CLOSING SUBMISSIONS OF VIVIENNE JANE CLARKE

I am a local resident and have made a number of representations in the context of this Examination.

I have observed each of the Open Floor, Issue Specific and Compulsory Acquisition Hearings, either in person or via the PINS website.

Not mentioning an issue that I have raised in my previous submissions or at all does not mean I do not maintain that view or accept the Applicant's position.

In these Closing Submissions I am highlighting some specific matters of particular concern, some only emerging very recently, which I hope the ExA will consider carefully.

1. Water resources for watering new trees, shrubs and hedges

In my Deadline 6 submission [**REP6-090**] I commented on the inadequacy of the Applicant's response to my Deadline 4 submission [**REP4-133**].

In particular I drew attention to the mismatch between what was in the OLEMP [**REP3-100**] about watering and the Outline Water Resources Assessment document [**APP290**]. I had first raised my concerns about this topic in [**REP1-243**].

I am grateful to the ExA for picking this up at ISH7 and making it an action point for the Applicant to:

> "Provide details of an estimate for water requirements in a worst-case scenario and possible source and to include this in the Water Resources Strategy and also to consider how the use of rainwater harvesting measures implemented as SUDS could be used to provide water to support planting establishment and maintenance and ensure that the Drainage Strategies are consistent with the outline Water Resources Strategy."

Having reviewed the significant amendments in track changes which have been made to the Outline Water Resources Strategy **[**REP7-090] and OLEMP [**REP7-082**] it appears this is a matter which had not been properly assessed or dealt with by the Applicant, and still has not been, and raises serious issues as to whether the Applicant is able to comply with the commitments in the OLEMP and elsewhere.

Paragraph 3.2.1 of the Outline Water Resources Strategy [**REP7-090**] is an important amendment. The following words have been **added for the first time** for both the

construction and operational and maintenance phases in the section headed Areas of Water Demand

> "Landscape and ecological establishment watering, comprising targeted watering of newly planted trees, shrubs and hedgerows in accordance with the Outline Landscape and Ecological Management Plan (LEMP) [REP6-037]. "

The absence of this key demand for water in the original Outline Water Resources Strategy indicates that no proper thought had been given to the significant quantities of water required for this purpose during construction and the early years of operation, notwithstanding the commitments in the OLEMP, nor the amount which would be required or how it would be delivered.

Since the application documents were submitted there has been a significant mismatch between the OLEMP and the OWRS. Whatever consultation took place with Bristol Water or Wessex Water prior to or since the submission of the application (or at least until after ISH7) appears to have omitted the requirement for substantial quantities of water in summer for the watering of new trees, shrubs, hedges and, potentially, grass sward in PV areas (which is key to flood protection and mitigation).

Also absent, not only in the original OWRS but also in the one updated after ISH7, is any consideration of whether abstraction of large amounts of water in summer would be permitted at all, let alone if there were a Temporary Ban on Usage in place (as there is as at present in our area).

There are no Statements of Common Ground in the Document Library with either Wessex Water or Bristol Water although in the Statement of Commonality [**REP1-116**] there is reference to a draft having been issued to Wessex Water.

Despite the request in the action point made by the ExA, the Applicant has failed to produce a proper estimate of:

(1) an estimate of the amount of water which would be required, (on a worst case scenario or at all);

(2) how it would be sourced (other than reference to a possible mains connection near field A1 near Sherston with a supply of 7 m 3 /h); or

(3) the vehicular movements which will be needed to distribute that water around the site.

I note that in the tracked OWRS [**REP7-090**] at 1.1.6 that the **following words have been deleted**:

> "since it demonstrates there does exist a viable solution to supply"

Instead reference is now made to sources of water being identified in section 3.

The only wording I have found in the lengthy additions made to section 3 as to the source of water required is

> "Water for this purpose would be drawn from the supply sources identified in Section 4, including harvested rainwater for appropriate non-potable use where practicable."

What the Applicant now says in its tracked version of the OWRS [**REP7-090**] about supply sources in Section 4 is set out at 4.2.1 and 4.2.2:

> "4.2.1 The Scheme straddles two mains water supplier areas, Bristol Water and Wessex Water. Engagement has taken place with both undertakers. Bristol Water has confirmed the potential for a connection in the Lime Down A area, as set out below. Wessex Water is being consulted regarding the potential for an additional mains water supply to the Scheme if required. Previous engagement took place regarding possible supply connections, and Wessex Water has requested an updated developer enquiry setting out the current Scheme demand requirements so that an engineer within its Planning Liaison team can review potential supply. Wessex Water has not confirmed capacity, and no Wessex Water capacity is assumed in this Strategy. The purpose of continuing engagement is to investigate an additional or alternative mains supply which may provide further flexibility and reduce water transport distances where appropriate. Supply for the Scheme's identified water requirements is available from the sources set out below, and continuing engagement is directed at additional flexibility rather than at establishing supply.
>
> 4.2.2 However, Bristol Water confirmed that they are able to provide a water connection from an existing 4-inch cast iron water main in a location close to field A1 of the Scheme near Sherston and the CNL. Bristol Water also advised that a flow of 7m3 /hour was possible from this connection. That figure is the advised connection flow rate. It is not a confirmation of continuous 24-hour availability, and no guaranteed daily volume has been confirmed. This Strategy

therefore refers to 7m3 /hour as the Scheme advised connection rate and does not derive a daily volume from it."

The words deleted from the original 4.2.2 are of particular importance. Previously it was asserted [**APP290**] that:

" 4.2.2 Bristol Water also confirmed that a flow of 7m3 /hour was possible from this connection, which is sufficient to provide the 169m3 /day peak water demand required for the Scheme during its construction phase, especially given the conservative estimation of water demands used in this assessment."

The changes made to the OWRS in response to the ExA's action point demonstrate the serious deficiencies in the Applicant's water resources assessment and engagement with key water authorities.

It appears that as a consequence of the action point raised at ISH7 that the Applicant has amended its OLEMP. In the current tracked version [**REP7-082**] various additional statements are made about the care and replacement of trees, shrubs and hedges but the Applicant still maintains at 1.3.25 that

"The principal sources of required water is expected to be via existing mains supply"

It is not clear which mains supply is referred to here but my understanding is that the water main referred to in the OWR document (near Field A1) provides the local villages, in particular Sherston, with their drinking water.

One of the 30 m3 tankers proposed by the Applicant would take four and a quarter hours to fill from this source. The revised Outline Water Resources Strategy **[**REP7-090**]** makes it clear that Bristol Water was unwilling to commit to supplying water at this rate for a whole day.

Even if they were, tankers would have to be filling for more than 22 hours a day to supply what the Applicant says would be the peak daily construction phase water requirement of 155.15 m3 (Table 3-8). Reliance on this source is clearly inadequate even just for construction water **excluding landscape and ecological watering**.

Quite apart from the failure to include the need for water for landscape and ecological watering, the Applicant's estimate of the volume of panel washing water is also suspect. They quote a volume of 0.27 litres/m2 of panel per cycle, referencing a paper

by Xiong et al (2023). The value of 0.27 litres/m2 is quoted in Xiong et al from a study of the use of an automatic water jet system to clean panels installed on the roofs of two schools in Kuwait. Since the Applicants are clearly not going to use such a system and it is hard to imagine a more different environment from Lime Down, this value is clearly inappropriate and **does not represent a reasonable worst case assessment**.

Not considering the amount or source of the water needed to maximise the prospects of the survival of the hedges, shrubs and trees being relied on to mitigate the significant damage the Applicant has accepted would be caused by the scheme, and not informing the water companies about this prospective requirement appears to be a major omission in the Applicant's dealings with Bristol Water and Wessex Water and in its documents presented to the Examination.

This issue also has knock on effects. It would appear that, by omitting to consider this important issue (despite including watering in the OLEMP as a commitment), no assessment of the additional tankers or other vehicles required to deliver the water around the site has been included and so the Applicant has **failed to produce a reasonable worst case assessment of the construction and operational traffic caused by the commitment to watering during construction and operational phases.**

The amended OLEMP [**REP7-082**] 1.3.22 to 1.3.27 discusses the issues of amount of water but makes no quantitative estimates despite the request of the ExA. Given the volumes of water involved, and also the nature of the vehicles required to transport that water, this concerns me as a substantial omission which impacts the Applicant's ability to comply with the commitments in the OLEMP and to deliver the mitigation the new planting is supposed to provide.

Notwithstanding this failure by the Applicant, it is possible to make an estimate of the water needed for maintenance of planted trees and shrubs from the Applicant's own data as submitted to the Examination.

The approximate numbers of trees and shrubs can be obtained from the latest ES, Chapter 9, Ecology and Biodiversity, Rev 4 **REP7-022** . Approximately 11.37 ha of new native broadleaved woodland will be created (Paragraph 9.10.121).

At a standard amenity planting distance of 2m, hence 2,500 trees/ha, this is 28,425 trees.

The Arboricultural Association's An Introductory Guide to Young Tree Establishment

recommends, for trees in their first 3 years after planting (not just 1 year as in the OLEMP), watering at a rate of 50 litres of water per tree per week throughout the months of May, June, July and August under normal conditions. This amounts to 1,421 m3 per week, or 203 m3 per day just for the new broadleaved woodland. This is about eight times the Applicant's estimate of daily peak operational water use of 25.65 m3 per day (Table 3-9).

In addition, the Applicant is proposing 9.43 km of lines of trees ([REP7-022], para 9.10.140). At 2m spacing, this is 4,715 trees. At the same watering rate, these will require 236 m3 per week, or 34 m3 per day of water.

In addition, the Applicant is proposing 15.74 km of new hedgerow [[REP7-022], para 9.10.140). These will need less water per plant as they are likely to be smaller and hawthorn (Crataegus monogyna) at least is more drought resistant than most trees. Nevertheless, at a planting density of 5 plants per metre this is 78,700 plants, which allowing for 10 litres per week per plant would require 787 m3 per week, or 112 m3 per day of water.

Therefore, a reasonable worst case just for these three components of the tree and shrub planting would require 350 m3 per day of water in the summer, more than 13 times the Applicant's estimate of daily peak operational water use of 25.65 m 3 per day [REP7-090 (Table 3-9). **This appears to be another example of the Applicant failing to submit a reasonable worst case assessment.**

In addition, there are replacement hedges and gap-filling.

The Applicant's potentially secured water supply of a sporadic 7m3 per hour is clearly utterly inadequate for these needs. Even accounting for the fact that the above is a rough estimate, the figures are so out of proportion that there is no reasonable basis to conclude that the Applicant's proposed source in field A1 would be sufficient.

It is surprising that the Applicant has not conducted a basic assessment of the amount of watering required in these circumstances, or since the ExA made its request, as it directly relates to the possibility of whether in fact the steps secured in the OCEMP, OOEMP, and OLEMP are feasible.

The Applicant considers other sources of water in [REP7-090], including borehole water and abstracting from streams.

The Applicant seems unaware, or chooses not to include in its documentation, that the area has a low flow problem in summer which would preclude these options. Even in a

typical summer, Wessex Water has to pump water into the rivers from underlying aquifers to maintain river flows, which are depleted because of abstraction of drinking water.

A dry summer such as 2026 puts these resources under pressure. Further abstraction from boreholes would deplete these aquifers further, and abstraction from rivers would force Wessex Water to increase their own borehole abstractions to maintain river flows.

This is information which the Applicant should have provided as part of the Examination. **Assessed on a reasonable worst case basis these sources will not be available.** An adequate Water Resources Strategy would conclude that additional water would have to be sourced from outside the catchment, and properly assess that sourcing and delivery.

The section on rainwater harvesting also makes little sense and is, perhaps unsurprisingly, very vague. It would be very difficult to scale rainwater harvesting up to anything like the volume needed and to store it. It would have to be harvested from somewhere the rain was not needed anyway, so either from under the substations or BESS and would then need to be stored somewhere, and pumped out when needed. So far as I am aware there are no roofs or buildings in the scheme which are likely to produce sufficient rainwater for harvesting at this kind of scale and nothing in the documents about tanks or other storage areas so it is not understood how the Applicant would harvest rainwater anywhere within the Scheme and it has not committed to do so in any event.

Given the volumes involved, it is clear that such harvesting would be far from sufficient to make up any shortfall (not least as the periods within which the need to water will be most pressing is necessarily when there is no rainwater due to drought conditions).

If the Applicant intended to seriously rely on this as an approach it would be required to be assessed.

This is further evidence that the Applicant has failed to make a reasonable worst case assessment.

As the establishment of the mitigation planting is fundamental to the Applicant's assessment that the significant damage caused by the Scheme will be reduced by new planting, the inability to deliver the water required to tend the vast number of new trees, shrubs, hedges and other new planting is a major issue which I hope the ExA will consider carefully.

2 Traffic

During the course of the Examination I have become increasingly concerned at the likely increase in traffic on local roads. Not just the HGVs, which the Applicant has now admitted were significantly underestimated in the application documents (and so the consultation), but also how it will impact the behaviour of car drivers. This will not only be the drivers of vehicles bringing in construction workers, but also those who currently use the roads.

It is apparent from the surveys conducted by SLD and many of the Relevant Representations and statements during Open Floor Hearings that the local roads are much used by equestrians, cyclists and walkers. Even the one week survey of some limited places undertaken by the Applicant in hot weather in August recognised that local roads are much used by cyclists, particularly the part of the Fosse Way which is a key delivery route.

There will inevitably be drivers who seek to avoid the increased traffic on the main construction routes, eg from Dyson roundabout to Bradfield Cottages, and use back routes which are unsuitable, not least because they are used by equestrians, dog walkers and cyclists.

The risk of an increase in accidents generally and to NMUs in particular is not acknowledged by the Applicant.

As indicated above there seems to be no provision in the HGV figures produced by the Applicant for the distribution of water. I note that at 1.1.19 of the amended Outline Water Resources Strategy document [**REP7-090**] the Applicant states

> "Water will be distributed around the geographically dispersed Scheme by bowser, tanker or equivalent mobile distribution."

This is new wording added at Deadline 7 but, so far as I am aware, there is no provision in the Applicant's traffic documentation or schedules of vehicle movements in relation to bowsers or tankers during the construction or operational period for water distribution on this scale or any attempt to provide details of the numbers required. This is particularly important in the construction period due to the considerably increased number of HGVs and other vehicles as a result of the proposal.

The Applicant has failed to produce a reasonable worst case assessment.

3 Compaction

I have also been concerned by the statement made by Miss Webb, the soil expert for the Applicant, to the Examining Authority at ISH7 recording Part 3, time stamp 40 mins.24 seconds [**EV13-06**] where she stated when explaining how compaction would be avoided that in accordance with the Soil Resources Management Plan [**REP6-036**]

> "the ground surface should not be traversed when it is wet by machinery".

This statement was made in the context of compaction of soil, and that in order to reduce compaction, construction work would not take place when the ground was saturated.

Bearing in mind that land in the Lime Down area is mainly clay (as Miss Webb herself said) and often saturated for many months in the Autumn and Winter, I do not understand how, absent a binding commitment in the relevant control documents, the contractor is going to be prevented from carrying out groundworks which will compact the land and how the contractor is going to be stopped from working when the ground is wet unless no construction is permitted to be carried out from November to March.

So far as I can see what Miss Webb told the ExA is not consistent with what is in the control document [REP7-080] which refers in various places to Good Practice Guides but does not appear to commit the Applicant's contractor to compliance or to not traversing the ground with machinery when wet. This is important where it is accepted by the Applicant that compaction is a relevant matter in assessing whether run off will cause increased flooding.

I also do not understand how the Applicant intends to ensure that the grassy sward, which it says will prevent increased run off will be in place, or not compromised during construction. It appears that the Applicant is just hoping that there are no heavy rains during the construction period or until the sward is fully grown. If there were such rains, which is highly likely, then even on the Applicant's case there would be an increase in run off, as predicted by Professor Skeffington, likely to increase flooding downstream from the PV sites, particularly at Norton, Corsham and potentially further downstream.

Thus, absent a binding commitment not to take machinery onto land likely to be compacted when wet the Applicant has not provided a reasonable worst case assessment for the flood risk during or resulting from construction.

4 Views from Cotswold National Landscape

The choice of areas so close to the Cotswold National Landscape has already resulted in the Applicant having to remove panels from some fields close to the CNL. However the proposed panels in Lime Down B, specifically those in Field B6, certainly do not further the purposes of the CNL.

Whilst not in the CNL the edge of Field B is only 300 metres from the "border" of the CNL as can be seen on the layered map produced by SLD. Walkers on SHER11 coming directly from the CNL would see the panels in B6 and B7 from afar. This is particularly the case since the Applicant has chosen 4.5m tracking panels which will be even more obvious and intrusive. It will change the view enjoyed from the CNL.

I refer only to these Lime Down B fields in my Closing Submissions since this is something I spoke about at an ISH and provided details and photos in [REP4-133]. In response to that submission the Applicant confirmed that it

> "recognises the change to the visual amenity and associated Significant Adverse effects to users of those routes as a consequence of the Development. For users of both the Fosse Way (TR145), and Honey Lane Northwest Towards Easton Grey Plain, Norton (TR060) these Significant Adverse effects would remain until the proposed mitigation planting had established (Year 15), at which point views of the adjacent sections of the array would be screened. Both sections of highway are located immediately adjacent to the proposed infrastructure, and are therefore the Applicant agrees that users of these routes are likely to experience adverse visual effects as a consequence of Development. This is recognised within NPS EN-1 at Para 5.10.13 which states that "All proposed energy infrastructure is likely to have visual effects for many receptors around proposed sites."

What the Applicant does not recognise is that there will be the same effects for those coming from and viewing these fields from the CNL or appear to recognise the Section 85 duties applicable to the National Landscape but to rely on NPS EN-1 as justifying any adverse visual effects.

As the CNL is at a higher elevation that the fields in question it is certainly not clear to me how the proposed mitigation planting will change things in this location.

5 Economic damage

Another of my concerns [REP1-243] related to the Applicant's "We know better than you" approach to socio-economic loss and conclusion that

> "the Scheme would not result in significant adverse effects on local businesses".

It is noteworthy that even after the ISH on socio-economic effects, and hearing the direct evidence of some affected, particularly those in the equine area and the survey carried out by SLD, that the Applicant remains "confident" in its assessment (a term much used by the Applicant throughout) that there will be no significant effects. This confidence is certainly not shared by many of those who live in the area.

The whole approach to socio-economics is unsatisfactory. Having been required by the ExA to carry out further investigations into the equine businesses in the area, and sent out questionnaires, it is noteworthy that in the Applicant's updated Equine Business Report [REP7-112] no particulars of how many questionnaires were sent, or to whom have been provided but the conclusion remains

> "Based on the evidence available, significant adverse effects on business viability, examples of which are outlined in Table 2 of this document, are not expected."

This is despite none of the authors of the Equine Business Report (or any equine expert) having visited or contacted the studs and livery yards most affected despite requests by those affected.

The Applicant prefers to rely on desk-based assessment of impact.

The updated Equine Business Report states:

> "Due to the limited quantitative information received from responders to the questionnaire used to evidence this assessment, professional judgement has been required to apply the likely level of impact the Scheme may have on these businesses. This has been based on the likely impacts from the Scheme, as identified in Table 2 above, which has set out the likely pathways for impacts from the Scheme to affect equine businesses. The sensitivity of individual businesses has not been assessed directly, however, consideration has been given to the type of business, and the representations made by those business

owners about the nature of their operations. Together, these considerations form the basis for the assessment."

It is unclear which of the 3 authors has exercised the professional judgement referred to in the quote above as to the likely level of the impact of the Scheme and how they could have done so without knowledge of the businesses or having any contact with the business owners.

I have seen a number of the responses sent to the Applicant which were shared with me and they all referred to the harm they expected would be caused to their businesses. The submissions made to the ExA by others similarly reflect that significant effects are considered likely by those impacted by the scheme.

Once again it appears the Applicant is dismissive of the evidence submitted by those affected and reluctant to provide underlying evidence to support its conclusions.

There are a number of statements in the Non-Equine Businesses Technical Report [**REP5-111**] and elsewhere in the socio-economics chapter which make no sense to those who live in the area. The statement in the table at 2.12 that 10.5% of businesses within 5km of the PV sites are in construction is simply not a recognisable number. This number appears to be relied on to support the Applicant's assessment about the number of local construction workers who will apparently be recruited which forms part of the benefit claimed for the local area. It suggests to me that the desktop analysis should not be relied on.

It does not seem appropriate to me for the Applicant to have used a 5km distance from the whole of the 22km cable route corridor when assessing socio-economic impacts where tourism is a major source of revenue for the area. It is those near the PVs who will be most impacted, not those who live and carry on businesses south of the M4 in Chippenham, Melksham or other towns which are within 5km of the 22km cable route corridor but miles from the PVs and BESS.

The Applicant's dismissal in [**REP7-128**] of the survey carried out by SLD [**AS-027**] is also troubling. As in so many of the responses the Applicant claims its desk-based assessment, without any interaction with businesses and operations likely to be affected, is to be preferred.

The Applicant dismisses the results of the SLD business survey as being evidence of perceived risk rather than demonstrating that the risk will occur. It disregards the importance of business sentiment and the role "perceived risk" plays in shaping decision-making on investment and employment.

So far as the long-term impact on tourism is concerned, the Applicant relies on the impact on landscape being minimal by year 15 and asserts at 2.1.9 of [**REP7-128** that

> "The Applicant recognises that there will be adverse effects on landscape character and visual amenity during the early phases of operation. Adverse effects on landscape character at Year 1 of operation and maintenance is acknowledged but, by Year 15 when landscape and planting has been able to mature, the effects of the mitigation will reduce the adverse effects on landscape to non-significant levels. **The above landscape and visual impacts have then been fully considered and are fundamental to the assessment of effects to tourism and visitor destinations and receptors"** (my emphasis)

Unless the Examining Authority accept that the impact on the landscape will be "minimal" by Year 15, and that the landscape and planting has survived and been able to mature, then the basis for their assessment in ES Volume 1 Chapter 16 [APP068] and ES Volume 3 Appendix 2 [APP241] and ES Volume 1 Chapter 8 Landscape and Visual Impact Assessment [REP6B-004] cannot safely be relied on.

There is no regard for the impact on the farmers whose land and livelihood is threated with compulsory acquisition rights some of which appear to seek rights which are not demonstrably required by the Scheme which should, at this stage, have a clear route for the cable.

Given the Applicant's own absence of a survey, it is difficult to understand why primary evidence from those affected should be disregarded in favour of a desk-based survey. It has been open to the Applicant to conduct a survey for over 2 years since the initial consultation was announced, and indeed given the value and size of the scheme it is hard to understand how it is not proportionate to do so.

The Applicant, has clearly spent a huge amount of money on its professional team to date, and is expecting the scheme to cost in the region of £1billion to build. It therefore appears quite wrong for the Applicant to claim that it was not proportionate for it to carry out a business survey.

Notwithstanding the enormous resources of the Applicant's current ultimate owner, and the vast number of professionals as well as the Lime Down team, a theme which has emerged from the Examination is the Applicant and its agents' failure to engage properly with or show any consideration to those affected.

6 Selection of Lime Down and transparency

Throughout the Examination the problems associated with the site selected by the Applicants for Lime Down have been highlighted by me and others.

Many of those problems would have been obvious prior to selection of PDA10 (Lime Down) not least:

- Significant parts of PDA10 abut the Cotswold National Landscape (CNL).
- The dispersed proposed sites required to be accessed by narrow country lanes and winding minor roads.
- A main access route from the motorway runs through the CNL.
- There is a well known history of flooding of villages downstream from the sites.
- To take a 400kV cable to a grid connection in Melksham would mean constructing a 22km path crossing the mainline railway in 2 places as well as the M4 and various watercourses.

How the Applicant assessed Lime Down in its RAG assessment seems "convenient" and not credible upon any proper assessment. I would urge the Examiners to consider that RAG assessment very carefully since it underpins the Applicant's justification for having selected Lime Down in the first place.

The reality from my perspective is that having secured a grid connection in Melksham this scheme was chosen by reference to there being large estates in the ownership of a relatively few people who had been persuaded by land agents to sign up to options to lease land, while other alternatives nearer to the grid connection, and without the obvious issues of Lime Down, were not assessed in the same way or at all.

Notwithstanding repeated requests from early 2024 onwards, when the scheme was first made public in the context of the non-statutory consultation, the Applicant refused to provide any details of the terms agreed with landowners, citing confidentiality provisions (in documents they drafted) only finally disclosed the lengths of the options when required to do so by the ExA in May 2026 following a question at ISH1. Despite making much of the voluntary nature of the access to the "pink land", unless those options are extended, or the Applicant uses its compulsory acquisition powers, the Applicant would not be able to deliver the Scheme for the period it seeks.

It is even more apparent from the evidence which has been made available through the course of the Examination (and should have been from the outset) that other than having a few willing large landowners the Lime Down location is particularly sensitive and inappropriate for this scale of development.

Relying on a consented but unbuilt DCOs as evidence to support its position, as the Applicant has on several occasions, (eg to support its car share for construction workers figures) does not make it good evidence, nor does it demonstrate there are parallels between the case relied on and this one.

The Applicant's expert assert that there will be no increase in flooding caused by run off but have no evidence to support that. There are no DCO's which have been built with 4.5m tracking panels. That is the same expert whose model of the likelihood of flood in the Gauze Brook bears no resemblance to the actual floods which take place regularly.

Not all examinations have been challenged as thoroughly as this one; it is well recognised that in such circumstances proper regard to those new reasons for challenge should be had.

I have, throughout the Examination criticised the transparency of the consultation documents. Plans which did not use the OS as a base, CGI generated misleading images of the BESS and photographs of PV panels not of the type proposed do not give lay people a true impression of what is planned. The repeated statement that the Scheme would assist reaching Net Zero by 2050 when evidence submitted by both SLD and Wiltshire Council indicate that the scheme would be a net carbon emitter beyond 2050 are, to my mind, misleading.

Even during the Examination there have been occasions when the evidence relied on by the Applicant, when checked, did not support the points they sought to make eg the paper supposed to support the 30m horse startling. There have been other errors and omissions identified by SLD and others in HGV numbers and impact on equestrian and other businesses which were not assessed. But for the involvement of those most affected, and the care taken by the ExA, these would not have been identified and allowed to stand unchallenged.

These are worrying features of the application and the consultation which preceded it.

7 CONCLUSION

I am not a person with any experience of planning law, let alone DCO applications so these comments are made based on my own knowledge of the local area and review of many (but certainly not all) of the materials submitted in this Examination.

For the reasons in these Closing Submissions and my earlier submissions, and the many cogent reasons put forward by others opposing this proposal, (and I support all

that SLD has submitted) I urge the Examining Authority, after continuing its careful review of the materials submitted in this Examination, to recognise the exceptional nature of this application and the deficiencies in it, and to recommend to the Secretary of State that the DCO should not be granted with detailed reasons. I likewise urge the Secretary of State to withhold development consent.

16 October 2026

Journal of Physics:
Conference Series

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Research on Dust Removal Strategies of Photovoltaic Panels in Ultra-high Altitude Photovoltaic Demonstration Base

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Research on Dust Removal Strategies of Photovoltaic Panels in Ultra-high Altitude Photovoltaic Demonstration Base

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Abstract. Photovoltaic modules are susceptible to dust in the environment when generating electricity outdoors. If not cleaned in time, the conversion efficiency of the modules will decrease. Outdoor centralized power generation components are different from distributed power generation components. Centralized power generation often covers a large area and is located in a complex climate. Even within the same plant, the impact of dust on photovoltaic panels varies from region to region. In recent years, there have been more and more technologies for cleaning the surface of photovoltaic panels, such as manual cleaning, water cleaning, mechanical cleaning, and electrostatic cleaning. Depending on the geographical environment and climatic conditions, various methods have both advantages and disadvantages. This work firstly sorts out the characteristics and typical applications of different leading photovoltaic panel cleaning technologies, and then, the dust removal technology strategies for specific photovoltaic plants located in Sichuan Province of China is proposed according to the environmental attributes of low-latitude, ultra-high altitude, and cold regions.
Keywords: Photovoltaic panel; photovoltaic plant; dust removal technology; dust removal strategy

1. Introduction

Among various new energy industries, solar power generation is environmentally friendly, because it doesn't emit harmful greenhouse gases or toxic byproducts [1-5]. In addition, the global available solar energy resources are prosperous, especially in low latitudes [6]. With the advancement of technology, the cost of photovoltaic power generation is getting lower and lower. It is estimated that by 2050, photovoltaic power generation can provide 20% of the world's energy consumption [7]. The expected life of photovoltaic modules is about 25 years, which requires careful design and implementation of long-term outdoor operation and maintenance. Factors affecting the life of photovoltaic modules include the process, use environment and cleaning and maintenance of the module itself. Therefore, proper cleaning and maintenance are critical to improving the module's life. Photovoltaic collectors are inevitably affected by outdoor environmental conditions, such as temperature, humidity, dust, wind speed, shadow shielding and bird droppings [8-10]. Among all the influencing factors, dust accumulation on the surface of photovoltaic panels has an enormous impact [11-15]. For example, in arid regions, dust accumulation can cause photovoltaic panel efficiency losses of more than 50%. In order to solve the problem of photovoltaic dust accumulation, effective dust cleaning methods have been studied based on geographical characteristics and installation features [16-19]. It is worth noting that effective cleaning and maintenance can not only improve the module's life, but also improve the power generation efficiency of the module and increase revenue. However, improper cleaning can also

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jeopardize the life of the module. This article will summarize and explain the various dust removal methods in recent years. On this basis, combined with the environmental characteristics of the cooperative photovoltaic power plants, a particular dust removal technology strategy is given.

2. Dust Removal Technologies for PV Panels

2.1. Manual Cleaning

This method is similar to cleaning the glass on the surface of buildings. Bunyan et al. studied the effect of manual cleaning on the output power efficiency of photovoltaic panels [20]. Two identical photovoltaic modules were installed outdoors in Shamar, Kuwait, with an inclination of 30 ° and always facing south. The panels were washed daily or on the first day of each month with tap water or a rag. Make et al. investigates the effect of manual cleaning on the output power of photovoltaic modules in the Sahara Desert [21]. The experimental test device consists of four series-connected arrays of polycrystalline photovoltaic modules. The experimental results show that the maximum output power has been significantly improved after cleaning, and the performance loss of photovoltaic modules remains between 2% and 2.5%.

2.2. Water Cleaning

Some photovoltaic plants use water jet trucks, water pipes, shower heads, pressurized water guns and other facilities to clean photovoltaic panels. At the same time, water is a suitable solvent and can be used with various cleaning agents to improve the cleaning efficiency significantly. Al-Otaibi et al. studied the effect of an automatic water jet system for cleaning photovoltaic panels [22]. The results showed a 1.7% increase in power generation per month after cleaning and a water consumption of about 0.27 L/m^2 per cleaning. Moharram et al. developed a spray cleaning system that can significantly improve the utilization of water resources [23]. In addition, a surfactant is added to the water, which significantly improves the cleaning efficiency of the photovoltaic panel. Abd-Elhady et al. reported that mixed surfactants were added to the water at 1g/L [24]. The photovoltaic panel is cleaned for 10 minutes every day for 45 days. The results showed almost no decrease in efficiency for 45 days. Only 10% of water was lost from the tank due to evaporation and overflow.

2.3. Mechanical Cleaning

A mechanical dust removal device usually consists of cleaning and moving systems. The cleaning system usually uses nylon brushes, wipers, roller brushes, blowers, etc. Some strategies are also equipped with a water supply device, which uses mechanical force to remove dust from the surface of the photovoltaic panel. The mobile device is the necessary vehicle for the cleaning system to clean the entire photovoltaic panel. It is usually driven by a motor, and is implemented with a track or crawler conveyor. A simple and straightforward water-jet solar panel cleaning system was designed by Sugiartha et al [25]. The system mounts wipers on two guide rails, which can be moved on the guide rails by a 60W DC motor. Comparing the change of PV panel output before and after dust removal found that when the wipers were cleaned 10, 20 and 30 times, the PV panels recovered to 57%, 79.1% and 86.7% of the clean conditions. For the cleaning of photovoltaic panels in water-scarce areas, some waterless cleaning methods need to be used. Deb et al. designed a waterless automatic cleaning device based on the specific conditions of the Indian photovoltaic industry [26]. The device uses a roller brush to clean the photovoltaic panels without any water, cleaning fluids and so on. After a month of experimental testing, the device increased the power generation of the PV plant by 9.05% with negligible energy consumption, proving its potential for PV panel cleaning in desert and arid areas.

2.4. Robotic Cleaning

The robots are usually equipped with intelligent devices such as position sensors, dust concentration sensors and signal receivers, which can automatically move and clean the panels according to their actual conditions. Chailoet et al. designed a modular assembly cleaning robot that can clean

photovoltaic panels of different lengths [27]. The robot consists of three parts: a cleaning system, a water supply system and a wheel drive system (figure 1). The cleaning system uses a DC motor to drive a spiral nylon roller brush, which is integrally mounted on an aluminum steel tube and forms the main part of the robot. Above the brush there is a water pipe with a miniature nozzle installed as a water supply system to spray water when cleaning. The wheel drive system consists of 8 front wheels, 8 side wheels and optical sensors. The optical sensors are used to sense the robot's position and prevent the PV panels from falling. The most important feature of the device is its modularity, which can be assembled into cleaning robots of different lengths to complete the cleaning of PV panels, suitable for densely installed large-area PV plants, such as solar farms, solar rooftops and floating solar plants.

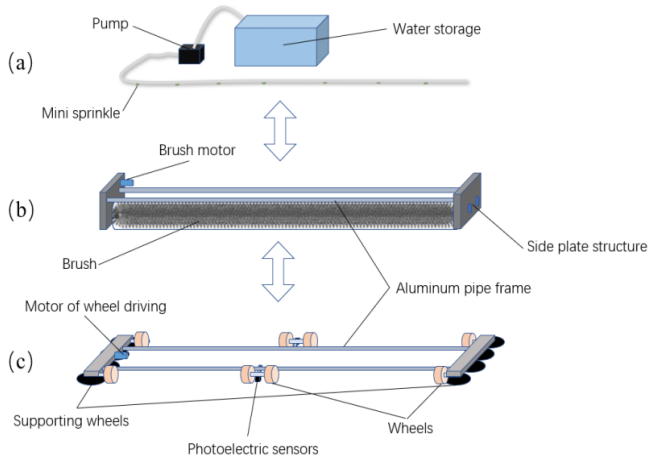


Figure 1. Components for solar panel cleaning robot (a) Water sprinkle system (b) Brush system (c) Wheel driving system.

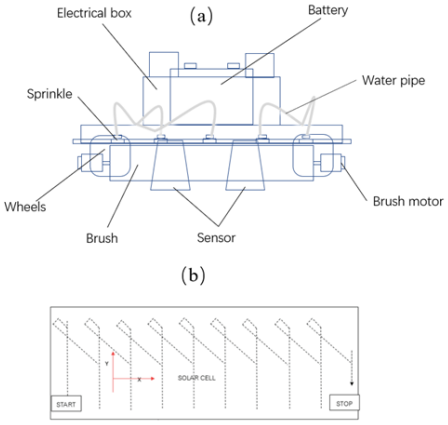


Figure 2. (a) Prototype a cleaning robot for solar cell panel (b) The walking path of the robot.

Ronnaronglit et al. designed a cleaning robot for photovoltaic panels in Thailand [28]. The robot uses a roller brush with a water jet to clean the solar panels. In addition, it is equipped with batteries, wheels, motors, and 4 ultrasonic sensors (figure 2). The use of ultrasonic sensors can precisely locate the position of the robot on the photovoltaic panel, so it can work at night and avoid reducing power generation due to blocking sunlight. The cleaning efficiency of the robot is as high as 80%.

2.5. Electrostatic Cleaning

Solar electrostatic precipitator technology is a very promising technology. The most classic method is to embed electrodes on the surface of photovoltaic panels. Two or more high voltages are then input, creating an electric field "screen" on the surface of the PV panel. The dust particles on the surface of the photovoltaic panel are cleaned under the action of the electric field. Altıntaş et al. improved the shape of electrodes in electrostatic cleaning systems [29]. The electrodes used in the traditional EDS system are parallel electrodes, while the improved electrodes in this study are arc-shaped electrodes. It was found that the cleaning efficiency increased from 65% to 75% after the improvement. Electrostatic cleaning usually requires embedding transparent electrodes on the surface of photovoltaic panels, and retrofitting existing PV panels requires a huge cost investment. For this reason, Kawamoto et al. developed a detachable photovoltaic panel electrostatic cleaning device [30]. Parallel screen electrodes are mounted on a plastic frame that passes a high AC voltage between the upper and lower electrodes. The study also verified the cleaning efficiency of the device at the PV plant in Doha, Qatar. When the panels are tilted at an angle greater than 20 °, 80% of the dust will be cleaned.

3. Dust Removal Strategy for Photovoltaic Panels in Special Areas

The selection of dust removal methods should be analyzed according to the specific conditions of the PV plant, mainly considering the following factors: Geographic location, climate conditions and cost.

The PV plant codenamed A with an installed capacity of 50 MWp studied in this work is located in the plateau area with an average altitude of 4,000 m. The PV panels are single-sided PV panels and are also equipped with a mechanical device to adjust the tilt angle of the panels, which allows the optimal tilt angle to be adjusted according to the change of seasons. This region belongs to the alpine region with low latitude and ultra-high altitude, where the climate is dry, the temperature difference between day and night is large, coniferous forests are abundant, plateau bird species are rich, and solar energy resources are abundant.



Figure 3. The actual scene of A plant: (a) Panoramic view of A station (b) Dust distribution on the panel (c) Panel bracket (d) Inclination control device

Most of the dust accumulated on the PV panels of plant A is brought by strong winds, and is mainly SiO_2, with a diameter of about 1-50 microns. The actual investigation found that the dust distribution in plant A has obvious regional concentration, that is, there is more dust on the PV panels located at the edge of the plant, and less dust in the central area of the plant. Under the action of wind, most of it is concentrated in the four corners of the edge of the PV panels, as shown in figure 3. In addition, a small amount of bird droppings appear on the panels during the migratory season, and the droppings are mostly distributed in the area close to the forest, mainly on the nearest row of PV panels, which is related to the habit of migratory birds to live in flocks.

Combined with the actual situation of plant A, this work gives the corresponding cleaning strategies:

1) The tilt controller can be used for dust removal. Figure 4(b) shows the wind mechanical model of dust accumulation on the panel, where G_X is the component force of gravity in the X direction, G_Y is the component force of gravity i n the Y direction, F_{vdw} is the van der Waals force, F_{es} and F_{et} are the electrostatic force, T_X is the force of the fluid in the X direction, T_Y is the force of the fluid in the Y direction, F_e is the capillary force, and F_A is the reaction force on the surface of the component to dust. Figure 4(c) shows the mechanical model when the dust on the panel is washed by rain, where H is the washing force of rain, and F_E is the capillary force under wet conditions. The inclination of the photovoltaic panel can be changed according to the local weather, so that the natural conditions can be maximized for dust removal. In windy weather, according to the force in figure 4(b), the photovoltaic panel is erected, and the dust is blown away by the natural wind. In rainy weather, the tilt angle of the PV panels is increased according to the force case of dust accumulation in figure 4(c), and the PV

panels are washed with precipitation.

2) Refs. [31-32] indicate that in semi-arid regions, wind speeds tend to decrease at night and relative humidity increases. The pollution of photovoltaic panels has increased significantly, and almost all dust accumulation occurs during 18:00-09:00. The photovoltaic panels can be erected at night, which can effectively reduce the amount of dust accumulated on the surface of the photovoltaic panels, as shown in figure 5(a).

3) The distribution of dust accumulation in the PV plant and its influence on the output power is analyzed and the components at the edges of the plant are cleaned by manual high-pressure water lances with the help of dust accumulation monitoring. Special attention should be paid to the choice of cleaning time.

4) The unmanned field patrol machine is used to identify and cooperate with the inverter to control the relative change of the output power of the photovoltaic modules of the array, and the photovoltaic panels with serious bird droppings pollution are cleaned irregularly by manual cleaning. It is recommended to erect the PV panels to facilitate manual cleaning, with tools such as soft brushes or mops to avoid scratching the tempered glass (figure 5(b)).

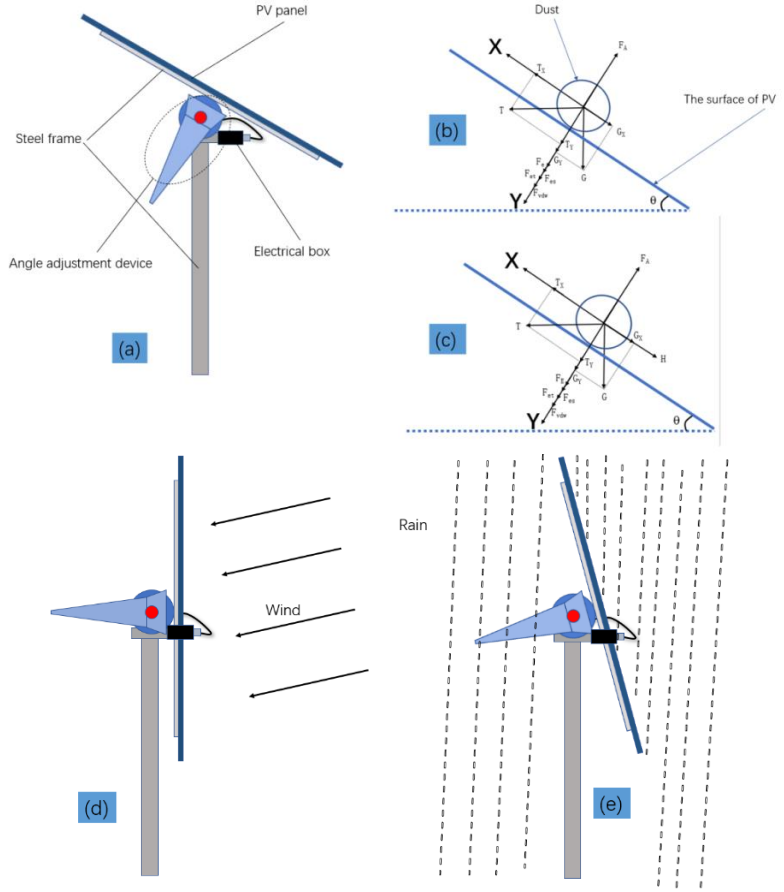


Figure 4. (a) Normal, (b) Dust accumulation is subject to the wind mechanical model, (c) Mechanical model of dust accumulation when washed by rainwater, (d) Windy weather, (e) rainy day

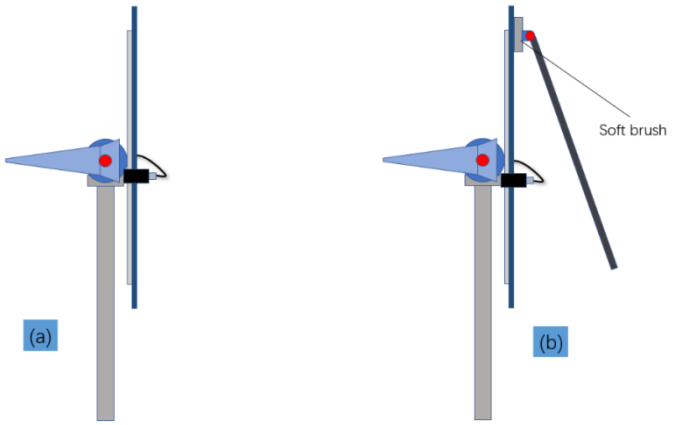


Figure 5. (a) Dustproof at night (b) Manual cleaning.

Since there is less dust in this area, through the above differentiated cleaning strategies with low initial investment, as long as a reasonable cleaning frequency and method are selected, the cost of cleaning operation and maintenance of the plant can be effectively reduced and a good cleaning effect can be obtained.

4. Conclusions

With more and more research on photovoltaic dust removal technology, various dust removal methods have been continuously improved and developed. Each dust removal method has its own characteristics and advantages, but also has certain shortcomings. Therefore, when formulating a dust removal strategy for a specific plant, a combination of a variety of dust removal methods can be used. One dust removal method is the main method, and the other method is auxiliary to achieve the most efficient and lowest cost dust removal strategy.

References

[1] Borchers A M, Duke J M and Parsons G R 2007 Does willingness to pay for green energy differ by source? *Energy Policy* **35**(6): 3327-3334.
[2] Kumar V, Shrivastava R L and Untawale S P 2015 Solar energy: Review of Potential Green & Clean Energy For Coastal And Offshore Applications *Aquatic Procedia* **4**: 473-480.
[3] Oliva D, Cuevas E and Pajares G 2014 Parameter identification of solar cells using artificial bee colony optimization *Energy* **72**: 93-102.
[4] Ortega-Izquierdo M and del R ó P 2016 Benefits and costs of renewable electricity in Europe *Renewable and Sustainable Energy Reviews* **61**: 372-383.
[5] Wang Y, Zhou S and Huo H 2014 Cost and CO2 reductions of solar photovoltaic power generation in China: Perspectives for 2020 *Renewable and Sustainable Energy Reviews* **39**: 370-380.
[6] Zhang S Y, et al. 2022 Estimation of Photovoltaic Energy in China Based on Global Land High-Resolution Cloud Climatology. Remote Sensing, 2022. 14(9).
[7] Yoshikawa K, et al. 2017 Silicon heterojunction solar cell with interdigitated back contacts for a photoconversion efficiency over 26% *Nature Energy* **2**(5).
[8] Hajighorbani S, et al. 2014 Evaluation of fuzzy logic subsets effects on maximum power point tracking for photovoltaic system *International Journal of Photoenergy*: 1-13.
[9] Mekhilef S, Saidur R and Kamalisarvestani M 2012 Effect of dust, humidity and air velocity on efficiency of photovoltaic cells *Renewable and Sustainable Energy Reviews* **16**(5): 2920-2925.
[10] Xu L, et al. 2020 The influence of dust deposition on the temperature of soiling photovoltaic

glass under lighting and windy conditions *Solar Energy* **199**: 491-496.
[11] Chaichan M T and Kazem H A 2020 Experimental evaluation of dust composition impact on photovoltaic performance in Iraq *Energy Sources Part A-Recovery Utilization and Environmental Effects*: 1-22.
[12] Chanchangi Y N, et al. 2020 Dust and PV Performance in Nigeria: A review *Renewable and Sustainable Energy Reviews* **121**: 109704.
[13] Maghami M R, et al. 2016 Power loss due to soiling on solar panel: A review *Renewable and Sustainable Energy Reviews* **59**: 1307-1316.
[14] Mani M and Pillai R 2010 Impact of dust on solar photovoltaic (PV) performance: Research status, challenges and recommendations *Renewable and Sustainable Energy Reviews* **14**(9): 3124-3131.
[15] Sarver T, Al-Qaraghuli A and Kazmerski L L 2013 A comprehensive review of the impact of dust on the use of solar energy: History, investigations, results, literature, and mitigation approaches *Renewable and Sustainable Energy Reviews* **22**: 698-733.
[16] Alshehri A, et al. 2014 Dust mitigation in the desert: cleaning mechanisms for solar panels in arid regions *2014 Saudi Arabia Smart Grid Conference (SASG)* p 1-6.
[17] Farrokhi Derakhshandeh J, et al. 2021 A comprehensive review of automatic cleaning systems of solar panels *Sustainable Energy Technologies and Assessments* **47**.
[18] Kazem H A, et al. 2020 A review of dust accumulation and cleaning methods for solar photovoltaic systems *Journal of Cleaner Production* **276**.
[19] Zahedi R, et al. 2021 Cleaning of floating photovoltaic systems: A critical review on approaches from technical and economic perspectives *Energies* **14**(7).
[20] Bunyan H, Ali W and Alnaser M 2016 Enhancing the performance of photovoltaic panel by proper washing periods in Kuwait *Smart Grid and Renewable Energy* **07**(06): 190-196.
[21] Maka A and Hasan A 2012 Effect of dust accumulation on performance of photovoltaic solar modules in sahara *Environment* **2**: 11030-11036.
[22] Al-Otaibi A, et al. 2015 Performance evaluation of photovoltaic systems on Kuwaiti schools' rooftop *Energy Conversion and Management* **95**: 110-119.
[23] Moharram K A, et al. 2013 Influence of cleaning using water and surfactants on the performance of photovoltaic panels *Energy Conversion and Management* **68**: 266-272.
[24] Abd-Elhady M S, Zayed S and Rindt C C 2011 Removal of dust particles from the surface of solar cells and solar collectors using surfactants *International conference on Heat Ecxchanger Foulong and Cleaning*.
[25] Sugiartha N, et al. 2020 Preliminary design and test of a water spray solar panel cleaning system *Journal of Physics: Conference Series* **1450**(1).
[26] Deb D and Brahmbhatt N L 2018 Review of yield increase of solar panels through soiling prevention, and a proposed water-free automated cleaning solution *Renewable and Sustainable Energy Reviews* **82**: 3306-3313.
[27] Chailoet K and Pengwang E 2019 Assembly of modular robot for cleaning various length of solar panels *IOP Conference Series: Materials Science and Engineering* **639**(1).
[28] Ronnaronglit N and Maneerat N 2019 A cleaning robot for solar panels *2019 5th International Conference on Engineering, Applied Sciences and Technology (ICEAST)*.
[29] Altıntaş M and Arslan S 2021 The study of dust removal using electrostatic cleaning system for solar panels *Sustainability* **13**(16).
[30] Kawamoto H 2019 Electrostatic cleaning equipment for dust removal from soiled solar panels *Journal of Electrostatics* **98**: 11-16.
[31] Figgis B, et al. 2017 Time-of-day and Exposure Influences on PV Soiling *2017 International Renewable and Sustainable Energy Conference (IRSEC)*.
[32] Figgis B and Ilse K 2019 Anti-soiling potential of 1-axis PV trackers.

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AN INTRODUCTORY GUIDE TO YOUNG TREE ESTABLISHMENT

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Published in the UK by
Arboricultural Association,
The Malthouse Stroud Green, Standish,
Stonehou e, Gloucestershire GL10 3DL

[redacted]

Web: www.**trees**.org.uk

First published in May 2022.

Arboricultural Association Ltd.
A company registered in England at
The Malthouse, Stroud Green, Standish, Stonehouse,
Gloucestershire GL10 3DL, UK.
Company number 4070377.

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INTRODUCTION

Arboriculture can be described as the science and practice of the cultivation, establishment and management of amenity trees for the benefit of society. In other words, arboriculture is tree care. The Arboricultural Association is the leading body for tree care professionals in the UK and beyond; it is a charity and a professional membership organisation which is committed to inspiring, supporting and promoting the tree care community for a society that better appreciates and cares for trees.

Tree planting is a popular activity, and never more so than in recent years. Many organisations, businesses and political parties in the UK and around the world have pledged to plant trees – tens of thousands, hundreds of thousands and even millions of trees. One of the drivers of this is the need to tackle climate change, with tree planting sometimes presented as the solution to the climate emergency in which we find ourselves.

Unsurprisingly, the Arboricultural Association believes that trees are good and that we need more of them. However, planting a tree is just one small part of the story. Arboriculturists work in tree time, not human lifespans or political cycles If you consider the first 100 years of a tree's life, then the act of planting might make up half an hour or so, or 0.000058%. It is undoubtedly a very important part of the process – a critical one – but there is so much more to the story.

In the years before an amenity tree is available for planting in the landscape – perhaps a street, a park or a garden – a lot o work will have been done. Propagation and germination selection and site assessment, tree pit design, consultation, nursery growing and ca e. After planting there are a few years of young tree maintenan e, nc uding watering, and then for decades or centuries to come the healthy survi al of the tree is dependent on inspections, pruning, management and protection.

Arboriculture is the profession which spans the whole lifetime of an amenity tree. It includes all the nursery workers, tree officers, contractors, consultants, researchers, suppliers, policymakers and educators who make the whole process happen. Tree planting is important, but it is just one chapter in a long story. The purpose of this guide is to set out some of the factors to consider when seeking to establish, rather than just plant, a tree. Getting a tree in the ground is often the easy part – it is the work which goes on before and particularly afterwards which makes the difference.

This is an introductory guide to young tree establishment; it is not intended to be comprehensive, and it should in no way be seen as a replacement for specialist advice. Arboriculture is an extremely complex and specialist discipline which covers a wide range of very different careers and areas of expertise. This guide provides some ideas for a non-professional audience, as well as signposting the reader to other resources which might prove useful. If in doubt, contact the appropriate arboricultural professional.



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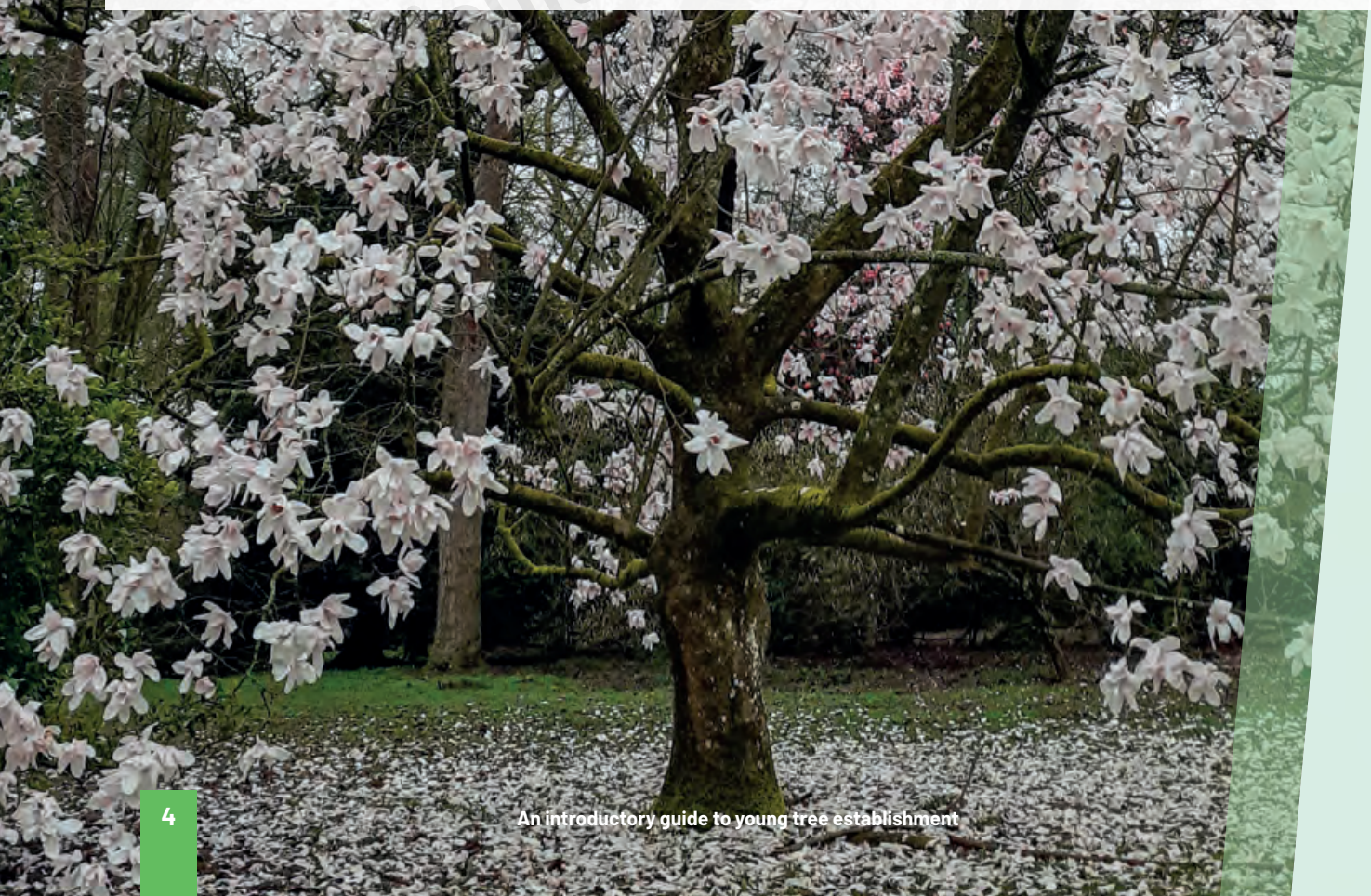
WHY PLANT A TREE?

Planting a tree is one of the best things anyone can ever do. Trees do so much for us, bringing our communities environmental, social and economic benefits and generally helping society. They are multi-functional infrastructure, doing many different things at once. Some of these benefits can be quantified and valued; others are less tangible but no less important. Trees can...

- Cool our urban areas.
- Reduce flooding
- Improve air quality.
- Slow traffic speeds.
- Reduce certain types of crime.
- Improve physical health and mental wellbeing for people.
- Provide habitat for a wide range of insects, birds, mammals and fungi.
- Sequester carbon.
- Look beautiful.
- Screen views of undesirable buildings or infrastructure.
- Add cultural and heritage value to an area.
- Provide a sense of place.
- Help community cohesion and local pride.
- Boost commercial activity.
- Create employment and career opportunities.

Many of the benefits associated with trees increase a the tree grows, and it is often the case that the larger he canopy, the greater the benefit. One common metric by which to measure the succes of our urban forests is canopy cover – assessing how much of a given area is taken up by tree canopy when looking down from above. However, these canopy cover targets will never be achieved through tree planting alone – we must retain and protect existing trees wherever possible and take appropriate steps to care for tho e that we do plant.

There are many reasons to plant a tree, and just as many reasons to make sure it is properly looked after.



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Inside this guide you will find more information about these tree care posters, which you can also download from our website at www.trees.org.uk/YoungTrees. Watering tags are available in a range of languages and can also be downloaded from our website so they can be printed, laminated and attached to tree stakes to encourage people to water trees: www.trees.org.uk/watering



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WHERE TO PLANT A TREE?

Planting a tree is a long-term investment, and it is unlikely that the person who is doing the planting will ever see the full benefit of their efforts. Tree planting is a gift for future, as well as current, generations, and we must consider the medium- and long-term implications of what we are doing. This is particularly true when selecting a location for a new tree. The question of where to plant a tree often goes hand in hand with the question of what tree to plant – a particular location might need to be found for a given species, or it might be necessary to select a species for a particular site.

This introductory guide is likely to be most relevant to people planting trees in soft landscapes (grass areas, gardens and parks) rather than hard landscapes (such as streets or plazas), but the considerations are equally relevant regardless of where the tree is being planted. When looking at a potential site it is important to consider the tree not as it is on the day of planting, but in the context of its likely final dimensions – as it should be in 10, 50 or 100 hundred years. Remember to always make sure you have the permission of the landowner before planting a tree.

Think about how close the tree will be planted to buildings, infrastructure or existing vegetation. A tree planted immediately adjacent to a building will grow outwards, seeking the light. A tree planted beneath the canopy of an existing tree is likely to struggle. Planting a ree too cl se to a lamp column or overhead utilities will mean hat regular pruning is required in the future. The sam goes for planting trees which will ultimately obscure sightlines – of views or buildings, but even more importantly of traffic lights, signs and visibility for safety reasons. It is also worth considering how easy it will be to reach the tree in later years for wate ing and maintenance.

What is below the ground is just as impo tant as what is above it. When matching a tree spec es with a location, consider the soil type. Is it sandy loamy or clay? Is it free-draining, or prone to waterlogging? Is there any risk that it might be cont m nated? Soil can be tested to find out more about its composition and condition. Underground utilities such a gas, electricity or water often mean that a site which ooks suitable for planting proves unsuitable. Hand-dug trial holes may be required before the final pit is excavated – consider having the site scanned for underground utilities before starting. Underground utilities can kill, so if you are in any doubt, always consult an appropriate professional.

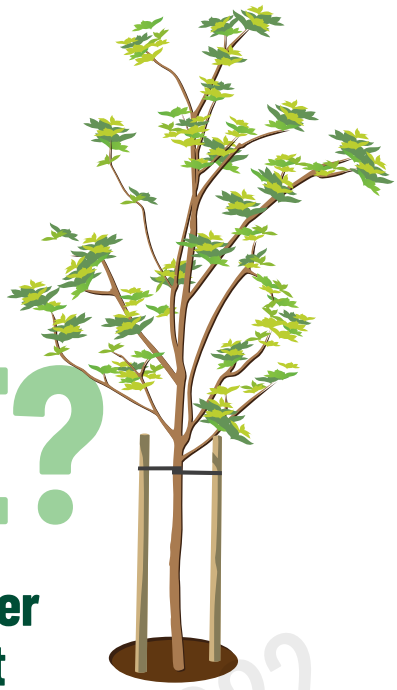
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WHERE TO PLANT A TREE?



When planting a tree it is very important to consider where it is going to be located, taking into account the short, medium and particularly the long-term implications.

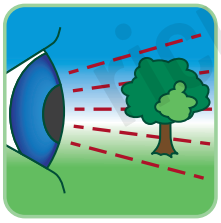
Trees grow! And if you want your tree to mature into an established specimen which delivers all of the wonderful benefits that trees deliver, then it needs to be **positioned in the right place**.

Some of the considerations listed here apply more to planting in hard landscapes (such as streets) than soft landscapes (such as parks or gardens) but they all need to be thought about. This poster should be read in conjunction with the others in this series, especially **What tree to plant?**

Often, the decision about ***where*** to plant and ***what*** to plant will go hand in hand.



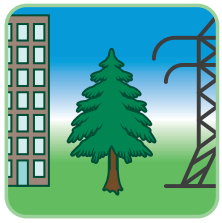
Above- and below-ground utilities



Safety sightlines



Potential obstruction of views



Proximity to structures and infrastructure



Proximity to existing trees or other vegetation



Proximity to roads, pavements and desire lines



Current land usage and local heritage



Access for maintenance



Underground conditions, including soil

IMPORTANT SAFETY NOTICE:
Underground utilities can kill.
Always make sure it is safe to dig before you start.

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Always consult an arboricultural professional if in any doubt about tree care.

For further information, including an introductory guide to young tree establishment, visit **trees.org.uk**.

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WHAT TREE TO PLANT?

Trees are multi-functional infrastructure – they do lots of things at once, to different extents – and some species will be better or worse at certain things than others. When selecting a tree species for planting, it is therefore important to consider what the ultimate aims of the planting are. Once you know what you want to achieve through the planting, it becomes much easier to determine which species is most appropriate. In addition, the decision about what to plant will also be influenced by the location of the planting, particularly with regard to how much space is available.

Please remember when selecting a tree species that in order to mitigate the risks of climate change and tree pests and diseases, and to maximise the environmental, social and economic benefits our urban forests bring, diversity in tree species is critical. When considering amenity trees, 'non-native' species are just as important as 'native' species.

Tree species selection is a complex process. There are many factors to consider, and there is not enough space in this short guide to fully explore them all. There are some key questions to think about which, when combined with additional research and input from a professional arboriculturist where required, can help inform the decision-making process. These questions include:

- **How much space is available for the tree to grow t its final dimensions?**
- **What are the main characteristics you are looking for?** These might include fruit autumn colour, interesting leaves or bark, and many more.
- **What are the soil conditions of the proposed location?** Acidic or alkaline, free-draining or prone to waterlogging?
- **How much maintenance does the species you are considering require?**
- **Are there any particular pests and disease of concern locally, either present now or likely to arrive in the future?**
- **What are the preferences and social values of the local community?**
- **What trees are currently in and around the site, and would you prefer to complement or contrast with them?**

In addition to the species, you must also consider other factors, such as size and root stock. Trees are supplied in a variety of different sizes at the time of planting, from whips (a very young tree, perhaps not more than 1m tall and with no side branches) up to semi-mature specimens. Many trees planted for amenity purposes have a girth size of between 10cm and 18cm. Large trees are often preferred beca se they create instant impact and are better able to withstand vandalism. However, they are also more expens ve and can be more difficult to handle, plant and est bli h. Small trees are easy to handle and plant, can e tablish quickly and are often cheap. However, they may re uir substantial protection for the first few years aft r planting.

The main types of root stock available are bare root, rootballed and container grown. As with selecting a size, the advantages and disadvantages of each root stock type should be considered. Bare-root trees tend to be cheaper and easy to handle and plant, but the range of species available is often relatively limited and they must be planted within the standard October to March planting season. They will also have lost much of their fibrous root system in production. Rootballed trees come with their fibrous root system and more species are available, but they can require more specialist handling and planting. Containerised trees can be much easier to transport and plant, offer considerable species choice, preserve the fibrous root system and if necessary can be planted outside the standard planting season (with appropriate aftercare). However, they are considerably more expensive than bare-root trees.

One of the most important considerations when sourcing a tree is biosecurity – preventing the spread of tree pests and diseases. Oak processionary moth and ash dieback (to name just two) were both imported to the UK on trees sourced without proper biosecurity practices. You should only ever purchase a tree from a reputable nursery with strong biosecurity practices. Trees should be UK-grown or, if imported, should have been subjected to an appropriate quarantine period before planting out.

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WHAT TO PLANT?

Selecting the right tree to plant is a big decision which could impact the local environment for decades to come.

This poster is not intended to tell you the best tree to plant – simply to set out some considerations you should think about when making your decision.

If we are to future-proof our urban forests against the twin threats of **climate change** and **tree pests and diseases**, then species diversity is essential. Native and non-native trees are equally important.

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1 INTENTION

What are you hoping to achieve from this planting?

Trees are multi-functional organisms, and the purpose of the planting will influence species selection.

2 SOURCING



Where will you be sourcing your tree?

Preventing the spread of tree pests and diseases (biosecurity) should be paramount. Only use a reputable nursery with a strong biosecurity policy.

3 SIZE

Trees are available in a range of sizes at time of planting. Large trees can create immediate impact but may be more expensive and difficult to transport, plant and establish. Smaller trees establish quickly but may require more protection in the first few years.

4 ROOT STOCK



Bare-root, rootballed and container-grown trees are available, each with their advantages and disadvantages. Bare-root trees are cheap and easy to transport and plant, but might offer limited species choice. Container-grown trees are more expensive but come in a wide range of species and if necessary can be planted outside the normal planting season.

5 SPECIES SELECTION



COMMUNITY. What are the community preferences and social values of the people in the area?

DIVERSITY. Does the species diversity of the local area need improving?

DIMENSIONS. Is there enough space for your tree to grow to its ultimate size?

CHARACTERISTICS. Do you want fruit interesting leaves or bark, magnificent autumn colour, or something else?

EVERGREEN OR DECIDUOUS. Year-round foliage or seasonal change?

SOIL CONDITIONS. Is the soil acidic or alkaline; sand, loam or clay? What is the drainage like?

MAINTENANCE. How much pruning and maintenance does your chosen species require? How much water?

LOCAL CHARACTER. What species would work best with the existing local heritage and landscape?

PESTS & DISEASES. Are any particular pests and diseases associated with your proposed species?

CLIMATE. How will the species you choose cope with the likely climate in 10, 50 or 100 years?

More information about tree species selection can be found in the Trees and Design Action Group publication *Tree species selection for green infrastructure*, available here:
www.tdag.org.uk/tree-species-selection-for-green-infrastructure.html

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Always consult an arboricultural professional if in any doubt about tree care.

For further information, including an introductory guide to young tree establishment, visit **trees.org.uk**.

AA Registered CONSULTANT trees.org.uk

www.treecare.org.uk | **www.trees.org.uk**
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HOW TO PLANT A TREE

In order to ensure that your tree has the best possible chance of reaching maturity, it is important to plant it properly. Always undertake work of this nature safely and responsibly, including taking all steps to ensure that you have permission from the landowner and are certain that no underground utilities are present. Some of the specifics around planting may vary with different tree sizes, but this guidance focuses on trees with a stem girth of around 10cm+, up to the sort of size which can be safely handled by one or two people. It also focuses on planting in soft landscapes. In addition, this guide does not cover additional infrastructure which might be used, such as underground guying (a support mechanism), root cells, tree guards, tree grilles, root barriers or watering pipes. If you are using any of these systems, please follow the manufacturer's guidance.

The hole for a new tree should be no deeper than the root ball/container, but approximately twice as wide. Holes can be circular or square, and different experts have different ideas about which shape is best. In soft landscapes, the soil closest to the surface might be better quality than the material found further down, so consider putting some to one side in order to backfill around the roots once the tree is in place. Measure the depth of the hole against the depth of the root ball before removing any container or hessian. It is very important to ensure that the final ground level around the stem matches the nursery line on the tree, which is the soil mark where the above-ground and below-ground bark meets.

Before setting the tree in place, consider if any formative pruning is required to remove damaged, broken or rubbing branches. It is much easier to do this before planting rather than after. If the tree has a co-dominant stem – i.e. more than one clear central leader – consider pruning back the ones which are no wan ed with clean, sharp, disinfected secateurs However do not prune the main leader as this will disrupt the tre 's hormonal growth pattern. Once the tree is in place and the packaging removed, backfill the hole with some of the material you previously excavated and compact with a boot or the end of a wooden support stake. Keep checking that the tree is straight during this process.

There are many different methods and styles of securing a tree in place after planting, and this choice will be influenced by a range of factors – including the size of the tree. A tree will respond to wind forces by adding new growth to its stem, and it is therefore important that it has room to move in the wind whilst being adequately supported. Crossbeams and diagonal staking are not recommended because they prevent the tree from moving in this way, which can create a weakness. This guidance recommends planting more substantial trees (with a stem girth of 10cm+) with two timber stakes and rubber ties. The orientation of the stakes may be influenced by esthetics and the prevailing wind direction. Take ca e wh n driving the stakes into the ground: consider both underground utilities and operator safety when sing a stake driver and be careful not to damage the tre Sometimes it is easier to install the stakes before the ree is placed into the hole. Always ensure that the stakes are driven through the ground and not the root ball or container of the tree. Ties should be attached at approximately 1/3rd of the total height of the tree. Stakes and ties should always be removed when no longer required. For smaller trees, such as whips, a bamboo cane and suitable tree guard should provide adequate support.

The recommended surface material to use around newly-planted trees is bark mulch. This suppresses competing vegetation, helps retain moisture, breaks down over time to enrich the soil and ensures that grass-cutting equipment is kept at a safe distance from the base of the stem. A depth of 5–10cm of mulch should be applied after planting, ideally covering a circle around the tree of a minimum 1m diameter. Make sure you do not pile mulch directly up against the stem.

As a general rule, the tree planting season in the UK extends from October to March. Deciduous trees should ideally not be planted when they are in leaf. Consider engaging the local community in your tree planting, and if possible it can be beneficial to leave the nursery identification tag in place so that people are able to identify the tree afterwards. Always water your new tree after planting.

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HOW TO PLANT A TREE



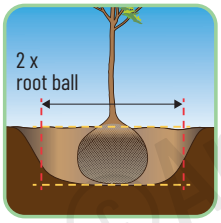
Always undertake work of this nature safely and responsibly, including taking all steps to ensure that you have permission from the landowner and are certain that no underground utilities are present.

The hole for a new tree should be no deeper than the root ball/container, but approximately twice as wide.

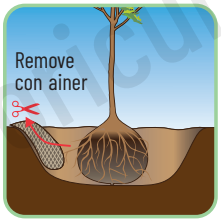
Measure the depth of the hole against the depth of the root ball. It is very important to ensure that the final ground level around the stem matches the nursery line on the tree, which is where you can see the soil mark.

These principles apply whether planting bare-root, rootballed or container-grown trees.

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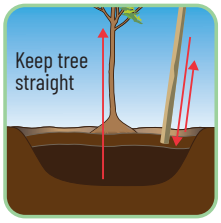
Dig a hole as deep as the root ball and twice as wide



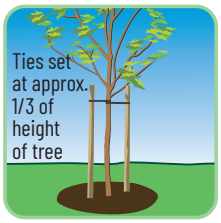
Remove any container or hessian



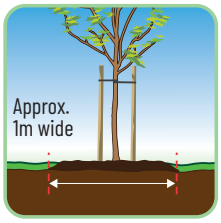
Consider formative pruning before setting in place



Backfill with removed soil, gently compact with stake or boot



Allow for wind movement with two stakes and rubber ties



Add a 1m wide circle of bark mulch, 5–10cm deep



UK planting season is October–March



Avoid planting deciduous trees when in leaf



Always water your new tree

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Always consult an arboricultural professional if in any doubt about tree care.

For further information, including an introductory guide to young tree establishment, visit **trees.org.uk**.

AA Registered CONSULTANT trees.org.uk

www.treecare.org.uk | **www.trees.org.uk**
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YOUNG TREE AFTERCARE

The years immediately after a tree has been planted are in some ways the most important in its life. This is the time when the young tree is most vulnerable – old enough to be planted out into the landscape, but young enough to still require plenty of care and attention. One of the most important tasks for the first years after planting is watering, which is dealt with in a separate section of this guide. However, there are also plenty of other considerations.

In a soft landscape situation (and in some hard landscapes) the area immediately around the tree will have been covered with organic bark mulch. This helps protect the tree from strimmer damage, removes competition from weeds and grass and is hugely beneficial to the tree overall. However, this mulch will break down sooner than you think and it is important to keep it topped up regularly. More information about mulch can be found elsewhere in this guide (see 'How to plant a tree').

If the tree has been supported with above-ground stakes and ties then these will need to be checked every year after planting. Adjust the stakes and ties as necessary, paying particular attention to ensuring that they are still doing the job they were intended to do. Painting the top of each stake with a different colour depending on the year in which the tree was planted can assist with identification and management. Tree support systems should be removed when they are no longer needed; leaving support systems in place for too long can cause damage to the tree.

Much of the pruning work undertaken with chainsaws many years after planting can be avoided if a tree is maintained in its first few years using hand tools to create smaller wounds from which the tree can recover more easily. Consider removing damaged, dead, broken or crossing branches, paying careful consideration to the future structure of the canopy. Always adopt good biosecurity practices to reduce the risk of spreading disease.

Visiting young trees in the years after they have been planted also provides an opportunity to check their overall health. Whilst detailed diagnosis of a condition will require professional arboricultural input, there are certain problems which should be easy to identify. These might include a failure of the tree to come into leaf in the spring; wilting, yellowing or die back of leaves and shoots; or exudations from the stem.

Around three years after planting the tree should be inspected with a view to deciding whether or not it is ready to be removed from the young tree maintenance programme. If it looks like the tree could do with some more establishment time then simply return the following year until you are satisfied. Once the tree seems secure and established it is time to take away the stake and ties and remove the tree from the young tree maintenance programme. It will now require inspection (and any associated maintenance work) as part of the wider tree stock.

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YOUNG TREE AFTERCARE



Planting a tree is just the beginning... the hard part is making sure that it becomes established in the landscape.

It is good practice to put newly-planted trees on a **young tree maintenance programme** for at least two or three years.

This can be achieved without huge investment, **just some time and attention**.

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- Regular watering is critical – refer to the Arboricultural Association watering guidance
- 1yr — Visit each newly-planted tree at least once a year.
- Remove weeds and grass from the tree pit by hand.
- Check stakes, ties and guards. Do they need adjusting or refastening?
- Check the overall health of the tree: is it OK, or does it seem to be struggling?
- Check for broken, damaged or crossing branches and consider formative pruning.
- Keep mulch levels topped up around the tree.
- ! Careless grass strimming kills young trees – stay well away!

After three years consider if the tree is ready to be taken off the young tree maintenance programme, or if it needs a bit longer. If it is ready then it is time to remove the stakes and ties.

Always consult an arboricultural professional if in any doubt about tree care.

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For further information, including an introductory guide to young tree establishment, visit **trees.org.uk**.

www.treecare.org.uk | **www.trees.org.uk**
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TREE WATERING



One of the main causes of death in newly-planted trees is a lack of water. In simple terms, water is drawn up by the tree via the roots, through the stem and branches and then exits the tree via the leaves in a process called evapotranspiration. A newly-planted tree will not have an established or extensive root system, meaning that in the summer months when the canopy is in full leaf it will struggle to bring in enough water from the ground to balance what is being lost through the leaves. For the first few years after planting, trees need our help in order to find that water.

Tree watering is an inexact science and there are many variables involved. These include tree species, size, condition, root stock, soil type, location, weather and climatic conditions. It is not realistically possible to take all of these variables into account in a meaningful way and most recommendations will, therefore, necessarily be oversimplified. The advice provided here is based on a collaboration between the Arboricultural Association, the Association of Tree Officers, the London Tree Officers Association and the Municipal Association of Tree Officers. This group of organisations has also produced the tree watering tags referenced within this guide and available online, which can be affixed to newly-planted trees to encourage passers-by to water them

We recommend that for the first three years after p anting, a newly-planted tree should receive approximately 50 litres of water each week throughout May, June, July and August (in the UK). Depending on seasonal variations it may be necessary to s art wate ing trees as early as April and continue as late as September. These 50 litres can be added to the tree n one visit, or spread over multiple visits. Watering will ideally be carried out in the early morning or in the evening, when temperatures are lower than during the day.

Wherever possible, water used for irrigating trees should be sustainably sourced. Harvested rainwater is ideal, and should be used in preference to potable (drinking quality) water. Recycling grey water, such as from baths or washing-up bowls, is also an option to irrigate trees but the impact of soap and detergent on soil structure is not fully understood. However, in times of drought when using potable water is expressly banned, the benefits of grey water likely ou we gh the potential risks. In general terms it is of grea importance that we seek to move away from using potable water in tree care wherever we can.

A watering pipe is sometim s installed alongside a tree. If a watering pipe is present then approximately half of the water should be poured down the pipe and half added to the ground surface around the tree. Some trees are planted with watering bags; if your newly-planted tree has a watering bag then fill it in accordance with the manufacturer's specification. Try to ensure that the water is actually penetrating the ground and is not simply being intercepted by the layer of mulch on the surface.

Under some circumstances it is possible to overwater a tree, which can in itself lead to health problems. However, in general terms it can be said that the risk of a lack of water is greater than the risk of an excess of water. When planting in clay soils it may be advisable to cut a drainage channel, extending away from the base of the pit and filled with gravel, to prevent waterlogging. If you are in any doubt then please speak to an arboricultural professional. Note also that trees in full leaf can still require watering even when it has recently rained, and that a light shower is not going to be sufficient to deliver the required level of water to the roots of the tree.



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PLEASE WATER YOUR TREES!



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LTOA
London Tree Officers Association

ATO
Association of Tree Officers

Municipal Tree Officers' Association
MTOA
The Voice of Municipal Arboriculture

Newly-planted trees need to be watered regularly over the summer months if they are going to become established and thrive.

If you have a tree outside your house, or one that you pass on your daily walk, then you can help.

Requirements vary depending on a number of factors such as species and location, but a general rule is that they should receive at least 50 litres of water per week in May, June, July and August.

Please water regularly during dry periods with as much as you can – Every little helps

Watering should ideally be carried out in the early morning or evening.

3yrs

It is good practice to water trees for the first three years after planting.

If the tree has a watering pipe, then half of the water should be poured down the pipe and the other half on the ground surface around the tree. If the tree has a watering bag, then fill that.

Where possible, water should be sustainably sourced. Harvested rainwater is ideal, but bath water, or water which has been used for washing up, is also suitable.

More information about tree watering can be found in the **London Tree Officers Association** (LTOA) publication *Sustainable water management*, available for free download at **www.ltoa.org.uk**

For further information, including an introductory guide to young tree establishment, visit **www.trees.org.uk**

www.treecare.org.uk | **www.trees.org.uk** | **www.ltoa.org.uk** | **www.ato.org.uk** | **www.mtoa.co.uk**
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CONCLUSION

We hope that this introduction to young tree establishment proves a useful guide to anyone who is selecting, planting and caring for a new tree. Tree planting can be easy to do, but difficult to get right. If the trees we plant today are to grow into the mature and ancient specimens of the future then a lot of thought and work is required. It is essential to consider where we are planting them, which species we are planting, how we are planting them and then how we are taking care of them afterwards, including appropriate watering.

As the name of this publication suggests, this is just an introductory guide and should not in any way be regarded as a substitute for professional input. Arboriculture is a complex and specialist discipline covering many areas of expertise from growing, contracting, consulting and management to research and academia. For future amenity treescapes to be successful it is important that arboricultural professionals and the wider tree care community work together to share knowledge, ideas and experience for the good of our trees and our communities.

Sitting behind the summary information contained within this guide is a wealth of documentation, books, webinars and other resources which we encourage you to go and explore Here and on the next page are some recommended resources with a particular focus on young tree planting and ca e, but this is far from being a comprehensive lis and there are many, many fantastic resources about trees out there. Some of these are free to access online others have to be purchased.

USEFUL WEBSITES

Arboricultural Association: **www.trees.org.uk**

Arboricultural Association Online Learning: **www.trees.org.uk/Learning**

Association of Tree Officers: **www.ato.org.uk**

London Tree Officers Association: **www.l oa.org.uk**

Municipal Tree Officers Associa ion: **www.mtoa.co.uk**

Observatree: **www.observatree.org.uk**

Perennial: **www.perennial.org.uk**

Plant Healthy Certification Scheme: **www.p anthealthy.org.uk**

Sustainable Soils Alliance: **www.sustainablesoils.org**

Tree Alert: **www.forestresearch.gov.uk/tools-and-resources/fthr/tree-alert**

Tree Care Supporter: **www.treecare.org.uk**

Trees and Design Action Group: **www.tdag.org.uk**

FURTHER READING

Application of biosecurity in arboriculture.
Arboricultural Association (2017).

Applied tree biology.
[redacted] (2018).

Arboricultural Association Strategic Plan 2022–24.
Arboricultural Association (2022).

Collins tree guide.
[redacted] (2004).

European tree pruning guide (Second Edition).
European Arboricultural Council (2022).

Plantsman's Choice: ARB Magazine article series.
[redacted] 2016–22).

Stonehouse Community Arboretum Management Plan.
Stonehouse Town Council (2021).

Surface materials around trees in hard landscapes.
London Tree Officers Association (2017).

Sustainable water management: Trees are part of the olution.
London Tree Officers Association (2012).

The pruning of trees, shrubs and conifers
[redacted], T. (2004)

The tree experts
[redacted] (202).

Tree species selection for green infrastructure: A guide for specifiers.
Trees and Design Action Group (2018).

Trees – A lifespan approach. Contributions to arboriculture from European practitioners. Editors: [redacted] (2016).

Trees of Britain and Northern Europe.
[redacted]. (1992).

Trees: Owners' workshop manual – Haynes Guide.
[redacted]. (2019).

Trees: Their natural history.
[redacted] (1997).

ABOUT THE ARBORICULTURAL ASSOCIATION

The Arboricultural Association is the leading organisation in the UK for tree care professionals working in all areas of arboriculture, including central and local government, consultancy, contracting, management, production, policymaking, research and education. It has more than 3000 members in the UK and around the world, and is increasingly recognised as an international, as well as a national, leader in arboriculture. The Association is dependent on its members, its volunteers – including Trustees, Committee members and Branch officials – and a dedicated staff team operating out of the Malthouse in Stonehouse, Gloucestershire.

Regarded by UK central government departments, local government and sector partners such as the Royal Horticultural Society as the focal point for best practice in tree care, the Association is unique in that its membership operates across the entire spectrum of the profession. It represents its members on numerous projects, working parties and groups, and collaborates closely with international partners such as the European Arboricultural Council, the European Forum on Urban Forestry and the International Society of Arboriculture.

The Association is a charity as well as a membership organisation, working to advance the science of arboriculture and raise awareness and knowledge of tree care globally, inspiring the general public about the importance of amenity trees and the arboricultural professionals who care for them. Much of this work is done through partic pa ion at community and public events, school membership, political engagement and, most recently, via the Tree Care Supporter initiative and public-facing content.

Membership grades are available to suit all arboricultural professionals, to whom the Association offers a wide range of services and benefits. Training courses for membe s at all stages of their professional career are held in a range f topics, in-person around the country and also, in many cases, online. A busy calendar of events includes the ARB Show, the Annual Amenity Conference – he main UK arboricultural conference of the year – and packed online programme including an acclaimed web nar series enjoyed by viewers worldwide in mor than 140 countries.

The Approv d Contractor, Utility Approved Contractor and Registered Consultant Accreditation Schemes help raise professional standards and increase awareness of arboriculture, and the Association publishes best practice guidance documents and two quarterly publications – the *ARB Magazine* and *Arboricultural Journal*. The Association has worked for the good of our members, for the profession and for wider society for more than 50 years, and will continue to do so into the future.



Become a Tree Care Supporter

...because tree **care** is just as important as tree **planting**.

The Arboricultural Association is a registered charity and professional membership organisation. By signing up as a Tree Care Supporter you will be helping us to care for trees, and for the people who care for trees.

How your support helps

Funding the work of the Association, including:

- Producing and sharing best practice guidance for tree care
- Development of guides for tree owners
- Community and schools outreach
- Lobbying government

What do Tree Care Supporters get?

- A Tree Care Supporter **Card**
- **Digital** ARB Magazine
- Monthly Tree Care news e-bulletin
- Information about tree care
- Access to tree care webinars



Image © John Parker

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Supporting trees, and the people who care for trees.

www.treecare.org.uk

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Published: May 2022

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