HyNet North West

OUTLINE CONSTRUCTION ENVIRONMENT MANAGEMENT PLAN (OCEMP) (TRACKED)

Appendix 1 Outline Soil Management Plan

HyNet Carbon Dioxide Pipeline DCO

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulations 5(2)(a)

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1. INTRODUCTION

1.1. PROJECT BACKGROUND

1.1.1. This Outline Soil Management Plan (SMP) supports the assessment contained in **Chapter 11 – Land and Soil (Volume II)** and is an appendix to the **Outline Construction Environmental Management Plan (Document reference: D.6.5.4**).

1.1.2. The Applicant intends to build and operate a new underground carbon dioxide (CO_2) pipeline from Cheshire, England to Flintshire, Wales with necessary Above Ground Installations (AGIs) and Block Valve Stations (BVSs), hereafter referred to as the 'DCO Proposed Development'. Further details of each element of the DCO Proposed Development are set out in **Chapter 3 – Description of the DCO Proposed Development (Volume II).**

1.1.3. The DCO Proposed Development will form part of HyNet North West ('the Project'), which is a hydrogen supply and Carbon Capture and Storage ('CCS') project. The goal of the Project is to reduce CO_2 emissions from industry, homes and transport and support economic growth in the North West of England and North Wales. The wider Project is based on the production of low carbon hydrogen from natural gas. It includes the development of a new hydrogen production plant, hydrogen distribution pipelines, hydrogen storage and the creation of CCS infrastructure. CCS prevents CO_2 entering the atmosphere by capturing it, compressing it and transporting it for safe, permanent storage.

1.1.4. Further details of each element of the DCO Proposed Development are set out in **Chapter 3 – Description of the DCO Proposed Development (Volume II).**

1.2. SOIL SENSITIVITY

1.2.1. Reading Agricultural Consultants (RAC) conducted a detailed Agricultural Land Classification (ALC) survey, between March and May 2022 **(Ref. 9)**. This supplemented existing ALC survey data produced by ADAS **(Ref. 1)**. ALC surveys determine the quality of agricultural land on a 5-point scale, with Grade 1 being excellent quality and grade 5 being very poor-quality **(Ref. 6)**. The grading is based on climatic, site and soil properties

1.2.2. The National Planning and Policy Framework (NPFF) **(Ref. 7)** and Planning Policy Wales Edition 11 (PPW) **(Ref. 8)** defines land classified as Grades 1, 2 and 3a as the Best and Most Versatile (BMV) agricultural land. PPW states that BMV land "*should be conserved as a finite resource for the future*".

1.2.3. Non-BMV soil should also be treated as a finite resource as "*any loss or degradation of this resource reduces the national stock and the capacity to support ecosystem services in all cases*" **(Ref. 4)**.

1.2.4. IEMA (2022) **(Ref. 4)** guidance states that "*in the first instance, developers should be seeking to avoid negative effects on land and soil… Adapting the generic mitigation hierarchy to soils: avoid > minimise > restore on site > reuse off-site*".

1.2.5. Without implementing suitable soil handling practices, soils are prone to degradation which leads to numerous environmental impacts both on and off-site, such as:

- Soil erosion (loss of a resource);
- Carbon release (disturbance of organic rich soils);
- Loss of soil organic matter leading to a decline in soil and poor soil structure;
- Soil compaction leading to loss of soil structure and waterlogging, restricting aeration and rooting potential;
- Sedimentation of water features, reducing biological productivity and habitat quality;
- Loss of soil biological activity; and
- Visual impact of slope failure or soil erosion.

~~1.3. SCOPE~~

1.3. ~~TO~~ REPORT PURPOSE AND LIMITATIONS

1.3.1. This Outline SMP has been ~~commissioned~~produced to ensure that effects on soil resources are minimised and adequate provisions for all land being returned to agricultural use are made~~, this~~. The Outline SMP ~~has been commissioned to provide~~provides ~~outline~~ guidance on appropriate soil management practices (for the categories explained below) and requirements for the development of the ~~Final~~ Detailed SMP (that will be completed by the appointed Construction Contractor(s)). This Outline SMP:

- Describes soil handling methods (stripping, stockpiling and reinstatement) ~~specifically for the soil types identified in the **ALC and Soil Resources Report** (**Appendix 11-4, Volume III**);~~
- Describes required monitoring procedures ~~during stockpiling~~for soil management during, and after, construction;
- Describes roles and responsibilities suitable for monitoring soil during the construction phase; and
- Describes suitable methods for restoration of land to its former use.

2. METHODOLOGY

2.1. SOURCES OF INFORMATION

2.1.1. Reading Agricultural Consultants (RAC) conducted detailed ALC surveys, between March and May 2022, that covered the Newbuild Infrastructure Boundary **(Ref. 9 & 10)**. The associated ALC survey reports can be found within **Appendix 11.4 – Agricultural Land Classification and Soil Resources (Newbuild Carbon Dioxide Pipeline)** **Report [APP-133]**and **Appendix 11.5 - Agricultural Land Classification and Soil Resources (Block Valve Stations)** **Report (Volume III) [APP-134]**.

2.1.2. This Outline SMP is informed by:

- Reading Agricultural Consultants (RAC) (2022). HyNet Pipeline Agricultural Land Classification and Soil Resources **(Ref. 9)**.
- Reading Agricultural Consultants (RAC) (2022). HyNet Pipeline Agricultural Land Classification and Soil Resources - Talacre and Block Valves **(Ref.10)**.

2.2. LIMITATIONS

2.2.1. This Outline SMP has been developed using the available soil data from within the ALC reports. It should be noted that this guidanceThis Outline SMP does not assess potential soil resources in non-agricultural land areas identified by the ALC survey **(Ref. 9)**. The appointed Construction Contractor(s) willshould (commission a soil resource survey of these areas, if soil resources are identified. The findings of this canwill be implemented into the FinalDetailed SMP to ensure appropriate management of non-agricultural soils.

2.2.2. Peat areas within the DCO Proposed Development are not covered in this report. These are assessed in the Outline Peat Management Plan (**Document Reference: D.6.5.4.2**).

2.2.1.2.2.3. This Outline SMP does not consider human health and controlled water risk assessment associated with potentially contaminated soils. This is discussed in **Chapter 11 – Land and Soils** **[(Volume II APP-063])** of the Environmental Statement and subsequent addenda (**ES Addendum 2023 Change Request 1 [CR1-124]** and **Change Request 2 [CR2-017]**).

2.2.2.2.2.4. During the ALC survey some areas were not surveyed due to access issues. In these instances, the reasonable worst-case scenario has been applied, and these areas have been assumed to be BMV agricultural land. This ensures that necessary provision for soil handling and reinstatement are considered. However, these areas will be surveyed prior to the completion of the FinalDetailed SMP by the appointed Construction Contractor(s) to ensure that the soils present are managed and reinstated appropriately.

~~2.2.3.~~2.2.5. The soil volume excavation estimations are assumed under a worst-case scenario using the Preliminary Design information that is currently available for the pipeline route, AGIs, BVSs, open-trench and trenchless construction methods. This is to ensure that a ~~suitably robust~~suitable estimation of soil and associated requirements for management have been considered. The reasonable worst-case scenario assumptions used are discussed below.

2.2.6. The soil excavation volumes in this Outline SMP do not distinguish between upper and lower subsoil, and basal materials. These distinctions will be made in the detailed Soil Resource Plan (SRP) that will be included in the ~~Final~~Detailed SMP.

~~2.2.4.~~2.2.7. Temporary construction features that require topsoil stripping, have not been considered in the calculations (including temporary access roads, localised and trenchless compounds). These will need to be factored in to soil excavation estimates by the Construction Contractor(s) in the detailed design stage – with consideration also given to the use of proprietary systems such as ‘trackway’ to reduce soil excavation requirements and protect soils in relation to vehicle movements, where engineering and environmental constraints permit.

3. RESULTS

3.1. OVERVIEW

3.1.1. The ALC report for the DCO Proposed Development states that 51% of agricultural land within the Newbuild Infrastructure Boundary is Best and Most Versatile (BMV) **(Ref.9)**.

3.2. SOIL TEXTURES

3.2.1. All soil textures for the sampling points in the ALC survey were determined through hand texturing during the ALC survey and were confirmed by laboratory analysis where necessary. Soil texture results are displayed in **Annex B** and the laboratory data can be found in the ALC report **(Ref. 9)**.

3.2.1.3.2.2. The soil textures determined, and agroclimatic characteristics (see **Annex B**), are used to assign a resilience category for each soil profile present, asthat was assessed during the ALC survey. The resilience categories are described in **Table 3.1.**

3.2.3. The resilience categories assigned in **Annex B** are limited to the sampling locations assessed during the ALC survey and cannot be generalised across larger areas of the site. To determine the resilience categories, across larger areas, the spatial extent of soil textures, identified by the ALC survey, shouldwill be assessed during soil stripping. a qualified Soil Scientist should be present during soil stripping. The Soil Scientist should assess the spatial extent of soil textures identified by the ALC survey and assign soil resilience in the field (using the approach in **Table 3.1**).

Table 3.1 - Soil Resilience Characteristics*

Topsoil and Subsoil Resilience	Soil Texture, Field Capacity Days and Wetness Class
Low resilience	Soils with high clay and silt fractions (clays, silty clays, sandy clays, heavy silty clay loams and heavy clay loams) and organo-mineral and peaty soils where the Field Capacity Days (FCD) are 150 or greater. Medium-textured soils (silt loams, medium silty clay loams, medium clay loams and sandy clay loams) where the FCDs are 225 or greater. All soils in wetness class (WCV or WCVI).

Topsoil and Subsoil Resilience	Soil Texture, Field Capacity Days and Wetness Class
Medium resilience	Clays, silty clays, sandy clays, heavy silty clay loams, heavy clay loams, silty loams and organo-mineral and peaty soils where the FCDs are fewer than 150. Medium-textured soils (silt loams, medium silty clay loams, medium clay loams and sandy clay loams) where FCDs are fewer than 225. Sands, loamy sands, sandy loams and sandy silt loams where the FCDs are 225 or greater or are in wetness classes WCIII and WCIV.
High resilience	Soils with a high sand fraction (sands, loamy sands, sandy loams and sandy silt loams) where the FCDs are fewer than 225 and are in wetness classes WCI to WCII.

*Taken from IEMA (2022). A New Perspective on Land and Soil in Environmental Impact Assessment **(Ref. 4)**.

3.3. SOIL EXCAVATION VOLUME ESTIMATIONS

DESIGN FEATURES

3.3.1. Newbuild Carbon Dioxide Pipeline construction features, that will involve soil excavation, were identified. The dimensions of these features were informed by **Chapter 3 – Description of the DCO Proposed Development (Volume II)** in the Environmental Statement. Where design information is not currently available these are assumed under a reasonable worst-case scenario, to ensure that a suitably robust estimation of soil and associated requirements for soil management have been considered.

3.3.2. Dimensions and/or assumptions for the different construction features are as follows:

- Open trench construction
  - Approximate footprint area along the entire indicative pipeline route used for the EIA: 108,000m^2; 36,000m x 3m. These are based on assumptions of the final pipeline alignment length, and of the average trench width (considering that usually trenches are trapezoidal in cross-section) and does not consider surface features (e.g., rivers or roads).
  - The depth of the trench will be variable but is anticipated to be within the range of 2.5m – 6.0m, with an assumed typical depth of 3m for the

purposes of this assessment (**Chapter 3 – Description of the DCO Proposed Development (Volume II)**).
    - Topsoil depth was assumed to be 0.3m.
- Working width
    - Approximate footprint area along the entire indicative pipeline route used for the EIA: 1,044,000m²; 36,000m x 29m (32m working width minus the 3m open trench construction width above).
    - Topsoil will be stripped across the full working width.
    - Topsoil depth was assumed to be 0.3m.
- Trenchless crossing pits
    - A total of 43 trenchless crossings over the length of the Newbuild Carbon Dioxide Pipeline (**Appendix 3.1 – Table of Trenchless Crossings, Volume III**) are proposed. An estimated 86 trenchless crossing pits will be required.
    - Assumed reasonable worst-case scenario of the most intrusive trenchless crossing method that could be used (Auger Boring method). This is assumed to have an entrance pit footprint area of 32m² (8m × 4m), an exit pit footprint area of 16m² (4m × 4m) and a depth of 6m (**Chapter 3 – Description of the DCO Proposed Development, Volume II**).
    - Topsoil depth was assumed to be 0.3m.
- AGIs and BVSs
    - There are four AGIs and six BVSs within the Proposed Development.
    - Anticipated topsoil and subsoil removal for each, and their associated access roads, has been considered at this design stage and is presented in **Table 3.6**.
    - Topsoil depth of 0.3cm is assumed.
    - Subsoil excavation is case by case, depending on cut and fill amounts.
    - Soil excavation volumes for Stanlow AGI were not calculated as this is a brownfield site.
- Centralised Compounds
    - This Outline SMP has assessed locations for 8 Centralised Compounds within the DCO Proposed Development. Although 8 centralised compounds are being assessed, only 7 are expected to be implemented to facilitate construction of the DCO Proposed Development (**Chapter 3 – Description of the DCO Proposed Development, Volume II**).
    - Indicative footprint areas for each Centralised Compound are given in **Table 3.5**.
    - Topsoil will be stripped across the whole area. This is a reasonable worst-case scenario, as it is unlikely that the entire area of all

compounds will be stripped. (**Chapter 3 – Description of the DCO Proposed Development (Volume II)**).

- Topsoil and subsoil depths were informed by the average of ALC soil depth data where available. **Table 3.5** shows the soil depths used for the volume calculations.
- There are existing buildings at Wood Farm Compound, therefore, the footprint area reported is the area without buildings, that will need to be stripped **(Table 3-5)**.

3.4. APPROXIMATE EXCAVATION VOLUME ESTIMATES

3.4.1. **Table 3.2** indicates that 32,400m³ of topsoil will be excavated for open trench construction (when rounded to the nearest 100m³). The amount of subsoil excavation will depend on the depth of the trench, anticipated to be within the range of 2.5m – 6.0m, calculated as a range between 237,600m³ - 615,600m³ (respectively). Subsoil excavation volumes are estimated to be 291,600m³ if the typical open trench depth of 3.0m is adhered to.

3.4.2. Approximately 313,200m³ of topsoil will be temporarily stripped for the working width **(Table 3.3)**. This topsoil will be reinstated.

3.4.3. An estimated 600m³ of topsoil and 11,800m³ of subsoil will be excavated for trenchless pit construction **(Table 3.4).**

3.4.4. The volume estimates for open trench and trenchless construction include volumes that are also discussed specifically within the Outline Peat Management Plan (Document Reference Number: D.6.5.4.2).

3.4.5. Material from trench excavations will be returned to the trench via backfilling. Any surplus material (that is chemically/physically suitable) shall be beneficially re-used for re-profiling within the working width before topsoil is reinstated on a field-by-field basis.

3.4.6. IfWhere surplus soil materials are to be used for re-profiling, impacts on the soil properties (including soil horizon depth and water holding capacity) and ALC grade, mustwill be considered. In following pipeline installation best practices and the measures outlined in this Outline SMP, Finalsoil re-use will not result in soil degradation or ALC downgrading.

3.4.6.3.4.7. Centralised Compounds are anticipated to require approximately 113,800m³ of topsoil to be stripped **(Table 3.5)**. Topsoil will be reinstated at compounds.

3.4.7.3.4.8. Approximately 10,762m³ of topsoil and 4,388m³ of subsoil will be excavated for AGI and BVS construction **(Table 3.6)**. Excess subsoil and topsoil will be re-used on site where suitable (e.g., for bank or drainage ditch backfilling). The FinalDetailed SMP will detail how bank or drainage ditch backfilling will be undertaken and ensure that this is an appropriate re-use method for the surplus soil material.

~~3.4.8.~~3.4.9. If there is a requirement for materials to be disposed of off-site, disposal will be undertaken in accordance with waste management regulations (England and Wales). Material will be taken to an offsite recycling facility in accordance with an agreed Materials Management Plan (MMP) produced by the Construction Contractor(s).

Table 3.2 - Estimated Soil Excavation for Open Trench Construction

Design Feature	Number of Features	Area (m^2)	Depth (m)		Amount of soil stripped (m^3)	
			Topsoil	Subsoil Upper and lower layers and basal material (if present at given depths)	Topsoil	Subsoil Upper and lower layers and basal material (if present at given depths)
Open Trench Construction						
2.5m trench depth	N/A	108,000	0.3	2.2	32,400	237,600
3.0m trench depth	N/A	108,000	0.3	2.7	32,400	291,600
6.0m trench depth	N/A	108,000	0.3	5.7	32,400	615,600
~~**3.0m trench depth**~~	~~N/A~~	~~108,000~~	~~0.3~~	~~2.7~~	~~32,400~~	~~291,600~~

*** Excavation volumes here do not distinguish between upper and lower subsoil layers and basal material. Volumes for each of these will be calculated separately in the detailed SRP that will be produced for the ~~Final~~Detailed SMP.**

Table 3.3 – Estimated Topsoil Stripping for Working Width

Approximate Working Width Area (m^2)	Topsoil depth (m)	Volume of topsoil stripped (m^3)

1,044,000m	0.3	313,200

Table 3.4 - Estimated Soil Excavation for Trenchless Crossings Pits

Design Feature	Number of Features	Area (m^2)	Depth (m)		Amount of soil stripped (m^3)	
			Topsoil	Subsoil Upper and lower layers and basal material (if present at given depths)	Topsoil	Subsoil Upper and lower layers and basal material (if present at given depths)
Trenchless Crossing Pits						
Entrance Pit	43	32	0.3	5.7	413	7,843
Exit Pit	43	16	0.3	5.7	206	3,921
				Total	**619**	**11,764**

*** Excavation volumes here do not distinguish between upper and lower subsoil layers and basal material. Volumes for each of these will be calculated separately in the detailed SRP that will be produced for the ~~Final~~Detailed SMP.**

Table 3.5 - Estimated Soil Excavation for Centralised Compounds

Compound name	Area (m^2)	Topsoil depth (m)	Volume of topsoil stripped (m^3)
Stanlow	66,000	0.32	21,120
Picton Lane	32,000	0.29	9,280
Chorlton Lane	41,000	0.35	14,350
Sealand Road	48,000	0.33	15,840
Wood Farm	55,200	0.30	16,560
River Dee	43,000	0.35	15,050
Shotton Lane	37,000	0.30	11,100
Northop Hall	35,000	0.30	10,500
		Total	**113,800**

Table 3.6 - Anticipated Soil Excavation for AGIs and BVSs

Name	Amount of soil stripped (m^3)	
	Topsoil	Subsoil Upper and lower layers and basal material (if present at given depths)
Ince AGI	1,660	0
Northop Hall AGI	986	567
Flint AGI	2,850	75
Rock Bank BVS	700	323
Mollington BVS	691	107
Aston Hill BVS	1,025	336
Cornist Lane BVS	1,090	2,350
Pentre-Halkyn BVS	770	450
Babell BVS	990	180
Total	**10,762**	**4,388**

*** Excavation volumes here do not distinguish between upper and lower subsoil layers and basal material. Volumes for each of these will be calculated separately in the detailed SRP that will be produced for the ~~Fina~~Detailed~~l~~ SMP.**

4. SOIL MANAGEMENT DURING CONSTRUCTION

4.1. MAIN PRINCIPLES

4.1.1. All soil handling and storage procedures should conform to the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites **(Ref. 3)**. which is referenced in various sections below. Other guidance that is useful for sustainable soil handling is the Good Practice Guide for Handling Soils in Mineral Workings **(Ref. 5)** and A New Perspective on Land and Soil in Environmental Impact Assessment **(Ref. 4)**.

4.1.2. The FinalDetailed SMP, that will be produced by the Construction Contractor(s), will include a detailed SRP. This will cover all soil resources for each stagepart of the DCO Proposed Development and will be in line with the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites **(Ref. 3)**. The SRP will utilise the ALC data to detail soil resources present; provide plans of the soil handling units; soil volumes; location of stockpiles; and restoration criteria.

4.1.2.4.1.3. The main threats to soils during construction are trafficking by vehicles/plant, and incorrect handling. These can both cause damage to soil structure through compaction and smearing (deformation). Deformation effects soil functions and the suitability for reuse within the DCO Proposed Development which can increase costs of reinstatement. The risk of deformation increases with increasing field capacity days (FCD) and average annual rainfall (AAR), along with lighter soil textures.

4.1.3.4.1.4. The following good practice measures should be followed to minimise the risk of damage to soil structure:

- A suitably qualified soil scientist shouldwill be appointed by the Construction Contractor(s) to overseemonitor all soil managementhandling activities, and good practice measures, as stipulated in this Outline SMP;
- All individual soil horizons shouldmustwill be stripped, stored, and reinstated separately. This includes topsoil, upper and lower subsoil layers, and basal material (if present at the stripping depths). These will be identified for the detailed SRP in the Final Detailed SMP, and individually managed;
- No trafficking of vehicles/plant or materials storage to occur on unprotected topsoil or reinstated soil;
- Consideration of use of 'trackway' or similar low-ground pressure systems at temporary works zones for vehicles, to reduce excavation and protect soils;
- Only direct movement of soil should occur between the areas being stripped/reinstated to/from designated stockpiles (minimising handling and/or ad hoc storage);

- No soil handling to be carried out when the soil moisture content is above the lower plastic limit.
- No mixing of topsoil with subsoil, or of soil with other materials (unless planned and part of a soil ameliorating strategy);
- Store soil only in designated soil storage areas;
- Stockpiles should not be compacted, but instead gently consolidated;
- Plant and machinery should only work when ground/soil surface conditions enable their maximum operating efficiency and be maintained in a safe and efficient working condition;
- Detailed daily records to be maintained, detailing operations undertaken and Site and soil conditions; and
- Ground should be suitably prepared prior to the reinstatement of soil and an appropriate aftercare plan in place.

4.1.4.4.1.5. For each stockpile a plan must be kept and maintained detailing:

- Material type (topsoil or, upper subsoil), lower subsoil) as informed by **Annex B;**
- Date/ time when soil was stockpiled and weather conditions;
- Volume of material;
- Stockpile location; and
- Source location of material.

4.1.5.4.1.6. The Construction Contractor(s) will be responsible for ensuring that daily records of site and soil conditions are kept, and that a detailed stockpile plan is created and maintained.

4.2. SOIL MOISTURE CONDITIONS FOR HANDLING

4.2.1. Handling soils at appropriate moisture levels avoids damage to soil structure (compaction and smearing). Due to the low resilience of the soils within the Newbuild Infrastructure Boundary, adhering to the moisture conditions for handling is extremely important.

4.2.2. Following the Institute of Quarrying guidance **(Ref. 5)**, the DCO Proposed Development is based in climatic zone 1. This means that the proposed handling times are between Mid-April and Early-October, when the climatic zone wetness estimates, clay proportion and depth of soil horizon are considered.

4.2.3. Removal of excess vegetation, soil stripping, reinstatement and post-reinstatement cultivation should not commence if the moisture of the soil (either in the field or in the stockpiles) is above its lower plastic limit. The plastic limit can be determined using the standardsmethodology set out in BS 1377-2:

1990Supplementary Note 4 '*Soil Wetness*' in the Institute of Quarrying guidance **(Ref.11 5)**.

4.2.4. Works can be carried out during occasional showers, however, must cease during prolonged or intense rainfall that increases the soil moisture to above the lower plastic limit. If the works are interrupted by a rainfall event, soil stripping should be suspended; and where the soil profile has already been disturbed, the works should be completed to the base level in that location. Before recommencing work, soil moisture content should be retested.

4.2.5. The Construction Contractor(s) should appoint a soil scientist who is suitably experienced and competent in carrying out such soil moisture tests.

4.3. PREPARATORY WORKS

4.3.1. Before any work on site involving vehicles commences the Construction Contractor(s) will:

- Ensure to mark, and signpost the following areas within the Newbuild Infrastructure Boundary including:
  - The undisturbed areas where no construction activities will take place. Here soil will not be stripped or trafficked for purposes other than planting, cultivation, and vegetation maintenance;
  - Tree protection zones;
  - Areas from which soils will be stripped;
  - Locations of topsoil and subsoil stockpiles; and
  - Haul routes.
- Remove scrub vegetation (following any seasonal ecological constraints and mitigation requirements) in the areas requiring stripping; and
- Remove other vegetation present, so that it is not incorporated into the soil strip. If applicable, cut the grass/crop to ground level.

4.4. STRIPPING

4.4.1. The stripping method shouldwill follow the method within **Ref. 3** that also includes illustrations of best practice guidance. This method is summarised below.

4.4.2. Subsoils willshould only be stripped if they are being re-used or are of low resilience to reduce compaction. Areas which are going to be used for subsoil storage should have the topsoil stripped to avoid mixing. Subsoils of high to medium resilience do not need stripping underneath haul routes, if they are of low resilience it is advised to strip to a more resilient layer and ensure proper decompaction is carried out following the construction stage.

4.4.3. Careful management and consideration of alternative methodologies (e.g. ‘trackway’) may mean subsoil does not need to be stripped if care is taken. Topsoil must be stripped before any subsoil destined for reuse is stripped to reduce the risk of mixing the horizons.

4.4.4. Where feasible, vehicles will be tracked to reduce compaction and stripping should be carried out in the driest conditions possible.

4.4.5. Key points to minimise soil compaction, and maximise readiness for re-use include:

- Integrating all soil stripping, moving, storage and reuse/reinstatement operations into the enabling works programme;
- Ensuring dump trucks only operate on the “basal”/non-soil layer, the wheels must not travel on the soil layer;
- Ensuring the excavator only operates on topsoil layer;
- Plant and machinery only working when ground conditions allow maximum efficiency;
- The moisture content of the soil must be below the lower plastic limit. If it cannot be avoided, provision needs to be made for remediation of soil ~~texture~~structure prior or following reinstatement;
- The operation must cease during periods of rainfall and only recommence if the forecast predicts no further rainfall for a day and soil moisture conditions are suitable;
- Ensuring the lower soil layers must not be left exposed to rainfall, this is achieved by always stripping to the basal layer before rainfall occurs and/or before stripping is suspended;
- Protecting the soil and the basal layer from ponding of water by diverting water inflow away from it;
- Not working when there is standing water on the soil surface or the basal layer;
- Not mixing topsoil with subsoil and soil with other construction materials; and
- Storing topsoil on topsoil and subsoil on subsoil or on the basal layer

4.4.6. This best practice will~~should~~ be adhered to as far as reasonably practicable.

TOPSOIL STRIPPING METHOD

4.4.7. Prior to commencement, the width of each strip will~~should~~ be determined by looking at the length of the excavator less the stand-off to operate. Using the reach of the excavator to its full potential before moving it, reduces the number of areas subject to the weight of the standing plant.

4.4.8. Following this, remove surface vegetation by blading off, by scarification and raking (not less than two weeks before stripping commences to reduce the likelihood of anaerobic conditions forming during storage). If the above method is not viable, the careful application of a suitable non-residual herbicide may be necessary.

4.4.9. The transport vehicle willshould run on the basal layer under subsoil if subsoil is also to be stripped. If only topsoil is to be stripped, the vehicle would run on the subsoil layer.

4.4.10. Stripping willshould be undertaken by thean excavator standing on the surface of the topsoil, digging the topsoil to its maximum depth (topsoil depths shown in Annex B) and loading into site or off-site transport vehicles.

4.4.11. The earthmoving plant used willshould be appropriate to the volume of soil to be stripped, site size and hauling distances. This will be determined by the Construction Contractor(s) for the Final Detailed SMP.

SUBSOIL STRIPPING METHOD

4.4.11.4.4.12. For each soil unit the soil layers above the base/formation layer willshould be removed in sequential strips that can be up to 6m wide (the reach of a 360° excavator). Using an excavator bucket with teeth is preferable to achieve desired outcome.

4.4.12.4.4.13. Where there is a cover of topsoil, that layer is removed first before stripping subsoil to the specified depth.

4.4.13.4.4.14. The soil transport vehicle willshould run on the layer beneath the required subsoil stripping depth.

4.4.15. The earthmoving plant used willshould be appropriate to the volume of soil to be stripped, site size and hauling distances. This will be determined by the Construction Contractor(s) for the FinalDetailed SMP.

4.5. SOIL STORAGE

4.5.1. Resilience has been assigned to each soil horizon to inform the height at which soil (**Annex B**) willshould be stockpiled to. This area has a relatively average AAR (678mm to 792mm) and FCD (152 to 188) which influences the handling resilience of the soil, **Annex A** shows the agroclimatic data by ALC sample point. Stockpile height should not exceed 2m as far as reasonably practicable.

4.5.2. Soil stockpiles willshould be split into different soil types, including topsoil, upper subsoil, lower subsoil, and basal material.

4.5.2.4.5.3. After being stripped, soil units willshould be stored in stockpiles close to their source and stockpiles should be in areas where they will not be disturbed during construction activities.

4.5.3.4.5.4. Soil stripping, storage and reinstatement must be integrated into the enabling works programme by the Construction Contractor(s).

4.6. STOCKPILE LOCATIONS

4.6.1. Stockpiles willshould be located on medium or high resilience soils away from ditches or watercourses to reduce the impact on controlled waters. This willshould include temporary storage of materials at a minimum distance of 10m from any watercourses and 50m from any watercourse identified on Ordnance Survey 50,000 scale mapping **(Ref. 2)**.

4.6.2. Stockpiles willshould be located away from trees, hedge lines and existing/future excavations. This avoids repeated handling/transfer of soil, reducing potential for degradation of the soil structure.

4.6.3. Each source area willshould have its own stockpile location, with topsoils and subsoils stockpiled separately.

4.6.4. Stockpile locations within will be determined by the Construction Contractor(s) when the design has been finalised. The locations will be detailed in the FinalDetailed SMP.

4.7. FORMING THE STOCKPILES

4.7.1. Dimensions of the stockpiles may be adjusted but the angle of repose shall not exceed 1 in 2 (25^{o}) even if seeded and regularly maintained.

4.7.2. Each stockpile must be clearly marked and labelled with the source area and, material type and thesevolume. These labels willshould be kept up to date.

4.7.3. Soil stockpiles should also be clearly mapped.

4.7.3.4.7.4. The dry and wet stockpiling methods from **Ref. 3** are summarised below:

DRY SOIL STOCKPILING METHOD

- Loose tip heaps of soil from a dump truck starting at the furthest point in the storage area, working towards the access point;
- A tracked excavator or dozer then levels the heaps and firms the surface to enable a second layer to be added;
- Repeat until the stockpile has reached the desired height; and

- With a tracked excavator or dozer, compact and re-grade the sides and top of the stockpile to a smooth gradient to reduce infiltration and the likelihood of ponding.

WET SOIL STOCKPILING METHOD

- Tip soil into a line of heaps to form a "windrow", start at the furthest point, finish at the access point;
- Space windrows sufficiently apart so a tracked dozer or excavator can move between them to heap the soil up to 2m maximum;
- No machinery should traverse the windrow to avoid compaction and subsequent structural damage to the soil;
- Once the soil has reached a non-plastic consistency, which often takes many weeks, combine the windrows to form larger stockpiles using a tracked excavator; and
- Regrade and compact the sides and top of the stockpile using a tracked excavator or dozer, to prevent ponding and infiltration.

4.8. MAINTENANCE OF STOCKPILES DURING STORAGE

4.8.1. Seeding is advised if soils are to be stockpiled for over six months or over winter. In these events stockpiles willshould be seeded with a suitable grass mix to protect against soil erosion, minimise nutrient loss and maintain its biological activity. The grass willshould be cut two to three times a year and removed completely before reinstatement of soil.

5. SOIL REINSTATEMENT

5.1. GENERAL METHODS TO BE USED WITHIN RESTORATION

5.1.1. All methods should align with the guidance on handling and soil moisture content that have been discussed in this Outline SMP.

5.1.2. Any decompaction or remediation activities willshould be undertaken when the soils are in a suitably dry condition. Soil moisture should be tested using the method outlined in section 4.2.

5.1.2.5.1.3. Soil horizons should be reinstated sequentially in the order they were removed – basal material, lower subsoil horizons, to upper subsoil horizons, to topsoil. This will be ensured by following best practice for stockpiling which includes clear labelling of stockpiles and soil textures, avoiding horizons being mixed.

5.2. EXCAVATION OF SOIL STOCKPILES

5.2.1. The method to be followed for the excavation of soil stockpiles is taken from **Ref. 3** and explained below.

5.2.2. Dump trucks willshould enter on the basal layer (if topsoil and subsoil are stripped) or subsoil (if topsoil only stripped). If a back-acting excavator is used, it must stand on top of the stockpile to load the dump truck. The stockpile willshould be dug to the base before moving progressively back along its axis.

5.2.3. If a front-loading machine is used, any exposed edges or surface of the stockpile willshould be shaped to reduce the pooling of water at the onset of rain and end of each day.

5.3. PREPARATION OF THE BASE LAYER

5.3.1. Areas where stockpiles, haul routes and other high traffic are located will require decompaction before topsoil reinstatement. This includes ripping subsoils in agricultural areas to return them to their ALC grade and not introduce a wetness limitation. For decompaction, a wing-tine ripper is recommended.

5.3.2. Large stones and debris should be removed from the area before reinstatement.

5.4. SOIL REINSTATEMENT

5.4.1. All horizons willshould be reinstated in the same order as they were before disturbance, avoiding mixing of textures where possible. All land should be reinstated to the standards of the baseline ALC grade (prior to disturbance), the limiting factors of each grade can be found in the MAFF Revised guidelines and criteria for grading the quality of agricultural land **(Ref. 6)**.

5.4.2. Reinstatement willshould take place when the soil is below the plastic limit, if it rains more than 10mm in 24 hours it is advised to suspend reinstatement until the soil is below the plastic limit. Soil is not advised to be reinstated when the ground is frozen or in other adverse weather conditions.

5.4.3. To return soils to an area the loose tipping method is recommended as this allows minimal disturbance to the soils structure. This method is described below **(Ref.3)**.

5.4.4. Loosen the receiving group using a wing-tine ripper, with a toothed bucket (which avoids excessive smearing) and load the stockpiled soil in to dump trucks to transport and discharge the soil into the desired location.

5.4.5. The soil willshould be reinstated in strips based on the reach of the excavator. An excavator willshould be used to spread the soil to the desired thickness. If replacing both subsoil and topsoil, all subsoil willshould be laid then all topsoil. Topsoil willshould be laid without the excavator travelling on the newly placed subsoil.

5.4.6. Agricultural topsoil can be mounded to a maximum of 400mm above previous ground level, providing the landowner/farmer is in agreement and the soil meets suitability criteria for reuse. Locally excavated soil material may also be spread across the working width where appropriate to do so.

5.4.7. All reinstated topsoil willshould be cultivated to its full depth to reduce compaction and increase aeration. Cultivation should remove the presence of any large, compacted lumps. For seeding, a maximum aggregate size of 10mm is recommended. If any undesirable materials (such as stones or fill over 50mm in any dimension) are present, it is recommended to remove them by raking or picking.

5.4.8. All land willshould be reinstated to the standards of the baseline ALC grade (prior to disturbance) as far as is reasonably practicable. The limiting factors of each grade can be found in the MAFF revised guidelines and criteria for grading the quality of agricultural land **(Ref. 6)**. This includes all BMV land being returned to its original quality.

5.4.9. A target specification for the restored soils (according to location, soil types, end use and required ALC grade) willshould be developed, by a suitably qualified Soil Scientist, and reported in the FinalDetailed SMP.

6. AFTERCARE OF REINSTATED SOILS

~~6.1.1. The soils replaced for each area will be assessed on landowner use and agricultural management requirements such as organic status. This can be refined using samples taken from the stockpiled soil before they are reinstated.~~

~~6.1.2.~~6.1.1. After reinstatement, soils tend to self-compact and settle, especially those with low resilience. It can take between one to three years for their structures to stabilise. This can lead to waterlogging and anaerobic conditions, which can contribute to erosion and flooding, but can also lead to negative impacts on root function and plant health.

~~6.1.3.~~6.1.2. To avoid the negative impacts above reinstatement will~~should~~ be inspected by a competent soil scientist and an aftercare plan developed to help the successful reinstatement of the soils. For example, keeping livestock off reinstated grassland in the winter will reduce the likelihood of compaction due to the soils structure being unstable. The aftercare plan will be prepared by the Construction Contractor as part of the ~~Final~~ Detailed SMP.

7. SOIL REUSE AND DISPOSAL

7.1.1. In the event that there is a soil surplus from construction activities, all suitable (chemically/physically suitable and asbestos free) material will be beneficially reused on site through measures put in place through the Materials Management Plan (MMP) that will be produced by the Construction Contractor(s) as part of the CEMP.

7.1.2. If excavated materials are unsuitable for reuse, such as contaminated soils or hazardous materials (not soils i.e., anthropogenic material) this will be removed off-site and disposed in accordance with an agreed MMP. The Construction Contractor(s) will follow appropriate legislative requirements and best practice. The material would be appropriately classified prior to transport to a suitably licenced landfill /treatment centre.

7.1.3. The landowner / occupier will be engaged where any off-site disposal is required. In such instances, disposal will be undertaken in accordance with waste management regulations (England and Wales). Further detail is provided in **Chapter 14 – Materials and Waste (Volume II).**

8. SUMMARY AND CONCLUSIONS

8.1.1. This Outline SMP estimates reasonable worst-case volumes of soil excavation and sets out best practice measures for soil management. This best practice willshould be adhered to during, and after, the construction of the DCO Proposed Development. The Outline SMP also identifies further actions required by the appointed Construction Contractor(s), for the Final Detailed SMP. It is recognised that there is a degree of professional judgement involved in quantifying assumptions.

8.1.2. There are a number of opportunities to reduce the extent of excavation and/or increase the extent of re-use opportunities as good practice measures. These include:

- reducing excavation depth required for the DCO Proposed Development infrastructure;
  - Seeking to minimise open trench depth towards the lower end of the range.
  - avoiding wholescale excavation of subsoil at AGIs and BVSs.
- consideration of application of ‘trackway’ to reduce excavation volumes and protect soil at relevant locations where vehicle movements are required in temporary works zones;
- re-use of all excavated material for engineering fill and landscaping; and
- appropriate re-use of excavated material for reinstatement and profiling on site.

8.1.3. Applying the reasonable assumptions discussed above, it is expected there will be sufficient re-use opportunities within the Newbuild Infrastructure Boundary to avoid any surplus.

8.1.4. Any material identified as waste shall be managed in accordance with appropriate legislation and regulatory guidance.

3. REFERENCES

- **Ref. 1** - ADAS (1994). Agricultural Land Classification Detailed Post 1988 ALC survey, Hapsford MSA Jn.14 M56, Helsby (ALCW15194).
- **Ref. 2** - CIRIA (2006). Control of water pollution from linear construction projects: technical guidance. Publication C648; Construction Industry Research and Information Association, London.
- **Ref. 3** - DEFRA (2009). Code of practice for the sustainable use of soils on construction sites. [online] Available at: https://www.gov.uk/government/publications/code-of-practice-for-the-sustainable-use-of-soils-on-construction-sites [Accessed January 2022].
- **Ref. 4** - Institute of Environmental Management and Assessment (IEMA) (2022). A New Perspective on Land and Soil in Environmental Impact Assessment. February 2022.
- **Ref. 5** - Institute of Quarrying (2021). Good Practice Guide for Handling Soils in Mineral Workings. [online] Available at: https://f.hubspotusercontent30.net/hubfs/885685/Soils%20Guidance/IQ%20Soil%20Guidance%20Part%201.pdf [Accessed June 2022].
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- **Ref. 7** - Ministry of Housing, Communities and Local Government (2021). National Planning Policy Framework. [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf [Accessed July 2022].
- **Ref. 8** - Welsh Government (2021). Welsh Government | Planning Policy Wales (Edition 11, February 2021). [online] Available at: https://gov.wales/sites/default/files/publications/2021-02/planning-policy-wales-edition-11_0.pdf [Accessed July 2022].
- **Ref. 9** - Reading Agricultural Consultants (RAC) (2022). HyNet Pipeline Agricultural Land Classification and Soil Resources.
- **Ref. 10** - Reading Agricultural Consultants (RAC) (2022). HyNet Pipeline Agricultural Land Classification and Soil Resources - Talacre and Block Valves.
- **Ref.11** – British Standard (BS) 1377-1 (1990). Methods of test for Soils for civil engineering purposes — Part 1: General requirements and sample preparation. ISBN 0 580 17692 4.

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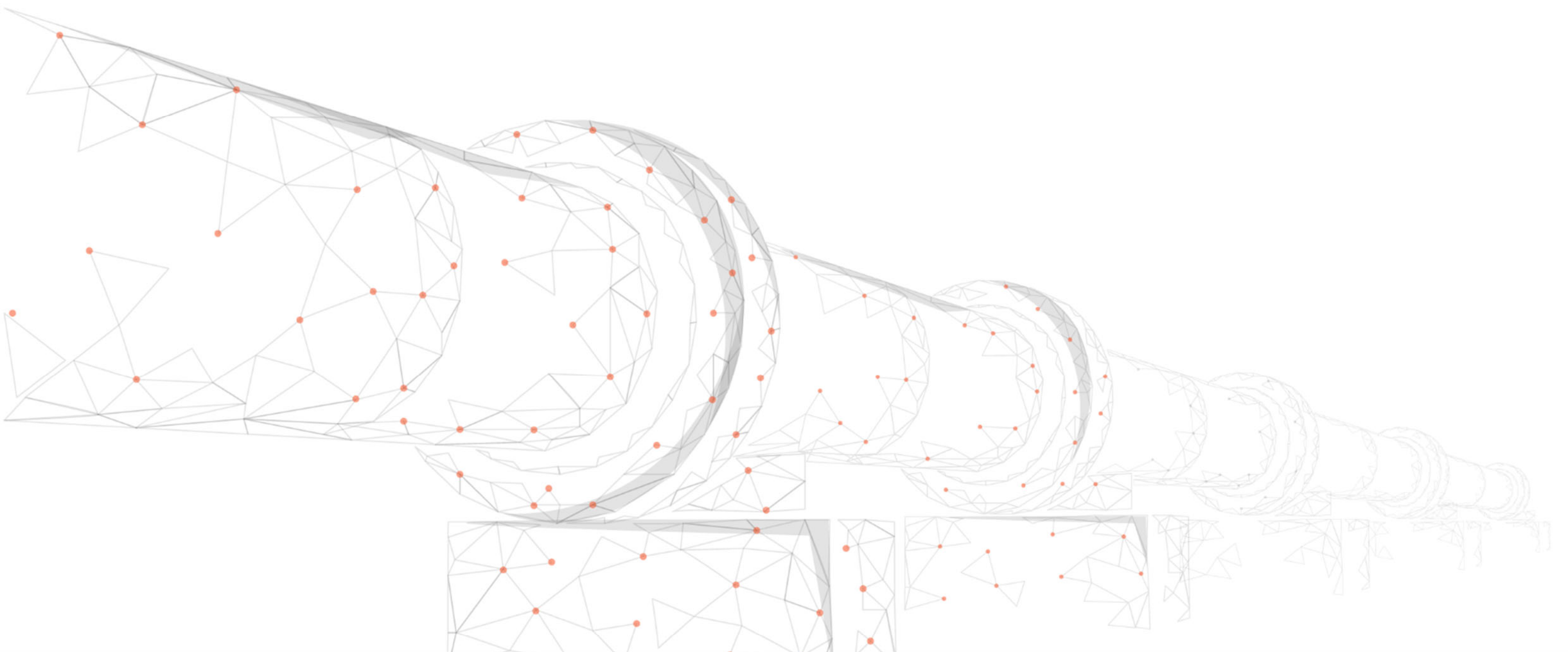
Annexures



Annex A

AGROCLIMATIC DATA

Table A1 - Agroclimatic data by ALC sample point

ALC sample points	Field Capacity Days	Average Annual Rainfall
1 to 52	155	691
53 to 94	152	678
95 to 137	156	
138 to 188	158	
192 to195	171	
196 to 215	180	778
238 to 269	184	792
270 to 294	188	

Annex B

SOIL RESILIENCE

Table B1 - Soil textures and their accronyms

Soil texture	
cS	coarse sand
mS	medium sand
fS	fine sand
LcS	loamy coarse sand
LmS	loamy medium sand
LfS	loamy fine sand
cSL	coarse sandy loam
mSL	medium sandy loam
fSL	fine sandy loam
cSZL	coarse sandy silt loam
mSZL	medium sandy silt loam
fSZL	fine sandy silt loam
MZ	marine light silt
ZL	silt loam
cSCL	coarse sandy clay loam
SCL	sandy clay loam
fSCL	fine sandy clay loam
mCL	medium clay loam
CL	clay loam (borderline)
hCL	heavy clay loam
mZCL	medium silty clay loam
ZCL	silty clay loam (borderline)
hZCL	heavy silty clay loam
SC	sandy clay
LC	loamy clay
C	clay
ZC	silty clay

Table B2 - Resillience of soils based on soil characteristics

Sample number	Topsoil (T)	Depth of horizon		Soil texture	Resillience
1	T	0	21	hZCL	Low
		21	35	mZCL	Medium
		35	80	ZL	Medium
		80	120	ZC	Low
2	T	0	10	ohZCL	Low
	T	10	25	C	Low
		25	50	C	Low
		50	75	ZC	Low
		75	120	PL	Low
3	T	0	20	oZC	Low
pit		20	60	C	Low
		60	120	PL	Low
4	T	0	5	ohZCL	Low
	T	5	25	C	Low
		25	33	C	Low
		33	70	C	Low
		70	120	C	Low
5	T	0	25	C	Low
		25	48	ZC	Low
		48	120	PL	Low
6	T	0	25	C	Low
		25	45	ZC	Low
		45	80	PL	Low
		80	120	PL	Low
7	T	0	22	hZCL	Low
		22	55	ZC	Low
		55	80	PL	Low
		80	120	PL	Low
8	T	0	39	mCL	Medium
		39	50	SCL	Medium
		50	80	C	Low
		80	120	C	Low
9	T	0	36	mCL	Medium
		36	70	SCL	Medium
		70	100	C	Low
		100	120	C	Low
10	T	0	35	mCL	Medium
		35	48	SCL	Medium
		48	90	C	Low
		90	120	C	Low
11	T	0	35	SCL	Medium
		35	39	hCL	Low
		39	50	SCL	Medium
		50	90	C	Low
		90	120	C	Low
12	T	0	35	SCL	Medium
		35	40	SCL	Medium
		40	93	SCL	Medium
		93	95	C	Low
		95	120	C	Low
13	T	0	35	mSZL	High
		35	40	SCL	Medium
		40	50	C	Low
		50	90	C	Low
		90	100	fS	High
		100	120	fS	High
14	T	0	30	SCL	Medium
		30	75	SCL	Medium
		75	80	SCL	Medium
		80	120	C	Low
15	T	0	38	SCL	Medium
		38	48	SCL	Medium
		48	70	C	Low
		70	90	C	Low
		90	120	C	Low
16	T	0	35	mCL	Medium
		35	55	SCL	Medium
		55	80	C	Low
		80	120	C	Low
17	T	0	38	mCL	Medium
		38	48	hCL	Low
		48	90	C	Low

Table B2 - Resillience of soils based on soil characteristics

		90	120	C	Low
18	T	0	38	mCL	Medium
		38	70	C	Low
		70	90	C	Low
		90	120	C	Low
19	T	0	35	mCL	Medium
		35	40	mCL	Medium
		40	55	SCL	Medium
		55	90	C	Low
		90	120	C	Low
20	T	0	25	mCL	Medium
pit		25	40	hZCL	Low
		40	100	C	Low
		100	120	C	Low
21	T	0	37	CL	Medium
		37	68	LmS	High
		68	90	C	Low
		90	120	C	Low
22	T	0	35	SCL	Medium
		35	45	SCL	Medium
		45	57	SC	Low
		57	120	C	Low
23	T	0	32	SCL	Medium
pit		32	40	SCL	Medium
		40	57	SCL	Medium
		57	80	C	Low
		80	120	C	Low
24	T	0	37	mCL	Medium
		37	90	C	Low
		90	120	C	Low
25	T	0	36	mCL	Medium
		36	70	C	Low
		70	90	C	Low
		90	120	C	Low
26	T	0	36	SCL	Medium
		36	55	C	Low
		55	90	C	Low
		90	120	C	Low
27	T	0	35	SCL	Medium
		35	42	SCL	Medium
		42	70	C	Low
		70	90	C	Low
		90	120	C	Low
28	T	0	25	mSZL	High
		25	35	mSZL	High
		35	43	hCL	Low
		43	90	C	Low
		90	120	C	Low
29	T	0	38	mCL	Medium
		38	58	SCL	Medium
		58	90	C	Low
		90	120	C	Low
30	T	0	35	mCL	Medium
		35	45	SCL	Medium
		45	100	C	Low
		100	120	C	Low
31	T	0	20	mCL	Medium
		20	35	mCL	Medium
		35	38	hCL	Low
		38	70	C	Low
		70	90	C	Low
		90	120	C	Low
32	T	0	32	SCL	Medium
		32	45	SL	High
		45	51	mCL	Medium
		51	80	C	Low
		80	100	C	Low
		100	120	C	Low
33	T	0	33	mSZL	High
		33	40	SCL	Medium
		40	90	C	Low
		90	120	C	Low
34	T	0	40	mSZL	High

		40	48	SCL	Medium
		48	100	C	Low
		100	120	C	Low
35	T	0	40	mSL	High
		40	100	fS	High
		100	120	fS	High
36	T	0	40	mSZL	High
		40	43	SCL	Medium
		43	90	C	Low
		90	120	C	Low
37	T	0	43	mSZL	High
		43	60	SCL	Medium
		60	100	C	Low
		100	120	C	Low
38	T	0	38	mSZL	High
		38	70	C	Low
		70	100	C	Low
		100	120	C	Low
39	T	0	40	mSZL	High
		40	60	SCL	Medium
		60	120	C	Low
40	T	0	40	mSZL	High
		40	55	SCL	Medium
		55	70	C	Low
		70	80	C	Low
		80	120	C	Low
41	T	0	40	SCL	Medium
		40	50	SCL	Medium
		50	100	mS	High
		100	120	mS	High
42	T	0	38	SCL	Medium
		38	70	SCL	Medium
		70	90	C	Low
		90	120	C	Low
43	T	0	28	SCL	Medium
		28	46	SCL	Medium
		46	85	hCL	Low
		85	100	C	Low
		100	120	C	Low
44	T	0	27	SCL	Medium
		27	45	SCL	Medium
		45	78	SL	High
		78	105	C	Low
		105	120	C	Low
45	T	0	27	mCL	Medium
		27	40	mCL	Medium
		40	74	SCL	Medium
		74	85	SC	Low
		85	100	C	Low
		100	120	C	Low
46	T	0	27	SCL	Medium
		27	40	SL	High
		40	75	SL	High
		75	105	hCL	Low
		105	120	C	Low
47	T	0	27	SCL	Medium
		27	45	SCL	Medium
		45	70	SC/SCL	Low
		70	120	SCL	Medium
48	T	0	27	SCL	Medium
		27	45	SCL	Medium
		45	65	SC	Low
		65	100	C	Low
		100	120	C	Low
49	T	0	27	SCL	Medium
		27	45	SC	Low
		45	95	C	Low
		95	120	C	Low
50	T	0	29	SL	High
		29	51	SL/SCL	Medium
		51	60	C	Low
		60	80	C	Low
		80	120	C	Low

Table B2 - Resillience of soils based on soil characteristics

51	T	0	28	SL	High
		28	40	SL/SCL	Medium
		40	50	C	Low
		50	80	C	Low
		80	120	C	Low
52	T	0	28	SL	High
		28	40	SL/SCL	Medium
		40	55	C	Low
		55	65	SL	High
		65	95	C	Low
		95	120	C	Low
53	T	0	28	oSCL	Low
		28	43	SCL	Medium
		43	55	hCL	Low
		55	75	C	Low
		75	120	C	Low
54	T	0	36	SL	High
		36	70	LS	High
		70	120	LS	High
55	T	0	35	SL	High
		35	70	mS	High
		70	120	LS	High
56	T	0	28	SCL	Medium
		28	40	SL	High
		40	80	SL	High
		80	120	CL/C	Low
57	T	0	28	SL	High
		28	45	SL	High
		45	120	oLS	Low
58	T	0	38	SL	High
		38	70	SL	High
		70	105	mS	High
		105	120	mS	High
59	T	0	38	SL	High
		38	70	SL	High
		70	110	LS	High
		110	120	mS	High
60	T	0	38	SL	High
		38	80	LmS	High
		80	105	SC	Low
		105	120	LS	High
61	T	0	40	SL	High
		40	65	SL	High
		65	95	SL	High
		95	120	SCL	Medium
62	T	0	30	ohZCL	Low
		29	120	PL	Low
63	T	0	10	PL	Low
	T	10	23	ohZCL	Low
		23	40	PL	Low
		40	120	PL	Low
64	T	0	30	ohZCL	Low
		29	120	PL	Low
65	T	0	29	ohZCL	Low
		29	120	PL	Low
66	T	0	28	ohZCL	Low
		28	35	PL	Low
		35	120	PL	Low
67	T	0	28	oCL	Low
		28	40	CL/C	Low
		40	75	PL	Low
		75	120	hZCL	Low
68	T	0	25	ohZCL	Low
		25	40	PL	Low
		40	120	PL	Low
69	T	0	15	ohZCL	Low
		15	28	C	Low
		28	120	PL	Low
70	T	0	28	SCL	Medium
		28	40	SCL	Medium
		40	68	SCL	Medium
		68	80	C	Low
		80	120	C	Low

Table B2 - Resillience of soils based on soil characteristics

71	T	0	28	SCL	Medium
		28	40	SCL	Medium
		40	65	SCL	Medium
		65	80	C	Low
		80	120	C	Low
95	T	0	30	mSZL	High
		30	40	mSZL	High
		40	68	SCL	Medium
		68	85	C	Low
		85	120	C	Low
96	T	0	39	mZCL	Medium
		39	60	hCL	Low
		60	120	C	Low
97	T	0	33	mCL	Medium
		33	60	C	Low
		60	120	C	Low
98	T	0	20	mCL	Medium
		20	33	hCL	Low
		33	60	C	Low
		60	120	C	Low
99	T	0	38	SCL	Medium
		38	55	SCL	Medium
		55	80	C	Low
		80	120	C	Low
100	T	0	33	hCL	Low
		33	50	C	Low
		50	120	C	Low
101	T	0	40	mCL	Medium
		40	55	hCL	Low
		55	80	C	Low
		80	120	C	Low
102	T	0	35	mCL	Medium
		35	45	hCL	Low
		45	90	C	Low
		90	120	C	Low
103	T	0	30	mCL	Medium
		30	40	mCL	Medium
		40	50	SCL	Medium
		50	120	C	Low
104	T	0	35	hCL	Low
		35	90	C	Low
		90	120	C	Low
105	T	0	35	mCL	Medium
		35	68	SCL	Medium
		68	80	C	Low
		80	120	C	Low
106	T	0	25	mCL	Medium
		25	28	C	Low
		28	120	C	Low
107	T	0	36	mCL	Medium
		36	48	hCL	Low
		48	70	C	Low
		70	120	C	Low
108	T	0	35	mSZL	High
		35	43	SCL	Medium
		43	80	C	Low
		80	120	C	Low
109	T	0	30	mCL	Medium
		30	40	mCL	Medium
		40	55	hCL	Low
		55	85	C	Low
		85	120	C	Low
110	T	0	35	mCL	Medium
		35	40	hCL	Low
		40	58	hCL	Low
		58	90	C	Low
		90	120	C	Low
111	T	0	30	hCL	Low
		30	42	hCL	Low
		42	80	C	Low
		90	120	C	Low
112	T	0	20	mZCL	Medium
		20	30	mZCL	Medium

		35	42	mZCL	Medium
		42	90	C	Low
		90	120	C	Low
113	T	0	33	mSZL	High
		33	40	hCL	Low
		40	70	SCL	Medium
		70	80	C	Low
		80	120	C	Low
114	T	0	30	mCL	Medium
		30	40	hCL	Low
		40	48	C	Low
		48	75	C	Low
		75	90	C	Low
		100	120	C	Low
115	T	0	38	mSL	High
		38	48	SCL	Medium
		48	90	C	Low
		90	120	C	Low
116	T	0	30	mCL	Medium
		30	38	SCL	Medium
		38	48	SCL	Medium
		48	90	C	Low
		90	120	C	Low
118	T	0	35	mSZL	High
		35	60	SCL	Medium
		60	90	C	Low
		90	120	C	Low
119	T	0	35	hCL	Low
		35	40	SCL	Medium
		40	65	SCL	Medium
		65	90	C	Low
		90	120	C	Low
120	T	0	38	SCL	Medium
		38	45	hCL	Low
		45	60	C	Low
		60	90	C	Low
		90	120	C	Low
121	T	0	30	mCL	Medium
		30	40	mCL	Medium
		40	70	hCL	Low
		70	90	C	Low
		90	120	C	Low
122	T	0	35	mSZL	High
		35	48	SCL	Medium
		48	70	C	Low
		70	120	C	Low
123	T	0	30	SCL	Medium
		30	43	SCL	Medium
		43	90	C	Low
		90	120	C	Low
124	T	0	20	SCL	Medium
		20	35	SCL	Medium
		35	48	SCL	Medium
		48	70	C	Low
		70	80	SCL	Medium
		80	100	mS	High
		100	120	mS	High
125	T	0	20	mCL	Medium
		20	38	mCL	Medium
		38	70	C	Low
		70	120	C	Low
126	T	0	33	hCL	Low
		33	38	hCL	Low
		38	60	C	Low
		60	120	C	Low
127	T	0	30	hCL	Low
		39	50	hCL	Low
		50	120	C	Low
128	T	0	33	hCL	Low
		33	38	hCL	Low
		38	60	C	Low
		60	120	C	Low
129	T	0	30	mSZL	High

		30	40	mSZL	High
		40	49	SCL	Medium
		49	75	C	Low
		75	80	C	Low
		80	120	C	Low
138	T	0	38	ZL	Medium
		38	55	ZL	Medium
		55	100	fSL	High
		100	120	fSL	High
139	T	0	43	LfS	High
		43	70	fS	High
		70	120	fS	High
140	T	0	35	ZL	Medium
		33	43	fSL	High
		43	80	fS	High
		80	120	fS	High
141	T	0	45	fSL	High
		45	80	fS	High
		80	120	fS	High
142	T	0	43	LfS	High
		43	80	fS	High
		80	120	fS	High
143	T	0	43	fSL	High
		43	80	fS	High
		80	120	fS	High
144	T	0	39	ZL	Medium
		39	80	fS	High
		80	120	fS	High
145	T	0	30	ZL	Medium
		30	43	ZL	Medium
		43	80	fS	High
		80	120	fS	High
146	T	0	30	ZL	Medium
		30	43	ZL	Medium
		43	80	fS	High
		80	120	fS	High
147	T	0	40	fSL	High
		38	58	fS	High
		58	70	fS	High
		70	120	fS	High
148	T	0	30	ZL	Medium
		30	43	ZL	Medium
		43	100	fS	High
		100	120	fS	High
149	T	0	30	ZL	Medium
		30	43	ZL	Medium
		43	100	fS	High
		100	120	fS	High
150	T	0	30	mZCL	Medium
		30	43	mZCL	Medium
		43	100	fS	High
		100	120	fS	High
151	T	0	30	ZL	Medium
		30	48	ZL	Medium
		48	100	ZL	Medium
		100	120	fS	High
152	T	0	30	ZL	Medium
		30	40	ZL	Medium
		48	110	ZL	Medium
		110	120	fS	High
153	T	0	40	ZL	Medium
		40	110	ZL	Medium
		110	120	fS	High
154	T	0	30	ZL	Medium
		30	45	ZL	Medium
		45	110	fS	High
		110	120	fS	High
156	T	0	35	mZCL	Medium
		35	45	mZCL	Medium
		45	50	C	Low
		50	80	C	Low
		80	120	C	Low
157	T	0	40	mZCL	Medium

		40	45	mZCL	Medium
		45	50	ZC	Low
		50	80	ZC	Low
		80	120	ZC	Low
158	T	0	35	ZL	Medium
		35	45	ZL	Medium
		45	80	ZL	Medium
		80	120	ZL	Medium
159	T	0	35	mSZL	High
		35	48	fS	High
		48	80	ZL	Medium
		80	120	ZL	Medium
160	T	0	35	ZL	Medium
		35	48	ZL	Medium
		48	80	hZCL	Low
		80	120	C	Low
161	T	0	38	ZL	Medium
		38	45	mZCL	Medium
		45	55	ZC	Low
		55	80	fS	High
		80	120	fS	High
162	T	0	38	ZL	Medium
		38	50	ZL	Medium
		50	90	fS	High
		90	120	fS	High
163	T	0	38	ZL	Medium
		38	40	ZL	Medium
		40	58	ZL	Medium
		58	90	ZC	Low
		90	120	ZC	Low
164	T	0	38	ZL	Medium
		38	100	fS	High
		100	120	fS	High
165	T	0	40	ZL	Medium
		40	45	ZL	Medium
		45	78	fS	High
		78	90	C	Low
		90	120	C	Low
166	T	0	35	ZL	Medium
		35	48	fS	High
		48	80	ZC	Low
		80	120	ZC	Low
167	T	0	40	mZCL	Medium
		40	70	ZC	Low
		70	90	ZL	Medium
		90	120	ZL	Medium
168	T	0	35	mZCL	Medium
		35	45	mZCL	Medium
		45	90	ZL	Medium
		90	120	ZL	Medium
169	T	0	20	ZL	Medium
		20	75	ZCL	Medium
		75	120	ZCL	Medium
170	T	0	20	ZL	Medium
		20	50	ZC	Low
		50	75	ZL	Medium
		75	120	ZL	Medium
171	T	0	33	ZL	Medium
		33	50	ZC	Low
		50	90	ZL	Medium
		75	120	ZL	Medium
172	T	0	30	ZL	Medium
		30	40	ZL	Medium
		40	70	ZCL	Medium
		70	85	C	Low
		85	120	C	Low
173	T	0	30	ZL	Medium
		30	48	ZL	Medium
		48	90	ZL	Medium
		90	120	ZL	Medium
174	T	0	35	ZL	Medium
		35	40	ZL	Medium
		40	60	ZL	Medium

		60	85	ZC	Low
		85	120	ZC	Low
175	T	0	35	ZL	Medium
		35	68	fS	High
		68	90	C	Low
		90	120	C	Low
176	T	0	20	ZL	Medium
		20	35	mZCL	Medium
		35	60	C	Low
		60	120	C	Low
178	T	0	28	ZL	Medium
		28	80	mZCL	Medium
		100	120	mZCL	Medium
181	T	0	28	ZL	Medium
		28	50	ZL	Medium
		50	80	ZL	Medium
		80	120	ZL	Medium
182	T	0	38	hZCL	Low
		38	40	hZCL	Low
		40	50	hZCL	Low
		50	80	fS	High
		80	120	fS	High
183	T	0	30	hZCL	Low
		30	40	hZCL	Low
		40	70	C	Low
		70	120	C	Low
184	T	0	38	mSZL	High
		38	60	C	Low
		60	120	C	Low
185	T	0	38	mZCL	Medium
		38	40	mZCL	Medium
		40	120	C	Low
186	T	0	30	ZL	Medium
		30	45	cSL	High
		45	80	C	Low
		80	120	C	Low
187	T	0	28	mZCL	Medium
		28	45	C	Low
		45	50	mZCL	Medium
		50	120	C	Low
188	T	0	15	oZCL	Low
		15	60	hCL	Low
		60	80	C	Low
		80	120	C	Low
192	T	0	40	SCL	Medium
		40	120	C	Low
193	T	0	38	SCL	Medium
		38	45	SCL	Medium
		45	120	C	Low
194	T	0	30	mCL	Medium
		30	45	mCL	Medium
		45	90	C	Low
		90	120	C	Low
195	T	0	30	SCL	Medium
		30	50	SCL	Medium
		50	90	SCL	Medium
		90	120	SCL	Medium
196	T	0	27	LmS	High
		27	60	LmS	High
		60	80	LmS	High
		80	120	mS	High
197	T	0	27	mSL	High
		27	50	LmS	High
		50	72	LmS	High
		72	90	LmS	High
		90	120	mS	High
198	T	0	25	SCL	Medium
		25	70	SCL	Medium
		70	120	SCL	Medium
199	T	0	25	mCL	Medium
		25	55	mCL	Medium
		55	80	hCL	Low
		80	120	hCL	Low

Table B2 - Resillience of soils based on soil characteristics

200	T	0	25	mCL	Medium
		25	45	SCL	Medium
		45	55	SCL	Medium
		55	120	C/CL	Low
201	T	0	25	mCL	Medium
		25	40	mCL	Medium
		40	120	C	Low
202	T	0	25	mCL	Medium
		25	45	hCL	Low
		45	120	C	Low
203	T	0	25	mSL	High
		25	47	LmS	High
		47	120	LmS	High
204	T	0	40	LmS	High
Pit		40	120	LmS	High
205	T	0	28	mCL	Medium
		28	65	C	Low
		65	120	C	Low
206	T	0	32	SCL	Medium
		32	120	SCL	Medium
207	T	0	28	SCL	Medium
		28	86	SCL	Medium
		86	120	SCL	Medium
211	T	0	28	mSL	High
		28	45	mSL	High
		45	120	mSL	High
212	T	0	17	mSL	High
		17	27	mSL	High
		27	120	mSL	High
213	T	0	27	mSL	High
		27	51	mSL	High
		51	60	LmS	High
		60	120	LmS	High
214	T	0	30	SCL	Medium
		30	50	SCL	Medium
		50	120	SCL	Medium
215	T	0	28	mCL	Medium
		28	46	hCL	Low
		46	120	C	Low
238	T	0	30	SZL	High
		30	70	hCL	Low
		70	120	hCL	Low
239	T	0	26	mCL	Medium
		26	70	C	Low
		70	120	hCL	Low
240	T	0	29	mCL	Medium
		29	70	C	Low
		70	120	C	Low
241	T	0	27	mCL	Medium
		27	55	fSCL	Medium
		55	120	C	Low
242	T	0	30	mCL	Medium
		30	60	fSCL	Medium
		60	120	C/CL	Low
250	T	0	30	SCL	Medium
		30	58	SCL	Medium
		58	120	C	Low
251	T	0	31	mCL	Medium
		31	55	hCL	Low
		55	120	C/CL	Low
257	T	0	29	SCL	Medium
		29	60	mSL	High
		60	75	mSL	High
		75	120	LmS	High
258	T	0	33	SCL	Medium
		33	65	SCL	Medium
		65	75	mSL	High
		75	120	mSL	High
259	T	0	25	mCL	Medium
		25	45	mCL	Medium
		45	65	fSCL	Medium
		65	120	C	Low
260	T	0	28	mCL	Medium

Table B2 - Resillience of soils based on soil characteristics

		28	40	hCL	Low
		40	54	hCL	Low
		54	75	fSCL	Medium
		75	120	C	Low
261	T	0	27	mCL	Medium
		27	50	SCL	Medium
		50	70	mCL	Medium
		70	90	LmS	High
		90	120	LmS	High
262	T	0	26	mCL	Medium
		26	45	SCL	Medium
		45	70	SC	Low
		70	120	hCL	Low
263	T	0	28	mCL	Medium
		28	60	mCL	Medium
		60	92	hCL	Low
		92	120	C	Low
264	T	0	26	mCL	Medium
		26	55	hCL	Low
		55	80	C	Low
		80	100	SCL	Medium
		100	120	SCL	Medium
265	T	0	27	mCL	Medium
		27	40	hCL	Low
		40	50	C	Low
		50	70	hCL	Low
		70	120	C	Low
266	T	0	30	mCL	Medium
		30	48	mCL	Medium
		48	120	C/CL	Low
267	T	0	28	SCL	Medium
		28	52	LmS	High
		52	70	LmS	High
		70	120	Sandstone	N/A
268	T	0	27	hCL	Low
		27	40	hCL	Low
		40	120	C	Low
269	T	0	28	mCL	Medium
		28	45	hCL	Low
		45	55	C	Low
		55	120	C	Low
270	T	0	30	mCL	Medium
		30	40	mCL	Medium
		40	120	C	Low
271	T	0	30	mCL	Medium
		30	40	mCL	Medium
		40	45	mCL	Medium
		45	60	C	Low
		60	120	C	Low
272	T	0	40	SCL	Medium
		40	45	SCL	Medium
		45	55	C	Low
		55	100	C	Low
		100	120	C	Low
273	T	0	35	mCL	Medium
		35	40	mCL	Medium
		40	120	C	Low
274	T	0	35	SCL	Medium
		35	40	SCL	Medium
		40	50	SCL	Medium
		50	70	SCL	Medium
		70	120	C	Low
276	T	0	30	mCL	Medium
		30	45	mCL	Medium
		45	75	hCL	Low
		75	85	C	Low
		85	120	C	Low
277	T	0	35	mCL	Medium
		35	48	hCL	Low
		48	90	C	Low
		90	120	C	Low
278	T	0	30	mCL	Medium
		30	35	mCL	Medium

Table B2 - Resillience of soils based on soil characteristics

		35	55	hCL	Low
		55	70	C	Low
		70	90	C	Low
		90	120	C	Low
279	T	0	35	mCL	Medium
		35	55	mCL	Medium
		55	80	C	Low
		80	120	C	Low
280	T	0	40	SCL	Medium
		40	50	C	Low
		50	120	C	Low
281	T	0	38	mCL	Medium
		38	40	hCL	Low
		40	55	hCL	Low
		55	70	C	Low
		70	120	C	Low
282	T	0	30	mCL	Medium
		30	40	mCL	Medium
		40	120	C	Low
283	T	0	30	mCL	Medium
		30	40	mCL	Medium
		40	120	C	Low
284	T	0	35	mCL	Medium
		35	60	hCL	Low
		60	80	C	Low
		80	120	C	Low
285	T	0	35	mCL	Medium
		35	55	hCL	Low
		55	70	C	Low
		70	120	C	Low
286	T	0	35	mCL	Medium
		35	45	mCL	Medium
		45	55	hCL	Low
		55	100	C	Low
		100	120	C	Low
287	T	0	35	mSL	High
		35	75	mSL	High
		55	95	LmS	High
		95	120	LmS	High
288	T	0	35	mCL	Medium
		35	45	mCL	Medium
		45	50	SCL	Medium
		50	60	C	Low
		60	120	C	Low
289	T	0	39	SCL	Medium
		39	40	SCL	Medium
		40	120	C	Low
290	T	0	35	mCL	Medium
		35	70	C	Low
		70	120	C	Low
291	T	0	38	mCL	Medium
		38	40	hCL	Low
		40	80	C	Low
		80	120	C	Low
292	T	0	40	SCL	Medium
		40	120	C	Low
293	T	0	39	SCL	Medium
		39	40	hCL	Low
		40	120	C	Low
294	T	0	40	SCL	Medium
		40	45	SCL	Medium
		45	120	C	Low