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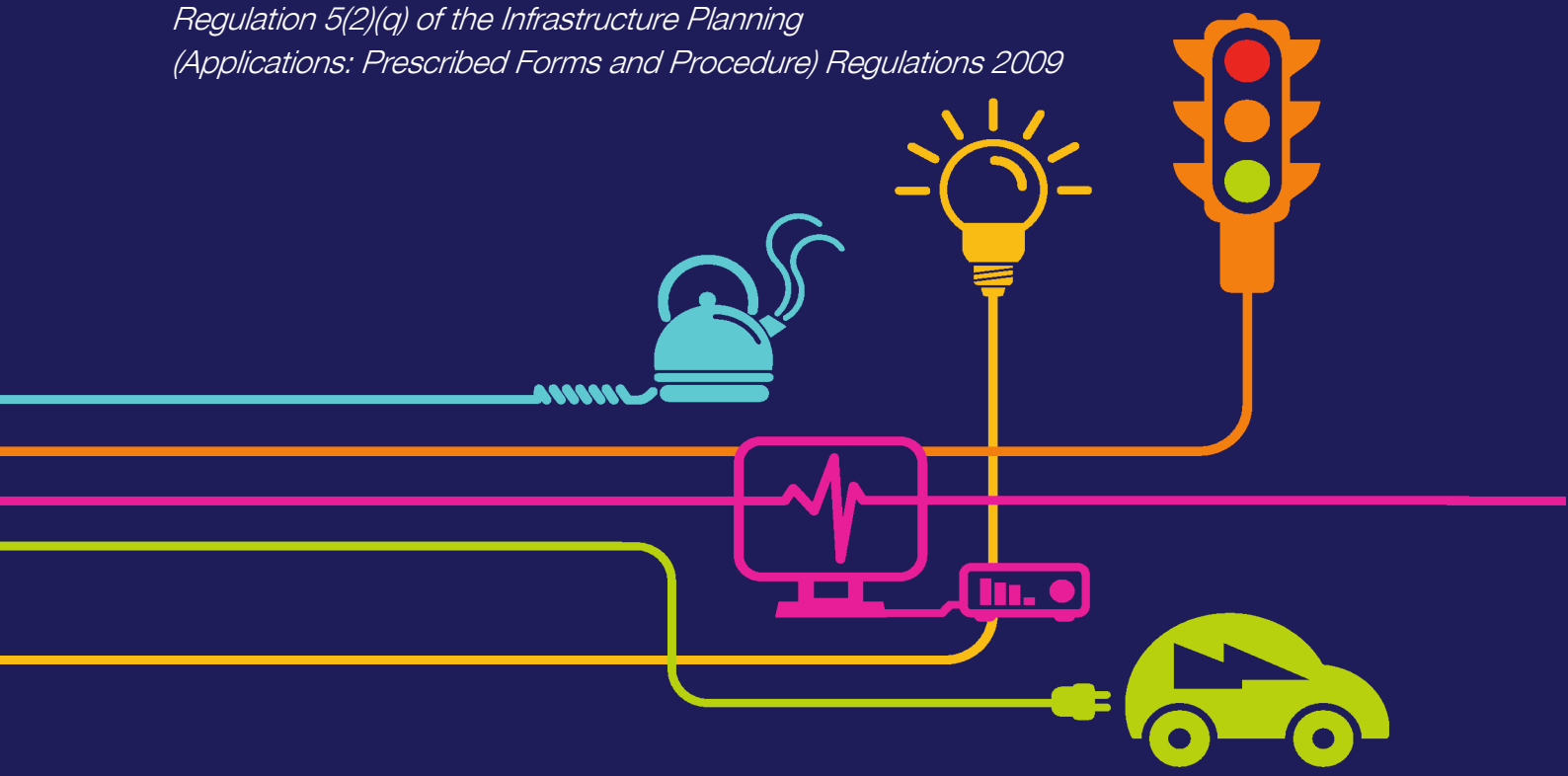
DOCUMENT 7.10

Outline Soil Management Plan

National Grid (North Wales Connection Project)

Regulation 5(2)(q) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



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North Wales Connection Project

Volume 7

7.10 Outline Soil Management Plan

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1 Introduction

1.1 INTRODUCTION

1.1.1 This Outline Soil Management Plan (OSMP) sets out principles and procedures for general good practice mitigation tailored to specific soil types, for the handling, storage and reinstatement of soil to be used for the North Wales Connection Project (the Proposed Development) to minimise adverse effects on the nature and quality of the soil resource.

1.1.2 This OSMP is based upon guidance contained in the Department for Environment, Food and Rural Affairs' (Defra's) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Ref 10.1); the Ministry of Agriculture, Fisheries and Food's (MAFF's) Good Practice Guide for Handling Soils (Ref 10.2); and professional experience.

1.1.3 All technical terms and abbreviations used within this document are defined in the Glossary (**Document 1.4**).

1.2 ENVIRONMENTAL CONTROL AND MANAGEMENT MEASURES

1.2.1 To comply with control measure SM11 in the Construction Environmental Management Plan (CEMP) (**Document 7.4**), this OSMP sets out the management systems and approach to soil management that will be implemented during construction. This is secured by Requirement 6 of the draft DCO (**Document 2.1**).

1.3 OTHER CONTROL AND MANAGEMENT PLANS

1.3.1 The controls and management measures presented in the OSMP apply to all soils within the Order Limits, unless otherwise stated. Additional soil control measures are in place pertaining to protected species; areas identified as ecologically important habitats; areas of importance for biodiversity; and areas of archaeological importance. These are set out in the plans and strategies listed in Table 10.1 which are submitted as part of the DCO application and secured by Requirement 6 of the draft DCO (**Document 2.1**).

Table 10.1 General Measures		
Plan / Strategy	**Description**	**Document Number & DCO Requirement**
Biodiversity Mitigation Strategy (BMS)	Describes measures to avoid, reduce and compensate for likely adverse effects on ecological receptors.	**Document 7.7** secured by Requirement 6
Archaeological Strategy	Sets out the steps that need to be taken to mitigate the predicted effects on archaeology, geo-archaeology and historic landscape heritage assets.	**Document 7.8** secured by Requirement 6

1.3.2 Furthermore, Table 10.2 lists the plans and procedures that will be developed for each stage of the Proposed Development, to set out in detail the soil management systems and approach that will be implemented during construction to comply with the CEMP.

Table 10.2 Construction Mitigation Plans to be produced under Requirements 7	
Plan/Strategy	**Description**
Soil Management Plan (SMP)	This plan will set out the site- and soil-specific measures to protect soils, based upon this Outline SMP as a minimum, and supplemented by additional survey data where required.
Drainage Management Plan (DMP)	This identifies all known risks to the water environment and identifies appropriate measures to prevent pollution during construction. A phased approach may be taken to the development of the DMP to reflect the phasing of the construction programme.
Dust Management Plan (DuMP)	This plan will include measures to control dust during the construction of the Proposed

Table 10.2 Construction Mitigation Plans to be produced under Requirements 7	
Plan/Strategy	**Description**
	Development
Invasive non-native species Method Statement (INNSMS)	This plan will set out the measures which will be implemented to avoid the spread of INNS during construction and ensure legal compliance.

1.4 REVIEW AND UPDATE OF THE OSMP

1.4.1 Prior to construction, site and soil-specific measures will be set out in a SMP, based upon this OSMP as a minimum, and supplemented by additional survey data where required.

1.4.2 To secure effective delivery of the SMP, the contractor must implement it through location-specific construction method statements. 'Locations' will be determined by the contractor or their soils specialist depending upon factors such as, but not limited to, the works to be undertaken, the machinery to be used, soil types and results of any additional survey works, and site constraints (for example, depth to water table, or ecological constraints). The works must also be monitored to audit compliance with the SMP (and location-specific construction method statements) and to allow ongoing advice on soil handling to be provided.

1.5 ROLES AND RESPONSIBILITIES

1.5.1 The effective implementation of the SMP requires that roles and responsibilities are clearly defined and understood. Specific job titles, roles and responsibilities will be defined by the contractor; however, in specific relation to soil management and the implementation of the SMP, it is expected that the contractor will appoint an Agricultural Liaison Officer (ALO), or similar, and a Technical Specialist Advisor (TSA) whose roles and responsibilities are expected to be similar to those described below.

Agricultural Liaison Officer

1.5.2 The ALO, or similar, will ensure that the specifications of the SMP and any location or task specific construction method statements (where required) are implemented. It is envisaged that the ALO will have sufficient soil science experience or that they will work in cooperation with a TSA (see

below) with soil science capability. The main duties of the ALO will comprise, but will not limited to:

- liaison between the contractor, landowners and National Grid;
- assessment of the soil condition before, during and after the works using tactile and visual methods to determine most suitable soil handling Method (see section 2.3);
- assessing compliance of the work on site with the SMP; and location or task specific construction method statements (where required);
- signing off the quality of reinstatement (with respect to soils) to allow for the commencement of the aftercare;
- ensuring the adequacy of the detailed aftercare programme and its annual updates (if required);
- soil sampling and production of annual aftercare reports; and
- signing off completion of the aftercare.

1.5.3 It is noted that some of the above tasks may be completed by Agricultural Inspectors, or similar, reporting to the ALO.

Technical Specialist Advisor

1.5.4 The main duties of the TSA will comprise, but will not limited to:

- providing advice with respect to construction activities and their interface with respective technical areas of expertise;
- undertaking any necessary pre-construction soil surveys and supervising the implementation of specific mitigation measures, where required;
- undertaking any required monitoring related to their specialism;
- providing reports and maintaining contact with relevant stakeholders, as required; and
- providing specific advice with respect to any issues that may arise.

1.6 SOIL RESOURCE

1.6.1 The agricultural soil resource is considered the upper layer of the earth's crust, in which plants grow. Descriptions usually identify the relevant

characteristics of its (usually) horizontal layers in terms of their significance for soil characteristics and crop growth, usually to 1.2 m depth.

1.6.2 The erodibility of a soil (susceptibility to damage and loss) influences the level of mitigation required to protect it, and the measures to be put in place through the SMP and location or task specific construction method statements.

Soils with low risk of erosion

1.6.3 Standard control and management mitigation measures (as stated in Defra's Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Ref 10.1); the MAFF's Good Practice Guide for Handling Soils (Ref 10.2)), will provide appropriate protection to these soils as they are generally more resistant to damage and loss. Measures to protect soils at all stages of the project, including the pre-construction archaeological investigation works are set out below and described in the CEMP (**Document 7.4**).

Soils with moderate risk of erosion

1.6.4 Standard control and management mitigation measures will provide appropriate protection to these soils, however damage is likely to occur if worked in less than ideal conditions, for example when they are wet. Therefore, on a location by location basis, depending upon factors such as physical soil properties, local topography etc. the careful consideration of the most appropriate standard control and management mitigation measures will be required. The soils should be given appropriate consideration because of their importance for agricultural production.

Soils with high risk of erosion

1.6.5 The studies undertaken to inform the ES (**Volume 5**) have not identified any soils with a high risk of erosion (by water or wind) within the Order Limits. However, although unlikely, it is possible that discrete areas of high erosion risk soils which were too small to have been recorded within the high-level published data used to inform the ES, may be present. Should the presence of these soils be identified during the additional, pre-construction, survey work, development on these soils should be avoided if possible given the flexibility maintained within the draft DCO (**Document 2.1**). However, where this is not possible, special consideration and careful planning of construction methods, for example, use of temporary working surfaces, sensitive storage, protection from drying out, in order to preserve their functions should be implemented in order to preserve their structure and function. If required, these measures will be included in the SMP.

2 Good Practice Mitigation

2.1 GENERAL CEMP MEASURES RELEVANT TO AGRICULTURAL EFFECTS

2.1.1 The general CEMP measures relevant to agricultural and soil effects are summarised in Table 10.3.

Table 10.3: General CEMP Measures Relevant to Agricultural Effects

CEMP Code	Description	Benefit
SM11	Prior to construction, a detailed SMP will be prepared, based upon the outline document (**Document 7.10**) and supplemented, by additional survey data, where required.	Minimise disturbance to, and loss of, the soil resource
SM12	The Outline SMP (**Document 7.10**) includes mitigation measures in accordance with Defra guidance (Ref 18.1).	Minimise disturbance to, and loss of, the soil resource
AE15	The Dust Management Plan (DuMP) will contain measures in relation to storage and handling of materials.	Minimise soil erosion (loss of the soil resource) and subsequent dust generation
WE51, WE52, WE56.	A Drainage Management Plan (DMP) will specify measures to minimise the impact of the construction on existing drainage systems.	Minimise disturbance to agricultural land drainage
WE55	Measures to prevent sediment laden run-off entering watercourses/standing water bodies.	Minimise disturbance to, and loss of, the soil resource to watercourses/standing water bodies
R2	To facilitate the reinstatement of land, soil and watercourses, pre-condition surveys will be discussed with landowners and where agreed, carried out on land within working areas. This will include a photographic record, written	Facilitates the complete and accurate reinstatement of land, soil and watercourses.

Table 10.3: General CEMP Measures Relevant to Agricultural Effects		
CEMP Code	Description	Benefit
	description and topographical survey, which will be used to ensure appropriate reinstatement of land.	
R3	Reinstatement will include making good any damage or disturbance to any soil structure, native or other planting, grass, fencing, hard landscaping or structures, where in-situ reinstatement is possible.	Facilitates the complete and accurate reinstatement of land, soil and watercourses.

2.2 GENERAL PRINCIPALS OF SOIL HANDLING

2.2.1 The main threats to soil resources at construction sites are trafficking of vehicles/plant and incorrect handling, which can cause damage to soil structure through compaction and smearing (both effects are sometimes referred to as deformation). These effects compromise the ability of the soil to perform its functions, such as providing adequate amounts of water, air and nutrients to plant roots. The risk of compaction and smearing increases with soil wetness. To minimise the risk of damage to soil structure, the following main rules must be observed during all soil handling tasks:

- no trafficking of vehicles/plant or materials storage to occur outside demarcated working areas;
- no trafficking of vehicles/plant on reinstated soil (topsoil or subsoil);
- only direct movement of soil from donor to receptor areas (no triple handling and/or *ad hoc* storage);
- soil handling methodology to be determined based upon soil moisture content. Where practicable soil handling when soil moisture content is above the lower plastic limit (the moisture content at which soil begins to behave as a plastic material and the soil is deemed too wet to handle without causing damage to the soil structure), should be avoided; however, it is acknowledged that wetlands and floodplain areas have been identified within the Order Limits as discussed in Chapter 11, Geology, Hydrogeology and Ground Conditions (**Document 5.11**). Therefore, given the general moisture status of soils in these areas, soil handling above the lower plastic limit will likely be necessary in these areas. In such cases,

appropriate location-specific methods must be in place (see section 2.9). Although handling non-wetland/floodplain soils when dry will be the preferred option, it is also acknowledged that in some cases it may be necessary to handle soils when they are wet, for example due to programme, engineering or other constraints, again appropriate location-specific methods must be in place (see section 2.9) should this be necessary;

- where soils are wet or damp, to minimise compaction, soils should be handled using excavators rather than dozers;
- no handling of soils to be carried out during periods of prolonged, heavy rainfall with prior consent of the ALO (see section 2.5);
- no mixing of topsoil with subsoil, or of soil with other materials;
- soil only to be stored in designated soil storage areas;
- plant and machinery only work when ground or soil surface conditions enable their maximum operating efficiency (i.e. when machinery is not at risk of being bogged down or skidding causing compaction or smearing);
- all plant and machinery must always be maintained in good working condition to ensure that the soil is stripped correctly, for example to ensure that the depth of the strip can be accurately controlled, and to minimise the risk of contamination through spillages; and
- daily records of operations undertaken, and site and soil conditions should be maintained during soil handling activities (see section 5 for the summary of monitoring and record keeping schedule).

2.2.2 Low ground pressure (LGP models) and tracked vehicles should be used where possible when working directly on bare or vegetated soils. This will greatly minimise the extent and/or intensity of the soil loosening/decompaction required after reinstatement.

2.2.3 The SMP and location-specific methods statements must be defined based on the results of detailed site-specific soil survey, where required. The survey results will be used to specify in detail:

- the ‘before’ statement of physical characteristics of the soil to be disturbed;
- where special consideration and careful planning of standard control and management mitigation measures are required;

- the depth and properties of topsoil; and
- the depth of subsoil and presence of any distinct soil horizons.

2.3 SEASONAL WORKING CONSTRAINTS

2.3.1 A project-wide seasonal constraint to the construction programme is not recommended, as this may not be achievable in practice. However, this constraint should be considered during the preparation of the construction programme for works involving the movement of large volumes of soil, for example:

- during the establishment of construction compounds;
- during the excavation of foundations and the preceding removal of excess vegetation (if applicable);
- during soil reinstatement; and
- during any cultivation of reinstated soil, such as subsoiling, harrowing and sowing.

2.3.2 Where possible, these works should be programmed when the soils are not too wet or saturated (i.e. when they are below their plastic limit).

2.3.3 The period when the soil conditions will generally be the driest typically occur in the summer, when plant evapotranspiration will have dried the soil. Therefore, the optimum time window for soil handling operations is from May to October; although this will vary depending upon local conditions and prevailing weather conditions.

2.3.4 However, it is acknowledged that identified areas of wetland and permanently wet ground within the Order Limits coupled with necessary programming constraints will necessitate soil handling when soil conditions are above the lower plastic limit. As a result, appropriate location-specific methods must be in place (see section 2.9) and specified in the SMP.

2.3.5 Once the placement of soils into stockpiles has been completed, rainfall and soil moisture conditions are of lesser importance, providing they do not lead to erosion resulting in a loss of the soil resource and potentially a change in soil composition if fine material is lost leaving a greater proportion of stones. Stockpile erosion can also result in significant environmental impacts, such as discharges of sediment laden water to drainage ditches and other watercourses. The control and management measures relevant to minimising potential soil erosion are set out in section 5 and the CEMP (**Document 7.4**).

2.4 DETERMINING SOIL CONDITIONS

2.4.1 The determination of soil conditions is essential in determining the appropriate methodology for soil handling and storage. The OSMP provides two methodologies for soil handling and reinstatement, to be applied depending upon whether soils are dry (below the plastic limit): Method 1; or wet (above the plastic limit): Method 2, when soil stripping occurs. Ideally, to avoid compaction and damage to soil structure, soils should be handled when dry, however as described above, this may not be practicable for all soil handling operations.

2.4.2 If soil is excavated and placed in stockpiles when wet it can be easily compacted by the machinery handling it, or by the weight of the soil above it in the stockpile. As well as this damage to soil structure, when soil within a stockpile is compacted, the core of the stockpile remains wet and anaerobic throughout the storage period. This can result in the soil being very difficult to handle and re-spread at the time of reinstatement as it will not be in a friable state and will not break down into a suitable tilth. Therefore, in order to achieve the required standard of reinstatement, Method 2 requires a period of drying and appropriate additional cultivation (to repair soil structure and re-aerate the soil) to ensure the soil is acceptable for post-reinstatement planting.

2.4.3 The following paragraphs set out the methodology for determining whether soils are sufficiently dry and are therefore in a state where they can be handled using Method 1; or whether they are wet and will require Method 2 to be followed. This field testing of soil conditions will contribute to the daily records of soil conditions during soil handling activities, it is essential that a record of which methodology was employed (to identify soils requiring drying and additional cultivation on reinstatement) is maintained.

Field testing of soil conditions

2.4.4 The following two stage methodology, comprising a moisture state test (Table 10.4) and a consistency test (Table 10.5) is considered to be less open to interpretation and easier to conduct than use of consistency testing alone.

2.4.5 The number of field samples to be tested per area is driven by the type and extent of working to be undertaken on a given day; for example, a minimum of one point per 50 m of the length of the working area for linear features such as access tracks, or two samples per ha in other areas such as construction compounds and pylon working areas. The sample should be a composite of at least five subsamples from around each sample point.

Samples of both topsoil and subsoil (where necessary) should be taken and sampled separately.

Soil moisture state

2.4.6 The samples should first be tested for soil moisture state, as described in Table 10.4.

Table 10.4 Testing for Soil Moisture State	
Test	Method to be employed
If soil sample is wet, films of water are visible on the surfaces of grains and aggregates; or If soil sample readily deforms into a cohesive 'ball' when squeezed	Method 2
Soil peds break up/crumble readily when squeezed in the hand. Sample does not form a cohesive ball.	Method 1
If the sample is moist, there is a slight dampness when squeezed between the fingers, but it does not significantly change colour (darken) on further wetting.	Method 1 can be followed using excavators not dozers providing the consistency test for Method 1 is passed (Table 10.2).
Sample is dry and brittle. Sample looks dry and changes colour (darkens) on wetting.	Apply consistency test (Table 10.2).

Table 10.5 Soil Consistency Testing	
STEP A Attempt to roll sample into a ball by hand	
It is impossible because the soil is too hard (dry)	Method 1
It is impossible because the soil is too loose (dry)	Method 1

It is impossible because the soil is too loose (wet)	Method 2
It is possible to roll the sample into a ball by hand	See Step B
STEP B Attempt to roll the ball into a thread of 3 mm diameter on a flat non-adhesive surface using light pressure from the flat of a hand	
It is impossible as the soil crumbles or disintegrates	Method 1
It is possible to roll a 3 mm diameter thread	Method 2

2.4.7 The final decision on soil handling methodology will be made based upon at least 80% of samples passing the particular test. The above criteria should be clearly understood by all personnel responsible for the management of soil handling operations.

2.5 STOP CONDITIONS

Adverse weather

2.5.1 In certain weather conditions the handling of topsoil and subsoil should be effectively managed to prevent damage. Topsoil and subsoil handling must cease if the following criteria apply:

- if there is heavy rain (e.g. heavy showers, slow moving depressions), the suspension of soil handling must be considered;
- if there is sustained heavy rainfall of more than 10 mm in 24 hours, soil handling must be suspended and not restarted until the ground has had at least a full day to dry, or an agreed soil moisture limit can be met as advised by the ALO or TSA or without prior agreement with ALO; and
- soil shall not be handled or trafficked immediately after a heavy rainfall (or snow/hail) in a waterlogged condition, or when there are standing pools of water on the soil surface without prior agreement of the ALO.

2.5.2 When a rainfall event requiring works to be suspended occurs when soil stripping is underway, any areas in which the soil profile has already been

disturbed (i.e. areas where soil strip has started prior to the rainfall), the works should be completed to the base level (i.e. measured topsoil depth) in that location before works are fully suspended. No new areas of soil strip should be started.

2.5.3 Before recommencing work, soil moisture content must be tested, as described in section 2.4, to determine the appropriate soil handling methodology (i.e. dry (Method 1) or wet (Method 2) soil handling methodology). The weather forecast must also be checked and works only recommenced (by the ALO or TSA) if there is no further heavy rain forecasted in a period which could require a stoppage mid-way through stripping of an area.

2.5.4 Additionally, soil should not be handled or trafficked when the ground is frozen or covered by snow.

2.5.5 The above criteria will be communicated to all personnel involved in the groundworks through appropriate toolbox talks communicating the principles of good practice in soil management and its goals, and the contents of the SMP.

2.5.6 The stop conditions and field testing described above refer to mineral soils only.

2.6 SOIL HANDLING GOOD PRACTICE

2.6.1 The machinery used for soil handling will normally conform to the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Ref 10.1). Soil handling procedures include:

- pre-construction site preparation;
- soil striping;
- soil storage;
- maintenance; and
- reinstatement (where required)

2.7 PRE-CONSTRUCTION SITE PREPARATION

2.7.1 Pre-construction site preparation includes the removal of vegetation; minimising working areas and vegetation clearance within designated sites and areas of protected habitat to only that essential for works as discussed in the CEMP (**Document 7.4**); and the clear marking and signposting of

access tracks and all areas to remain undisturbed during construction activities.

2.7.2 Soil storage areas for different types of topsoil, subsoil and mineral substrate will be identified prior to construction activities to avoid the mixing of these resources. In some locations, the excavated soil profile may contain more than one distinct subsoil horizon (i.e. upper and lower subsoil). Where excavations are required to extend below the upper subsoil, due to the different properties of the horizons, they must be excavated and stored separately. Locations requiring the storage of more than one subsoil horizon should be identified through review of the soil survey records, see paragraph 2.2.3, and specified in the location-specific construction method statements.

2.7.3 To reduce the likelihood of anaerobic conditions developing within the topsoil stockpile prior to the soil strip commencing, the topsoil surface should either be bare, under stubble, or have only short surface vegetation. To achieve short surface vegetation (for example in areas of permanent pasture or under a hay crop) the area should be mown or strimmed with all cuttings disposed of off-site to a suitably licensed facility (for example to a local composting facility). Cuttings must not be added to or mixed with the stripped soil, as the presence of excessive amounts of plant material in the stockpile will be detrimental to its quality due to its putrefaction (rotting) in anaerobic conditions.

2.7.4 Alternatively, the vegetation may be killed off by application of a suitable, NRW approved, non-residual herbicide applied not less than two weeks prior to commencement of soil stripping operations at the location. Herbicide may only be used with the consent of the landowner and National Grid would ensure that ALOs maintain communication with farmers/landowners to ensure their needs are understood before, during and after construction

2.7.5 Chapter 9 of the ES Ecology and Nature Conservation (**Document 5.9**), identifies a number of areas of special habitat significance. In these areas, soil handling activities will be subject to the mitigation measures set out in this document and the BMS (**Document 7.7)** with respect to the management and protection of soil resources and managing biosecurity. It is noted that the use of herbicide is not permitted in specific habitats, such as semi-improved, marshy, neutral and acid grassland within the Order Limits of the Proposed Development, to reduce impacts on local biodiversity, as stated in Chapter 9 Ecology and Nature Conservation (**Document 5.9**).

2.8 SOIL STRIPPING

2.8.1 The guidance in this section applies to both Method 1 and Method 2.

2.8.2 The soil stripping method should follow the guidance set out in Defra's Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Ref 10.1). This method uses back-acting excavators, generally fitted with toothed buckets, in combination with dump trucks to strip the topsoil and subsoil (upper and lower where identified) progressively down to the sub-base (basal layer). When preparing the working areas for the pylons, the excavated soil will be stored on the margin of the working area. Therefore, in most locations the use of dumper trucks will not be required.

2.8.3 Topsoil can be stored on either topsoil (of the same type) or on subsoil. Subsoil can only be stored on subsoil and therefore the topsoil must be stripped from subsoil storage areas in advance of subsoil stripping.

2.8.4 Deviations to this standard practice includes instances when the protection of archaeological or cultural heritage features is an important consideration, when the soil stripping method will be guided by the requirements of archaeological works.

2.8.5 The Archaeological Strategy (**Document 7.8**), identifies a number of areas of known archaeological significance or high archaeological potential which will be subject to 'Strip, Map and Sample' archaeological investigation prior to the commencement of main construction activities. In these areas, the soils will be stripped mechanically (under archaeological supervision) to a depth where archaeological deposits are/will be exposed. The soil strip will be subject to the standard control and management mitigation measures set out in this document with respect to the management and protection of soil resources; however, a toothless bucket should be employed to prevent damage to any underlying archaeology. It is expected that (in most locations) the excavated soil will be stored on the margin of the working area and that the use of dumper trucks will not be required.

2.8.6 Where soils are to be stored away from the excavation area, such as may occur within the substation extension at Pentir, and the construction compounds at Braint and Tŷ Fodol, it is expected that multiple excavators and transport vehicles will be required for soil stripping operations. will Excavators used for soil stripping should be fitted with a toothed bucket, except in the areas of known archaeological significance or high archaeological potential (see paragraph 2.8.5). The method, if correctly carried out, should avoid severe compaction as soil trafficking is minimised.

2.8.7 The size of the earthmoving plant to be used should be tailored to the size of the area to be stripped and the space available within the working area. The use of a long reach excavator, which will minimise the need for movement across the soil surface, and the use of tracked vehicles will further reduce soil compaction.

2.8.8 The depth of the topsoil strip is to be determined on a location by location basis using the pre-construction soil survey data as described in paragraph 2.2.3 and communicated via the SMP. During the strip, the excavator should stand on the surface of the topsoil, digging the topsoil to the required depth and forming the stockpile or loading it into the transport vehicle (dump truck). Following topsoil removal, the subsoil can be excavated (if required).

2.8.9 Topsoil should be recovered to the full width of the strip without contamination with the subsoil. The boundary between the topsoil and subsoil is usually very clearly visible through a change in colour (the topsoil being much darker due to greater organic matter content). However, this may not always be the case, as oftentimes the topsoil gradually transitions into subsoil, and their colours are similar.

2.8.10 The main ways to reduce soil compaction and maximise its readiness for reuse are:

- the operations of the vehicles (excavator and dumper trucks, if relevant) on the topsoil should be limited where possible;
- soils should be handled using the appropriate methodology identified using the tests set out in Tables 10.1 and 10.2;
- stop conditions as set out in Section 2.5 must be observed;
- protect the subsoil from ponding of water by diverting water inflow away from it; and
- do not work when there is standing water on the topsoil or subsoil surface (unless where wetlands and floodplain areas have been identified within the Order Limits, location-specific mitigation measures are specified in the SMP.

2.9 CREATION OF SOIL STOCKPILES

2.9.1 This section defines the methodologies for handling and stockpiling dry and wet soils (Method 1 and Method 2, respectively).

2.9.2 Soil stockpiling will be required during construction activities in order to enable the reuse of the soil resource, limit soil damage from weather and other construction activities and soil loss.

2.9.3 Stockpiled soil must not be vulnerable to compaction nor erosion; must not cause pollution to surrounding watercourses; and must not increase flood risk to the surrounding area.

2.9.4 As detailed in the CEMP (**Document 7.4**), soils will not be stockpiled within 8 m of surface water features, will not block surface runoff pathways, and will preferably be located in Flood Zone A. In addition, sufficient gaps will be left in/between stockpiles so as to not impede flood flow pathways.

2.9.5 Ecologically important soils, as identified from the BMS (**Document 7.7**) and the pre-construction soil surveys, must be stripped and stored separately and not mixed with neighbouring agricultural soils. For example, woodland or hedgerow soils must be stored as distinct units. Additionally, to maintain biodiversity, care must be taken not to mix soils supporting different grassland types, although this will most likely be achieved through the stripping/storage of soils as individual field units, the SMP will reference Figure 1 of Appendix 9.3, Phase 1 Habitat Report **(Document 5.9.2.3)** and the BMS **(Document 7.7)**.

2.9.6 Stockpiles must be appropriately marked out and clearly signed to ensure that they are easily identifiable for reinstatement.

2.9.7 Generally, topsoil stockpiles should not exceed 4 m in height and subsoil stockpiles should not exceed 5 m in height. However, if the soil to be stockpiled is dry (below the plastic limit) formation of higher stockpiles may be permissible, if required, as the soil is likely to remain dry in the core of the stockpile for the entire storage period. However, the appropriateness of higher stockpiles will need to be established on a location by location basis by the ALO or TSA.

2.9.8 As described Section 2.4, there are two principal methods for forming soil stockpiles, based on their soil moisture and consistency.

2.9.9 **Method 1** should be applied to soil that is in a dry and non-plastic state (see Section 2.4). The aim is to create a large core of dry soil, and to restrict the amount of water that can get into the stockpile during the storage period. Dry soil that is stored in this manner can remain so for a period of years and is reuseable within days of respreading.

2.9.10 **Method 2** should be applied if the construction programme or prevailing weather conditions result in soil having to be stockpiled when wet and/or

plastic in consistency. This method minimises the amount of compaction, while at the same time maximising the surface area of the stockpile to enable the soil to dry out further. It also allows the soil to be heaped up into a 'Method 1' type stockpile, once it has dried out.

2.9.11 Soil should be stored in an area of the site where it can be left undisturbed and will not interfere with site operations. Ground to be used for storing the topsoil should be cleared of vegetation and any waste arising from the development (e.g. building rubble and fill materials).

2.9.12 As stated in paragraph 2.8.3, topsoil can be stored on either topsoil (of the same type) or on subsoil. However, as subsoil should only be stored on subsoil, topsoil should first be stripped from any land to be used for subsoil storage.

Soil Stockpiling Method 1 (Dry non-plastic soils)

2.9.13 Stockpiles are formed by loose-tipping followed by shaping to form a level surface on top of the pile and uniform gradients down the sides. During forming, the top and sides are smoothed with the bottom of the excavator bucket along the stockpile surface so that they can shed water more easily. This ensures that entry of water into the stockpile is limited and that the stored soil remains dry; and helps prevent erosion and ponding.

2.9.14 The natural angle of repose of a soil, and hence the maximum gradient of the stockpile sides, depends upon its texture and moisture content. The maximum achievable slope angle is 40° however, shallower angles are often more appropriate. As stated in the CEMP (**Document 7.4**), with the exception of stockpiles with a lifetime of less than 3 months, all stockpiles will be seeded to reduce runoff, those in place for shorter durations will be covered to reduce the risk of silty runoff. As a result, a maximum slope of 25° (1 in 2) will be considered appropriate for seeded soil stockpiles.

Soil Stockpiling Method 2 (wet plastic soils)

2.9.15 Stockpiles are formed by loose-tipping in a line of heaps to form a 'windrow' up to a maximum height of 2 m. Additional windrows, as required, can be created, spaced sufficiently apart to allow tracked plant to gain access between them (see Image 10.1 (a – c)).

2.9.16 Once the soil has dried out and is non-plastic in consistency (typically after several weeks of dry and windy or warm weather), the windrows can be combined to form larger stockpiles, as descried in Method 1, using a tracked excavator. The surface of the stockpile is then regraded and compacted (see Image 10.1 (a – c)).

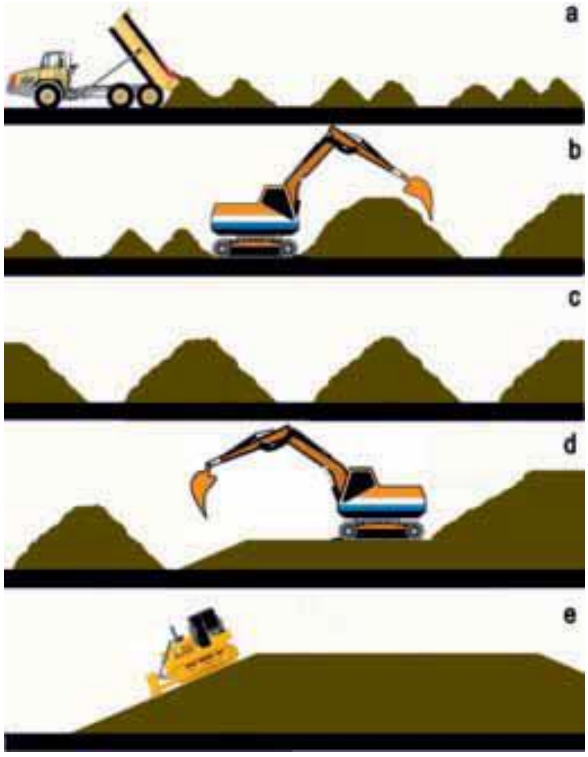

Image 10.1: Soil Stockpiling Method 2 (wet plastic soils)

2.9.17 The topsoil and subsoil stockpiles are typically formed using a back-acting excavator, often without the need for a separate transport vehicle.

2.9.18 If transport is required, the method described in the MAFF Guide, Sheet 2: Building Soil Storage Mounds with Excavators and Dump Trucks will be followed (Ref 10.2). A dump truck will be used to transfer soil between the stripping and storage areas. The dump truck will enter the storage area, reverse and back-tip the soil load, starting at the furthest end of the stockpile, and repeated to create the soil stockpile. This process avoids the wheels traversing onto stockpiled material, minimising soil compaction. A second back-acting excavator will be required with the boom reach allowing it to form a stock pile of up to 4 m (for soils in a non-plastic state) while standing on it.

2.9.19 The use of a front-loading machine to form the stockpile is possible if this is a contractor's preference. If this alternative is chosen, the tipped soil must not be tracked over or pushed with a bulldozer blade. The soil will be lifted by a front-loading machine and tipped into place to form the stockpile. The

top and side surfaces of the stockpile will be formed so as to shed rainwater (see above).

2.9.20 The locations and footprints of each stockpile will be accurately recorded on a plan of appropriate scale. Marker posts will be provided in locations which have been surveyed and recorded.

2.9.21 Furthermore, the approximate volume of each stockpile will be recorded, along with details of the type of soil stored. Particular reference will be made to ecologically important soils (section 2.9.5).

2.10 STOCKPILE MAINTENANCE

2.10.1 It is expected that the soil will be stored for a period of more than three months. Therefore, the stockpiles should be seeded with an appropriate low maintenance grass/clover mixture (for example EG22c Emorsgate Seed, or similar); although it is noted that, in specific areas identified by Chapter 9 Ecology and Nature Conservation (**Document 5.9**) and as described by CEMP measure AE15 (**Document 7.4**) seeding of stockpiles may be required to use native species local to the area and appropriate to the existing habitat. Seed mixes are defined in the BMS (**Document 7.7).**

2.10.2 Seeding of stockpiles is required to protect the soil against erosion, minimise soil nutrient loss, and maintain soil biological activity. Appropriate seeding willalso help prevent colonisation of the stockpile by weeds, including noxious / injurious weeds, that could spread seed onto adjacent land.

2.10.3 In the period when grass cover is establishing on the stockpiles, and where required during dry weather, the stockpiles will be sprayed with water to prevent wind erosion (generation of dust) and to ensure that the seeds establish.

2.10.4 The stockpile vegetation cover is to be managed (by spraying, mowing or stripping as appropriate and as defined in location-specific construction method statement, or similar), to prevent the spread of seeds from the stockpile onto adjacent land.

2.10.5 The use of herbicide is not permitted in specific habitats, such as semi-improved, marshy, neutral and acid grassland within the Order Limits of the Proposed Development, to reduce impacts on local biodiversity, as stated in Chapter 9 Ecology and Nature Conservation (**Document 5.9**).

2.10.6 The condition of the stockpiles will be regularly monitored. If rainwater gathers on the stockpile surface or in areas directly adjacent to them,

drainage pathways to soakaway areas away from the stockpile should be provided.

2.11 REINSTATEMENT

2.11.1 Most of the land disturbed as a consequence of the Proposed Development will be reinstated to its existing habitat type (like-for-like reinstatement); however, some areas will be restored to a different land use (for example landscaping areas within the proposed THH/CSEC sites). The existing habitat types, are shown in Figure 1 of Appendix 9.3, Phase 1 Habitat Report (**Document 5.9.2.3**) and the BMS (**Document 7.7**).

2.11.2 The main objective for the reinstatement of agricultural land is to restore the land to its original (pre-development) agricultural quality, as determined by ALC grade obtained during the pre-construction survey. This is primarily achieved by ensuring that the full soil profile is reinstated in the correct sequence of horizons, and in a state where good soil profile drainage and plant root development are achieved; and by ensuring that the reinstatement works cause minimum damage to soil structure.

2.11.3 Therefore, soil reinstatement methods have been designed to achieve soil profiles as close to the original (pre-construction) as possible, which is a pre-requisite for the maintenance of the original agricultural land quality/other prior land use.

General methods to be used during reinstatement

2.11.4 Soil reinstatement will be subject to the same constraints of weather (stop conditions) as soil stripping (see Section 2.4). With the application of soil stockpiling Methods 1 and 2, all stored soils will be in a dry condition. All methods must adhere to the general principles set out below.

Excavation of soil stockpiles

2.11.5 In most locations, direct excavation of the soil from the stockpiles using a long-reach back-acting excavator will be possible. Where larger stockpiles are created and there is a necessity for soils to be transported to the reinstatement area via dump truck excavation is to follow the methodology described by Defra (Ref 10.1). In this method, the dump trucks enter the storage area travelling on the base layer (where topsoil and subsoil stripped) and on the subsoil (where only topsoil stripped). If back-acting excavator is used it must stand on top of the stockpile to load the dump truck. The stockpile is dug to the base (the original subsoil) before moving progressively back along its axis.

Placement of excavated materials

2.11.6 Where reinstatement involves the replacement of excavated materials other than soils (i.e. material (overburden) from a depth greater than the base of the subsoil); the overburden must be replaced first. The overburden material may be overfilled by 10 to 15% to allow for settlement to the design profile.

2.11.7 Following the placement of overburden to form the base layer, where required, the surface should be graded to the required landform and any debris removed before soils are reinstated. Similarly, where required, the surface of the overburden should be loosened to an appropriate depth of not greater than 1.2 m.

Soil reinstatement

2.11.8 Soil reinstatement is the reverse of soil stripping with topsoil being replaced over subsoil. The specifications for reinstated soil profiles are to be determined on a location by location basis using the soil survey data as described in paragraph 2.1.3; and set out in location-specific construction method statements. Care must be taken to ensure that soil horizons are replaced to the correct thickness (with an allowance of up to 20% to allow for settlement).

2.11.9 In most locations, direct excavation and reinstatement of the soil from the stockpiles using a long-reach back-acting excavator will be possible. In this method, the subsoil will be replaced first, with the excavator travelling on the subsoil and gradually taking the topsoil from the stockpile, and depositing it on the subsoil. The deposition is to be carried out by loose tipping and a toothed digger bucket is to be used.

2.11.10 Prior to topsoil placement, subsoil decompaction will be required. The use of a LGP bulldozer fitted with winged subsoiler tines is recommended. For the decompaction to be effective, the moisture content of the soil must be below the lower plastic limit, so that the soil is dry enough to shatter and for fissures to be created.

2.11.11 Soil replacement will follow the methodology set out by Defra (Ref 10.1). In this method, the soil is replaced in strips above the base layer to recreate the original soil profile. The topsoil is replaced on the previously decompacted subsoil. The replacement is carried out in strips in a similar manner to the stripping operations. First, the initial strip width and axis is to be demarcated. The width of the strip is determined by excavator boom length less the stand-off to operate; typically, 5 to 8 m. A wide bladed bucket should be used to spread the soil (use of a toothed bucked must be avoided in this case).

2.11.12 The dump truck should reverse to the edge of the current strip and tip the lowest layer, without the wheels riding onto the strip. The dump truck must not drive away until all the soil is deposited within the strip without spillage over the basal layer. To achieve this, assistance from the excavator to 'dig away' some of the tipped soil may be required. The tipped soil should be spread to full thickness required, by the excavator utilising the digging, pushing and pulling action of the bucket. Each load must be spread before another is tipped. The process should be repeated along the strip until it is completely covered with the required depth of the soil layer. Should the spread soil comprise of large blocks (>0.3 m), they should be broken down by 'slicing' them with the excavator bucket.

Achieving the reinstatement standard

2.11.13 Where land is returned to agricultural use, the quality of the soil reinstatement will need to be verified by the ALO as described below.

2.11.14 The aftercare will commence after soil characteristics required to achieve the reinstatement standard have been achieved. For the land in agricultural use before construction this means that the land is brought as close as practically possible to the physical state it was before construction.

2.11.15 A soil survey should therefore be carried out to record the 'after' statement of physical characteristics of the reinstated soils (Defra, 2004 (Ref 10.8)). This will allow the post-construction/reinstatement condition of the soils and land to be judged against/compared with their pre-construction condition, as determined through the detailed pre-construction soil surveys, paragraph 2.2.3.

2.11.16 The ALO will then compare reinstatement details to the 'before' statement to verify that the land has been reinstated to the required standard. If the reinstated soil properties are found to differ from the 'before' characteristics to an extent that makes it impossible for the standard to be reached, remediation will need to be carried out. This approach will ensure that any problems are identified and rectified early after construction and before the aftercare period commences.

2.12 AFTERCARE

Responsibilities and content of the aftercare

2.12.1 Depending on the land-use, agricultural activities, site-specific conditions, and site-specific construction activities, the aftercare may include treatments such as: cultivation (e.g. subsoiling), installation of underdrainage, seeding, liming, and/or fertilising, as and when required.

2.12.2 The aftercare programme is to be discussed with the landowner, and (if applicable) tenant farmer as committed in CEMP measure R2 (Table 10.3).

Period of the aftercare

2.12.3 Due to the prevalent agricultural land quality and agricultural land use within the Order Limits, a flexible period of aftercare of minimum one-year is suggested (Defra, 2009 guidance (Ref 10.1) suggests aftercare between 1 and 5 years post construction), with the aftercare deemed complete when the reinstatement standard has been achieved. The period of aftercare will be determined during the preparation of the SMP. It will be responsibility of the ALO (or similar appointed person) to determine when the reinstatement standard has been met.

3 Biosecurity

3.1 INTRODUCTION

3.1.1 As set out in Section 10 of the CEMP (**Document 7.4**), during large-scale projects, there is the potential for disease, pathogens and harmful/non-native weed transfer between different areas of agricultural land (i.e. a biosecurity risk). The movement of soil resource is considered as a main cause of disease, pathogen and weed transfer, due to the transfer of soil from infected to uninfected areas. Therefore, the use of the best practice measures set out in section 2, will minimise soil loss and soil movement.

3.1.2 To avoid the spread of invasive non-native species (INNS), pests and pathogens during construction; and ensure legal compliance an INNSMS will be produced detailing specific control procedures as defined in CEMP measure BS11. Specific measures are defined for different INNS plant species in CEMP measures BS21, BS22, BS31, BS32, BS41, BS61 and BS62.

4 Soil Resource and Sensitivity

4.1 INTRODUCTION

4.1.1 The studies undertaken to inform the ES have not identified any soils with a high risk of erosion (by water or wind) within the Order Limits. However, although unlikely, it is possible that discrete areas of high erosion risk soils which were too small to have been recorded on the high-level published data, may be present. Should the presence of these soils be identified during the additional, pre-construction, soil survey work, development on these soils should be avoided if possible. However, where this is not possible, special consideration and careful planning of construction methods, for example, use of temporary working surfaces, sensitive storage, protection from drying out, in order to preserve their functions should be implemented in order to preserve their structure and function. If required, these measures will be included in the SMP.

4.1.2 A review of the available high-level soil data (Refs 10.5 and 10.6) and soil erodibility data derived from Knox *et al.,* 2015 (Ref 10.7) shows that the organic (peaty) soils of the Adventurers' 1 association comprise 0.4% of soils in the Order Limits. These soils are considered to be sensitive to damage.

4.1.3 The Adventurers' 1 association comprises deep peat soils of amorphous and semi-fibrous peat. The high-level data used to inform the ES indicate that pylon 4AP055 may be to be located within this association; however, this will be confirmed by detailed pre-construction soil survey.

4.1.4 Should the presence of peat soils be identified at pylon 4AP055 or other locations during the pre-construction soil survey work, a site specific peat management plan will be produced, it will contain bespoke mitigation measures such as, but not limited to, the following:

- use of 'floating roads' (for example geotechnical membrane overlain on surface with stone) placed on top of the existing surface without any peat removal;
- de-compression of the peat once the floating road is removed and re-seeding any bare peat, ideally with seed collected from the adjacent peat habitat;

- adoption of 'stop rules' based on guidance (Ref 10.9) and implemented based on data from on-site apparatus;
- consideration of direct piling methods, to remove requirement for peat removal;
- use of suitable plant to minimise damage to the vegetation and peat surface. Wide-tracked and lightweight vehicles are preferable, for example a LGP, long-reach 360° excavator, with operating weight below ten tonnes;
- no mixing of distinct peat horizons (acrotelm and catotelm). Acrotelm and catotelm peat will be stored separately; and peat will be stored separately from mineral soil;
- suitably prepared temporary storage areas in locations with low ecological value, where firmer, shallower peat or no peat is present, and with low gradient slopes (preferably of less than 2°), so long as the area of land is within the Order Limits and on the same landownership;
- stockpile height not to exceed 2 m, with side slopes not steeper than 1:4. The peat should be stored in large volumes to minimise exposure to wind and sun which will cause it to dry. Existing natural and man-made hollows should be utilised if available;
- application of measures to keep the peat wet throughout the temporary storage period, for example by using covers, or spraying with water, where practicable; and
- storage time should be as short as practicable.

4.1.5 Mitigation by design measures have been incorporated into the design of the Proposed Development to minimise or prevent potential impacts. For example, where there is an area of peat soil (Adventurers' 1) in Section C the proposed access track shown on Figure 4.1 Construction Plans (**Document 5.4.1.1**) has been routed around the field, and the permanent infrastructure works within this field have been reduced as far as practicable to limit the amount of ground disturbance. This commitment is included in the Schedule of Environmental Commitments (Commitment HAB039; **Document 7.4.2.1**).

4.1.6 Soils of the Wick 1 and Eardiston 1 soil associations are of moderate risk of water erosion, and comprise 8.5% of soils in the Order Limits. All other soils are considered to be of low or no risk of erosion from air or water.

4.1.7 If stockpiles of Wick 1 and Eardiston 1 soil associations are required, these will be formed and seeded as described in section 2.10. The stockpile will then be covered in geojute (or similar covering) to stabilise it until the vegetation cover becomes effective. Depending upon specific site and soil conditions, other standard mitigation measures for erosion sensitive soils will be expected to include, but not necessarily be limited to, the use of specialist surface run-off control systems and wind barriers.

5 Monitoring Schedule

5.1 INTRODUCTION

5.1.1 Table 10.6 summarises the needs for record keeping and monitoring during the construction phase.

Table 10.6 Soil Monitoring

	What to look for	Responsibility	Frequency
Soil stockpiles	Erosion rills, water ponding, loss of protective vegetation, invasive weeds.	Contractor	Once a month and after rainfall exceeding 10 mm in 24 h
Soil handling	Conformance with the SMP, record operations undertaken, weather and soil conditions, any problems and corrective actions undertaken.	Contractor	Daily during soil handling activities
	Conformance with the SMP, check daily record.	ALO	Varies, but at least once a week.
Verification of the reinstatement standard	Has the soil profile been reinstated, as much as practicable to do so, to a condition when last used for agriculture	ALO	Once, after reinstatement, re-inspected after remediation (if necessary)
Aftercare reports	Significant differences in crop performance, compaction and waterlogging between the reinstated and undisturbed land	TBC	Annually as required

5.1.2 Annual reports will be prepared during the aftercare period. A minimum of one report will be prepared as the proposed minimum aftercare period is one year. The aftercare report will contain results of appropriate soil testing, the technical specialist advisor will determine what tests are required and

carry out the testing and record the soil condition during the first half of the growing season (April–June). As a minimum the testing will comprise:

- visual assessment of plant cover and ground surface; and
- the hand excavation of soil profile pits to assess the soil structure at depth and penetration by plant roots, these may be predominantly focussed on areas where the visual assessment indicates that there may be an issue with the quality of the reinstatement. Therefore, the density of soil profile pits will vary. Non-conformance reporting, corrective actions, and incident responses are to be undertaken by the ALO according to the procedures described in the CEMP (**Document 7.4**).

6 References

Ref 10.1: Defra, (2009); 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites'. Accessed on 14/05/2018. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/707134/pb13298-code-of-practice-090910.pdf

Ref 10.2: MAFF (2000). Good Practice Guide for Handling Soils. Accessed on 30/05/2017. Available at http://webarchive.nationalarchives.gov.uk/20090306103114/http:/www.defra.gov.uk/farm/environment/land-use/soilguid/index.htm.

Ref 10.3: Construction (Design and Management) Regulations (CDM), 2015. Accessed on 30/05/2017. Available at http://www.legislation.gov.uk/uksi/2015/51/contents/made.

Ref 10.4: Health and Safety at Work Act, 1974. Accessed on 31/05/2017. Available at http://www.legislation.gov.uk/ukpga/1974/37/contents.

Ref 10.5: National Soil Resources Institute, Cranfield University 1:250,000 scale National Soil Map, digital dataset (Landis NATMAP dataset).

Ref 10.6: Soil Survey of England and Wales (1984) Soils and their Use in Wales and accompanying 1:250,000 map Sheet 2.

Ref 10.7: Knox *et al.* (2015). 'Research to develop the evidence base on soil erosion and water use in agriculture: Final Technical Report. pp147'.

Ref 10.8: Defra (2004), 'Guidance for Successful Reclamation of Mineral and Waste Sites'. Accessed on 30/05/2017. Available at http://webarchive.nationalarchives.gov.uk/20090318074725/http://www.defra.gov.uk/farm/environment/land-use/reclamation/guidance-full.pdf