has also published a number of documents relevant to highway schemes:

- The effect on the landscape of borrow-pits used in major roadworks (Sherwood, 1974);
- The wise use of landscape resources in road construction and maintenance: Scotland, (Winter, 2002);
- Establishment of vegetation for slope stability, (Marriot, 2001);
- Vegetation for slope stability, (Macneil, 2001);
- The use of vegetation for traffic noise screening, (Huddart, 1990); and
- The establishment and maintenance of roadside vegetation. A review of methods available, (Sherwood, 2009).

Other highway guidance

- 8.25 In addition, there are other pieces of guidance which are relevant to the assessment and design of major highway schemes. **Fitting Landscapes: Securing More Sustainable Landscapes** (Transport Scotland, 2014b) explains the Scottish Government's policy on addressing the landscape design and management of transport corridors. It establishes four aims to:
- Ensure high quality of design and place;
 - Enhance and protect natural heritage;
 - Use resources wisely; and
 - Build in adaptability to change.
- 8.26 This guidance goes on to explain how successful landscape fit can be achieved through strengthening the design role, promoting engagement and consultation, and strengthening the integration of maintenance and management.
- 8.27 **Lighting in the Countryside: Towards Good Practice** (2006) was published by the Office of the Deputy Prime Minister (now Ministry of Housing, Communities and Local Government). Section 6 of this document sets out an approach to an assessment of the effects of lighting on the landscape and section 7 follows with guidance on landscape design (ODPM, 2006).
- 8.28 Part 3 of the Highways England **Network Management Manual** (NMM) includes information on the management of the soft estate, which is valid for existing older DFBO contracts. This includes guidance on the management of roadside vegetation, including trees and woodlands and weeds (Highways England, 2009). For Asset Support Contracts (ASC) reference should be made to the **Asset Maintenance and Operational Requirements** (AMOR) (Highways Agency, 2015) and for the more recent contracts it is **Asset Data Management Manual** (ADMM) and **DMRB GM 701: Asset delivery asset maintenance requirements** also known as ADAMr .
- 8.29 The Countryside Agency (now Natural England) published some helpful guidance on **including landscape in road design, construction and mitigation** in their good practice discussion note (Natural England, 2006). The purpose of the note was to provide guidance on reducing the impact of new roads built in environmentally sensitive areas by ensuring that they reflect the character of the surrounding landscape.
- 8.30 Active travel, and particularly cycling infrastructure, has increasingly become a focus in recent years and is set to increase as one response to the COVID-19 pandemic. The Department for Transport's **Local Transport Note 2/08: Cycle Infrastructure Design**, 2008 established general design parameters and provides detailed guidance on the design of cycleways, public realm and landscape treatments (Department for Transport, 2008). The UK government plans to invest in this sector and has produced **Statutory guidance for local authorities on reallocating road space in response to COVID-19**.
- 8.31 There is also recognition in the **National Pollinator Strategy** (Defra, 2014) that infrastructure can provide important linear habitats which act as pollinator corridors. Further guidance on the practical steps is provided in **Managing Transport Corridors For Pollinators** (Buglife, 2017).

Guidance for street design

- 8.32 The DMRB is suited to major highway schemes. For non-trunk roads, the **Manual for Streets** remains a good resource (DCLG, 2007). It explains how to design, construct, adopt and maintain new and existing residential streets, with sections on the design process, layout and connectivity and creating quality places. The **Manual**

for Streets 2 builds on the earlier guidance, providing greater detail on how its key principles can be applied to busier streets and non-trunk roads (CIHT, 2010).

- 8.33 In Scotland, the **National Roads Development Guide** (Society for Chief Officers of Transport in Scotland, 2017) follows **A Policy Statement for Designing Streets** (Scottish Government, 2010) in raising the importance of street design in placemaking. These documents draw links to but also distinctions from DMRB guidance related to the Strategic Road Network and focus on the design of roads and streets in and around settlements.

Rail

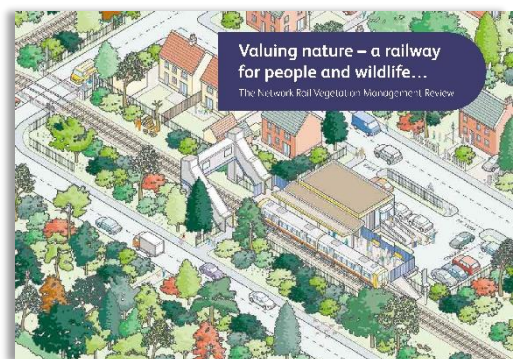


Introduction

- 8.34 There are over 15,800km of railway lines in Great Britain and a further 360km in Northern Ireland, much of which were laid out in the 19th century. Demand for rail has increased significantly in recent years, which has led to new investment in the improvement of existing railway lines and the construction of new stations and junction improvements.
- 8.35 A few lines have been reopened or new lines laid out. Examples include the High Speed 1 Channel Tunnel Rail Link (opened in 2007) and the Waverley Route between Carlisle, Hawick and Edinburgh (re-opened in 2015). Several new transit systems have also been laid out in the past few decades, including the Manchester Metro, Sheffield Supertram, Edinburgh Tram and London's Crossrail. New major rail routes are now proposed, which have the potential to transform the landscape through which they pass. Current major rail projects include:
- Phase 1 of High Speed 2 (HS2) is under construction and Phase 2 is in the advanced stages of planning prior to seeking Royal Assent.
 - East West Rail is a proposal to re-open the line between Oxford and Cambridge with the section between Oxford and Bedford partially completed.
 - Although specific details are being worked on, some preparatory work has begun on the Transpennine Route upgrade to the railway between Manchester Victoria to Leeds and Selby / York.
 - Crossrail 2 is in the advanced stages of planning. It will link southwest and northeast London with destinations across Surrey and Hertfordshire.
- 8.36 Rail is a highly regulated, safety-focussed industry. The role of the Landscape Professional in the design stages will be similar to major roads, advising on responding to place and integration with the landscape. These high safety standards and a programme of electrification create challenges for retrofitting new infrastructure within confined corridors. This can lead to the removal of trees but create an opportunity to increase biodiversity through the introduction of scrub and species rich swards, for example. Working closely with professional ecologists and stakeholders is important to design creative solutions.

Network Rail

- 8.37 Network Rail owns and operates the majority of railway infrastructure in England, Wales and Scotland. It is one of the UK's largest landowners and owns 52,000 hectares of land on which there are approximately 6.3 million trees. (Network Rail, 2018a).
- 8.38 Publicly available guidance published by Network Rail relevant to landscape is mostly focussed on the management of trees and other vegetation, which pose a risk to rail operations. The **Lineside vegetation management manual** (Network Rail, 2018b) establishes principles and processes which define actions for proactively managing the landscape within the route corridor. Lineside vegetation management can be an emotive subject and result in public outcry, particularly when it requires the removal of mature trees. Network Rail's recent Vegetation Management Review (the Varley review) - *Valuing nature – a railway for people and wildlife...* establishes an aim to achieve 'no net loss' of biodiversity by 2024, and a net gain by 2040 (Network Rail, 2018). Further guidance is anticipated in response to this review.



- 8.39 The Catalogue of Network Rail Standards provides regular updates on standards which are current at the date of publication (Network Rail, 2019). These standards are not publicly available but can be acquired through services such as the IHS Markit Engineering Workbench™.
- 8.40 Network Rail has also published publicly available guidance on the design and construction of station buildings. **Station Design Principles for Network Rail** is of particular relevance to Landscape Professionals as it establishes the principles by which the design vision and concepts should be guided (Network Rail, 2015).

High Speed 2

- 8.41 HS2 is a publicly owned company, established to deliver a new high-speed rail network connecting London with Birmingham, Manchester and Leeds. HS2 has produced a range of technical guidance and standards, which ensures the approach to the design of the scheme is consistent. Whilst the technical standards are internal to HS2 and its suppliers, the **HS2 Landscape Design Approach** (HS2, 2016) is publicly available. The HS2 Design Vision is founded on the principle that the scheme will be a catalyst for growth across Britain underpinned by the principles of People, Place and Time (HS2, 2017). In response, HS2 advocates a landscape-led approach to design and provides a resource to designers of the scheme and stakeholders. It in turn informs HS2's ambition to deliver a 'green corridor' consisting of new wildlife habitats, native woodlands and community spaces to help integrate the new line into its surrounding landscape and environment. The Landscape Design Approach establishes a seven-step landscape design process, which can easily be adapted to be relevant to other types of infrastructure project (HS2, 2018):



- Step 1: Understand the landscape
- Step 2: Identify opportunities for landscape
- Step 3: Develop integrated landscape design options
- Step 4: Test options and refine parliamentary design
- Step 5: Test and Develop Detailed Design
- Step 6: Production Information
- Step 7: Implementation & Management

Water



Introduction

8.42 Infrastructure related to water is a complex area, covering:

- Collection and conveyance (e.g. catchments, rivers, streams and canals);
- Storage (e.g. reservoirs and lakes);
- Supply (e.g. fresh water and sewerage); and
- Flood protection (e.g. storage and attenuation, urban drainage and coastal defence).

8.43 Landscape Professionals can expect to be involved with water related projects acting on behalf of government bodies, local authorities or utilities in the design, implementation and management of schemes. This might include, for example, the design and management of major flood alleviation schemes such as the Environment Agency's Jubilee River and Perry Barr and Witton Forge Mill Flood Storage Reservoir or major new reservoirs, such as the one planned at Havant Thicket in Hampshire.

8.44 The Government published a **Draft National Policy Statement for Water** Resources in November 2018 (Defra, 2018). This document recognises the importance of a detailed LVIA in informing the mitigation strategy for water infrastructure related development. Whilst it does not include specific requirements or standards, it does establish the expectation that landscape will be considered from the earliest stage of a project.

8.45 The various environmental protection agencies of the UK are responsible for water quality and resources, including many rivers, flood and coastal protection measures. Guidance relevant to each of these bodies is provided below.

Environment Agency (England)

8.46 The principal piece of guidance for Landscape Professionals engaged to work on behalf of the Environment Agency is the **Landscape and Environmental Design Guidance** (LEDG), (Environment Agency, 2007). This is a comprehensive set of standards, procedures and specifications. As it is an internal document and is not publicly available, a copy should be requested and reviewed prior to carrying out any work for the Environment Agency. It is divided into the following sections:

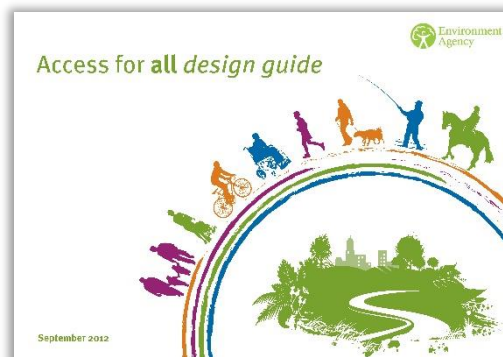
- Introduction and summary
- Environmental design process and procedure
- General guidance on the environmental design process
 - Option selection and design development
 - Construction
 - Post-construction
- Subject guidance
 - Landscape character assessment and landscape and visual impact assessment
 - Environmental principles of flood embankment design
 - Tree protection and establishment

- Environmental principles of floodwall design

8.47 The **Fluvial Design Guide** (Environment Agency, 2009) is aimed at professional staff engaged in the design process from the early stages of looking at alternative solutions through to the delivery of the outputs of design for the construction, maintenance, refurbishment or alteration of flood defence or land drainage assets. The guide is thus intended to be used by both designers and asset managers.

8.48 The **Access for All Design Guide** (Environment Agency, 2012) has been archived, but provides a useful resource, setting out a variety of standard approaches and design advice covering a range of features related to access to water. Design solutions for landscape elements include:

- Surface, ramps and steps;
- Handrails and gates;
- Signage and visitor information;
- Fishing pegs, canoe and boat access;
- Dipping platforms and boardwalks
- Street furniture, car parks and kerbs,
- Cycle, equestrian access and footbridges.



8.49 The **channel management handbook for flood risk management** (Environment Agency, 2015) outlines techniques, illustrated by cases studies, for the effective creation and management rivers and drainage channels. This includes nature-based solutions for dealing with banks, beds and sedimentation, and the role of planting and vegetation management.

8.50 The Environment Agency has also provided advice on the **aquatic and riparian plant management: controls for vegetation in watercourses** (Environment Agency, 2014). This guidance is split into a field guide, technical guide, case study report and literature review. A decision-making spreadsheet tool provides parameters for a range of interventions, including mechanical and chemical control which can assist with determining the most cost-effective control measures to a range of issues.

8.51 Landscape is also given special consideration in **Design, operation and adaptation of reservoirs for flood storage** (Environment Agency, 2016). Guidance is provided on the planning, preliminary design, detailed design and operation and maintenance of new flood storage reservoirs and how existing infrastructure can be adapted. The role of the landscape architect in such projects is from the earliest stage is recognised and guidance is provided on specific landscape considerations such as planting and landform.

Scottish Government

8.52 The Sustainable Urban Drainage Scottish Working Party comprises representatives from the Scottish Environment Protection Agency (SEPA), the Scottish Government, bodies such as the Royal Incorporation of Architects in Scotland (RIAS), and Landscape Institute Scotland. The working party has collectively published the **Water Assessment and Drainage Assessment: Guide A guidance document for developers, planners and others involved in water and drainage**, which includes guidance on the design and management of surface water and SuDS (Sustainable Urban Drainage Scottish Working Party, 2015). This includes guidance on dealing with run-off from road surfaces, and attenuation design.

Welsh Government

- 8.53 The Welsh Government has set out “**Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems**” (Welsh Government, 2018b). This document is intended to support the implementation of the Flood and Water Management Act 2010 (Schedule 3), which came into effect in Wales on 7 January 2019. It requires new developments to include Sustainable Drainage Systems (SuDS) features that comply with national standards. This includes guidance on the design and management of vegetated SuDS as a key component of ecological networks.

Canals and Rivers Trust

- 8.54 The guidance set out in the **Environmental Framework for Waterway Restoration Projects in England and Wales** (Canal and Rivers Trust, 2016) focuses on the ‘Built Heritage and Natural Environment’ and ‘Water Management’ themes of the Restoration Work Stages for waterway restoration projects. It includes useful information on biosecurity measures, conservation of ecology and heritage and the management of trees.
- 8.55 Guidance on promoting high quality waterside development is found in the joint British Waterways and English Heritage document on **England’s Historic Waterways** (British Waterways and English Heritage, 2009). This document sets out principles of good architectural and public realm design to regenerate areas of historic waterside development, such as canals and dockyards.

Internal Drainage Boards (England) and Drainage Districts (Wales and Scotland)

- 8.56 Internal Drainage Boards (IDBs) are public bodies established where there is a special need for drainage. They undertake works to reduce flood risk to people and property and manage water levels for agricultural and environmental needs within their district. There are 112 IDBs in England, maintaining 22,000 km of watercourses. The **Association of Drainage Authorities** (ADA, 2019) maintains a map of IDBs, which can be used to check whether an infrastructure scheme is likely to affect a watercourse or other asset.
- 8.57 ADA has also published several pieces of guidance of relevance to Landscape Professionals. The **Drainage Channel Biodiversity Manual: Integrating wildlife and flood risk management** (ADA, 2008) includes advice on the design and management of watercourses, with specific guidance relating to channels, margins, banks and hinterland. The sections on planting within channels are particularly useful, with well-illustrated sections and details.
- 8.58 The River Restoration Centre - **Manual of River Restoration Techniques** (The River Restoration Centre, 2013) provides detailed examples of innovative and best-practice river restoration techniques. Case studies are used to illustrate potential design solutions to a range of river and watercourse related scenarios, such as the integration of meanders, the felling and placing of trees to create niche habitats and creating step pools and fish passes.
- 8.59 The Canal and Rivers Trust document on **Principles for Waterway Crossings (Part 2)** was developed to maximise the opportunities borne out of the HS2 project but is relevant to any major infrastructure project which intersects a watercourse. It makes the case for delivering “*the very best in contemporary architecture and engineering, creating structures that contribute positively to the multiple layers of transport history that are evident throughout the canal corridor*”. It comprises general guidance on appeal, views, horizon, character, scale, tranquillity, quality and relationship. It also includes design principles for horizontal and vertical alignment, pier alignment, span, abutments and parapets and planting (Canal and Rivers Trust, 2014).

Water companies

- 8.60 The supply of fresh water and sewage services in England and Wales is a privatised industry. In Scotland services are provided by Scottish Water and in Northern Ireland by Northern Ireland Water. Investment in the water utility network is based on five-year Assessment Management Plan (AMP) periods. Technical guidance related to landscape matters is limited, but the government's catchment-based approach to improving water quality is relevant. This stresses the importance of managing environmental activities at the landscape-scale through an ecosystem services based approach (Defra, 2013).

Other guidance

- 8.61 The Keeping Rivers Cool partnership was a project that looked at approaches to address the pressures of climate change on freshwater ecosystems using trees. The **Keeping Rivers Cool: A Guidance Manual Creating riparian shade for climate change adaptation** (Woodland Trust, 2016) includes guidance on the site selection and design, plant selection, protection and maintenance.
- 8.62 Reservoir design needs to meet stringent safety standards to comply with the Reservoirs Act 1975. The Environment Agency has published **a guide to planning, designing, constructing and commissioning a water storage reservoir** (Environment Agency and Cranfield University, 2008), which includes design considerations for embankments to meet technical standards and enhance biodiversity.
- 8.63 **The coastal handbook A guide for all those working on the coast** (Environment Agency, 2010) is a helpful resource, particularly for design relating to coastal and **Estuary Edges**, (Environment Agency, 2018) including management techniques.

Energy



Introduction

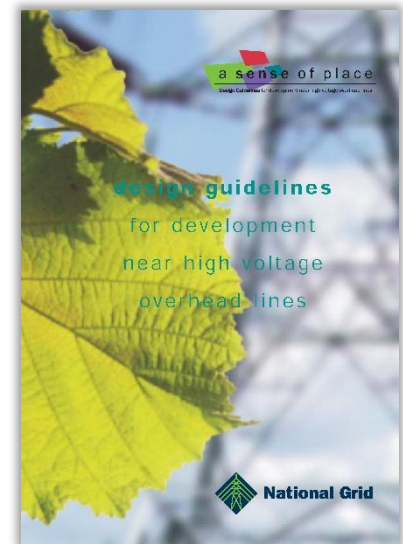
- 8.64 The scale of modern energy related development can be very tall, for example a nuclear turbine hall, wind farms or rows of pylons across the countryside, or extensive, such as solar farms. Energy infrastructure is also generally provided to supply the national grid and people affected locally may not see the direct benefit. Changes in the mix of energy, produced on a larger number of sites and often at smaller scale, is necessitating changes to the distribution network. This presents the Landscape Professional with a range of challenges.
- 8.65 The UK Government's position on power is set out in the **Overarching National Policy Statement for Energy (EN-1)**, which recognises the importance of understanding and addressing landscape and visual impacts (Department of Energy and Climate Change, 2011). It includes a section on criteria for "good design" for energy infrastructure, which states that:
- 8.66 *"Applying "good design" to energy projects should produce sustainable infrastructure sensitive to place, efficient in the use of natural resources and energy used in their construction and operation, matched by an appearance that demonstrates good aesthetic as far as possible. It is acknowledged, however that the nature of much energy infrastructure development will often limit the extent to which it can contribute to the enhancement of the quality of the area."*
- 8.67 There are also technology specific National Policy Statements covering:
- **Fossil Fuel Electricity Generating Infrastructure (EN-2);**
 - **Renewable Energy Infrastructure (EN-3);**
 - **Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4);**
 - **Electricity Networks Infrastructure (EN-5); and**
 - Nuclear Power Generation (EN-6): Annexes **Vol. I** and **Vol. II**

National Grid

- 8.68 National Grid owns and operates the electricity transmission network across England and Wales and the gas transmission network across Great Britain. In Scotland the electricity network is divided between Scottish Power Transmission Limited for southern Scotland and Scottish Hydro Electric Transmission plc for northern Scotland and the Scottish islands groups (Ofgem, 2019). Northern Ireland Electricity Networks Limited (NIE Networks) is the electricity asset owner of the transmission and distribution infrastructure in Northern Ireland (Northern Ireland Electricity Networks, 2019).
- 8.69 NPS EN-5 for Electricity Networks Infrastructure sets the policy context. The **Holford Rules**, which EN-5 specifies, are intended as a common-sense approach to the routing of new overhead lines and should be followed by developers when designing their proposals. The **Horlock Rules** are also relevant to the siting and design of substations.
- 8.70 General guidance on development near overhead lines is provided in the document "**Planning and amenity aspects of high voltage electricity transmission lines and substations**". This covers policy in relation to the siting of such elements to minimise their visual impact and to assist in landscape integration (National Grid, 2008). Specific guidance is also available on the **design and routeing of new electricity transmission lines** (National Grid, 2012).

8.71 A key piece of guidance for landscape design matters in relation to development near high voltage overhead lines is the **Sense of Place design guidelines** (National Grid, 2016). This document explains the technical limitations and health and safety considerations of siting development near power lines and provides detail on planting design and management.

8.72 National Grid's Landscape Enhancement Initiative, which is part of the Visual Impact Provision project, may also be relevant in some locations. This aims to reduce the landscape and visual impact of National Grid's existing electricity infrastructure and enhance the quality of the affected designated landscapes of National Parks and AONBs. Further information, including links to a landscape assessment, is available on the National Grid website (National Grid, 2020).



Wind power

8.73 Much of the current guidance on assessing and mitigating the effects of Wind Farms on the landscape and views originates from Scotland. The document **Siting and designing wind farms in the landscape** (Scottish Natural Heritage, 2017) is a comprehensive guide, which addresses key considerations in relation to the receiving landscape, including in coastal locations. It covers technical aspects of wind farm design, such as size, layout and colour, the need for lighting and changes to accommodate construction, such as the construction of access roads. It also includes guidance on the appropriate scope of LVIA, referring to other guidance relevant to wind farms including:

- **Spatial Planning for Onshore Wind Turbines – natural heritage considerations** (SNH, 2015);
- **Assessing the impact of small-scale wind energy proposals on the natural heritage** (SNH, 2016);
- **Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape** (SNH, 2012a);
- **Assessing the Cumulative Impact of Onshore Wind Energy Developments** (SNH, 2012b); and
- **Visual Representation of Wind farms** (SNH, 2017).

8.74 Specific guidance is also applicable to **wind farm development within the Scottish Highlands** (Highland Council, 2019).

Solar farms

8.75 The economic case for large scale solar farms has increased in recent years. There was a peak of applications for schemes of around 5mw at the beginning of the previous decade when feed-in tariffs made investment attractive. As the feed-in tariff reduced and the technology and unit cost compared to other energy sources improved, applications for larger solar farms have appeared. Solar farms with a capacity of 50mw or greater fall within the NSIP regime and therefore require a DCO. Schemes just below this threshold or substantially greater have become more common. As of June 2019, solar voltaics accounted for 2.12 TWh of energy, which was approximately 7% of all energy generated from renewables. This was a 18.7% increase on the previous year, significantly higher than any other source (Department for Business, Energy and Industrial Strategy, 2019).

8.76 Solar farms require approximately 2 hectares of land per megawatt of energy. A large-scale solar farm of 50mw may therefore require around 100ha of land. This demands a landscape-scale response to design and

management of land and can present opportunities, particularly in areas of intensive agriculture where existing biodiversity is low.

- 8.77 Despite the high demand for new, larger solar farms, there is relatively little technical information on environmental design. BRE has published two documents, which offer helpful guidance.
- 8.78 The document **Planning guidance for the development of large-scale ground mounted solar PV systems** (BRE, 2013) provides information and guidance on aspects of the design, such as access tracks, fencing and maintenance. It also gives detail on general matters relating to landscape and views, ecology and cultural heritage. Appendix A of this document provides more detailed “*guidance on the information which should be provided within a Landscape and Visual Impact Assessment*”. This is based on advice from the Cornwall Council Landscape and Urban Design Unit and may be helpful in informing the scope and broader considerations of design, but its approach pre-dates the introduction of GLVIA3.
- 8.79 The BRE National Solar Centre has also published **Biodiversity Guidance for Solar Developments** (BRE, 2014). This document includes advice on the design and management of boundary features such as hedgerows, grassland, woodland and water bodies. It establishes the expectation that each solar farm should have a Biodiversity Management Plan, which may also be referred to as a Landscape and Ecology Management Plan.

Aviation



Introduction

- 8.80 Demand for global air travel is likely to continue to grow, albeit in face of increasing evidence of its contribution to global warming and climate change and notwithstanding the likely impact of COVID-19 in the short to medium term. Major airports are often under almost continual programmes of redevelopment, to increase capacity and respond to changes in aircraft design and travel habits. Landscape Professionals are likely to continue to have a role in the planning and assessment of major changes to airport infrastructure and the design of public realm, for example.
- 8.81 The Airports National Policy Statement: new runway capacity and infrastructure at airports in the South East of England (DfT, 2018) includes the delivery of a third runway at Heathrow Airport. It is also relevant to applications for new runway capacity and other airport infrastructure in London and the South East of England. The Statement includes a section specifically on the assessment and mitigation of landscape and visual effects. A legal challenge to this NPS was successfully upheld by the Court of Appeal in February 2020 and it has been found unlawful on climate grounds. At the time of writing, it is unclear what action the government will take to address the issues raised.

Civil Aviation

- 8.82 The need to ensure safety and security can have a significant bearing on the design and management of airports and the land surrounding them. It is important to note that restrictions may apply on development some distance from an airport where this is likely to increase the risk of bird strikes, as explained below.
- 8.83 Document **CAP 772: Wildlife Hazard Management at Aerodromes** states that any landscaping scheme on an aerodrome should be avoided on the basis that it could increase the attraction of wildlife (Civil Aviation Authority, 2017). It also states that, where possible, there should not be any trees within airside areas of the airport boundary. If trees are to be planted or maintained, they should offer minimal food sources and should be planted in such a way as to reduce their attraction to birds. Advice should be taken to consider how the design can be developed within these constraints.
- 8.84 Further advice is provided within **Safeguarding of Aerodromes Advice Note 3: Potential Bird Hazards from Amenity Landscape and Building Design** (Airport Operators Association and General Aviation Awareness Council, 2006). This refers to **CAP 738: Safeguarding of Aerodromes**, which establishes a requirement for consultation within a 13km radius of an aerodrome where a proposed development may increase the risk of bird strikes. This includes developments such as “*waste disposal sites, reservoirs, sewage works, major landscaping schemes, areas of water and bird sanctuaries*” (Civil Aviation Authority, 2006).

9. References and further reading

Association of Drainage Authorities (ADA). (2019). *Internal Drainage Boards*. Available: https://www.ada.org.uk/member_type/idbs/. Last accessed 10/11/2019.

Association of Drainage Authorities (ADA). (2008). *The Drainage Channel Biodiversity Manual: Integrating wildlife and flood risk management*. Available: <https://www.ada.org.uk/wp-content/uploads/2017/01/The-Drainage-Channel-Biodiversity-Manual.pdf>. Last accessed 10/11/2019.

BRE. (2013). *Planning guidance for the development of large-scale ground mounted solar PV systems*. Available: https://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf. Last accessed 10/11/2019.

BRE. (2014). *Biodiversity Guidance for Solar Developments*. Available: <https://www.bre.co.uk/filelibrary/pdf/Brochures/NSC-Biodiversity-Guidance.pdf>. Last accessed 10/11/2019.

British Waterways and English Heritage. (2009). *England's Historic Waterways: A working heritage Promoting high quality waterside development*. Available: <https://canalrivertrust.org.uk/media/original/24169-promoting-high-quality-waterside-design.pdf?v=344b40>. Last accessed 10/11/2019.

Buglife. (2017). *Managing Transport Corridors for Pollinators*. Available: https://cdn.buglife.org.uk/2019/07/Transport-Corridors-Pollinator-Sheet-Final_1.pdf. Last accessed 08/03/2020.

Campaign for Better Transport. (2018). *Roads and the environment Putting an innovative approach at the heart of RIS2*. Available: https://bettertransport.org.uk/sites/default/files/pdfs/Roads%20and%20the%20environment%202018_0.pdf. Last accessed 10/11/2019.

Canal and Rivers Trust. (2016). *Environmental Framework for Waterway Restoration Projects in England and Wales*. Available: https://www.waterways.org.uk/pdf/restoration/environmental_framework_waterway_restoration. Last accessed 10/11/2019.

Canal and Rivers Trust. (2014). *HS2 Design Principles for Waterway Crossings*. Available: <https://canalrivertrust.org.uk/media/original/6524.pdf?v=a023db>. Last accessed 10/11/2019.

Chartered Institution of Highways and Transportation (CIHT). (2010). *Manual for Streets 2*. Available: https://www.manual-for-streets.co.uk/manual_for_streets_2.htm. Last accessed 10/11/2019.

Department for Business, Energy and Industrial Strategy, 2019. (2019). *UK Energy Statistics, Q1 2019*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812626/Press_Notice_June_19.pdf. Last accessed 10/11/2019.

Department for Communities and Local Government (2015). *Planning Act 2008: Guidance on pre-application process*. London: Department for Communities and Local Government.

Department for Communities and Local Government (DCLG). (2007). *Manual for Streets*. Available: <https://www.gov.uk/government/publications/manual-for-streets>. Last accessed 01/11/2019.

Department for Environment, Food and Rural Affairs (Defra). (2018). *Draft National Policy Statement for Water Resources Infrastructure*. Available: https://consult.defra.gov.uk/water/draft-national-policy-statement/supporting_documents/draftnpswaterresourcesinfrastructure.pdf. Last accessed 10/11/2019.

Department for Environment, Food and Rural Affairs (Defra). (2014). *The National Pollinator Strategy: for bees and other pollinators in England*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794706/national-pollinator-strategy.pdf. Last accessed 08/03/2020.

Department for Environment, Food and Rural Affairs (Defra). (2013). *Defra's social and environmental guidance to Ofwat*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/243444/9780108512261.pdf. Last accessed 08/03/2020.

Department for Environment, Food and Rural Affairs (Defra). (2009). *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716510/pb13298-code-of-practice-090910.pdf. Last accessed 08/03/2020.

Department for Infrastructure. (2019). Home. Available: <https://www.infrastructure-ni.gov.uk/>. Last accessed 10/11/2019.

Department for Transport (DfT). (2020). Road Investment Strategy 2 (RIS2): 2020 to 2025. Available: <https://www.gov.uk/government/publications/road-investment-strategy-2-ris2-2020-to-2025>. Last accessed 24/04/2020.

Department for Transport. (2019). *Transport analysis guidance (TAG)*. Available: <https://www.gov.uk/guidance/transport-analysis-guidance-webtag>. Last accessed 05/11/2019.

Department for Transport (DfT). (2018a). *Draft Road Investment Strategy 2: government objectives*. Available: <https://www.gov.uk/government/publications/draft-road-investment-strategy-2-government-objectives>. Last accessed 10/11/2019. Department for Transport (DfT). (2018b). *Airports National Policy Statement: new runway capacity and infrastructure at airports in the South East of England*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/714106/airports-nps-new-runway-capacity-and-infrastructure-at-airports-in-the-south-east-of-england-web-. Last accessed 10/11/2019.

Department for Transport (2016). *Value for Money Supplementary Guidance on Landscape*. London: Department for Transport.

Department for Transport (2015). *Value for Money Framework*. London: Department for Transport.

Department for Transport (DfT). (2014). *Road investment strategy: 2015 to 2020*. Available: <https://www.gov.uk/government/collections/road-investment-strategy>. Last accessed 10/11/2019. Department for Transport. (2008). *Local Transport Note 2/08: Cycle Infrastructure Design*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/329150/lt-n-2-08_Cycle_infrastructure_design.pdf. Last accessed 10/11/2019.

Department for Transport (2008). *Local Transport Note 2/08*. London: Department for Transport.

- Department of Energy and Climate Change. (2011). *Overarching National Policy Statement for Energy (EN-1)*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf. Last accessed 10/11/2019.
- Design Council CABE. (2012). *A design-led approach to infrastructure*. Available: <https://www.designcouncil.org.uk/resources/guide/design-led-approach-infrastructure>. Last accessed 27/10/2019.
- Environment Agency. (2018). *Estuary Edges: Ecological Design Guidance*. Available: <http://www.ecrr.org/Portals/27/Publications/Estuary%20Edges%20-%20design%20advice.pdf>. Last accessed 10/11/2019.
- Environment Agency. (2016). *Design, operation and adaptation of reservoirs for flood storage*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/570537/Design_operation_and_adaptation_of_reservoirs_for_flood_storage_-_report.pdf. Last accessed 24/04/2020.
- Environment Agency. (2015). *The channel management handbook for flood risk management*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/414076/Channel_management_handbook.pdf. Last accessed 10/11/2019.
- Environment Agency. (2014). *Aquatic and riparian plant management: controls for vegetation in watercourses*. Available: <https://www.gov.uk/government/publications/aquatic-and-riparian-plant-management-controls-for-vegetation-in-watercourses>. Last accessed 10/11/2019.
- Environment Agency. (2012). *Access for all design guide*. Available: https://webarchive.nationalarchives.gov.uk/20140328090806/http://cdn.environment-agency.gov.uk/LIT_7571_bba664.pdf. Last accessed 10/11/2019.
- Environment Agency. (2010). *The coastal handbook A guide for all those working on the coast*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/292931/geho0610bsue-e-e.pdf. Last accessed 10/11/2019.
- Environment Agency. (2009). *Fluvial Design Guide*. Available: <https://www.gov.uk/government/publications/fluvial-design-guide>. Last accessed 10/11/2019.
- Environment Agency (2007). *National Environmental Assessment Service Operational Guidance Volume 3: Landscape and Environmental Design Guidance*: Environment Agency.
- Environment Agency and Cranfield University. (2008). *Thinking about an irrigation reservoir? A guide to planning, designing, constructing and commissioning a water storage reservoir*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/297089/ge-mi0408bnzp-e-e.pdf. Last accessed 10/11/2019.
- Forest Research. (2019). *Ecological Site Classification Decision Support System (ESC-DSS)*. Available: <https://www.forestresearch.gov.uk/tools-and-resources/ecological-site-classification-decision-support-system-esc-dss/>. Last accessed 27/10/2019.
- Forest Research. (2019a). *Urban Tree Manual*. Available: <https://www.forestresearch.gov.uk/tools-and-resources/urban-tree-manual/>. Last accessed 01/11/2019.

Forest Research. (2019b). *The Right Trees for Changing Climate Database*. Available: <http://www.righttrees4cc.org.uk/>. Last accessed 01/11/2019.

Forest Research. (2007). *Forest Reproductive Material: Regulations controlling seed, cuttings and planting stock for forestry in Great Britain (2nd edition)*. Available: <https://www.forestresearch.gov.uk/research/forest-reproductive-material-regulations-controlling-seed-cuttings-and-planting-stock-for-forestry-in-great-britain-2nd-edition/>. Last accessed 01/11/2019.

Forestry Commission. (2019). *Work with planting material for forestry purposes*. Available: <https://www.gov.uk/guidance/work-with-planting-material-for-forestry-purposes>. Last accessed 27/10/2019.

Forestry Commission. (2017). *The UK Forestry Standard*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/687147/The_UK_Forestry_Standard.pdf. Last accessed 27/10/2019.

Gov.uk. (2019). *Highways England*. Available: <https://www.gov.uk/government/organisations/highways-england>. Last accessed 10/11/2019.

Harris, M. (2019). *The Roads Beautifying Association in Warwickshire*. Available: <https://www.ourwarwickshire.org.uk/content/article/roads-beautifying-association>. Last accessed 05/11/2019.

Highland Council. (2019). *Development guidance - Onshore wind energy*. Available: https://www.highland.gov.uk/directory_record/712079/onshore_wind_energy. Last accessed 10/11/2019.

Highways Agency and English Heritage. (2007). *Assessing the Effect of Road Schemes on Historic Landscape Character*. Available: <https://historicengland.org.uk/images-books/publications/assessing-the-effect-of-road-schemes-on-historic-landscape-character/>. Last accessed 24/04/2020.

Highways England. (2019a). *LA 117: Landscape Design*. Available: <http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol10/section0/LA%20117%20Landscape%20design-web.pdf>. Last accessed 10/11/2019.

Highways England. (2019b). *GG 103 Introduction and general requirements for sustainable development and design*. Available: <http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol0/section2/GG%20103%20Introduction%20and%20general%20requirements%20for%20sustainable%20development%20and%20design-web.pdf>. Last accessed 10/11/2019.

Highways England. (2019c). *LA 107: Landscape and Visual Effects*. Available: <http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20107%20Landscape%20and%20visual%20effects-web.pdf>. Last accessed 10/11/2019.

Highways England. (2018). *The Road to Good Design: Highways England's design vision and principles*. Available: <https://www.gov.uk/government/publications/the-road-to-good-design-highways-englands-design-vision-and-principles>. Last accessed 10/11/2019.

Highways England. (2017). *Highways England Environment Strategy*. Available: <https://www.gov.uk/government/publications/highways-england-environment-strategy>. Last accessed 24/04/2020.

Highways England. (2009). *Network Management Manual: Part 3 - Routine Maintenance*. Available: http://www.standardsforhighways.co.uk/ha/standards/nmm_rwsc/docs/nmm_part_3.pdf. Last accessed 10/11/2019.

Highways England. (2006). *TD 19/06 Requirement for Road Restraint Systems*. Available: <http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol2/section2/td1906.pdf>. Last accessed 10/11/2019.

HM Treasury. (2016). *National Infrastructure Delivery Plan 2016–2021*. Available: <https://www.gov.uk/government/publications/national-infrastructure-delivery-plan-2016-to-2021>. Last accessed 27/10/2019.

HMSO. (2002). *The Forest Reproductive Material (Great Britain) Regulations 2002*. Available: <http://www.legislation.gov.uk/ukxi/2002/3026/contents/made>. Last accessed 27/10/2019.

HS2. (2018). *HS2 Green Corridor*. Available: <https://www.hs2.org.uk/building-hs2/environment-sustainability/hs2-green-corridor/>. Last accessed 10/11/2019.

HS2. (2017). *HS2 Design Vision*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/607020/HS2_Design_Vision_Booklet.pdf. Last accessed 10/11/2019.

HS2. (2016). *HS2 Landscape Design Approach*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/550791/HS2_Landscape_Design_Approach_July_2016.pdf. Last accessed 10/11/2019.

Huddart, L. (1990). *The use of vegetation for traffic noise screening*. Available: <https://trl.co.uk/reports/RR238>. Last accessed 10/11/2019.

Infrastructure and Projects Authority. (2019). *About us*. Available: <https://www.gov.uk/government/organisations/infrastructure-and-projects-authority/about>. Last accessed 27/10/2019.

Institute of Government. (2020). *Infrastructure: How to improve infrastructure decision making in the UK*. Available: <https://www.instituteforgovernment.org.uk/our-work/policy-making/infrastructure>. Last accessed 24/04/2020.

JCLI Contracts Forum. (2014). *JCLI Practice Note No. 11: Contract Growing Guidance*. Available: <https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/migrated-legacy/JCLIPN11ContractGrowingGuidance2014-10.pdf>. Last accessed 01/11/2019.

JCLI. (2014). *JCLI Practice Note 11: Contract Growing Guidance*. Available: <https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/migrated-legacy/JCLIPN11ContractGrowingGuidance2014-10.pdf>. Last accessed 08/03/2020.

Landscape Institute. (2019). *Building Information Modelling (BIM)*. Available: <https://www.landscapeinstitute.org/technical/bim-working-group/>. Last accessed 27/10/2019.

Landscape Institute. (2019). *Plant Health and Biosecurity: The Landscape Consultant's Toolkit*. Available: <https://www.landscapeinstitute.org/technical-resource/biosecurity-toolkit/>. Last accessed 27/10/2019.

Landscape Institute. (2018). *Environmental Colour Assessment: Technical Information Note 04/2018*. Available: <https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2018/11/18-4-Environmental-Colour-Assessment.pdf>. Last accessed 08/03/2020.

- Landscape Institute. (2017). *LI Digital Plan of Works for Landscape*. Available: <https://www.landscapeinstitute.org/technical/bim-working-group/li-digital-plan-of-works-for-landscape/>. Last accessed 27/10/2019.
- Landscape Institute. (2017). *Townscape Character Assessment Technical Information Note 05/2017*. Available: <https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2017/12/tin-05-2017-townscape.pdf>. Last accessed 08/03/2020.
- Landscape Institute. (2016a). *Ecosystem Services and Ecosystem Service Frameworks*. Available: <https://www.landscapeinstitute.org/technical-resource/ecosystem-services-and-ecosystem-service-frameworks/>. Last accessed 24/04/2020.
- Landscape Institute (2016b). *BIM for Landscape*. Abingdon: Routledge.
- Landscape Institute. (2015). *Landscape Character Assessment Technical Information Note 08/2015*. Available: https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2016/01/Landscape-Character-Assessment-TIN-08_15-20160216.pdf. Last accessed 08/03/2020.
- Landscape Institute. (2015). *Green Bridges: Technical Guidance Note 09/2015*. Available: <https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2018/01/tgn-09-2015-green-bridges.pdf>. Last accessed 08/03/2020.
- Landscape Institute (1997). *Landscape Institute Royal Charter*. London: Landscape Institute.
- Lynch, K., Appleyard, D., and Myer, J.R. (1965). *The View from the Road*. Cambridge, MA, United States: MIT Press; Harvard-MIT Joint Center for Urban Studies Series.
- Macneil, D., Steele, D., McMahon, W., Carder, D. (2001). *Vegetation for slope stability*. Available: <https://trl.co.uk/reports/TRL515>. Last accessed 10/11/2019.
- Marriott, C., Hood, K., Crabtree, J., Macneil, D. (2001). *Establishment of vegetation for slope stability*. Available: <https://trl.co.uk/reports/TRL506>. Last accessed 10/11/2019.
- National Grid. (2020). *Landscape Enhancement Initiative*. Available: <http://lei.nationalgrid.com/>. Last accessed 08/03/2020.
- National Grid. (2016). *A Sense of Place: design guidelines for development near high voltage overhead lines*. Available: <https://www.nationalgrid.com/sites/default/files/documents/Sense%20of%20Place%20-%20National%20Grid%20Guidance.pdf>. Last accessed 10/11/2019.
- National Grid. (2012). *Our approach to the design and routing of new electricity transmission lines*. Available: <https://www.nationalgrid.com/sites/default/files/documents/13794-Our%20approach%20to%20the%20design%20and%20routing%20of%20electricity%20transmission%20lines.pdf>. Last accessed 10/11/2019.
- National Grid. (2008). *Development near overhead lines Planning and amenity aspects of high voltage electricity transmission lines and substations*. Available: [https://www.nationalgrid.com/sites/default/files/documents/Development near overhead lines_0.pdf](https://www.nationalgrid.com/sites/default/files/documents/Development%20near%20overhead%20lines_0.pdf). Last accessed 10/11/2019.
- National Infrastructure Commission. (2020). *Design Principles for National Infrastructure*. Available: <https://www.nic.org.uk/wp-content/uploads/NIC-Design-Principles-Final.pdf>. Last accessed 08/03/2020.

National Infrastructure Commission. (2019). *What we do*. Available: <https://www.nic.org.uk/what-we-do/>. Last accessed 27/10/2019.

National Infrastructure Commission. (2018). *Developing Design Principles for National Infrastructure*. Available: <https://www.nic.org.uk/wp-content/uploads/Developing-Design-Principles-for-National-Infrastructure.pdf>. Last accessed 27/10/2019.

Natural England. (2019). *An approach to landscape sensitivity assessment – to inform spatial planning and land management*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/817928/landscape-sensitivity-assessment-2019.pdf. Last accessed 24/04/2020.

Natural England. (2015). *Green Bridges: A literature review (NECR181)*. Available: <http://publications.naturalengland.org.uk/publication/6312886965108736>. Last accessed 08/03/2020.

Natural England (2014). *An Approach to Landscape Character Assessment*. London: Natural England. 05/11/2019.

Natural England. (2012). *Natural England Commissioned Report NECR105 An Approach to Seascape Character Assessment*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/396177/seascape-character-assessment.pdf. Last accessed 08/03/2020.

Natural England. (2006). *Including landscape in road design, construction and mitigation (CA217)*. Available: <http://publications.naturalengland.org.uk/publication/36008>. Last accessed 10/11/2019.

NBS. (2015). *NBS BIM Toolkit*. Available: <https://toolkit.thenbs.com/>. Last accessed 27/10/2019.

Network Rail. (2019). *Catalogue of Network Rail Standards*. Available: <https://www.networkrail.co.uk/industry-and-commercial/third-party-investors/network-rail-is-open-for-business/reviewing-our-standards/>. Last accessed 10/11/2019.

Network Rail. (2018a). *Valuing nature – a railway for people and wildlife... The Network Rail Vegetation Management Review*. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/759698/valuing-nature_a-railway-for-people-and-wildlife-the-network-rail-vegetation-management-review.pdf. Last accessed 10/11/2019.

Network Rail. (2018b). *Lineside Vegetation Management Manual*. Available: <https://cdn.networkrail.co.uk/wp-content/uploads/2018/05/Lineside-Vegetation-Management-Documentation.pdf>. Last accessed 10/11/2019.

Network Rail. (2015). *Station Design Principles for Network Rail*. Available: <https://cdn.networkrail.co.uk/wp-content/uploads/2018/04/S1-Station-design-principles.pdf>. Last accessed 10/11/2019.

Non-Native Species Secretariat (NNSS). (2019). *GB Non-native Species Information Portal*. Available: <http://www.nonnativespecies.org/factsheet/index.cfm>. Last accessed 01/11/2019.

Office of the Deputy Prime Minister (2006). *Lighting in the Countryside: Towards Good Practice*. London: Office of the Deputy Prime Minister.

Office of the Deputy Prime Minister. (1997). *Lighting in the Countryside: Towards Good Practice*. Available: <https://webarchive.nationalarchives.gov.uk/20120920012017/http://www.communities.gov.uk/documents/planningandbuilding/pdf/158352.pdf>. Last accessed 10/11/2019.

Oxford University Press (2019). *Oxford English Dictionary*. Oxford: Oxford University Press.

Plantlife. (2019). *Managing grassland road verges*. Available: <https://www.wildlifetrusts.org/sites/default/files/2019-09/Managing%20grassland%20road%20verges.pdf>. Last accessed 08/03/2020.

Roads Beautifying Association (1930). *Roadside Planting*. London: Country Life.

Scottish Government. (2010). *A Policy Statement for Designing Streets*. Available: <https://www.gov.scot/binaries/content/documents/govscot/publications/corporate-report/2010/03/designing-streets-policy-statement-scotland/documents/0096540-pdf/0096540-pdf/govscot%3Adocument/0096540.p>. Last accessed 10/11/2019.

Scottish Natural Heritage (SNH). (2017). *Visual representation of wind farms: Guidance*. Available: <https://www.nature.scot/visual-representation-wind-farms-guidance>. Last accessed 10/11/2019.

Scottish Natural Heritage (SNH). (2016). *Assessing the impact of small-scale wind energy proposals on the natural heritage*. Available: <https://www.nature.scot/sites/default/files/2017-09/Guidance%20note%20-%20Assessing%20the%20impact%20of%20small-scale%20wind%20energy%20proposals%20on%20the%20natural%20heritage.pdf>. Last accessed 10/11/2019.

Scottish Natural Heritage (SNH). (2015). *Spatial Planning for Onshore Wind Turbines – natural heritage considerations*. Available: <https://www.nature.scot/sites/default/files/2019-10/Guidance%20-%20Spatial%20Planning%20for%20Onshore%20Wind%20Turbines%20-%20natural%20heritage%20considerations%20-%20June%202015.pdf>. Last accessed 10/11/2019.

Scottish Natural Heritage (SNH). (2012a). *Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape Guidance for Scoping an Environmental Statement*. Available: https://tethys.pnnl.gov/sites/default/files/publications/SNH_2012_Guidance.pdf. Last accessed 10/11/2019.

Scottish Natural Heritage (SNH). (2012b). *Assessing the Cumulative Impact of Onshore Wind Energy Developments*. Available: <https://www.nature.scot/sites/default/files/2017-09/A675503%20-%20Assessing%20the%20cumulative%20impact%20of%20onshore%20wind%20energy%20developments.pdf>. Last accessed 10/11/2019.

Sherwood, P. (2009). *The establishment and maintenance of roadside vegetation. A review of methods available*. Available: <https://trl.co.uk/reports/LR351>. Last accessed 10/11/2019.

Sherwood, P.T., Roe, P.G. (1974). *The effect on the landscape of borrow-pits used in major roadworks*. Available: <https://trl.co.uk/reports/SR122>. Last accessed 10/11/2019.

Society for Chief Officers of Transport in Scotland. (2017). *National Roads Development Guide*. Available: <http://www.scotsnet.org.uk/documents/national-roads-development-guide.pdf>. Last accessed 10/11/2019.

SusDrain. (2020). *Welcome Break, Wheatley*. Available: https://www.susdrain.org/case-studies/case_studies/welcome_break_wheatley.html. Last accessed 08/03/2020.

Sustainable Urban Drainage Scottish Working Party. (2015). *Water Assessment and Drainage Assessment: Guide A guidance document for developers, planners and others involved in water and drainage*. Available: https://www.sepa.org.uk/media/163472/water_assessment_and_drainage_assessment_guide.pdf. Last accessed 10/11/2019.

Sylvia Crowe (1960). *The Landscape of Roads*. London: The Architectural Press.

Sylvia Crowe (1958). *The Landscape of Power*. London: The Architectural Press.

The Countryside Agency (2006). *Including landscape in road design, construction and mitigation*. London: The Countryside Agency.

The Planning Inspectorate. (2019a). *National Infrastructure Planning: Register of applications*. Available: <https://infrastructure.planninginspectorate.gov.uk/projects/register-of-applications/>. Last accessed 01/11/2019.

The Planning Inspectorate. (2019b). *National Infrastructure Planning: National Policy Statements*. Available: <https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/national-policy-statements/>. Last accessed 01/11/2019.

The Planning Inspectorate. (2019c). *National Infrastructure Planning*. Available: <https://infrastructure.planninginspectorate.gov.uk/>. Last accessed 01/11/2019.

The Planning Inspectorate. (2016). *Advice Note 8.2: How to register to participate in an Examination*. Available: <https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/04/Advice-note-8-2v3.pdf>. Last accessed 08/03/2020.

The Planning Inspectorate. (2013). *Advice Note three: EIA Notification and Consultation*. Available: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/07/advice_note_3_v5.pdf. Last accessed 08/03/2020.

The River Restoration Centre. (2013). *Manual of River Restoration Techniques, Update 2*. Available: <https://www.therrc.co.uk/manual-river-restoration-techniques>. Last accessed 10/11/2019.

The Stationary Office (TSO). (2019). *Standards for Highways*. Available: <http://www.standardsforhighways.co.uk/ha/standards/index.htm>. Last accessed 05/11/2019.

Transport for Scotland. (2019). *Design of trunk roads*. Available: <https://www.transport.gov.scot/transport-network/roads/design-of-trunk-roads/>. Last accessed 10/11/2019.

Transport for Scotland. (2019a). *Scottish Road Research Board*. Available: <https://www.transport.gov.scot/our-approach/industry-guidance/scottish-road-research-board/#overview>. Last accessed 10/11/2019.

Transport for Scotland. (2014a). *Section 17*. Available: <https://www.transport.gov.scot/publication/stag-technical-database/section-17/>. Last accessed 10/11/2019.

Transport for Scotland. (2014b). *Fitting Landscapes: Securing More Sustainable Landscapes*. Available: https://www.webarchive.org.uk/wayback/archive/20161001202918mp_/http://www.transport.gov.scot/system/files/uploaded_content/documents/tsc_basic_pages/Environment/j279083.pdf. Last accessed 10/11/2019.

Trees and Design Action Group (TDAG). (2018). *Tree Species Selection for Green Infrastructure: A Guide for Specifiers*. Available: <http://www.tdag.org.uk/species-selection-for-green-infrastructure.html>. Last accessed

01/11/2019. Trees and Design Action Group (TDAG). (2014). *Trees in Hard Landscapes: A Guide for Delivery*. Available: <http://www.tdag.org.uk/trees-in-hard-landscapes.html>. Last accessed 01/11/2019.

Turner, T. (2017). *The landscape architecture of highways*. Available: <http://www.landscapearchitecture.org.uk/landscape-architecture-highways/>. Last accessed 05/11/2019.

UK Parliament. (2017). *Planning for Nationally Significant Infrastructure Projects*. Available: <https://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN06881>. Last accessed 01/11/2019.

United Kingdom Accreditation Service (UKAS). (2018). *National Highway Sector schemes for quality management in highway works scheme 18: particular requirements for the application of ISO 9001:2015 for the natural environment and landscape including ecology for infrastructure*. Available: https://www.ukas.com/download/publications/publications_relating_to_certification_bodies/NHSS-18_9001-2015_Issue-2_02-2018.pdf. Last accessed 08/03/2020.

University of Glasgow. (2017). *Greening the Grey: A Framework for Integrated Green Grey Infrastructure (IGGI)*. Available: <http://eprints.gla.ac.uk/150672/>. Last accessed 08/03/2020.

University of Reading. (2019). *Landscape Institute archive and library*. Available: https://www.reading.ac.uk/merl/collections/Archives_A_to_Z/merl-SR_LI.aspx. Last accessed 01/11/2019.

US Department of Agriculture. (1934). *Roadside Improvement*. Available: <https://archive.org/details/roadsideimprovem191simo/page/n7>. Last accessed 05/11/2019.

Welsh Government. (2018a). *Highways Standards*. Available: <https://beta.gov.wales/highway-standards>. Last accessed 10/11/2019.

Welsh Government. (2018b). *Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems*. Available: <https://gov.wales/sites/default/files/publications/2019-06/statutory-national-standards-for-sustainable-drainage-systems.pdf>. Last accessed 10/11/2019.

Welsh Government (2017). *Welsh Transport Appraisal Guidance*. Cardiff: Welsh Government.

Woodland Trust. (2016). *Keeping rivers cool: shade for climate change adaptation*. Available: <https://www.woodlandtrust.org.uk/publications/2016/02/keeping-rivers-cool/>. Last accessed 10/11/2019.

Zawadzka, J.E, Corstanje, R., Fookes, J., Nichols, J., Harris, J. (2017). *Operationalizing the ecosystems approach: Assessing the environmental impact of major infrastructure development*. Ecological Indicators. 78, 75-84.

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 - Christoph Brintrup CMLI, HS2
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 - Henry Penner CMLI, Highways England
 - Julian Francis CMLI, Environment Agency
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 - Roger Kent FLI
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Landscape Institute
85 Tottenham Court Road
London
W1T 4TQ

www.landscapeinstitute.org

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