Archaeology and Solar Farms: Good Practice Guide

A toolkit for developers, archaeological advisors, consultants and contractors

Association of Local Government Archaeological Officers	CADW	Chartered Institute for Archaeologists	FAME
Historic England	Local Government Association	Solar Energy UK	

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PART 1 – CONTEXT AND PRINCIPLES

1 Introduction

1.1 About this guide

1.1.1 This guide on archaeology and solar farms has been written to set out good practice and promote consistent approaches to the process and timing of archaeological work on large-scale solar farms.

1.1.2 It is intended for use by developers, archaeological advisors, planning case officers, archaeological consultants, and contractors. It is designed to support individuals in these roles by promoting a shared understanding and encouraging collaborative, constructive working relationships. The guide aims to help developers gain a clearer understanding of archaeology and the various approaches to managing it, while also helping archaeologists better understand how developers plan and deliver solar farm projects. The archaeology and development sectors are constantly learning and this document captures that process in relation to archaeology on solar farms.

1.1.3 The guide is in two parts.

- Part 1 outlines the shared principles that stakeholders across both sectors are encouraged to adopt. It explains the importance of collaborative working practices, with the overarching aim of supporting the transition to clean energy through the development of solar farms. This collaboration must balance the need for efficient and timely project delivery with the requirement to uphold policies that protect the historic environment. The close relationship between the provision of detailed information on design and the ability of archaeological advisors to provide timely advice is explained.

- Part 2 offers practical tools and targeted guidance on how these principles can be implemented. It defines the main impacts of solar farm development, explains the key roles which professionals play, outlines when specific actions should be taken and explores the range of techniques available for assessing archaeological potential and mitigating impacts on heritage assets. A model checklist is included for the applicant to complete and provide to the archaeological advisor identifying the location and possible impact of all aspects of the solar development.

1.1.4 The information in this guide flows from discussions between the solar and archaeology sectors, and a workshop in March 2025 attended by solar farm developers, engineers, archaeological advisors, consultants and contractors. This exchange of ideas has deepened understanding between the sectors and of issues affecting development and archaeology. Key to these discussions were consideration of scope, methods and timing of evaluation within this context and the need to meet national and local policy requirements in ensuring the historic environment forms part of sustainable development (noting the differences between planning processes in each UK nation and between those determined by the local authority and those determined through other mechanisms – eg, through the Planning Inspectorate in England).

1.1.5 The guide has been jointly written and reviewed by representatives from the Association of Local Government Archaeological Officers (ALGAO); Cadw; the Chartered Institute for Archaeologists; Federation of Archaeological Managers and Employers; Historic England; the Local Government Association; and Solar Energy UK.

1.1.6 Solar farm developments have specific characteristics. Understanding these informs us how and when archaeological, design and impact information is collected and shared between parties. Approaches to evaluating the presence, significance, character, depth and extent of archaeological remains need to be effectively integrated with the design process. This integration should be both informed by and contribute to solar farm design development, ensuring that archaeological considerations are addressed adequately.

1.1.7 This guide supports policy in each UK nation, noting the central importance of reducing the impacts of climate change. Each UK nation has targets for renewable energy production and solar farms are an important component of the shift to clean energy. Policy also requires that consideration is given to the historic environment, of which archaeological remains are a part. This document does not cover specific details of relevant planning processes in each UK nation but has been written to be relevant to all.

1.2 OVERVIEW OF INTENDED DEVELOPMENTS IN PRACTICE

1.2.1 The revised approaches set out in this good practice guide recognise that solar farms will be critical to the delivery of one of the UK Government's six key missions – to "make Britain a clean energy superpower" – as well as to similar targets of the Governments in Northern Ireland, Scotland and Wales.

1.2.2 This guide considers above- and below-ground archaeological remains and the potential for direct impacts upon them from the preparation for and construction, operation and decommissioning of solar farms. It does not cover the setting of heritage assets or visual impacts upon historic landscapes. We note that on occasion archaeological investigations do feed into setting assessments.

1.2.3 The good practice recommendations in this guide encourage a nuanced and phased approach to archaeological assessment, using a wide range of non-intrusive evaluation methods at the pre-determination stage. Post-determination trial trenching should target areas of high impact and sensitivity and address key questions raised by the pre-determination non-intrusive evaluation results. This approach requires good communication and provision of scheme-specific information on design and impacts for the whole-life cycle so that archaeological assessment can be effectively targeted.

1.2.4 Policy requirements mean that an appropriate level of information is needed to enable advice to be given and decisions to be made. To provide such information, this guide also recommends the considered application of a wider range of non-intrusive evaluation methods as a first phase of works and more effective synthesis of these results to predict the presence and absence of archaeological remains and their sensitivity, albeit recognising that some questions can only be answered by targeted trial trenching.

1.2.5 At the pre-submission planning and determination stages of a scheme, an emphasis on zoning areas of potential impact is recommended, considering any 'fixed elements' of impact – eg, grid connection, access, substations, habitat creation, etc – where there will be limited flexibility to relocate and there could be impacts upon archaeological remains (where present), necessitating a need for their early assessment prior to any final design. It is expected that a planning submission will be accompanied by the results of non-intrusive survey across the proposed solar farm area as a minimum to provide a first phase assessment of the character of archaeological remains present.

1.2.6 Where detailed design and whole-life cycle information cannot be provided until post-consent, this document supports a structured process of communication between the applicant and their representatives, the planning authority (case officer) and archaeological advisor. These exchanges should iteratively define the timing, type and scope of targeted evaluation, based on both archaeological potential and the likely ground disturbance associated with different parts of the proposals. It is noted that some elements of a solar farm are relatively low impact (panel supports) and others would have impacts which are similar in nature to many other forms of development (buried cable routes, hardstanding for substations). Section 4 of this guide provides more details on the possible impacts caused by different elements of a solar farm.

1.2.7 Evaluation results should inform design revisions, aiming to reduce harm through avoidance or preservation within the scheme. This approach recommends moving the majority of the intrusive archaeological data collection (and subsequent detailed design work) from pre-submission and pre-determination to post-consent. The effectiveness of this approach is dependent on the provision of comprehensive archaeological information, synthesised from a wide range of non-intrusive assessments, as well as demonstration of the necessary design flexibility to accommodate any changes needed to protect additional archaeological remains identified post-determination.

1.2.8 This guide promotes the development and maintenance of strong relationships between solar farm developers and archaeologists, to enable the sharing of information and help engender mutual understanding as the technology used to construct solar farms develops. This document, and its futures revisions, should reflect and influence the need for, and type of, archaeological evaluation in the future. It should also shape the ways in which solar farm design could evolve in the future to further improve the early provision of construction design information.

2 UNDERSTANDING ARCHAEOLOGY ON SOLAR FARMS

2.1 WHY SOLAR FARMS DIFFER FROM MANY OTHER TYPES OF DEVELOPMENT

2.1.1 Solar farms differ from traditional forms of built development, and this distinction has direct implications for how archaeological risk should be understood and managed. Unlike housing estates, transport infrastructure, commercial buildings and other forms of energy-generating stations which typically involve intensive ground disturbance across much of the scheme area, solar farms are typically characterised by often larger areas of dispersed, relatively low-intensity construction impacts (eg, vertical supports), flexibility in layout, and a fixed lifespan. The scale of solar farms, in spatial area, is often larger than many other types of development (eg, an industrial estate). This scale means that developers can often make design choices with archaeological sensitivity in mind to ensure lower ground disturbance where required.

2.1.2 Solar developments include areas of more conventional (higher) impact (eg, substations and cable runs) and while solar farms have a fixed lifespan, the physical impacts that these types of construction activities have on any archaeological remains are permanent.

2.1.3 Allowing time for an iterative approach to collecting and sharing archaeological and design information is critical, as some archaeological areas can be more sensitive to impact than others and not all preparation, construction, habitat creation and operational and decommissioning works are low impact. These characteristics demand an archaeological and design approach specifically adapted to these circumstances.

2.1.4 Recognising these differences has been essential to developing this good practice guide that balances the sustainable management of the finite archaeological resource with the need for efficient delivery of low-carbon energy infrastructure. It also provides strong justification for improving communication between all parties involved with solar developments.

2.2 GRID CONNECTION AND HOW IT AFFECTS THE PROGRAMME

2.2.1 Solar farm sites are selected partly on the basis of the grid connection that they offer. This non-archaeological issue, which is of critical importance to a solar farm development, is one of several factors which affect the location of land pulled into a proposal. Developers cannot select land only to avoid certain qualities (eg, heritage setting); they must consider grid connection as a particularly crucial matter. Other factors then influence whether that land is appropriate for an application; this can include heritage setting, archaeological potential, landscape and visual matters, ecological concerns and various other technical matters.

2.2.2 While securing a grid connection is a fundamental part of the project lifecycle, the process of delivering that connection, especially in the UK, is currently subject to widely publicised delays. These delays are often due to the need for broader grid reinforcement works that are outside the control of the developer of any particular solar project.

2.2.3 These delays do not affect the overall viability of solar projects, but they can significantly influence the implementation timeline. In particular, long lead times between planning consent and construction start are becoming increasingly common. As a result, it is often necessary for land to remain in agricultural use for several years after consent is granted, simply because the connection infrastructure is not yet in place.

2.2.4 The extended timeline associated with arranging grid connection has practical and financial implications for how and when certain preparatory activities, such as intrusive archaeological investigations, are carried out. The timing of their implementation, if required, should align with the anticipated grid delivery schedule to minimise disruption to land earlier than necessary.

2.3 LIMITED BELOW-GROUND IMPACTS WITHIN SOLAR PANEL ARRAYS

2.3.1 The below-ground impacts of large parts of solar farms are typically limited and of a relatively dispersed character (see Section 4). This is because much of a solar farm consists of solar panel arrays mounted on narrow steel supports that are driven vertically into the ground, rather than requiring excavation. These supports affect only small cross-sectional areas, typically with rectangular steel frames, with a steel thickness of 3–5mm, often in a C-shaped cross-section. The spatial arrangement of the arrays, typically with several metres between each row, results in limited disturbance to below-ground deposits. Consequently, the overall ground disturbance caused by these supports is considerably less than that of developments requiring more substantial foundations (eg, residential or commercial buildings).

2.4 HIGHER BELOW-GROUND IMPACTS ASSOCIATED WITH INFRASTRUCTURE

2.4.1 There are a variety of other types of ground disturbance associated with solar farm developments. These include, but are not limited to, the main cable routes to the point of connection, cable routes which run adjacent to solar panel arrays on some solar farms (in other cases they are held above ground and run between panels), construction compounds and substations (also outlined in Section 4). These parts of a solar farm have higher impacts than solar panel supports. In spatial terms these higher-impact areas take up a small part of the solar farm. See Section 8 for a checklist of the range of development impacts associated with solar farms.

2.4.2 Other impacts which need consideration include the way in which land is treated prior to remains being preserved by either design solutions (eg, non-penetrating panel supports) or by avoidance. Such land must not experience other ground-breaking impacts prior to preservation, or that preservation may be nullified. The method by which solar farms are decommissioned also needs consideration and careful management to ensure that minimal impacts during construction are not followed by large impacts as the solar farm is taken out of use.

2.4.3 It is noted that upgrading works, or large-scale repair/replacement of parts, which may happen during the lifetime of a solar farm could also involve ground disturbance. There is a need for planning conditions which consider the construction, use and decommissioning periods of a solar farm in relation to archaeological matters (see Section 9).

2.5 WHY ASPECTS OF SOLAR FARM DESIGN CANNOT BE FIXED AT THE PLANNING APPLICATION STAGE

2.5.1 When reviewing pre-application proposals for solar farms and considering how archaeology may be impacted by them, decision makers and advisors may ask why more precise design information, such as exact substation locations or cable trench locations, is not available. If there was more precise information on the location of impacts and their spatial and vertical extent/s, then advice could be given in more specific ways.

2.5.2 The more information available on design, the better able an archaeologist is to design targeted assessment and thereby to help remove risk earlier in the project lifecycle. A best-case scenario would be to have detailed information upon proposed design/s and detailed information on the spatial extent, depth and character of archaeological remains. That would allow officers to give the optimum level of advice to decision makers.

2.5.3 The reason such precise information is often unavailable lies in the staged and responsive nature of solar farm project design. Prior to an application being made, the layout is necessarily indicative or conceptual. It shows general equipment zones, access and infrastructure, sufficient for environmental impact assessment, but it does not reflect detailed engineering design. This is because detailed design depends on post-consent work, including

- topographic and geotechnical surveys
- contractor input on construction methods
- refined drainage, landscape and cable routing strategies

2.5.4 All of these are informed by site-specific conditions and evolve in tandem. For instance, final drainage design depends on detailed levels and contractor methodology, and landscape mitigation depends on where final equipment is sited. Information resulting from further archaeological assessment, which may take the form of post-consent trial trenching, should also be considered when finalising the design.

2.5.5 We note that substations needed for a solar farm may come under a separate application. These are not always built by the solar farm developer; instead they may fall under the remit of a Distribution Network Operator (DNO). On occasion, cable routes, which run offsite to link to the grid, also fall under a separate application. These types of infrastructure are among those likely to cause greater ground disturbance.

2.6 Design flexibility

2.6.1 Most large-scale solar farms benefit from a high degree of design flexibility. Infrastructure such as inverters, substations, cable runs within the solar farm, and access roads can usually be repositioned within the site boundary to avoid areas of known archaeological sensitivity.

2.6.2 Certain design elements will be less flexible. For example, main cable routes to connect the solar farm to the external grid will be substantially inflexible. Furthermore, the location of some items may also be constrained by other factors, such as the setting of a heritage asset or ecological considerations. It is noted that main cable routes are often shown as a corridor at the proposal stage. The ground disturbed in order to lay a cable would only be a portion of that corridor and it is often the case that the exact cable location can be moved within a corridor to follow an optimal route.

2.6.3 The characteristic of generally high flexibility contrasts with linear or high-density developments like roads or housing, where avoidance is often impractical. The deployment of this elasticity in design, especially on larger schemes, needs to be informed by archaeological assessment and the evolving relationship, both pre- and post-consent, between archaeological understanding and scheme design. Landscapes with complex depositional processes may be more likely to conceal large or highly sensitive features and may require a broader range of assessment techniques to be used to better understand them.

2.6.4 While presence of archaeological remains may influence the layout or impose additional mitigation costs, it rarely renders a project unviable. This is particularly the case for larger projects, where layouts are more flexible. The relatively large scale of many solar farms means that there is an opportunity to conserve archaeological remains if a level of flexibility (in design) is maintained, something this document seeks to encourage.

2.7 Constraints at the pre-consent stage

2.7.1 There are challenges that constrain the pre-consent phase of solar farm developments. While not unique to solar farm developments they are noted here as they potentially delay the provision of clean energy via solar farms, which is cited as a shared goal in the introduction of this guide.

2.7.2 The amount of land which many solar farms occupy is larger than many other forms of development. Much of that land is in agricultural use prior to becoming part of a proposed solar farm. This means crop compensation and disruption to the agricultural cycle, which affect many development types, are amplified on solar farm applications. It may also be the case that other forms of development, for example quarry sites, are phased over many years, meaning the effect of trial trenching is experienced over a longer timeframe along with the disruption and costs associated with it.

2.7.3 Projects can take several years to progress from site identification to planning application submission, during which access to land is often limited because of ongoing agricultural use. Intrusive evaluation (trial trenching) can disrupt cropping schedules and/or livestock management. This can make early-stage large-scale intrusive archaeological investigation difficult to achieve without significant cost, delay or reputational risk with landowners.

2.8 Lifespan of a solar farm

2.8.1 Most solar farms are consented for a lifespan of 40 or 60 years, after which the planning permission will expire and the land will revert to its former use, unless further planning applications are made. The relatively fixed-term lifespan of such developments contrasts with permanent developments like industrial or housing estates. Repowering/upgrading of a solar farm during or at the end of its proposed lifespan may also occur. This possibility and what that means in archaeological terms is something to be considered when conditions are attached to a planning application (see Section 9).

2.8.2 A fixed-term use does not equate to a temporary harm of archaeological remains. Impacts on below-ground archaeological remains will be permanent where they take place. In cases where solar farm construction leads to archaeological remains being wholly or partially preserved, having been taken out of regular mechanical ploughing, that preservation may also come to an end when the solar farm is decommissioned. Methods for decommissioning and land restoration will need to be developed as part of the planning application to demonstrate how these favourable conditions will be maintained during this process.

2.9 Timing and costs of evaluation works

2.9.1 Detailed on-site assessment does not usually take place until grid connection and land acquisition are well advanced, which can be several years after the site selection stage. Desk-based assessment, which includes walkover survey and analysis of a range of data sources, can takes place at various points in the project cycle including at the land acquisition stage, or later when the design of proposals is being considered along with other disciplines such as Landscape and Ecology.

2.9.2 Geophysical surveys require access rights from landowners; having surveyors on land which may have crops and/or livestock on it is disruptive to the farming cycle. This can mean that these surveys are not carried out until the viability of a project is clear. A balance is needed as leaving these surveys until late on in the process reduces the ability to fit around the farming cycle and reduces the opportunity to plan further targeted work around cropping and cultivation.

2.9.3 Intrusive trial trenching involves disturbance of the soil and potential damage to crops/pastureland. This is more disruptive to a working farm than non-intrusive surveys. The physical effects on soil, which can affect future crop yields, and the potential strain on landowner relationships is notable. In addition to the archaeological costs of trial trenching, additional payments in relation to crop loss/compensation increase the financial cost of these surveys. Because of the large size of solar development sites, intrusive works will be experienced by solar developers as high costs prior to a planning permission being granted (relative to the costs of other pre-application surveys). The costs are still present once permission is granted subject to conditions, but a degree of uncertainty over the project has then been removed, and this is a significant turning point in the management of project risk.

2.10 The purpose of archaeological data-gathering (evaluation)

2.10.1 In a planning and development context archaeological investigations typically have one of two purposes. The first is to determine the presence or absence of buried archaeological remains within a particular site, and if present to understand the nature, spatial extent, depth and significance of those remains. These types of archaeological investigations are referred to as archaeological evaluations and their function is to determine the archaeological potential of a site. Trial trenching is a prospection technique designed to do this. It is, like all physical archaeological investigations, a destructive technique which removes archaeological deposits and finds. However, it gathers the information required to make decisions on the need, or not, for mitigation works.

2.10.2 The second purpose is to develop a methodology to avoid or to mitigate harm, the latter often through the excavation and recording of archaeological remains to create a record of them before they are impacted by a development and/or become inaccessible for the period that development is present. These types of investigations are referred to as mitigation measures, in the sense that the record created of the archaeological remains is considered to compensate for their loss. Mitigation measures may take other forms that do not require archaeological investigations, such as excluding areas of known archaeological interest or protecting them under specialised foundations.

2.11 Archaeological data-gathering

2.11.1 *Archaeological assessment* documents have several names; the most widely used is Archaeological Desk-Based Assessment:

- desk-based assessments collate known evidence from a site and the surrounding area and use it to provide an assessment of the likelihood that the site will have archaeological remains. Evidence reviewed includes records from the Historic Environment Record (HER), Portable Antiquities Scheme data, previous archaeological investigations, aerial photographs, lidar data, historic mapping, documentary evidence and details of local topography and geology. A walkover of the proposed development site is carried out to check for earthworks and other elements of the historic landscape such as hedgerows and historic footpaths. Walkovers can also help to spot land use which may have truncated remains (eg, terracing or mineral extraction).

2.11.2 *Archaeological evaluations* include non-intrusive and intrusive activities:

- non-intrusive or minimally intrusive surveys (covered in the rest of this document by the term non-intrusive) either use sensors to analyse the properties of the soil to help detect archaeological features (eg, surveys, fieldwalking, geophysical survey, airborne remote sensing) or involve the retrieval of a small sample of physical evidence to help clarify the archaeological potential of a site, such as boreholes to collect information for deposit modelling, test pitting and archaeological metal detecting.
- intrusive field evaluations, such as trial trenching, involving trenches of, for example, 50m length and 1.8m width.

2.11.3 Each type of archaeological evaluation has different strengths and limitations, explained in more detail in Section 6. Furthermore, the effectiveness of different types of archaeological evaluations will vary depending on the nature of the archaeological remains and their context. For example, the investigation of areas where archaeological remains may be deeply buried (in fenland or river valleys for example) may require a combination of survey methods to be used, for example boreholes and deposit modelling alongside geophysical survey techniques best suited for those environments. These factors must be understood before determining which types of archaeological evaluation are necessary to adequately determine the archaeological potential of a site.

2.11.4 Maximising the information gathered through a range of non-intrusive methods, synthesised at a landscape scale, can provide an effective characterisation of the potential archaeological resource within an application area. It is often cheaper to invest in developing a thorough understanding of the site through these methods to help better target any intrusive works, such as trial trenching, which may follow.

3 PRINCIPLES FOR GOOD PRACTICE

PRINCIPLES FOR GOOD PRACTICE - HEADLINES

1) Solar farm development is supported by strong policy targets
2) Archaeological remains are a valued cultural resource worthy of protection
3) Archaeological consultation should be integrated into solar farm planning processes
4) Design flexibility can be utilised to protect archaeological remains
5) Differentiated impact zones on solar farms have implications for archaeological impacts
6) Archaeological methodologies should be aligned to specific site conditions and project impacts
7) High quality non-intrusive evaluation is critical to developing an understanding of archaeological potential
8) Targeted and sustainable trial trenching: enhancing confidence while considering development impact
9) Mitigation: balancing archaeological sensitivity with relative impact
10) Flexibility of design is key in establishing the requirements for archaeological mitigation strategies at the determination stage
11) Archaeological sensitivity across solar farm sites may be managed through adaptive zoning
12) Planning Conditions/DCO Obligations have a role to play in recognising the benefits of design flexibility in solar farms
13) Public engagement and knowledge dissemination should be integrated into the delivery of solar farms

3.1 PRINCIPLE 1 – SOLAR FARM DEVELOPMENT IS SUPPORTED BY STRONG POLICY TARGETS

3.1.1 UK and devolved governments have set ambitious targets for renewable energy generation. These targets will require a five-fold increase in solar power production, and ground-mounted solar will play a key role in reaching that target. Solar power is one of the cheapest forms of renewable energy and this guide supports efforts to reach net zero and acknowledges the role which archaeology plays in enabling that goal to be reached.[1]

3.2 PRINCIPLE 2 – ARCHAEOLOGICAL REMAINS ARE A VALUED CULTURAL RESOURCE WORTHY OF

[1] Department for Energy Security & Net Zero. National Policy Statement for Renewable Energy Infrastructure (EN-3). Presented to the Houses of Parliament pursuant to section 9(8) of the Planning Act 2008

PROTECTION

3.2.1 The IEMA, CIfA, and IHBC *Principles of Cultural Heritage Impact Assessment* state that 'Our valued cultural heritage is a resource worthy of protection. This is recognised in government policy and legislation that seeks to safeguard and maintain the most important cultural heritage assets. Safeguarding the cultural significance of places and objects need not prevent change.'[2]

3.2.2 Solar farm developers, as well as archaeologists, are committed to ensuring that the projects they design and deliver achieve this aim. Any solar farm application could have implications for below-ground archaeological remains. The purpose of archaeological investigation is to yield information about the past to advance our understanding of the human story. This core purpose of archaeological work is a public benefit.

3.2.3 Archaeological remains are an irreplaceable resource and should be conserved in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of existing and future generations. The approach to the conservation and, where necessary, the appropriate assessment, investigation and recording of archaeological remains impacted by development should be proportionate to the importance of the remains in question and the proposed impact upon them.

3.3 Principle 3 – Archaeological consultation should be integrated into solar farm planning processes

3.3.1 Detailed information on proposed impacts must precede quality advice on the likely effects of those impacts on archaeological remains. This makes the ongoing provision of comprehensive information and discussions on proposed impacts of critical importance at the relevant stages of the planning development process. This could initially take the form of potential zones of impact supplied by the applicant, albeit with both parties acknowledging that these zones may change subject to further survey and technical details being forthcoming.

3.3.2 Communication between solar farm developers, local authority planners and archaeological advisors (and other statutory heritage consultees) should take place early in the process of preparing an application. This consultation process should involve professional advice (from a consultant) to help understand and advise upon the technical requirements which archaeology may have. The precise timing of consultation is likely to depend on various non-archaeological factors/risks and will need to be decided on a case-by-case basis, although as early as possible and ongoing is recommended.

3.3.3 Communication should continue throughout the application process, as the exchange of emerging data about design, proposed impact and the archaeological potential of the land will improve risk management and decision

[2] IEMA, CIfA, and IHBC (2021) *Principles of Cultural Heritage Impact Assessment in the UK*. Page 5, Section 1.3

making. Further detail may also be required in response to planning conditions (see Section 9).

3.4 Principle 4 - Design flexibility can be utilised in order to protect the significance of archaeological remains

3.4.1 Solar farms typically retain a relatively high level of flexibility in terms of the design and location of infrastructure. Therefore, the precise location of higher impact infrastructure can, usually, be moved away from zones of high archaeological sensitivity, and this should inform archaeological strategy.

3.4.2 Given this flexibility, sharing details of proposals as early as possible allows archaeologists the opportunity to help identify when moving infrastructure may be beneficial (in terms of avoiding archaeological impacts). When developers bring archaeologists into a position of awareness there are benefits to the design process.

3.5 Principle 5 – differentiated impact zones on solar farms have implications for archaeological impacts

3.5.1 The physical impacts on archaeological remains from solar farm developments are typically limited in comparison to many other types of development (eg, mineral extraction, rail and road infrastructure). Within a solar farm there are large parts of the land where the only impact is from the metal supports to which the solar panels are attached. These supports are inserted into the ground and only cause very localised impact/s. There are smaller parts of the site which are subject to higher impacts. The difference in levels of anticipated impact across a solar farm lends itself to the zoning of impacts.

3.5.2 Parts of the site which are subject to higher impacts can include slabs for substations, transformers and other electrical infrastructure, cable routes, drainage swales, balancing ponds, areas of planting for landscape reasons and changes agreed for ecological mitigation.

3.6 Principle 6 – archaeological methodologies should be aligned to specific site conditions and project impacts

3.6.1 Identifying buried archaeological remains and their survival, significance, extent and distribution across the landscape may require different forms of archaeological assessment. The precise methodologies applied to gather the data needed to inform decision making will, necessarily, depend on the types of archaeological remains on different pieces of land and types of impacts proposed. Therefore, a variety of archaeological techniques will be used to obtain a sufficient level of information, proportionate to the impact, with which to make well-informed decisions.

3.6.2 Archaeological remains range from dispersed, early prehistoric artefact scatters to dense and complex features such as well-preserved Roman or medieval settlements. Archaeological remains may comprise artefacts, features such as pits, ditches and walls, human remains and standing structures. The context in which archaeological remains are present is also important, as some environments preserve ancient remains better than others, so the buried remains may be reliant on a wider environment for their preservation.

3.6.3 Archaeological remains differ in character and sensitivity and, therefore, will be impacted in different ways by ground disturbance. For example, inserting panel supports along sections of large ditches may cause only minimal disturbance. However, other classes of deposits and archaeological features would experience a greater degree of impact. For example, a buried mosaic floor would experience a greater impact as a result of the same panel support being put through part of it. Therefore, the sensitivity of archaeological remains in relation to the proposed ground disturbance associated with a development proposal should be considered.

3.6.4 Developers should expect a consistent approach to the application of successive phases of archaeological work to gather non-intrusive data, and the targeting of additional phases of survey, to answer remaining questions at specific locations of impact. The types of survey should be based on the likely type of archaeology and potential for impacts from preparation, construction and decommissioning. Therefore, a consistent approach can reasonably lead to the application of different methodologies. Consultants and archaeological officers can provide more detailed advice on individual projects and the reasons behind the methodology being applied in each case.

3.7 Principle 7 – High quality non-intrusive evaluation is critical to developing understanding of archaeological potential

3.7.1 The approach to understanding solar farm areas should begin with a high-level historic environment appraisal at site selection stage to rule out key constraints presented by known heritage assets.

3.7.2 Subsequently, an understanding of the site should be formulated at a landscape scale, drawing together information on the known resources, eg from the Historic Environment Record (HER) and other existing data on geology, topography, aerial photography, cartography, documentary material and Portable Antiquities Scheme data and combining this with new information collected by the applicant, such as geophysical survey, airborne remote sensing, geoarchaeology and deposit modelling. Archaeologists should then apply professional judgement and use predictive modelling to create the best understanding of where archaeological remains are likely to be located on a site. Archaeologists should consider where remains are most likely to be located within land which is lacking definitive evidence. There is sector guidance on how such assessment works should take place.[3]

[3] CIfA 2014. *Standard and guidance for historic environment desk-based assessment*. Note. There are other standards and guidance documents covering specific techniques such as geophysical survey.

3.7.3 In some instances, this non-intrusive or minimally intrusive work will provide sufficiently detailed information for planning decisions to be made about the impact of the scheme on significance and allow solar developers to consider whether the presence of archaeological remains could affect the potential viability of the scheme where these could not be accommodated through site design. Where the results of this work are inconclusive, or if an insufficient range of non-intrusive techniques have been used to give confidence in the results of this work, or further information is required to determine the effect and mitigation of localised impacts upon significance, more intrusive assessment techniques may be necessary.

3.8 Principle 8 – Targeted and sustainable trial trenching: enhancing confidence while considering development impact

3.8.1 Trial trenching is a valuable technique that helps to test for the presence or absence of archaeological evidence and to clarify the results of non-intrusive surveys. The data they can provide gives a high level of confidence to archaeological advisors who are advising decision makers on archaeological impacts. They enable an understanding to be gained of the significance, depth, date, character, state of preservation and relative complexity of archaeological remains, enhancing the evidence collected at earlier phases of evaluation.

3.8.2 Where trial trenches are needed, timing should be carefully considered, with post-determination assessment preferred where possible. The location and quantity of trial trenches should be designed to answer specific questions from previous non-intrusive work. Untargeted trenching across large areas where a wide range of other non-intrusive techniques have not indicated a high archaeological potential should normally be avoided. Their use and precise layout is best defined at the point when the applicant is able to provide archaeological advisors with an acceptable level of information about the specifics and layout of the solar scheme and clarity around the degree of flexibility of specific parts of the site.

3.8.3 Additionally, when considering the use of trial trenches on solar farms, it is important to bear in mind the relatively low impact of large areas of the scheme (ie, panel supports) and the high level of flexibility in the design of solar farms. Trial trenching can involve more ground disturbance than the construction of panel supports. Finding an appropriate balance between ground disturbance caused by archaeological evaluation and that caused by construction needs careful thought. It is often the case that higher-impact infrastructure, such as cable trenches, connectors and transformers can be relocated, even post-determination. Where their location is fixed, undertaking targeted pre-determination trenching of these aspects of the solar development would provide decision makers with additional confidence where desk-based and non-intrusive work has suggested the possible presence of archaeological remains in these areas.

3.8.4 The archaeological sector should also be mindful of the environmental sustainability of trial trenching. There are carbon emissions associated with the use of plant, often powered by diesel fuel, and there is the release of soil carbon through soil disturbance (in particular on permanent pasture and areas of peatland). To support net zero and carbon reduction targets, those planning archaeological work should be confident that every trench has a clear and proportionate purpose.

3.9 PRINCIPLE 9 – MITIGATION: BALANCING ARCHAEOLOGICAL SENSITIVITY WITH RELATIVE IMPACT

3.9.1 Where evaluation results indicate the presence of archaeological remains within the area of development, some form of archaeological mitigation will be required. Given the flexibility of solar farms, preservation of these remains within the solar scheme should be the first consideration. The lowest impact option and one that is commonly used on solar developments is avoidance, through exclusion from the development area or inclusion as an area of open grassland. Where these options are chosen, such areas need to be protected during the construction programme, require methodologies for any habitat creation (to avoid potential impacts from activities such as soil inversion) and will benefit from management plans to ensure their long-term preservation.

3.9.2 Depending upon the relative significance of the archaeological remains it may be acceptable to install the panel arrays directly over an archaeological site, where the impact from panel supports will not affect the ability to understand the site in the future, thus preserving the site beneath the panel arrays. If remains are considered to be of such sensitivity that this level of impact is not appropriate, and avoidance is not possible, then alternative methods of construction could be considered for those most sensitive areas (eg, non-penetrative panel supports and cable trays). Where such solutions are implemented, consideration must be given to the formation depth for pads, for example, and/or need for ground levelling in order to implement such non-penetrative solutions. All of the above considerations rely upon a sufficiently detailed dataset existing for a proposed development area. This needs to contain information on the spatial extent, character, depth and importance of the archaeological remains in question. These all have a bearing on whether this form of mitigation is appropriate and the area over which it might be deployed.

3.9.3 The use of above-ground solutions (concrete feet or ballast) to preserve remains requires reflection on grounds of sustainability. These also affect the potential of land to be smoothly returned to agricultural use upon decommissioning. This is because the use of gravel below such concrete feet (foundation) and/or in the form of ballast introduces materials which were not formerly part of the topsoil. Innovation is needed to find more sustainable non-penetrative solutions.

3.9.4 In areas of higher impact (substations, construction compounds, cable routes) where archaeological remains are present and avoidance isn’t possible, archaeological excavation during or in advance of groundworks would usually be required.

3.9.5 Arriving at the correct mitigation option (and different options are likely to be required across a solar development site given their large size) will require discussion and consultation between the applicant, their consultants and the local authority/determining authority.

3.10 Principle 10 – Flexibility of design is key in establishing the requirements for archaeological mitigation strategies at the determination stage

3.10.1 A mitigation strategy is still required at the determination stage, even if full design details are not available prior to that point. It is essential that prior to the determination of a planning application, an archaeological mitigation strategy/outline written scheme of investigation (WSI) is submitted so there is some measure against which the acceptability of post-determination submissions can be tested. In cases where archaeological data-gathering (evaluation) is to continue post-determination, planning conditions/obligations should secure a process whereby such work is carried out (see Section 9). The scope of such works would be defined within approved WSI(s), and the result of such work iteratively informs an updated mitigation strategy.

3.11 Principle 11 – Archaeological sensitivity across solar farm sites may be managed through adaptive zoning

3.11.1 Archaeological sensitivity will vary across a site for a variety of reasons including the type of archaeological remains and the relative depth at which archaeological remains occur. When the presence and type of archaeological remains is understood, it is possible to create zones of higher and lower sensitivity, based upon the potential relative significance and character of assets and sensitivity to change.

3.11.2 On occasion, the removal of higher-sensitivity zones from active, mechanical ploughing (and incorporation into a solar farm) may help to conserve some remains for the 40–60-year duration of the solar farm's operation. To ensure that these benefits are not lost at the end of the scheme, the decommissioning/reinstatement strategy will need to consider how land restoration/recultivation can take place without damage to these preserved remains. For example, sub-soiling in response to concerns about pan formation would directly negate the scheme's preservation of remains by design up to that point.

3.11.3 As archaeological data is collected during the course of the development, understanding of sensitivity across the site may change. Therefore, an iterative approach is needed. Developers and archaeologists need to anticipate the potential for change in the boundaries and number of archaeological zones as more detailed information is gathered.

3.12 Principle 12 – planning conditions/DCO requirements have a role to play in recognising the benefits of design flexibility in solar farms

3.12.1 Planning conditions/DCO obligations should recognise the specific flexibility of design factors and differential impacts of solar farm applications. Such conditions have an important role to play in ensuring the sustainable management of the finite archaeological resource, while accounting for the needs of solar development and the delivery of nationally set clean energy targets (see Section 9).

3.13 Principle 13 – public engagement and knowledge dissemination should be integrated into the delivery of solar farms

3.13.1 Developers and their consultants and local planning authority archaeologists should consider how to maximise public benefits from archaeology undertaken as part of solar farm development from the beginning of the scheme, and where appropriate secure these through planning conditions.

3.13.2 Dissemination of knowledge gained through investigation should be woven into proposals. Information produced by any archaeological evaluation or investigation needs to be fully analysed and reported on, the results placed in the public domain and the material curated in an appropriate archive.

3.13.3 Opportunities to engage local communities and improve public understanding of the landscape should also be considered. For example, public rights of way located within or on the edges of solar farms may present options to disseminate archaeological information to the public.

PART 2 – PRACTICAL ADVICE

4 DEFINING THE ARCHAEOLOGICAL IMPACT OF SOLAR FARMS

4.1 ELEMENTS OF A SOLAR FARM

4.1.1 A solar farm scheme often consists of the following elements (not an exhaustive list):

- solar arrays
- cabling trenches
- roads
- substations and battery storage
- fencing
- landscaping and drainage
- temporary construction infrastructure
- habitat creation

4.1.2 The following paragraphs describe the potential impacts on archaeological remains from each design element and consider possible future impacts from decommissioning. An example checklist identifying all potential construction activities and their possible archaeological impacts, which should be completed by the solar developer and their consultants, is provided in Section 8.

4.2 ARRAYS

4.2.1 Large parts of a solar development consist of the panels, mounted on frames which have one to three (galvanised) steel supports that are driven into the ground. The depths will vary with ground conditions but typically range from 1m to 3m below ground level. These supports have a range of profile designs (depending on the manufacturer but a flanged C or U shape is common) and usually measure about 20cm by 10cm. The metal sheeting is usually 3–5mm thick. They are pushed/driven into the ground on a standard grid layout by small track-mounted rigs which cause minimal disturbance to the topsoil.

4.2.2 The physical impact of these supports on archaeological remains has not been directly investigated but based on available guidance on piling and archaeology,[4] the impact of any individual support would be like a sheet pile, albeit with a different profile. In most ground conditions the support is pushed

[4] Historic England 2019 *Piling and Archaeology: Guidance and Good Practice*. Swindon: Historic England. https://historicengland.org.uk/images-books/publications/piling-and-archaeology/ (accessed 2025-06-17)

into the ground with limited vibration. The area that is disrupted by the installation would usually be limited to the cross-section of the support, and soil either side of the metal support would rarely be disturbed or disrupted.

4.2.3 A typical array layout has supports at 2–3m intervals along a set of panels, and a gap of 3–4m to the next set of panels. Usually, the area disturbed by the supports is less than 1 per cent of the land parcel. Archaeologically, the impact of one metal support is limited and unlikely to harm the archaeological interest of most archaeological features (ie, make it hard for the future investigation of the site to take place once the solar array is removed). For example, there are few instances where installing a solar array support into a pit or a ditch will have a significant impact on the ability to understand that feature in the future.

4.2.4 There are some types of archaeological remains, such as burials/graves, that it would not be acceptable to install supports into, and others such as ancient masonry, earthen structures or waterlogged wood where the impact could be larger than just the cross-section of the support, so installation of supports in these areas would not be recommended.

4.2.5 Where solar schemes are constructed in areas of previous wetlands (such as the fens, or in river valleys), installing panel supports into existing waterlogged deposits (like buried peats) will be very unlikely to lead to any changes to either the water levels or the burial environment more generally.

4.3 Fencing

4.3.1 Most sites will have an exterior fence around the edge. The impacts of fencing will be similar to the solar array supports – frequent small-diameter posts pushed or hammered into the ground. Such activities are commonplace in agricultural settings.

4.4 Cable trenches

4.4.1 Cables that connect the solar panels to each other are usually attached to the back of the panels. These are connected to cables from the other rows of panels at one end of the array (usually at the edge of the field) and run in cable trenches to transformers and other electrical infrastructure. In some instances, even the cables linking panels are buried, and in such cases the quantity of cable trenches is increased.

4.4.2 Cable trenches are usually about 1m deep and about 1m wide, and their excavation would physically impact any archaeological remains within the trench through their removal or truncation (if undertaken without appropriate archaeological mitigation). Cable trenches cause ground disturbance similar to other development types (such as footings and utilities needed for housing). The approach to cable routes is important where archaeological remains are concerned: if panel supports mean that large parts of a solar farm are considered low-impact zones, then careful consideration needs to be given to the method by which these panels are connected to cables. If that involves buried cables on a large scale, then these would no longer be low-impact zones.

4.5 Roads

4.5.1 Permanent roads are constructed into and around the site to facilitate construction and maintenance of the solar arrays. These can be designed to sit on the topsoil or may require the removal of topsoil and subsoil to build a more solid base prior to surface treatment. The archaeological impact of soil removal for roads will be similar to that of cable trenches.

4.6 Substations and battery storage

4.6.1 Given the substantial weight of these facilities, they usually require foundations, which involve the removal of soil from the area under the structure.

4.7 Landscaping and drainage

4.7.1 Schemes will often incorporate areas of landscaping for Biodiversity Net Gain (BNG) or require areas to be excavated for drainage (such as swales and attenuation ponds). Landscaping that disturbs the soil could have impacts on archaeological remains.

4.8 Temporary construction infrastructure

4.8.1 It is possible to create construction compounds and temporary roads by building up from the topsoil (laying protective matting or appropriate geotextile separator materials and imported fill on which to build these temporary facilities). Where topsoil or subsoil is removed prior to their construction, temporary structures would have similar potential impacts on archaeological remains to permanent roads or other infrastructure.

4.9 Habitat creation

4.9.1 The creation of new habitat can have a variety of impacts on archaeological remains. For example, the creation of ponds has an obvious below-ground impact where excavation is needed to lower ground levels. The creation of wildflower meadows can involve the turning of soil, and depending upon the depth of this, there is the potential for impacts on below-ground remains. Such activities need to be considered on a case-by-case basis in order to understand the likelihood of impact on below-ground remains. Notably, habitat creation is sometimes required early in the scheme construction process (so that the new habitat is established prior to any species translocation), so in terms of timing this may require early assessment.

4.10 Decommissioning

4.10.1 Solar developments are consented for a fixed duration, after which they will be decommissioned. As very few solar farms have yet been decommissioned it is not possible to list known impacts here. However, this section is included as a reminder that uninstalling panel supports, removing cabling or re-landscaping drainage features (for example) could all have potential archaeological impacts in the future. Each should be carefully considered in any decommissioning documentation submitted with applications or that is developed during the lifetime/end of life of these schemes.

4.10.2 Even after decommissioning it is likely that the construction and use of the solar farm will have a significant impact on the effectiveness of any future geophysical survey (particularly magnetometry), which is another reason why this would usually be expected to be completed as part of the suite of non-intrusive survey methods for a solar scheme.

5 Roles and responsibilities

Stakeholder	Role	Responsibilities	Key Laws & Guidance
Solar Developer	Applicant and Project Driver	Identifies and acquires site Leads on overall project strategy and timeline coordination Commissions planning and heritage consultants Provides adequate information on site and design including updates and options Engages in stakeholder consultation and addresses objections in liaison with heritage consultant Funds required assessments (DBA, Environmental Impact Assessment, associated surveys or Preliminary Environmental Information Report (PEIR)/Environmental Statement (ES) for DCO – England only) Prepares and submits planning application	1 (DCO), 2, 3, 4, 5, 6, 7, 8(Wales), 13
Local Planning Authority (Archaeologists)	Statutory Consultee and Regulator (Non-DCO)	Advises on regional priorities and issues Liaises with solar developer and heritage consultant Requests/reviews further information (DBA, EIA, eval) Sets conditions for archaeological work Reviews planning applications for heritage impact Advises planning committee on heritage issues Advises planning committee on heritage law and guidance May prepare Local Impact Report for DCO Reviews and approves WSI and mitigation strategies Monitors compliance during and after development	2, 3, 4, 5, 7, 9, 10, 13
The Planning Inspectorate (PINS) and the Planning and Environment Decisions Wales (PEDW) (for DCO projects, ie, >100MW England, PEDW currently determine applications for solar farms between 10mw	Examining Authority and Process Manager	Receives and validates DCO applications Appoints Examining Authority Oversees examination process including hearings and public questions Makes recommendation to Secretary of State for final decision Ensures compliance with procedural requirements	1, 4, 6, 11, 13

Stakeholder	Role	Responsibilities	Key Laws & Guidance
and 350mw in Wales.)			
National Heritage Organisation (ie, HE, Cadw) (when applicable ie, scheduled monuments and listed buildings, etc)	National Heritage Regulator	Advises on developments affecting scheduled monuments or Grade I/II* listed buildings Considers Scheduled Monument Consent Statutory consultee on process (ie, DCO) Offers expert opinion on harm and mitigation May submit Relevant Representation May advise refusal or recommend conditions	1, 4, 5, 7, 9, 10, 13
Heritage Consultants	Planning Advisor and Heritage Coordinator	Advises solar developers on planning law and process Prepares or commissions DBA, EIA, surveys/fieldwork Liaises with consultees, LPA, PINS, HE, etc Oversees implementation of survey/fieldwork Prepares for DCO examination engagement and questions Advises on design in light of heritage constraints Identifies opportunities for public engagement and value creation	1, 2, 3, 4, 5, 6, 7, 12, 13
Construction contractors	Groundworks and installation of equipment	Detailed design of methodology for delivery of permitted outline design, in collaboration with the client. The chosen method of working can deviate from the outline design, but must not lead to a radically different approach which involves wider-scale groundworks	
Archaeological Subcontractors	Fieldwork Implementers and Technical Specialists	Respond to specifications issued by consultants or LPAs Conduct surveys and fieldwork Develop, test, and refine innovative methods Produce reports for integration into planning documentation and LPA liaison May present findings at public inquiry or submit evidence Compliance with professional and legal standards	1, 3 (indirect via briefs), 4 (indirect), 12, 13

Guidance key:
1 = Planning Act 2008 (England and Wales)
2 = Town and Country Planning Act 1990 (England, Wales and N Ireland)
3 = EIA Regs 2017 England, Wales and N Ireland)
4 = NPPF 2024 (England)
5 = PPG (England)
6 = EN-1 & EN-3 NPS (England and Wales)
7 = Historic England Guidance (GPA 2, GPA 3) (England)
8 = PPW/TAN 24 (Wales) (Wales)
9 = Ancient Monuments and Archaeological Areas Act 1979. Please note, in Wales, this has been replaced by the Historic Environment (Wales) Act 2023 and supporting legislation – see https://cadw.gov.wales/advice-support/historic-environment-wales-act-2023.

Stakeholder	Role	Responsibilities	Key Laws & Guidance
10 = Listed Buildings Act 1990 (England) 11 = Infrastructure Planning (EIA) Regs 2017, (England and Wales) 12 = CIfA standards (UK wide) 1 3= National Planning Framework (NPF4) & Historic Environment Policy for Scotland (HEPS) (Scotland)			

6 STRENGTHS AND LIMITATIONS OF VARIOUS ARCHAEOLOGICAL EVALUATION TECHNIQUES

6.1 STRENGTHS AND LIMITATIONS

6.1.1 The table below provides a list of common types of archaeological evaluation, with a brief description of the strengths and limitations of each technique. It is generally considered good practice to use a combination of techniques to evaluate a site, as a strength in one can compensate for a limitation in another. The range of evaluation techniques needed to evaluate a particular site will depend on the nature of the site and the remains likely to be present.

6.1.2 Not all techniques will be needed for most sites, and one technique, such as magnetometry, may negate the need for others, such as resistivity or aerial photographic analysis. The approach this document recommends is for the deployment of the most effective range of non-intrusive techniques for a given location, the results of which should be properly synthesised and considered at a landscape scale to make predictions as to the likely presence of archaeological remains. These predictions and assumptions form the basis of the zoning approach and may require further testing through intrusive archaeological evaluation.

Type	**Intrusive, minimally intrusive or non-intrusive**	**Strength**	**Limitation**
Desk-based assessment	Non-intrusive	Can provide important context for understanding archaeological potential. The walkover element combined with skilled interpretation of existing data can result in new insights into a piece of land. A skilled archaeologist can glean new information through a walkover survey and through sources such as lidar and aerial photographs.	Desk-based assessments largely consider what is already known about an area, and the depth and range of historic environment records is influenced by the amount of work conducted locally, which is limited in certain areas.
Aerial photographic analysis	Non-intrusive	Can detect cropmarks and some earthworks that can be difficult to discern at ground level.	Cropmarks may only appear under certain conditions. Also, the information provided may be dated. Not all buried remains of interest can be detected.
UAV multi-spectral photography	Non-intrusive	Can detect some buried remains by examining reflectance properties of	Effectiveness is dependent on the type of vegetation and the

Type	Intrusive, minimally intrusive or non-intrusive	Strength	Limitation
		vegetation and thermal properties of soils from a drone.	time of year. Not all buried remains of interest can be detected.
Magnetometry	Non-intrusive	Can detect some buried remains through magnetic properties, especially burnt materials, and also cut features such as ditches, pits and sometimes smaller pits	Detects cut or buried features only providing there is sufficient contrast between the background and the feature; the detection of smaller features being also limited by the density and interval of sampling (which influences cost). Some feature types such as lithic scatters are not usually detected and evidence from some periods tends to be more visible (ie Roman) than others (Early Medieval)
Ground-penetrating radar	Non-intrusive	Can identify a large range of archaeological features as well as map voids and structural remains. Can also produce three-dimensional models of buried structural remains.	Will not easily detect features with fills which have a similar reflectance as the substrate. Not as effective in certain wet or waterlogged environments.
Electro-magnetic survey	Non-intrusive	Can measure levels of conductivity at significant depths. Areas of low conductivity are associated with drier ground/features and high conductivity with wetter areas. This survey can help map buried landscapes and larger buried features.	The readings can be affected by water levels and/or aquifers which increase moisture, increasing conductivity.
Resistivity survey	Non-intrusive	This survey is effective in detecting a range of features is is often used to better define structural remains. Certain resistivity techniques (such as ERT) can also be used to model layers, which can be further	Survey requires specific conditions, such as moderate levels of moisture.

Type	Intrusive, minimally intrusive or non-intrusive	Strength	Limitation
		constrained by borehole information.	
Borehole surveys/ deposit models	Minimally intrusive	Data can be used to construct deposit models that can provide an understanding of geomorphological processes and soil variation. This can often correlate with types or periods of archaeological features. Can also be an effective means of obtaining sealed samples for paleoenvironmental investigation or scientific dating.	Provides a very limited window and cannot be used to easily detect or map individual archaeological features.
Fieldwalking/ archaeological metal detecting	Fieldwalking – non-intrusive Metal detecting – minimally intrusive	Fieldwalking can detect artefact scatters, building remains and early prehistoric activity which has little associated below-ground evidence. Can also suggest the presence of further remains below ground and help map key areas of interest. Can be augmented with archaeological metal detecting where appropriate, for instance early medieval cemeteries, military camps/engagements, etc.	Requires a site to be ploughed to be effective for fieldwalking. The absence of artefacts in fieldwalking or metal detecting may not reflect the actual potential for buried remains, especially if remains are deeply buried.
Geochemical survey/analysis	Minimally intrusive	Can be used to map extent of sites and provide additional information relating to some activities present on site. It is best used in combination with other surveys, ie, geophysics or UAV MS	This is a relatively new technique and there are few published, peer-reviewed examples of its use in the UK for site prospection.
Test pits and trial trenches	Intrusive	By exposing features, these interventions can allow features to be physically examined, sampled and mapped. Can also verify the findings of non-intrusive surveys. Reveals depth of cover and incorporation of remains into plough soil.	These provide a narrow view of features, so complex features can be difficult to discern and map within the exposed area. This method is also more destructive than others, both in terms of impacts to archaeological features and to topsoil and subsoil layers on the

Type	Intrusive, minimally intrusive or non-intrusive	Strength	Limitation
			proposed development area.

6.1.3 CIfA has issued Standards and Guidance for all stages of the archaeological process. These cover evaluation and mitigation stages. Professional judgement as to which methods are appropriate is encouraged. The CIfA *Standard and Guidance for Archaeological Advice by Historic Environment Services* states:

> 'Some aspects of custom and practice may vary from one historic environment service to another, and according to individual circumstances. However, the principles governing the provision of archaeological advice by historic environment services should be the same: it should be clear, consistent, compliant, reasonable, timely, informed, impartial and proportionate.'[5]

[5] CIfA 2020. *Standard and guidance for archaeological advice by historic environment services*.

7 PROJECT LIFECYCLE

7.1 PREPARING FOR A DYNAMIC PROCESS

7.1.1 The following stages in the project lifecycle of a solar scheme have been identified and are explained as an aid to solar developers, archaeology advisors, planners, archaeological consultants and contractors. There will be variations to the lifecycle of different projects and there is no expectation that the following lifecycle will always be replicated. The series of steps is designed to indicate when a developer may seek advice from an archaeologist and when an archaeologist can expect certain data from a developer. The process is dynamic and the path from site selection through to an application being made has various steps where a project could be dropped, paused or pursued. Therefore, the following is for reference only and there are many variations on this pathway.

7.2 SITE SELECTION

7.2.1 Developers identify sites based on grid capacity and availability, solar resource, landowner willingness, suitability of land and known planning or environmental constraints. At this stage, various methods of ascertaining archaeological potential may be used (high-level rapid appraisal). Grid connection applications are submitted and, if feasible, land rights are secured. These are key milestones: both are highly competitive and time-sensitive, often requiring significant early investment.

7.3 PRE-APPLICATION

7.3.1 It can be useful to reflect upon the following steps at this part of the process:

7.3.2 *Step 1:* Land for a possible solar farm is identified as described in paragraph 7.2.1

7.3.3 Archaeological advice (from an archaeological consultant to the solar developer) at this stage may be provided in confidence and will be aimed at advising on feasibility. The intensity of research and advice will vary by project. The aim of this advice is to assess archaeological potential to identify risk and to enable an applicant to make informed decisions about whether to include/exclude particular pieces of land.

7.3.4 *Step 2*: An indicative plan showing the possible layout of a proposal may be created and shared. Even at this early stage it is often possible to identify and label parts of the site which may be considered low or high impact in archaeological terms:

- low impact: solar panel areas

- high impact: substations and cable routes

7.3.5 At this stage, communication may be within the applicant's technical team. The project may be nearing the point where it will be appropriate to seek external advice from consultees.

7.3.6 *Step 3*: It will often be appropriate to carry out a full desk-based archaeological assessment using existing records and, on occasion, certain non-intrusive surveys. Findings from these works can inform a proposal and it may be that certain areas are now included/excluded on the basis of these findings. Communication with consultees should take place at this stage (prior to the start of the DBA). This will ensure that appropriate methods of archaeological data-gathering are agreed and carried out. Often, the consultee will be the local planning authority archaeological advisor. This early collaboration helps improve the project and builds a good working relationship.

7.3.7 The findings made via this data-gathering can now be used to further refine proposals. This enables the more sensitive areas of archaeological remains identified by these techniques to be avoided and for non-intrusive surveys to be scoped, approved and carried out.

7.3.8 *Step 4*: By combining the advice from the local planning authority archaeological advisor with archaeological data gathered via assessment and evaluation, and by viewing both against the emerging proposals, it is possible to ensure those proposals take account of all known archaeological data. This can be with a view to avoiding such remains and/or ensuring that they are located within lower impact parts of a solar farm.

7.4 Determination

7.4.1 The applicant will need to provide the determining authority with information about the archaeological resource in the application area, the identified zones of sensitivity and the actions that will be taken to mitigate the impact of the development. This will be required to show that the archaeology, which is a material consideration in the determination of the application, has been fully considered and appropriate measures to mitigate the impact are included in the application.

7.4.2 The flexibility of solar farms creates opportunities for careful phrasing of planning conditions/obligations. This process could be best achieved through dialogue between the applicant and the relevant planning authority. Section 9 considers the types of information that it may be appropriate for the determining authority to include in conditions/obligations which best capture the flexibility which solar farms have in terms of design, and the need for careful conservation and/or mitigation of impact to archaeological remains.

7.5 Pre-commencement

7.5.1 Planning permission is issued subject to conditions including 'pre-commencement', ie, those which must be met before development can begin, ensuring that certain aspects of works are addressed and approved before being implemented. Where these works have been subject to conditions, these can include further non-intrusive and intrusive archaeological evaluations. Such conditions will also generally stipulate an appropriate methodology for mitigation (often based on the outcome of evaluation works). Procurement and construction sequencing must account for a changing approach (as set out in this guide). This could include moving the requirement for most intrusive evaluation (undertaken pre-determination) to post-consent; allowing a sufficient window for such assessment to be undertaken, reported on, and the results reviewed by the advisors; and any results then informing design changes and other forms of avoidance or mitigation.

7.5.2 The scope of archaeological works is often stipulated in a brief issued by the archaeology advisor to the relevant planning authority. A written scheme of investigation (WSI) will be required to respond to the scope of archaeological works required, setting out the methodology for undertaking them. The WSI must be approved by the advisors prior to commencement. Briefs may set out further evaluation and/or mitigation options. Specific arrangements should be made with the relevant planning authority to ensure the planning condition is correctly fulfilled.

7.6 Construction

7.6.1 Construction may proceed with archaeological monitoring and mitigation (if needed). Mitigation may be secured as part of a wider archaeological management plan and be overseen by an archaeological clerk of works. In other cases, archaeological fieldwork will have been completed by this stage.

7.7 Operation

7.7.1 Solar farms are designed and consented with a fixed lifetime in mind but future innovation of generating infrastructure or repair and maintenance work may necessitate changes during the operational lifetime of the scheme. On sites where the future of archaeological remains has been secured through avoidance or their location beneath an area of solar panels, their presence should be recorded (for example within an archaeological management plan). Mechanisms for ensuring that any future maintenance/upgrading work does not impact these remains should be included in relevant project documentation.

7.7.2 The main public benefit of solar farm construction is the supply of clean, renewable energy. However, the gathering of archaeological information and its dissemination is also a public benefit. There are various ways such information can reach the public and, given the generally rural location of solar farms and the abundance of public footpaths in such locations, these footpaths could be utilised to provide informative signage describing archaeological findings, and using these to contextualise this history of energy transitions and the landscape.

7.7.3 There are many other opportunities for increasing the public benefit of solar farms and these are explored in more detail in:

- CIfA – *Toolkit for Public Engagement*. Version 1.0 (September 2023)
- ALGAO: Scotland – 'Delivery of Public Benefit and Social Value Guidance for Archaeology in the Planning Process'.

7.8 DECOMMISSIONING

7.8.1 There are currently no reliable, accessible studies on the impact of the decommissioning of a solar farm upon buried archaeology. As this document is prepared, studies are being supported related to projects which may provide the first reliable data in the UK on this topic. This will be invaluable, as decommissioning is clearly of vital importance to ensuring that remains subject to low impact at the construction stage do not experience greater impacts at the decommissioning stage. These studies should inform future iterations of this guidance.

7.9 BEYOND THE PROJECT LIFECYCLE – KNOWLEDGE SHARING

7.9.1 Knowledge sharing between parties in the process of solar farm development is important. This is because solar farms remain an emerging and rapidly developing type of development. Sharing knowledge on a regular cycle will help to continually ensure good practice is shared and understandings evolve. This may be best achieved through a website dedicated to collecting and sharing case studies which illustrate different aspects of good practice. Through the application of the good practice described in this guide and through the evolution of new solar farm designs and new archaeological techniques, we can look forward to the development of even better solutions in the future.

7.9.2 To further build rapport and deepen understanding, it may be beneficial for site developers or operators to offer site tours to archaeological advisors so they can, for example, observe the process of construction. Solar farm developers, equally, could be offered opportunities to visit archaeological sites during investigation, to observe the archaeological process.

7.10 BEYOND THE PROJECT LIFECYCLE – DESIGN AND INNOVATION

7.10.1 The solar energy sector is maturing in a dynamic environment, with new technology and new approaches likely to develop. Those new technologies will feed back into the cycle as new sites are searched for and scoped as potential sites for development.

7.10.2 There are opportunities for both sectors to work together to design more effective investigation, mitigation, construction and decommissioning methods. Additionally, innovation and design changes may evolve during the construction of the current generation of consented and in-progress schemes. It is vital that developers and their consultants can adequately explain the possible impacts of any of these changes, with reference to the current understanding, as set out in this guide and any scheme-specific documentation.

8 PRE-DETERMINATION AND PRE-SUBMISSION CHECKLIST FOR AN APPLICANT AND THEIR AGENT/S

8.1 CHECKLIST (ILLUSTRATIVE EXAMPLE)

8.1.1 Information similar to the following should be provided to the archaeological advisor with a plan showing the location/s of the items listed. The earlier this is provided, the earlier the advisor can understand the level of impact a proposal may have upon archaeological significance. This is needed in order to best advise on what data-gathering is needed, and why.

8.1.2 If the location and dimensions are not known/cannot be stated, as much detail as possible should be provided. Depth and spatial extent are particularly useful as these determine the size of impact in physical terms, which is one of the key concerns with archaeological deposits. The number and type of rows and columns in this table will differ between projects. What matters most is identifying what could affect archaeological remains, and clearly stating the depth and area of that impact. Providing this key information early helps enable meaningful discussions with archaeological advisors. Additional details should be shared as they become available, as part of ongoing communication.

Function	Construction activity of relevance to archaeology (*text below is for reference only*)	Depth of impact (mm) and description of work (*text below is for reference only*)	Location – zone number & description of flexibility (*text below is for reference only*)
Temporary construction compound	Enabling works	There will be two construction compounds. One will be 40m x 28m and the other will be 18m x 14m. Both will be stripped to a depth of 350mm.	Zone X, medium flexibility.
Temporary equipment storage area		Equipment will be stored within the construction compounds.	Zone X, low options for re-siting. No-dig options possible.
Solar farm	Solar farm (an array of ground-mounted solar panels)	Supports for the solar arrays will be inserted 1000–1500mm into the ground. However, in identified archaeologically highly sensitive zones, panels could be surface mounted – ie, only non-intrusive array supports used and all cabling in cable trays above	Solar arrays in zones X–Y highly flexible micro siting options and 20% density/capacity leeway.

Function	Construction activity of relevance to archaeology (*text below is for reference only*)	Depth of impact (mm) and description of work (*text below is for reference only*)	Location – zone number & description of flexibility (*text below is for reference only*)
		ground.	
Battery energy storage system (BESS)	Battery energy storage system (BESS)	Containers to be placed on concrete slab/s. Formation depth likely to be 400–600mm. Spatial extent 60m x 30m.	
Ancillary infrastructure	Substation	Concrete slab/s. Formation depth likely to be 400–600mm. Spatial extent 20m x 20m.	Fixed<?>
	Inverters (mounted behind the solar panels)	No impact as the inverters are mounted to the back of the panels and do not touch the ground.	
	Transformer units	Transformer, 6.1m x 2.4m. Built off 150mm plinth, surface mounted. Some levelling of the surface may occur. This is likely to be up to 100mm deep.	
Cables	Cable runs between rows of panels	These will be surface mounted in trays for the most part. There may be some cables (running to the transformers) which need undergrounding (tbc).	
Cable route to grid	Cable trench	We anticipate that it would be in the region of 800mm wide and 800–100mm deep.	
	POC mast CSE compound	Variable but parts up to 1500mm.	
	Point of connection	Variable but parts up to 1500mm.	
Roads and tracks	Main access road	For the main road in/out, an allowance for 700mm depth should be made = 450mm of stone, 250mm of tarmac.	
Roads and tracks	Maintenance track (construction- and maintenance-related tracks)	Where new, the track will be 350mm deep, where existing, no change.	
Landscaping	There are stretches of new hedgerow being proposed.	Cultivation to 500mm below existing ground level, potential root penetration below 600mm in due course.	Site edges. Low flexibility, but subject to design decisions.
	There are several separate (small) areas of tree planting being proposed.	Cultivation to 500mm below existing ground level, potential root penetration below 600mm in due course.	

Function	Construction activity of relevance to archaeology (*text below is for reference only*)	Depth of impact (mm) and description of work (*text below is for reference only*)	Location – zone number & description of flexibility (*text below is for reference only*)
	There is a proposed area of scrub planting.	Cultivation to 500mm below existing ground level, potential root penetration below 600mm in due course.	
	There are areas of proposed wildflower meadow.	Cultivation 150mm below EGL.	
Ecology	Habitat compensation or enhancement areas	Cultivation to 600mm depth and potential root penetration, soil inversion and topsoil strip.	Unknown at this stage. Subject to ecological evaluation.
Drainage	There is a proposed drainage basin proposed in the south-western part of the site	The basin would be 1.3m deep.	
	Swales	There are swales for drainage; these would be 400 –600mm deep	
Fencing	Fencing around the solar farm	Posts would be 150mm x 150mm and the posts would be driven 750mm deep. They would be spaced 2.9m apart.	Site edges. Low flexibility.
	Fencing around the BESS	Posts would be 150mm x 150mm and the posts would be driven 1500mm deep. They would be spaced 2.4m apart.	
CCTV	Post	TBC – likely to be narrow poles (approx. 100mm x 100mm); would be inserted 600mm deep	
Satellite dish post	Post	TBC – likely to be narrow poles (approx. 100mm x 100mm); would be inserted 600mm deep	
Lighting	Post	TBC – spaced at intervals around fenced areas in substation.	

9 Planning conditions/obligations guidance

9.1 Creating bespoke conditions/obligations

9.1.1 Much of this Good Practice Guide has defined and explained the characteristics of solar farms. There are certain characteristics which could be utilised to create bespoke conditions/obligations. Clearly, the consenting authority would need to approve any wording before using it. The following sections set out some practical considerations that those drafting conditions/obligations might wish to consider and include, drawing on relevant archaeological advice.

[NOTE: This section is still in prep at the time of writing and will be added in once the Drafting Team have arrived at a suitable text.]

10 Further reading

10.1 Policy background:

Department for Energy Security & Net Zero, 2023. *National Policy Statement for Renewable Energy Infrastructure (EN-3)*. March 2023.

Llywodreath Cymru: Welsh Government, 2024. *Planning Policy Wales*. Edition 12. February 2024.

Ministry of Housing, Communities and Local Government, 2024. *National Planning Policy Framework*.

Scottish Government, 2014. *National Planning Framework 3*. 23 June 2014.

10.2 Historic England guidance:

Historic England, 2021. *Commercial Renewable Energy Development and the Historic Environment*. Historic England Advice Note 15.

10.3 Chartered Institute for Archaeologists Standards and Guidance:

Standard and guidance for archaeological advice by historic environment services.

Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives.

Standard and guidance for commissioning work or providing consultancy advice on archaeology and the historic environment.

Standard and guidance for the collection, documentation, conservation and research of archaeological materials.

Standard and guidance for archaeological geophysical survey.

Standard and guidance for the archaeological investigation and recording of standing buildings or structures.

Standard and guidance for forensic archaeologists.

Standard and guidance for historic environment desk-based assessment.

Standard and guidance for nautical archaeological recording and reconstruction.

Standard and guidance for stewardship for the historic environment.

Standard and guidance: appendices.

10.4 Reports focused on archaeological evaluation:

Chartered Institute for Archaeologists. 2022. 'Evaluation Strategies (Evals 1): understanding current practice and encouraging sector engagement. Report and recommendations'. August 2022. 70078423-ARC.

10.5 Public benefit of archaeology:

CIfA. *Toolkit for Public Engagement*. Version 1.0 (September 2023).

ALGAO: Scotland, 2023. 'Delivery of Public Benefit and Social Value Guidance for Archaeology in the Planning Process'.

10.6 Considering archaeology in a development context:

CIRIA. 2021. *Archaeology and construction: good practice guidance* (C799D).

Historic England, 2016*. Preserving Archaeological Remains. Decision-taking for sites under development*.

IEMA, CIfA and IHBC, 2021. *Principles of Cultural Heritage Impact Assessment.*

10.7 Heritage within the planning system (research):

DRP Archaeology, H Morel and D Phillips, 2021. *The Heritage Dimension of Commercial Renewable Energy Development in Planning*.