RWE

Tween Bridge Solar Farm

7.8 Outline Soil Management Plan

Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

APFP Regulation 5(2)(q)

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Table of Contents:

List of Tables:

List of Figures:

No table of figures entries found.

1 Introduction

1.1. Purpose and Scope of the Document

1.1.1. The outline Soil Management Plan (outline SMP) sets out the key principles and considerations for the handling of soils for the Scheme. This is an outline of a Soil Management Plan that will be required under the Development Consent Order (DCO).

1.1.2. The document is one setting out the key principles of soil management for the scheme.

1.1.3. The outline SMP has been prepared by Kernon Countryside Consultants Ltd. It draws on a detailed Agricultural Land Classification and soil survey carried out by Amet Property Ltd.

1.2. Structure of Report

1.2.1. The outline SMP sets out an outline of the soil management measures in the various works areas. This outline SMP:

- covers the key principles of soil management in section 2, describing good and bad practice and key timing considerations;
- covers soil suitability testing, necessary before soil movement takes place, in section 3;
- describes the principles for the solar PV development in section 4;
- briefly covers operational land management of the solar PV development in section 5;
- and outlines decommissioning works in section 6.

1.2.2. Implementation of this outline SMP, and adherence to its principles, will be the responsibility of the Applicant who will appoint a competent Principal Contractor who will implement onsite during the construction and decommissioning stages.

2 Key Principles of Soil Management

2.1. Guidance

2.1.1. Soil management principles are set out in a number of documents, but those of most relevance are listed below. References are set out in section 7:

- Code of Practice for the Sustainable Use of Soils on Construction Sites, Defra (March 2011) **[Ref. 1]**;
- Working with Soil Guidance Note on Benefitting from Soil Management in Development and Construction, British Society of Soil Science (v 3 January 2022) **[Ref. 2]**;
- Good Practice Guide for Handling Soils in Mineral Workings, The Institute of Quarrying (July 2021) **[Ref. 3];**
- Building on Soil Sustainability: principles for soils in planning and construction, Cornwall Council and others (September 2022) **[Ref. 4]**;
- Planning and aftercare advice for reclaiming land to agricultural use, Natural England (April 2022), especially in respect of soil bund management **[Ref. 5]**.

2.2. Overview

2.2.1. For much of the installation process there is no requirement to move or disturb soils. Soils will need to be moved and disturbed to create temporary construction compounds, and to create the access tracks and on-site supporting equipment bases. Soils will need to be disturbed to enable cables to be laid, but the soils will be reinstated shortly after they are lifted out (i.e. this is a swift process).

2.2.2. For those areas where soil needs to be disturbed to create the bases for the 132kV and RWE on-site 400kV Substation and the BESS areas, the soil will be stored in suitably managed conditions. The soil needs to be looked after because it will be needed at the decommissioning phase to restore the land under the bases back to agricultural use.

2.2.3. For the underground cabling, trenches will be required, and when dug, topsoil and subsoil should be kept separate. It will be evident where topsoil becomes subsoil.

In most places the topsoil is about 30cm – 35cm deep, with a graduation to a lighter-coloured subsoil.

2.2.4. Temporary works, to create construction compounds and temporary access will be short term. Where soil needs to be disturbed, it should be stored carefully for replacement in the same areas as far as possible.

2.2.5. The construction and operation phases will require the use of vehicles. The key consideration is to ensure that soils are passed over by vehicles (trafficked) when the soils are in a suitable condition, and that if any localised damage or compaction occurs (which is common with normal farming operations too), it is ameliorated suitably, such as by light cultivation prior to re-seeding.

2.2.6. The key principles for successfully avoiding damage to soils are:

- timing;
- retaining soil profiles;
- avoiding compaction;
- ameliorating compaction.

Timing

2.2.7. The most important management decision/action to avoid adverse effects on soils is the timing of works. If the construction work takes place when soil conditions are sufficiently dry, then damage from vehicle trafficking and trenching will be minimal.

2.2.8. Vehicle travel over soils creating limited impact is shown below. This is good practice and is to be aimed-for, so far as possible.

Photo 1: Soils Suitable for Trafficking

2.2.9. Poor practice is shown below. This should be avoided. If this type of soil disturbance occurs it can be rectified, as set out below, but as a point of principle if soils are rutting as shown in Photo 2 they are not well suited to being trafficked. Vehicle travel over soil should, so far as possible, be delayed until soils dry out. This is not a photograph of one of the Applicant's sites.

Photo 2: Soils not Suitable for Trafficking
[Note: This is a photograph showing poor practice and does not relate to any of the Applicant's sites.]

2.2.10. As a general rule any activity that requires soil to be dug up and moved, such as cabling works, should be minimised when ground conditions are saturated. Soils handled when wet tend to lose some of their structure, and this results in them taking longer to recover after movement, and potentially needing restorative works (e.g. ripping with tines) to speed recovery of damaged soil structure. The periods when soils are most likely to be saturated, and therefore when assessing soils before works commence is important (see below), are shown below.

Table 1-1: Least Suitable Periods for Working with Soils

Soil Type	Likely Period When Soil Suitability Tests Are Important
Subgrade 1,2, and 3a	November to March (December to February in dry years)
Subgrade 3b	Mid-October to Mid-April (November to March in dry years)

2.2.11. Works within these periods may be able to take place, but it will be necessary to carry out soil suitability tests more frequently as there will be times within those periods when soils will be too wet to handle.

2.2.12. Soil handling/assessment guidelines are set out in section 3.

2.2.13. The equipment used to construct solar farms is generally lightweight, as explained in section 4. It is unlikely that deep compaction will be caused, even with travel in suboptimal conditions. If access is needed to areas when ground conditions are not suitable, it may be possible to lay temporary surfacing (as described in section 4) or to use very low ground pressure machinery, to enable access and work without significant disturbance to soils. These mitigation measures could allow access. Soils should not be moved, however, when unsuitably wet.

2.2.14. In localised instances where it is not possible to avoid undertaking construction activities when soils are wet and topsoil damage occurs then soils should be recovered by normal agricultural management, using normal agricultural cultivation equipment (subsoiler, harrows, power harrows etc) once soils have dried adequately for this to take place. There may be localised wet areas in otherwise dry fields, for example, which are difficult to avoid.

Retaining Soil Profiles

2.2.15. The installation of cabling will usually require a trench to be dug into the ground to a maximum depth of 1.5m (see **ES chapter 2 Scheme Description [Document Reference 6.2.1.2]**). Topsoil depths vary across the Order Limits, but the coverage is generally about 30cm, with subsoils below that being generally similar to depth. As set out in the BRE Agricultural Good Practice Guidance for Solar Farms **[Ref. 6]**, at page 3:

"When excavating cable trenches, storing and replacing topsoil and subsoil separately and in the right order is important to avoid long-term unsightly impacts on soil and vegetation structure. Good practice at this stage will yield longer-term benefits in terms of productivity and optimal grazing conditions".

2.2.16. In those areas where the soil is dug up (especially for trenching or creating access tracks, the soils should be returned in as close to the same order, and in similar profiles, as it was removed.

Avoiding Compaction

2.2.17. It is stressed that the objective of the outline SMP is to avoid causing compaction. Compaction by normal machinery is very unlikely to affect land quality, but it results in the need for physical ameliorating with consequent cost implications. It should be avoided wherever possible.

2.2.18. This outline SMP sets out when soils should generally be suitable for being trafficked. There may be periods within this window, however, when periodic rainfall events result in soils becoming liable to damage from being trafficked or worked. In these (likely rare) situations, work should only continue with care, to minimise structural effects on the soils, until soils have dried, usually within 48 hours of heavy rain stopping

Ameliorating Compaction

2.2.19. If localised compaction occurs during construction, it should be ameliorated. This can normally be achieved with standard agricultural cultivation equipment, such as subsoilers (if required), power harrows and rolls.

2.2.20. The amount of restorative work will vary depending upon the localised impact. Consequently, where the surface has become muddy, for example in the photo 2, this can be recovered once the soil has dried, with a tine harrow and, as needed, a roller or crumbler bar.

2.2.21. If there are any areas where there has been localised damage to the soils due to vehicle passage, for example, a low wet area within a field which despite best efforts could not be avoided, this should be made good and reseeded at the end of the installation stage, when conditions are suitable. This is illustrated below:

Photo 3: Localised Restoration

2.2.22. The soils across the Order Limits, provided they have dried sufficiently, will readily restore. The ruts need to be harrowed level when the ground is dry, and then they will naturally restore.

2.2.23. Accordingly, the ground surface should be generally levelled prior to any seeding or reseeding.

3 Soil Suitability Tests

3.1.1. The soils across the Order Limits are generally able to be freely worked (i.e. physically moved) between April and October. Careful management practices and, if soils are wet then minimising work in the November to March period if possible is recommended. During that period extra care will be needed to ensure that soils are suitable for being handled.

3.1.2. The heavier clayey soils are most susceptible to traffic damage when wet. They will therefore need to be assessed after prolonged rain, depending upon the activities proposed.

3.1.3. Guidance on determining soils suitability to be handled is set out in extracts from the Good Practice Guide for Handling Soils **[Ref. 3]**.

3.1.4. If you can roll soil into a ball or a sausage easily and the soil holds that shape, it is too wet to travel over or move soils. This is illustrated in the photographs below.

Photos 4 and 5: Soils too wet to handle (not from the Order Limits)

3.1.5. If the soils once rolled then cannot be held in this manner and break or crumble, as shown below, they are likely to be suitable for being handled. See the Test Pitting Report **[Document Reference 6.3.8.5]**.

Photos 6 and 7: Soils suitably dry to handle (not from the Order Limits)

3.1.6. The following soils, not from the Order Limits, show another example where soils crumble and are suitable for being moved and handled.

Photos 8 and 9: Suitably Dry Soils

3.1.7. As described in the extracts from the Good Practice Guide **[Ref. 3]**, sandy soils are normally impossible to roll into a thread. Instead, an Examination Test must be used, rolling the soils into a ball to see if the sample darkens when squeezed indicating excess water. If it does not, as the example below shows, it is suitable for being handled.

Photos 10 and 11: Examination for Sandy Soils

3.1.8. Please note that there is a typing error on the extract in **Appendix 1.** Sandy soils are impossible to roll into a thread, not possible as stated at the bottom of Table 4.2.

4 Solar PV Development

4.1.1. This section covers:

- temporary access works;
- construction compounds;
- ground mounted solar PV generating stations and on-site trenching;
- internal cabling;
- access tracks;
- site fencing;
- under field drainage.

4.2. Temporary Access

4.2.1. Typical short-term access can be provided by removable trackways, such as shown below.

Photos 12 and 13: Removable Temporary Trackways

4.3. Construction Methodology of Construction Compound

4.3.1. Temporary construction compounds will be created at the start of construction and reinstated at the end, or during construction once they are no longer required.

4.3.2. Construction compounds are built by either matting over the top of the topsoil, or by stripping topsoil and storing it on the edge of the site. A matting is then laid down, and typically stone imported and levelled, as shown below.

Photo 14: Newly laid Construction Compound (Elsham-Lincoln Pipeline)

4.3.3. The matting prevents the stone from mixing with the subsoil, as shown below.

Photo 15: Matting

4.3.4. Topsoil if removed will need to be stored short-term, such as shown below. If soils are still wet when moved, the storage should initially be no higher than 1m, but otherwise and when soils have dried temporary storage can be up to 3m in height. The soils need to be sufficiently dry to handle. The works will be scheduled to start when soils are dry.

Photo 16: Topsoil Storage Example (Elsham – Lincoln Pipeline)

4.3.5. Guidance on determining soils suitability to be handled is set out in the Good Practice Guide for Handling Soils **[Ref. 3]**, and in section 3.

4.3.6. As described in this oSMP, most of the soils across the Order Limits will be suitable for being moved for much of the year. However, after prolonged periods of rain, especially in the November to March period, the advice in section 3 on assessing suitability should be followed. Generally, the programme should seek to avoid working the soils in this period.

4.3.7. The topsoils will be stripped to a depth of 30cm and placed in short-term storage in locations not at risk of flooding. Short term storage of soil is shown above. If the soil is likely to be stored for in excess of six months, then, depending upon timing, it should be seeded with grass. This binds the soil together and minimises erosion.

4.3.8. Therefore, if the construction compounds are not to be removed before the wet weather (normally November to March), the bunds should be seeded with grass, as per the example below, at a suitable time of the year. The compound can then be reinstated after April the following year.

Photo 17: Grass-seeded Soil Storage

4.3.9. The removal of the construction compound should be timed for dry weather. That is typically before November or in the following spring (typically from April).

4.3.10. The base area should be loosened when soils are dry, and the topsoil then spread over the site to the original depth. This should be lightly cultivated.

4.4. Solar PV Generating Stations

4.4.1. Installation of Solar PV Generating Stations can take place when soils are sufficiently dry for light vehicle traffic, unless low ground pressure machinery or temporary surfacing has been used.

4.4.2. The layout includes a network of access tracks and in most cases once the mounting structures have been installed, only small numbers of vehicle movements will be needed between each string of panels.

4.4.3. The machinery normally used is small, lightweight and tracked, and damage to soils will generally be minimal.

Photo 18: Example of Mounting Structure and Solar PV Modules Moving Equipment

4.4.4. Any surface disturbance will be limited, will not result in deep compaction, and can be ameliorated easily in the spring if required, as described above.

4.4.5. It is very unlikely that trafficking during construction when soils are relatively dry will result in compaction sufficient to require amelioration. However, if rutting has resulted the soil should be levelled by standard agricultural cultivation equipment such as tine harrows, once the conditions suit, and prior to seeding. This can be done with standard agricultural machinery, or with small horticultural-grade machinery such as is shown below.

Photos 19 and 20: Horticultural Machinery

4.4.6. The objective is to get the surface to a level tilth for seeding/reseeding as necessary, as was shown earlier.

4.4.7. Grass growth will then recover or establish rapidly.

4.5. Low Voltage Distribution Cabling Works

4.5.1. Cabling is done mostly with either a mini digger or a trenching machine. Trenches will be at varying depths. Topsoil should be placed on one side (0-30cm) and subsoil on the other (below 30cm).

Photo 21: Machinery Used (extract from BRE Good Practice Guidance **[Ref. 6]***)*

Cable trenching, showing topsoil stripped and set to one side, with subsoil placed on the other side ready for reinstatement (photo courtesy of British Solar Renewables)

4.5.2. It is important that topsoils are placed separately to the subsoils, and that they are then put back in reverse order, i.e. subsoils first.

4.5.3. All trenching work will (so far as possible) be carried out when the topsoil is dry and not plastic (i.e. it can be moulded into shapes in the hand).

4.5.4. The top 30cm will be dug off and placed on one side of the trench, for subsequent restoration. Subsoil will be removed and stored, for subsequent restoration.

4.5.5. Once the cables have been installed, the subsoil will be replaced. The topsoil will then be returned onto the top of the trench. It is likely, and right, that the topsoil will sit a few centimetres higher than the surrounding level. This should be left to allow it to settle naturally as the soils become wetter.

4.5.6. If there is a surplus of topsoil this may be because the lower subsoils were dry and blocky and there are considerable gaps in the soil. These will naturally restore once the lower soils become wet again. If the trench backfilling will result in the soil being more than 5-10cm proud of surrounding levels, which is unlikely but possible, the topsoil should not be piled higher. It should be left to the side, and the digger returned to add back the surplus soil once the trench has settled and add the rest of the topsoil onto the trench at that point.

4.5.7. Any excess topsoil should not be piled higher than 5 – 10cm above ground level.

4.5.8. If considered appropriate, a suitable grass seed mix could be spread over any parts of the trenches that would seem likely to benefit from extra grass. Seeding should take place at a suitable time of the year, being the spring or autumn.

4.6. Access Tracks and On-Site Supporting Equipment

4.6.1. Track construction involves removing the topsoil, normally to a depth of 30cm, and placing it to the side of the track (therefore enabling easy return to the same place on decommissioning). A geotextile membrane is then spread over the upper subsoil, and the track surface is laid onto this.

4.6.2. The small areas of on-site supporting fixed equipment will stand on a hardstanding constructed in a manner similar to the access tracks or concrete foundations, requiring some removal of soil to create the foundation.

4.6.3. Soil stripping should be carried out in accordance with Defra's "Construction Code of Practice for the Sustainable Use of Soils on Construction Sites" (Defra, 2009) **[Ref. 1]**. The removed soil should be stored in bunds in accordance with the Construction Code of Practice.

4.7. Site Fencing and Cameras

4.7.1. Fence designs can vary, but they all involve a post being inserted into the ground. Pole mounted internal facing closed circuit television (CCTV) systems are also likely to be deployed around the perimeter of the operational areas. Access gates will be of similar construction and height as the perimeter fencing.

4.7.2. The site fencing is likely to be metal mesh or deer fencing (or palisade fencing around the substations). This can be erected at any time, if soil conditions allow access for vehicles. The following photographs show typical deer and metal mesh fencing installed early in the process.

Photos 22 and 23: Typical deer/metal mesh fencing

4.7.3. Similarly, CCTV poles are inserted in the same way.

Photos 23 and 24: Typical CCTV Poles and Fencing

4.7.4. Any rutting that results from fencing should be made good with standard agricultural equipment.

4.8. Drainage Works

4.8.1. There is the potential for parts of the site to have in place under field drainage schemes. At the outset, prior to relevant construction activities, all efforts will be made with landowners to identify historic maps and records of any known under field schemes.

4.8.2. The extent to which there is the potential for an adverse effect will depend upon a number of factors including:

- the depth of drainage;
- the direction and spacing of any underdrainage;
- the extent to which the underdrainage is operational;
- the type of works being undertaken.

4.8.3. Further detailed investigation of the drainage will be needed before construction. Scanning for clay and plastic pipe field drainage is not possible, and the depth of drainage is not known.

4.8.4. The Agricultural and Horticultural Development Board advisory guide "Field Drainage Guide: principles, installations and maintenance" (2024) **[Ref. 7]** notes that given good maintenance a useful life of a system is at least 20 years, but some systems can last many decades longer (page 4 refers).

4.8.5. The key consideration in minimising the effects on under-field drainage is to identify the location and depth of the drainage. Page 11 sets out a methodology for identifying the location of field drainage.

4.8.6. The ALC land classification system methodology (MAFF, 1988) assumes that *"where limitations can be reduced or removed by normal management operations or improvements, for example cultivations or the installation of an appropriate underdrainage scheme, the land is graded according to the severity of the remaining limitations"*.

4.8.7. Consequently, any adverse effects on field drainage will not result in a downgrading or change to the ALC grading of the Order Limits.

4.8.8. The installation of cabling will be supervised by an experienced advisor. The advisor will know where to expect drainage and will be able to identify if drainage pipes are broken as either clay pipe fragments or plastic pipe will be evident in the material dug out.

4.8.9. Any areas affected by cable damage should be repaired in one of two ways:

- either the individual drains will be reconnected with new sections across the pipe, as illustrated below;
- or a collector drain will be laid along the cable trench and will then connect, at a low point, to a new drainage pipe to take water away.

Photo 25: Drainage System Repair Option

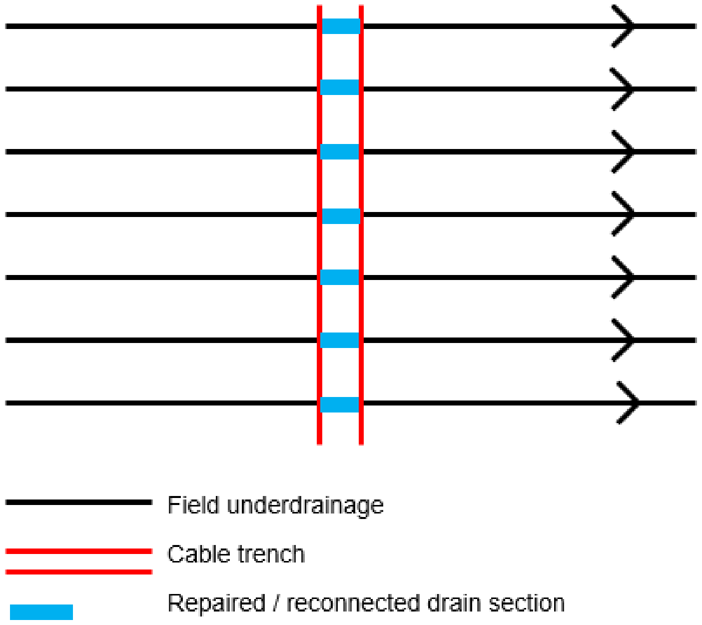
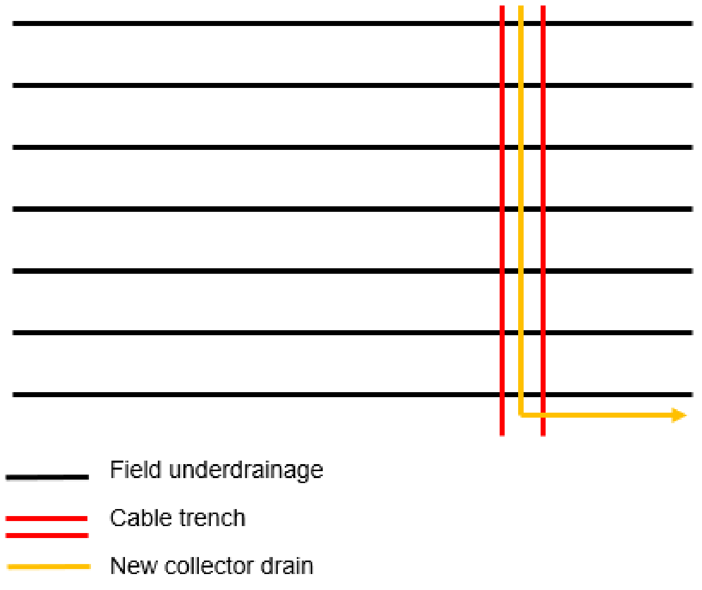


Photo 26: Drainage System Repair Option



4.8.10. Drains affected by piling will be repaired locally, if required.

4.8.11. The purpose of under-field drainage is to help crop growth and to extend the time that land can be accessed. Drainage allows earlier and later access to the land, and evens out the drainage across the land to help with cultivations etc.

4.8.12. Allowing the land to drain less rapidly does not affect the operation of the solar farm. Having under-field drainage working is not, therefore, important unless there are areas of standing water due to broken drainage.

4.8.13. Localised wet areas where drainage has been impeded such that surface puddling occurs, will be repaired with new sections of plastic drainage pipes dug around the blocked section to connect the old system.

5 Operational Phase: Land Management

5.1. Panel Areas

5.1.1. The land around the solar PV generating stations will be managed including potentially by the grazing of sheep, or otherwise mechanically.

5.1.2. Panels grazed by sheep tend to be free of weeds, as shown below.

Photo 27: Sheep Grazing Under Panels

5.1.3. Any localised weed control by hand can be carried out at the appropriate time of the year, in line with the Landscape and Ecology Management Plan.

5.2. Ongoing Maintenance

5.2.1. There are many different cleaners on the market, some tractor based and some operated from smaller machines, such as below.

Photo 28: Cleaning of Solar Arrays

5.2.2. The normal cleaning period is early summer, so that panels are clean for the maximum light period, so damage is unlikely.

5.2.3. If vehicles, including farm vehicles, cause ruts in the soil these will naturally repair in time, especially if the land is grazed by sheep as their feet are excellent at levelling land. Alternatively, a light harrow or rolling will restore the ruts, when the soil is still soft enough to roll but hard enough to not rut more.

Photo 29: Ruts Caused by Vehicles

5.2.4. If vehicles have caused rutting it is probably, as per the example above, only localised. In the photograph above this is a wet spot, and on the land either side of the ruts within the row there is no evidence of wheel indentation. If these areas are not levelled, they will tend to sit with water in them.

5.2.5. Localised, small rutting should be repaired by either treading-in the edges with feet, by light rolling or harrowing, or adding a small amount of soil simply to fill-in the depression so that water does not collect there.

5.2.6. Deeper rutting will require either light harrowing in the drier period, or some soil adding, or both, before reseeding.

5.3. Emergency Repairs

5.3.1. For the duration of the operational phase there should be only localised and infrequent need to disturb soils, such as for repair of a cable. Any works involving trenching should be carried out, ideally, when the soils are dry but recognising that any works will be those of emergency repair, that may not be possible.

5.3.2. Accordingly, if new cabling is needed and has to be installed in wet periods, it can be expected that the trench will look unsightly initially, but any area disturbed should be harrowed or raked level once the soils have dried and be reseeded. These areas will be small, and this can probably be done by hand. These areas will recover quickly.

6 Decommissioning Phase Principles

6.1.1. Given the length of time before decommissioning it is likely that the ALC methodology will have been amended by then. Further, unless we are successful in reducing global carbon emissions, climate change may have altered the seasons and rainfall patterns. Therefore, this guidance is prefaced with a requirement for a suitably qualified soil scientist to revisit the Order Limits prior to decommissioning, and to update the guidance and timing. The objective is to remove panels and restore all fixed infrastructure areas to return the land to the same ALC grade and condition as it was when the construction phase commenced.

6.2. Removal of Panels

6.2.1. A qualified soil scientist should advise prior to decommissioning time. The effects of climate change by the time of decommissioning may mean that the periods when soils are most suitable for being handled, have changed.

6.2.2. Once the panels have been unbolted and removed, the mounting framework will then be reduced to a series of legs.

Photos 30 and 31: The Framework

6.2.3. These are likely to be removed by low-ground pressure machines, in a reverse operation to the installation. These machines provide a pneumatic tug-tug-tug vertically upwards. This will break the seal between soil and framework leg, and once that surface tension is released the framework leg will come out easily.

6.2.4. The mounting framework will be loaded onto trailers and removed.

6.2.5. There will be no significant damage to the soils, and no significant compaction.

6.3. Removal of Cables

6.3.1. It is assumed that all the below-ground cables will be left in situ to avoid unnecessary disturbance to the ground or to nearby human or ecological receptors, in accordance with Paragraph 2.10.69 of the National Policy Statement for Renewable Energy Infrastructure (EN-3) **[Ref. 8]**.

6.4. Removal of On-Site Supporting Equipment

6.4.1. Equipment, such as that shown below, will need to be removed.

Photo 32: On-Site Supporting Equipment (example only)

6.4.2. Low ground pressure vehicles, and cranes, will be needed to lift the decommissioned units onto trailers, and removed from the Order Limits. An example is shown below.

Photo 33: Example of Low Ground Vehicles (from the BRE Guide)

Case Steiger Quadtrac used to deliver inverters and other heavy equipment to site under soft ground conditions (photo courtesy of British Solar Renewables)

6.4.3. Any concrete bases will need to be broken up. This will most likely involve breaking with a pneumatic drill to crack the concrete, after which it should be dug up and loaded onto trailers and removed.

6.4.4. The ground beneath the base may then benefit from being subsoiled, to break any compaction. This should be done by standard tractor-mounted equipment, such as the following examples.

Photos 34 and 35: Example of Tractor Mounted Equipment

6.5. Access Tracks

6.5.1. The access tracks will normally be the last fixed infrastructure removed (noting that some may be left in-situ in agreement with the relevant landowner). The access tracks will have been used for vehicle travel during the decommissioning stage. The access tracks will also be used for removal of material from the access tracks themselves, which will be removed from the furthest point first.

6.5.2. The stone will be removed and any matting removal. The base will then be loosened by subsoiler or deep tine cultivators, depending on specific advice given by the soil expert at the time following an analysis of soil compaction and condition.

6.6. Reinstatement of Soils

6.6.1. Topsoil from the storage areas will then be returned and spread to the depth removed. The area will then be cultivated, probably in combination with the whole of each field.

6.7. Fences and Gates, and CCTV Cabling

6.7.1. The cabling would be removed in appropriate conditions, after the panels have been removed (unless left in-situ). This will involve a tractor and trailer. The CCTV cabling is shallow buried and will probably pull out without the need for trenching, but if required trenches will be dug, as described above, and replaced in order once the cables have been removed.

6.7.2. Fences and gates will be rocked by machinery and pulled out. The holes are generally small and will fill in easily, but the bucket could be used to loosen the surface so that soil fills the void, if there is a risk of injury from the small holes.

6.8. Cultivation

6.8.1. The fields will be handed back to the farmers. Whether they are handed back as grassland or sprayed off and cultivated, will be determined in discussions with each landowner.

7 References

- **Ref. 1**: Department for Environment, Food and Rural Affairs (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites.
- **Ref. 2**: British Society for Soil Science (2022). Working with Soil Guidance Note on Benefiting from Soil Management in Development and Construction.
- **Ref. 3**: The Institute of Quarrying (2022). Good Practice Guide for Handling Soils in Mineral Works.
- **Ref. 4**: Cornwall Council and Others (2022). Building on Soil Sustainability: Principles for soils in planning and construction.
- **Ref. 5**: www.gov.uk (2022). Planning and Aftercare Advice for Reclaiming Land to Agricultural Use.
- **Ref. 6**: BRE (2014) Agricultural Good Practice Guidance for Solar Farms
- **Ref. 7**: AHDB (2024) Field Drainage Guide
- **Ref 8:** Department for Energy Security and Net Zero (2023). National Policy Statement for Renewable Energy Infrastructure (EN-3).

Appendix 1: Institute of Quarrying Field Tests for Soils Suitability

IQ
The Institute of Quarrying

Good Practice Guide for Handling Soils in Mineral Workings

	Climatic Zones		
Soil Clay Content	**1**	**2**	**3**
Soil Depth <30cm			
<10%	Mid Apr - Early Oct	Late Mar – Early Nov	Late Mar – Early Dec
10 -27%	Late May - Early Oct	Early May – Early Nov	Early Apr – Early Dec
Soil Depth 30-60cm			
<10%	Late Apr - Early Oct	Mid Apr – Early Nov	Early Apr – Early Dec
10-27%	Late May - Early Oct	Early May – Early Nov	Early Apr – Early Dec
>27%	Late June – Early Oct	Early June – Early Nov	Late May – Early Dec
Soil Depth >60cm			
<10%	Late Apr - Early Oct	Mid Apr – Early Nov	Early Apr – Early Dec
10-18%	Late May - Early Oct	Early May – Early Nov	Early Apr – Early Dec
18-27%	Late June – Early Oct	Early June – Early Nov	Late May – Early Dec
>27	Mid July – Mid Sept	Early July – Mid Oct	Late June – Mid Oct

Table 4.1: Indicative on-average months when vegetated mineral soils might be in a sufficiently dry condition according to geographic location, depth of soil and clay content

The timing of most soil handling operations takes place between April and September. Although in western (Zone 1) and central (Zone 2) areas it typically can be a later start in May with an earlier termination in August. Whilst the return to climatically 'excess rainfall' is later in the eastern counties (Zone 3) and can be as late as November/early December, there is a need to maintain transpiring vegetation to keep the soils being handled in a dry as possible condition and to establish new vegetation covers as soon as possible (on replaced soils and storage mounds). Hence, soil handling operations generally need to be completed no later than the end of September (Natural England, 2021), unless appropriate provisions can be assured.

Where data is available, more realistic local and real-time predictions can be made, however, because weather patterns and events differ between and within years, and soils can be vary locally in their condition. Experience has shown that the most practical approach for operations is to inspect the site and soils in question near to/ at the time when soil handling is to take place. Professional soil surveyors can advise on the best time for soil handling (stripping, storage & replacement) and carry out site assessments of soil wetness condition prior to the start of operations.

A Practical Method for Determining Soil Wetness Limitation

During the soil handling season (see Table 4.1 above), prior to the start or recommencement of soil handling soils should be tested to confirm they are in suitably dry condition (**Table 4.2**). The 'testing' during operations can be done by suitably trained site staff and reviewed periodically by the professional soil surveyors.

The method is simply the ability to roll intact threads (3mm diameter) of soil indicating the soils are in a plastic and wet condition (MAFF, 1982; Natural England, 2021). Representative samples are to be taken through the soil profile and across the area to be stripped. It is the best available indicator of soils being too wet to be handled and operations should be delayed until a thread cannot be formed. For coarse textured soils which do not roll into threads, a professional's view as to soil wetness and the risk of compaction may have to be taken.

Supplementary Note 4
Soil Wetness

Soil wetness is a major determinant of land use, and environmental and ecosystem services in the UK. It is also a factor in the occurrence of significant compaction arising from handling soils with earth-moving machines and the practices used (Duncan & Bransden, 1986).

Relative soil wetness can range from the waterlogged to moist (mesic) or dry (xeric) depending on rainfall distribution and depth to a water-table and duration of waterlogging. In the UK, soil wetness is largely seasonal with higher evapo-transpiration rates potentially exceeding rainfall in the summer resulting in the soil profile becoming drier where there is vegetation. Whilst soil wetness is largely weather system and equinox (climate) driven, it varies with geographical and altitudinal locations, and importantly the physical characteristics of the soil profile, such as texture structure, porosity, and depth to the water-table and topography including flood risk (MAFF, 1988). The Soil Wetness Class is based on the expected average duration of waterlogging at different depths in the soil throughout the year (days per year), and can be determined by reference to soil characteristics and local climate (MAFF, 1988). The likely inherent wetness and resilience status of a soil should be indicated in the SRMP (see **Part 1, Table 2 & Supplementary Note 1**), reflecting potential risks for soil handling such as low permeability, permanently high groundwater, or a wet upland climate.

Wet soils can also be a result of other circumstances. For example, the interception of water courses, drainage ditches and field land drains. Where these occur, the provisions are to be made in the SRMP to protect the soils being handled and the operational area.

Soils, when in a wet condition generally have a lower strength and have less resistance to compression and smearing than when dry. Lower strength when soils are wet also affects the bearing capacity of soils and their ability to support the safe and efficient operation of machines than when in a dry state.

In terms of resilience and susceptibility to soil wetness, the clay content of the soil largely determines the change from a solid to a plastic state (the water content at which this occurs is called the 'plastic limit' (MAFF, 1982)). This is the point at which an increasing soil wetness has reduced the cohesion and strength of the soil and its resistance to compression and smearing.

Whilst coarse textured sandy soils are not inherently plastic when wet, they are still prone to compaction when in a wet condition. Hence, handling all soils when wet will have adverse effects on plant root growth and profile permeability, which may be of significance for the intended land use and the provision of services reliant on soil drainage and plant root growth. It may be less so in other circumstances where wet soil profiles, perched water tables and ponding are the reclamation objectives, though drainage control, for example to control flooding, may still be important in these contexts.

In cases of permanently wet soils, such as riverine sites, upland or deep organic soils where there is a persistent high water-table throughout the seasons within the depth of soil to be stripped and/or the soil profile remains too wet, a strategic decision has to be made to be able to proceed with the development of the mineral resource. This may mean alternative and less favourable soil handling practices have to be agreed with the planning authority.

Predicting & Determination of Soil Wetness
There are well established methods to predict and determine soil wetness of undisturbed and restored soil profiles (Reeve, 1994). The challenge has been the prediction of the best time for soil stripping. Models based on soil moisture deficits and field capacity dates for a range of soil textures can provide indicative regional summaries (**Table 4.1**) that can help with planning operations at broad scale but cannot be relied upon in practice for deciding operationally whether to proceed on the ground given the actual variation in weather events from year to year and within years.

Table 4.2: Field Tests for Suitably Dry Soils

Soil tests are to be undertaken in the field. Samples shall be taken from at least five locations in the soil handling area and at each soil horizon to the full depth of the profile to be recovered/replaced. The tests shall include visual examination of the soil and physical assessment of the soil consistency.

i) Examination

- If the soil is wet, films of water are visible on the surface of soil particles or aggregates (e.g. clods or peds) and/or when a clod or ped is squeezed in the hand it readily deforms into a cohesive 'ball' means **no soil handling to take place.**
- If the samples is moist (i.e. there is a sligh dampness when squeezed in the hand) but it does not significantly change colour (darken) on further wetting, and clods break up/crumble readily when squeezed in the hand rather than forming into a ball means **soil handling can take place.**
- If the sample is dry, it looks dry and changes colour (darkens) if water is added, and it is brittle means **soil handling can take place.**

ii) Consistency
First test
Attempt to mould soil sample into a ball by hand:

- Impossible because soil is too dry and hard or too loose and dry means **soil handling can take place.**
- Impossible becuase the soil is too loose and wet means no soil handling to take place.
- Possible - Go to second text.

Second test
Attempt to roll ball into a 3mm diameter thread by hand:

- Impossible because soil crumbles or collapses means soil handling can take place.
- Possible means no soil handling can take place.

N.B.: It is possible to roll most coarse loamy and sandy soils into a thread even when they are wet. For these soils, the Examination Test alone is to be used.

A Rainfall Protocol to Suspend & Restart Soil Handling Operations
Local weather forecasts of possible rainfall events during operations and the occurrence of surface lying water have been used to advise on a day-to-day basis if operations should stop (Natural England, 2021). Single events such as >5mm/day in spring and autumn months, and >10mm/day in the summer have been suggested as more precise triggers for determining soil handling operations (Reeve, 1994). However, in practice the following generic guidelines are often used:

- In light drizzle soil handling may continue for up to four hours unless the soils are already at/near to their moisture limit.
- In light rain soil handling must cease after 15 minutes.
- In heavy rain and intense showers, handling shall cease immediately.

In all of the above it is assumed that soils were in a dry condition. These are only general rules, and it is at the local level decisions to proceed or stop should be based on the actual wetness state of the soils being handled. After the above rain event has ceased, the soil tests in **Table 4.2** above should be applied to determine whether handling may re-start, provided that the ground is free from ponding and ground conditions are safe to do so.There can be extreme instances where soil horizons have become very dry and are difficult to handle resulting in dust and windblown losses. In these conditions the operation should be suspended. The artificial wetting of extremely dry soils is not usually a practice recommended but has been successful in some cases.

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