EWR Alliance

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East West Rail Phase 2

Compound A1 Soil Management Plan

Client name: Network Rail

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Document History

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1. Introduction

This plan is to be used for the purpose of protecting and managing soils that are excavated from temporary land that is to be returned to its original use. For Compound A1 this use will include agriculture, and road verges. An overview of this procedure is provided in Appendix A, which outlines the requirements for two keys stages: Enabling Works / Construction Phase Considerations and Post-Final Completion Requirements.

This document incorporates the core principles that are set out in the following documentation:

- EWR Charter
- Project Alliance Agreement (PAA)
- Sustainability Policy
- Health and Safety Policy
- Quality Policy
- Collaborative Working Policy

Under the EWR Charter there are 9 core principles that are to be adhered to. These core principles are as follows:

- Best for Project. We will make all our decisions on a best for project basis.
- Win – win. Participants will either all win or all lose. Win/Lose outcomes will not be acceptable.
- Unanimous decisions. Alliance Leadership Team decisions will be unanimous.
- Safety underpins every decision. Make safety everyone's number one priority to transform it in to a personal core value.
- Value for Money. VfM is intrinsic to our approach.
- Best person for the job. We will select on the basis of technical capability and collaborative ability.
- Stakeholder expectations and sustainability underpins every decision.
- Safeguard the future competitiveness of the rail sector by investing in new and emerging.
- Technologies with payback periods that exceed the life of the project.

This document has been produced to ensure that we meet the core principles highlighted above. In particular, best for project, safety, VfM and Stakeholder expectations. The soil management plans will provide a methodology to manage soils appropriately ensuring that they are suitable for the reinstatement of land to be returned to agriculture, allotments or recreational land. The re-use of materials and restoring land to its previous condition is important for the project liaising with land owners, as stakeholders, and providing value for money. Stockpile management shall consider the health and safety implications of storing materials at height. As well as following the Health and Safety Policy of the project.

Under the PAA there is a requirement for ensuring that the project is 'Fit for Purpose', this is making sure that the design is appropriate for the site and in line with the Environmental Statement (ES). Under the ES there is a requirement for the restoration of land that is to be used temporarily in construction of the project, such as for use as compounds, temporary storage and offline highways. The SMP provides the methodology to ensure that soils are managed appropriately to maintain the integrity of the soil components to allow restoration of land in line with the ES and the Sustainability Policy. The Sustainability Policy requires that the project minimises its impact on the environment and delivers environmental benefits throughout the project lifecycle as well as managing the needs and expectations of stakeholders. The project should aim to leave a lasting positive legacy in the local community.

The quality policy has been adhered to following the check and review process as required by the project and documented at the front of this report. Collaboration has been sought with various teams including the Environment and Sustainability Function, the earthworks and construction teams. The document shall

be made available through eB cross-referencing other associated documentation. This document has been reviewed by key team members who shall be using the document to ensure that it is fit for purpose.

2. Scope/Purpose

2.1 Overview

The East West Rail (EWR) programme of works aims to establish a strategic railway connecting East Anglia with central, southern and western England. The Phase 2 (western section) project comprises works along an approximately 78 km route of existing railway and railway alignment, running between Bicester in the west to Bedford in the east, with a spur south to Aylesbury and a short spur north to Bletchley.

In order to manage soil disturbance and to mitigate the impacts to primarily agricultural soil for the Temporary Land Take areas where agricultural soil will be stripped, stored and restored, a number of Soil Management Plans (SMPs) have been prepared. They have the purpose of safeguarding soil resources by ensuring their protection, conservation, appropriate reinstatement and aftercare. A separate SMP covers each construction compound and its subsection of route section (see Appendix B).

A responsible person will be provided as a contact point for landowners affected by temporary works to ensure the liaison between the owners/farmers and contractors runs as smoothly as possible for land to be returned.

This SMP provides advice on soil and aftercare management of the 4.1 ha site proposed for a construction compound known as Compound A1, located within subsection 2A1, Bicester. This includes site preparation, soil stripping, soil volumes, soil storage, soil restoration and soil aftercare. The report is split into six main sections:

1. Introduction – general site introduction.
2. Land use and soil resource assessment - details the desk and field-based study of the soils, with division into soil units containing soils with similar physical characteristics.
3. Soil management during site works - details on how to prepare the site, strip and store the soil and maintain drainage.
4. Site clearance and soil reinstatement - details on how to clear up the site and replace the soil on completion of the works.
5. Land restoration of the temporary site compound - details on the work required to complete the restoration including how to remove any compaction and requirements for drainage.
6. Aftercare - details on how to manage sites in the early years after restoration.

This plan is to inform GRIP stage 6 using information available at the time of writing GRIP stage 5.

3. References

- Alliance Charter
- VfM Statement (133735-EWR-REP-MAN-000003)
- Waste (England and Wales) Regulations 2011
- Environmental Protection Act 1990
- Definition of Waste: Development Industry Code of Practice (DoWCoP) 2008
- DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites 2009
- NR/L3/CIV/140/052C Issue 2 – Model Clauses 052C: Earthworks 04/12/2010
- NR/L3/CIV/140/050C Issue 2 – Model Clause 050C: General Requirements for Earthworks and Excavations 04/12/2010
- BS3882:2007 Specification for topsoil and requirements for reuse
- BS8601:2013 Specification for subsoil and requirement for use

4. Definitions/Abbreviations

Term	Description
Agroclimatic area	A subdivision of the country with broadly similar land use and weather
Bund/soil bund	A mound of soil placed into long narrow rows for temporary or permanent storage or landscaping.
Cultivate/cultivations	The turning of soils to prepare the land for the next crop.
Dutch auger	A hand-held tool for extracting by increments a core of soil to a depth of 1 m.
Erosion	The movement of soil particles from their place of origin by wind or water.
Field capacity	A soil moisture state beyond which field drains start to flow. This state is normally reached in autumn and continues until plants start to grow in the spring.
Geotextile	A synthetic membrane placed between the soil surface and a protective stone layer, with the aim of protecting the soils and keeping the stone clean.
Glacial drift	Superficial mineral deposits left after the retreat of glaciers.
Gley/ed	Developed under conditions of poor drainage, a soil in which iron or other compounds have been altered by intermittent water saturation to give typical blue/grey colours.
Horizon	A distinct layer of soil within the soil profile which has different characteristics for soil texture, drainage and stone content to the layers above or below. These layers are normally described separately from one another.
Microrelief	A description of local undulations in the main slopes.
Mottles	Localised areas of secondary soil colours which are distinct from colour variation associated with the parent material. Mottles form in intermittently wet soil conditions and so provide an indication of impeded drainage.
Made Ground	Anthropogenic ground in which the material has been placed without engineering control and/or manufactured by man in some way, such as through crushing or washing, or arising from an industrial process.
Organic matter	Decomposed plant residues found in the surface horizon of soils.
Particle size distribution	A laboratory measurement of the different sized particles in the soil sample, giving an accurate measurement of the proportions of sand, silt and clay.
Plough layer	The top 20-25 cm of soil which is regularly turned by cultivations.
Plastic limit	A measure of the moisture content of the soil. Above the plastic limit the soil is sticky and more prone to structural damage if trafficked or moved. The plastic limit test is not applicable on sandy soils which cannot be rolled into threads.
Ridge and furrow	An historic land form consisting of pronounced linear ridges separated by depressions; formed by historic ploughing to cultivate the soil and improve drainage.
Saturated zone	The zone in which the voids of the rock or soil are filled with water at a pressure greater than that of the atmosphere.
Slowly permeable layer	A dense or heavy textured layer of soil which reduces water flow through the soil.

Term	Description
Silt trap	A physical structure designed to trap sediment from water, to reduce pollution of watercourses.
Soil Association	A grouping of different soils which regularly occur together in the landscape.
Soil profile	A term used to include the whole soil column up to 1m deep including topsoil and subsoil horizons.
Soil stripping	The action of lifting soil from the field for storage or use elsewhere.
Soil reinstatement	The process of replacing the stripped soils in the correct horizon sequence back into a field or other area.
Soil structure	An assessment of the way soil particles hold together to form the porosity and three-dimensional architecture of the soil.
Soil texture	A physical description of the soil's sand, silt and clay content, the feel and working characteristics of which can be modified by the organic matter content.
Soil unit	A grouping of soils which have similar physical characteristics especially relating to soil texture, drainage and stone content.
Subsoil	Layers of soil below the topsoil which are modified by weathering but contain less organic matter and soil organisms.
Surface layer	A layer of soils taken from the top of potentially disturbed non-agricultural land such as road verges and railways.
Topsoil	The surface layer of soil which has been modified by the build-up of organic matter and soil flora and fauna.
Waterlogged soil	Saturated soil where all the air spaces have been filled with water.
Weathered layer	The lower part of the soil profile which has been modified by temperature and chemical actions since the last ice age.
(Soil) Wetness (Class) [WC]	A measure of the average duration of waterlogging at specified depths in the soil; WC 1 is well drained and WC 4-6 are poorly drained.

5. Roles and Responsibilities

Table 5.1 – RACI

East West Rail Alliance RACI	EWR Roles							
R = Responsible **A = Accountable** **C = Consulted** **I = Informed** **Accountabilities shall not be delegated. Responsibilities may be delegated but all such delegations shall be formally recorded.**	Alliance Director	Deputy Alliance Director	Environment and Sustainability Functional Lead	Section Environment Manager	Project Leader	Consultant Soil Scientist	Earthworks Contractor	Materials Management Specialist
Document Production	I	I	R	C	I	C	C	C
Document Acceptance	C	C	R	C	I	I	I	A
Document Implementation	I	I	C	A	I	C	A	R
Document Review/Update	I	I	A	C	I	C	C	R

6. Procedure, Plan, Strategy

6.1 Aim of the Soil Management Plan

The aims of this SMP are to:

- Identify the different soil resources on site by undertaking a Land Use and Soil Resource Assessment.
- Ensure the protection and conservation of all soil resources on site.
- Maintain the physical and chemical properties of the soils on site.
- Retain soil function during and after restoration.
- Provide suitable mitigation and aftercare measures appropriate to the soil types on site including soil which contains anthropogenic components.
- Minimise the risks from erosion or flooding by controlling drainage.
- Provide on-site reference on soil management for site operators.

Although the soil resource survey did cover areas within the Permanent Land Take, these areas within the Permanent Land Take shall be considered within the scheme Material Management Plan (MMP) and are outside the scope of this document.

Variable quality topsoil (Unit 6 soils) with the potential to contain anthropogenic material such as brick and concrete may be present within Compound A1 particularly in the area of the new compound access. Unit 6 soils will be managed under this SMP. There is also the potential for a small volume of Made Ground to be identified in areas which haven't been surveyed but due to the likelihood and volume of this material, this material if found will be managed under this SMP. As such, requirements relating to the reuse of soils using an MMP (such as a verification report) have been incorporated into this SMP.

7. Land use and soil resource assessment

7.1 Overview

The aim of the land use and soil resource assessment is to establish a baseline of pre-existing land use and soil conditions to enable the grouping of topsoils and subsoils into different soil units which have similar physical characteristics. Detail was collected on soil texture, depth, drainage characteristics, geochemistry, stone content and foreign objects. Within the site boundary the agricultural soils were confirmed as sufficiently similar to be handled as one soil unit as summarised in Table 7.1. Further detail is provided at Section 7.2.

Table 7.1: Summary of soil units

Soil unit	Description
Unit 4	Medium topsoils over heavy subsoils
Unit 6	Variable topsoil / subsoil containing some anthropogenic materials road verges and non-agricultural topsoil

An area defined as Soil Unit 6 was limited to the road verges which were not surveyed as it lies outside the agricultural field. This Unit 6 material may contain anthropogenic material and there is the potential for contamination but this material would require reinstatement upon removal of Compound A1.

There is also the potential for a small volume of non-agricultural soils (especially around road verges / embankments (Unit 6) and Made Ground) to be identified in areas which have not been surveyed and between auger boring locations. This material would also require reinstatement upon removal of Compound A1 as per Section 9.

An on-site soil resources survey was undertaken by qualified soil scientists/soil surveyors on 18/09/2018 and the results are further described below. The soil data was used to develop a site-specific soil handling specification for site preparation, soil stripping, storage, reinstatement and aftercare.

7.2 Soil resources baseline

7.2.1 *Landforms*

The land take for compound A1 covers one single field. The field is on a slight ridge which drains both to the northern and southern boundaries and will also therefore not receive significant amounts of water from off-site.

The field had a prominent ridge and furrow pattern from historic farming practices which runs northwest to southeast, parallel with the north-eastern boundary. The presence of ridges and furrows will be taken into account when stripping the soil.

7.2.2 *Historical land use*

The compound A1 and the majority of the surrounding area has historically comprised agricultural land from before the 1880s. The Oxford and Bletchley Branch railway line has been present adjacent to the south of the site from the 1880s and allotment gardens have been present approximately 450 m to the north from 1922 until present. A former railway line was also present approximately 350 m east of the compound from 1955 to 1968.

7.2.3 *Current land use*

The compound A1 currently comprises an agricultural field and a grass roadside verge. At the time of the fieldwork, undertaken in September 2018, the field supported grass which was grazed by cattle. The field has a prominent ridge and furrow pattern from historic farming practices and their presence will be taken into account when stripping the soil.

To the west of the agricultural land a wide grass verge lies adjacent to the road forming the western compound A1 boundary. This grass verge is not considered as part of the agricultural field, but is immediately adjacent to it and is within the red line planning approval boundary of compound A1.

7.2.4 *Soil types – desk study*

Before the soil resource surveys were carried out, a desk study of geology, soils and flood risk was completed. The compound site was classified, by the Soil Survey of England and Wales, as Denchworth Association1.

Soil types within the Denchworth soil association are characterised by slowly permeable, heavy textured soils showing signs of seasonal wetness. The site is on the boundary with Wickham 2 Association soils, which are similar soils formed in drift. The results from the soil resource survey confirmed the presence of medium textured topsoils over heavy textured poorly drained subsoils.

No made ground is recorded as being present on site, on British Geological Survey maps[2].

7.2.5 *Soil Resources Survey*

Soils were investigated at less than 100 m spacing (linear length) and to a depth of up to one metre using a 50 mm Dutch auger. In total seven borings were completed. In addition, one soil pit was dug (at auger point 186) to assess soil physical conditions in the topsoil and subsoil. The position of each investigation point is shown on the Soil Resource Drawing in Appendix B and details of individual auger borings and the soil pit are listed in Appendix C. The soil survey results have been validated prior to use to ensure consistency between surveyors.

To enable the division of the soils into soil units which have similar physical characteristic, detailed information was collected on:

- Soil colour, depth and texture of each horizon.
- Drainage characteristics such as gley colours, mottles and saturated zones.
- Approximate stone content and type.
- Presence of foreign materials in the soil profile.

The soils along the whole of the EWR route will be separated into six soil units based primarily on their soil texture as shown in Table 7.2 below.

Soil unit 6 is considered to be variable quality topsoil with the potential for contamination, but this material will be replaced where it was excavated in order to restore the land to its original purpose, i.e. scrub-planted roadside verge. This material along with Made Ground, if identified, will be managed by the CEMP (Doc Ref: 133735-EWR-EMP-EEN-000002) but with additional measures implemented to manage this material in line with the CL:AIRE Definition of Waste Code of Practice.

[1] SSEW 1983; Soils of Midland and Western England
[2] British Geological Survey. [online]. http://www.bgs.ac.uk/GeoIndex/ (accessed December 2018).

Table 7.2: Summary of soil unit classification

Soil unit	Soil type	Predominant soil textures included
Unit 1	Heavy	Heavy clay loam and clays
Unit 2	Medium	Silt loam, silty clay loam, sandy clay loam and medium clay loam
Unit 3	Light	Sand to sandy loams, some with a high stone content
Unit 4	Medium topsoil over heavy subsoil	Topsoil: Silt loam, sandy clay loam, medium clay loam and silty clay loam Subsoil: heavy clay loam and clay at variable depths
Unit 5	Light topsoil over medium subsoil	Topsoil: Sand to sandy loams, some with a high stone content Subsoil: silt loam to medium clay loam
Unit 6	-	Topsoil / subsoil: variable in composition with potential for anthropogenic materials, therefore potential for contamination.

Based on the information available Soil Unit 4 occurs in most of compound A1, with a small amount of Soil Unit 6 outside the western boundary of the field beneath the grass verge.

Made Ground, to be treated as Unit 6 soil has been identified as recognised potential within small areas of Compound A1. The areas that are identified to have made ground potential are presented on drawings as unit 6 soils. The anthropogenic materials present within the topsoil has not been quantified, it is recommended that during excavation the soils are visually assessed for made ground constituents of the topsoil. If the materials are identified as potentially contaminated the procedure to be followed is presented in the CEMP (133735-EWR-EMP-EEN-000002)

Soil sampling for phosphorus, potassium, magnesium, pH and organic matter was undertaken to provide baseline data on soil nutrients (see Appendix D).

Soil sampling for metals, inorganics and organics have been undertaken from two locations within the A1 compound. The results of the analysis from these locations can be found in Appendix E.

7.2.6 *Soil handling units*

The soils were found to be fairly uniform across the site and for the purposes of soil stripping, storage and reinstatement can be considered as two soil units consisting of topsoil and subsoil over unweathered clay, they are classified as Unit 4 and Unit 6.

Unit 4 includes dark brown medium clay loam topsoil which ranges in thickness from 190 – 320 mm across the site with the deepest topsoils in the south. Topsoil depth will also be deeper in the furrows where more organic matter accumulates. The topsoil contains a few small stones. The subsoils are typically heavy clay loam over clay which show signs of poor drainage, having gley colours and mottles immediately below the topsoil.

Unit 6 is only mapped along the western boundary of the compound field and has the potential to be disturbed soil from roadworks. In addition, small areas of made ground could occur within the agricultural fields, therefore the procedure in the CEMP (133735-EWR-EMP-EEN-000002) should be followed and advice sought from the Alliance Environment and Sustainability Team. Unit 6 is considered to be soiled Made Ground i.e. ground that has been subject to anthropogenic intervention and therefore there has the potential for contamination.

Table 7.3: Summary of soils on site

Material	Bottom mean depth of horizon (mm)	Texture	Drainage	Stones
Unit 4				
Topsoil	220	Dark brown medium clay loam, slightly organic	-	Few
Subsoil	220 - 430/700	Yellowish brown medium and heavy clay loam	Ochreous mottles many and grey ped faces	Few
	430/700 - 1000	Yellowish brown and grey clay	Ochreous mottles abundant	Few
Comments: ridge and furrow affects the depth of the topsoil with the greatest depth of topsoil found in the furrows.				
Unit 6				
Variable topsoil / subsoil containing some anthropogenic materials road verges and non-agricultural soil therefore potential for contamination	Not surveyed	-	-	-

8. Soil management during site works

8.1 Overview

The compound is expected to remain in place from May 2020 until January 2023, approximately four years, during which the temporary land take area i.e. 4.1 ha of agricultural land will be out of agricultural production. In order to minimise any damage to soil structure and soil quality it is intended to strip and store all topsoil, except from under the topsoil bunds. Good quality subsoil will be protected, paying particular attention to those identified and informed by the soil resource survey results as shown in **Error! Reference source not found.**. Where poor quality subsoil is identified it shall not require additional protection measures to be employed, but will require to be loosened as part of reinstatement. Within compound A1 the soils have a better quality upper subsoil that will require protection.

Agricultural soils, non-agricultural soils including Unit 6 soils (made ground), and any soil with visual / olfactory evidence of contamination will be stripped and stockpiled separately.

All soil management works including soil stripping, soil storage, drainage and soil reinstatement should be undertaken in accordance with the measures set out in the Code of Construction Practice (CoCP, eB reference: 133753-EWR-EMP-EEN-000004) and CEMP to reduce potential impacts from dust, soil erosion, run-off and contamination.

The soil stripping will also take into consideration any archaeological and ecological requirements and service installations. The soil will be stored in bunds. All Topsoil should be stripped and stored as shown in

Table 8.2. Where subsoil stripping is required for archaeological strip, map and sample under the Written Scheme of Investigation, this shall be replaced for use beneath the compound. The site should be levelled, as per compound design and a combination of geotextile, geogrid and stone cover will be laid to provide a firm working surface for the compound. The use of the geogrid shall provide a level of protection to the subsoils reducing the potential damage caused by compaction.

The average period when the most suitable ground conditions for construction are likely to prevail in this agroclimatic area is between mid-April and early November; although this commonly varies by a month either side of these dates. This is the period when soil moisture is most likely to be below field capacity and when field drains are least likely to be flowing.

Prior to work commencing the following should be agreed with the landowner/farmer:

- The position of soil stockpiles and buildings to ensure no essential access points/services are covered.
- The control of plant and animal diseases, by retaining soil within the field of origin wherever possible. Any specific trafficking/vehicle cleaning requirements to be agreed prior to work commencing. Advice on avoiding such problems is available in a Department of Environment, Food and Rural Affairs (Defra formerly MAFF) publication[3].
- The location of known drains.

8.2 Soil stripping

Immediately prior to soil stripping the site any vegetation growth higher than 100 mm will be cut and removed from site.

A topographic survey of the site should be undertaken to map out the ridge and furrow pattern and to provide detail on land levels prior to the works. This information is presented on drawing number 133735_RW-EWR-XX-XX-M3-G-050053.

The location from which all soils are stripped must be recorded with details of the volume of soils of each unit type that are stripped and placed into a storage bund. The locations and volumes of the storage bunds must be recorded. This data will be included in a soils verification report produced once restoration is complete.

[3] MAFF (1991) 'Preventing the spread of plant and animal diseases' (PB 0486)

The soil stripping is designed to keep topsoil and subsoil separate at all times. Topsoils from agricultural uses should be kept separate from, Unit 6 soils at all times. The topsoil and subsoil from different soil units and from different fields should be kept separately to avoid cross contamination of soils. Topsoil and subsoil, as far as the base of the weathered layer, will be stripped to allow an archaeological study of the site except for an exclusion zone against hedges or trees and below the canopy of retained trees, as detailed in the tree protection plans[4], which define the root protection zone. Soils will be stored ensuring that they do not encroach on the fenced root protection zones. Soil will be placed in bunds whilst the compound is in use. Soils will be stripped with 360º excavators working along the ridges and taking account of the topsoil depth difference between the ridge and the furrow. Soil will be transported to the storage bunds in dump trucks and lifted onto the bunds with a 360º excavator.

Topsoil will be stripped from the compound and subsoil storage areas to the base of the darker topsoil layer which is typically to a depth of between 200-250 mm (as shown in Table 8.1 below).

Topsoil stripping will only occur when the soils are as dry as reasonably practicable, normally when they are below the plastic limit. It will not be stripped within 48 hrs of significant rainfall (i.e. <10 mm in 24 hrs). The soil will be tested on site by the Site Engineer attempting to form a worm of soil 3 mm in diameter by rolling it out on a flat non-porous surface. If the soil 'worm' will not form or is cracked the soil is sufficiently dry to handle.

Soil will be stripped when in a dry state where ever possible, but if the soils are at or above their plastic limit when stripped they will be deposited into windrows prior to lifting them into their final bund once they have dried out sufficiently. Windrows will be placed at a height of no more than 2.0m with sufficient distance between each to allow movement of tracked plant to gain access.

Care will be taken to remove the correct depth of topsoil from the undulating ridge and furrow surface by stripping parallel with the ridges, ensuring the blade of the excavator follows the contours and by adjusting the stripping depth as necessary to remove the full depth of organic topsoil. It should be noted that compound A1 is within an area of potential archaeology, therefore a smooth bucket and a tracked excavator should be utilised for topsoil/subsoil stripping. For further information refer to the Heritage Delivery Strategy (ref: 133735-EWR-REP-EEN-000244). All topsoil stripping in compound A1 will be monitored and directed by the supervising archaeologist.

Soil classed as Unit 6 should be stripped separately and stored by soil type in separate bunds.

If Made Ground is found within the agricultural area, it should be stripped and stored in separate bunds.

The stripping of soil, identification of visual / olfactory evidence of contamination and overseeing of what material is placed in what stockpiles should be the responsibility of the Materials Management Specialist.

The stripped topsoil will be stored in a bund at the southern end of the compound. Bunds will not normally exceed 2 m but may be up to 3 m if necessary, to avoid the need for a greater land take. Topsoil will not be stripped from under topsoil bunds so that topsoil is stored on similar material.

Bunds will be set back from the stripped area by at least 0.5 m to prevent the loss of topsoil into the excavation. Bunds will be fenced off from the compound to prevent materials being stored on the sides of the mounds.

The topsoil will remain within the field boundary for deposition in its original location during restoration unless otherwise agreed with the owner.

Subsoil will not require stripping except if required for archaeological investigation or for the installation of any service channels, however it should be protected from compaction and contamination from construction materials. This shall be achieved by using a geotextile lining that is resistant to tearing and a geogrid filled with stone to distribute the weight evenly across the subsoil layer, thereby reducing compaction damage. Once the required topsoil and any Made Ground (if found) has been stripped the surface of the compound can be levelled to provide an even surface to receive the geotextile / geogrid and stone, to form the required areas of hardstanding and carparks.

Any visual or olfactory evidence of contamination encountered during soil stripping must be reported immediately to the Environment and Sustainability Team in accordance with the EWR Incident Response Plan[5]. All soil stripping in that location must cease until advice is provided.

[4] 133735_2A-EWR-OXD-XX-DR-L-019001 to 019002 and 133735_2B-EWR-OXD-XX-DR-L-019003 to 01909
[5] Document Reference: 133735-EWR-EMP-EEN-000003

Table 8.1: Recommended average soil stripping depth

Soil unit	Auger borings	Bottom depth of horizon (mm)	Predominant topsoil texture	Stripping depth (mm) below ground level
Unit 4 Topsoil	185-187 + 189,191-193	220	Slightly organic medium clay loam	200 on ridges 250 in furrows
Unit 4 Subsoil	as above	450	Medium clay loam to heavy clay loam	450 (where required)
Unit 6 Topsoil	-	Strip to base of darker layer	-	-
Unit 6 Subsoil	-	Strip as required	-	-

8.3 Drainage

The field is on a slight ridge which drains both to the northern and southern boundaries and so will not receive significant amounts of water from off site.

The archaeological study identified several land drains running parallel with the railway line. The depth of the drains is unknown and soil stripping could affect their condition if they are close to the surface.

- Any existing field drains which are cut off/damaged by the works should be discharged into local drainage ditches through silt traps, to minimise sediment release.
- Water flowing into the ditch and watercourse shall have a silt mitigation installed at the exit point to reduce the sediment load of the discharge water during the life of compound A1. Further details regarding surface water management can be found in the construction environmental management plan[6].
- An audit sheet should record any existing drainage features located during soil stripping, including their type, depth, size, angle and condition. This detail will then be available to aid a review of the requirements of post construction remedial drainage.
- Permanent post construction drainage is likely to be required and existing agricultural land drainage will be replaced if damaged to ensure continued agricultural use.

8.4 Soil storage

The soils will be in store for approximately four years. Soil stores should be placed within the site boundary for screening and final restoration of the compound area. Soils will be stored in bunds to keep separate soils with significantly different soil textures. Topsoil from agricultural uses, Unit 6 soils and Made Ground (if identified) should be kept separate at all times. Bunds will be set back by more than 0.5 m from the edge of the excavation to prevent soils slumping into the cut. All bunds should be labelled with their volume and soil type (e.g. ***m^3; Unit 4 topsoil).

Soil types and volumes will be recorded for each bund.

[6] Document Reference: 133735-EWR-EMP-EEN-000002

Table 8.2: Soil bunds height

Soil type	Store on	Bund number	Height (up to _m)
Topsoil			
Unit 4	Topsoil	Bund 1	Ideally 2 m but up to 4 m if short of space.*
Topsoil / Subsoil with anthropogenic materials			
Unit 6 Variable topsoil / subsoil containing some anthropogenic materials therefore potential for contamination	Topsoil	Bund 3	3 m but up to 5 m for screening, if required.

* Soil generally gains strength and becomes more resistant to damage as it dries therefore stockpile heights should be minimised, where space allows.

Soil should be placed into store by tracked equipment where possible, in a loose condition and the top and sides of the bunds slightly firmed to consolidate the surface to reduce water penetration.

A low maintenance grass seed mix will be sown on bunds that will be in place for more than six months, at a rate of 5 g/m^2. Selection of the seed mix will depend on nutrient content of the soils, the need for a low maintenance regime and seasonal availability. The soil testing results will be provided to the supplier by the Materials Management Specialist who shall then specify an appropriate mix.

For the entire period during which soil is stored, all stockpiled material within the bunds will be reviewed annually, by the Materials Management Specialist, to ensure that it still meets the following:

- Materials remain suitable for their intended use (e.g. checking for contamination via visual inspections and suitable testing, if required).
- Necessity/certainty of use for those materials remains (i.e. still required for restoration purposes).
- The quantity being stored does not exceed design requirements (i.e. what is required to restore the site).

Any stockpiled excavated materials that fail to meet all of these requirements may be considered waste and appropriate action will be taken by the Materials Management Specialist.

Bunds will be inspected by the Materials Management Specialist in early May each year with the aim of keeping the grass weed free, by mowing or spraying weeds with a selective herbicide before they set seed. The type of herbicide will be determined by the plant species present and in agreement with the landowner.

9. Site clearance and soil reinstatement

Once construction is completed and access is no longer required, all temporary land take areas should be restored for return to agriculture and adjacent road verge. Any construction materials, services and temporary matting / geogrid / stones should be lifted and removed from site prior to remediating the land and replacing the soils. It is important to note that the geogrid should be carefully lifted to reduce the risk of splintered plastic contaminating the subsoil.

Topsoil should be reinstated over subsoils from the same soil unit e.g. Unit 4 topsoil should be placed over Unit 4 subsoil, with the subsoil below ripped and contamination such as stone, plastic and remnants from the geotextile membrane removed. If Made Ground is found this should be returned to its place of origin.

To ensure the land can be reused effectively on completion of the works, it is essential to minimise and repair any soil structural issues caused during soil handling. The following methodology will be adopted to minimise soil damage:

- The soils should only be taken out of store when they and the site are sufficiently dry to prevent compaction of the underlying soil. Ideally the soil should only be replaced between mid-April and the end of October when they are at their driest. Soil replacement should only take place when the soils are below their plastic limit and not within 24 hrs of significant rainfall (i.e. <10 mm in 24 hrs) so that the soils have a full day of drying before work recommences.
- 10 days prior to soil reinstatement soil stores will be sprayed off with a total contact herbicide, such as glyphosate, to kill all vegetation.
- Prior to spraying the following soil sampling should be undertaken:
  - In preparation for soil placement each topsoil bund should be sampled (using standard sampling techniques i.e. 25 subsamples from different depths bulked to form one sample) for major nutrients including, phosphorus, potassium, magnesium and pH, as per the testing suite in Appendix F. Samples from the deeper core of the bund should be collected with an excavator and added to the main sample.
  - Geochemical samples of the stockpiled topsoil and subsoil from Units 4 should be collected at a rate of 1 per 5,000 m^3 with a minimum of 3 samples taken and tested in accordance with the testing suite in Appendix E. Soil test results from topsoil and subsoil should be compared against the geochemical testing undertaken in Appendix E.
  - Geochemical samples of stockpiled Unit 6 and Made Ground soils should be collected and tested at a rate of 1 per 1,000 m^3, with a minimum of 3 samples to be taken and tested in accordance with the testing suite in Appendix E. Soil test results from the Unit 6 topsoil / subsoil and Made Ground should be compared against the scheme re-use criteria provided in Appendix G.
- All construction materials and cabins will be removed from site including the stone and geotextile placed over the subsoil. Care will be taken to remove the stone and geotextile without removing the upper layer of subsoil. The site will be litter picked to remove any remaining construction waste and stones larger than 100mm diameter and manged in accordance with the Site Waste Management Plan (SWMP). The surface of the subsoil should be inspected to ensure that all construction material has been removed and that the site is in a state fit to receive the topsoil.
- Following the removal of any temporary matting / stones, validation soil samples should be collected from the subsoil at ground surface at a rate of 5No. locations across the site to be determined by the Materials Management Specialist. This is to target areas where vehicles have been parked or oils have been stored to assess the potential risk of contamination to subsoils following the use of the compound. Samples will be collected in near surface soils targeting these high risk areas and tested in accordance with Appendix E. Testing results should be compared against the baseline laboratory analysis results from Compound A1 in Appendix F.
- The Environment and Sustainability Team should be notified immediately should any soil testing results fail the assessment criteria, visual inspection identifies potential contamination, or if soils are no longer required for restoration. If soils are considered to be unsuitable due to contamination

impacts, remediation may be required, and advice should be sought from the Materials Management Specialist.

- All temporary services and should be chased out and the trenches filled with subsoil from store.
- If significant soil structural damage, or damage to existing land drains is proved to have occurred, install a suitably designed agricultural land drainage scheme into the subsoil and fill the trench with permeable back fill to the top of the subsoil.
- Remove compaction in the subsoil prior to replacing the topsoil, unless the presence of utilities prevent deep cultivation. The soils should be ripped with a winged tine subsoiler set 20 mm below the bottom depth of the compact layer, ensuring that the subsoiler crosses the drains to improve water discharge.
- Unless otherwise agreed with the landowner the ridge and furrow undulations should be reinstated into the subsoil surface and tied into the contours on the undisturbed areas, leaving room for 220mm of topsoil. Continuity of the furrow is important to ensure that water can still flow across the site. Exceptions to the reinstatement of the ridge and furrow could potentially be negated upon agreement with the farmer and evidence that this will not adversely affect the surface water draining capability of the field.
- On completion of subsoiling the agricultural areas should be inspected by a Soil Scientist to ensure the site is in a suitable condition to receive the topsoil.
- Topsoil should be replaced with minimum vehicular movements to avoid re-compacting the loosened surface. Traffic movements will be controlled along defined routes and working only in dry conditions. Restoration should start at the furthest point from the exit to ensure that soils once deposited are not run on by earth moving machinery. If there are any wet patches on the haul roads, they should be covered with temporary metal tracks to protect the subsoil.
- Replace topsoil to its full depth maintaining and tying into the original contours on either side of the compound to allow surface water flow.
- Unit 6 soils and other Made Ground soils should be replaced in areas from which they were excavated referencing the records produced during soils stripping.

10. Restoration of the existing temporary compound area

A temporary compound was constructed in summer 2018 adjacent to the site entrance, by laying a membrane over the topsoil, infilling the ridge and furrow hollows with stone and laying a temporary hardstanding over the whole area for equipment. As part of the compound A1 construction this area will require remediation once the buildings and hardstanding have been removed as follows:

- Inspect the site to ensure all stone and construction materials have been removed.
- To prevent waterlogging tie in levels at the boundary between the temporary and larger compounds so that surface water flow is not interrupted along the furrows.
- Inspect the soil to determine the depth of introduced compaction and rip with a winged tine subsoiler set 20 mm below the bottom depth of the compaction. The subsoiler legs should be set apart at a distance of twice the working depth (e.g. if subsoiling at 300 mm set the legs 600 mm apart).
- Topsoil should be stripped and stored as per the rest of the site to be used as Compound A1.
- Check the condition of any drains to ensure they are still in working order and replace/repair as necessary.

11. Agricultural land restoration

Once the soils have been placed in their original sequence the restoration will be completed by undertaking the following works in the agricultural area:

- Following topsoil replacement, the soil will be thoroughly loosened to a depth of 400mm to tie the topsoil and subsoil together, but only in dry conditions. Dry conditions when materials are below the lower plastic limit and not normally within 48 hrs of significant rainfall (i.e. <10 mm in 24 hrs). The soil will be tested on site by attempting to form a worm of soil 3 mm in diameter by rolling it out on a flat non-porous surface. If the soil 'worm' will not form or is cracked the soil is sufficiently dry to handle.
- Soil loosening will be carried out, at an angle to the line of the known drains and, where possible, extended into the undisturbed soil on the lower ground. The depth of working and the type of equipment used will be determined by the depth of compaction. In addition, agricultural equipment should be used to loosen and aerate the soil and provide a connection between the topsoil and the subsoil. Equipment is likely to comprise of tines capable of working at different depths and a leveller board but the exact equipment required can only be determined by soil conditions on the day of activity.
- The site will be litter picked to remove any remaining construction waste and large stones brought up by subsoiling, prior to sowing the crop. These should be managed in accordance with the SWMP (133735-EWR-REG-EEN-000007).
- As agreed with the farmer/land owner a suitable crop will be planted to help stabilise the soil structure. A seed bed will be established with secondary cultivation equipment such as discs, tines and press, suitable for the intended crop. The field will be sown with either a seed mix specified by the landowner or a permanent pasture mix, as presented in the landscape design drawings[7]. Sowing shall be at a rate of 50 kg/ha and established with fertiliser at rates to be determined by nutrient analysis at the restoration stage.
- Any damage to hedgerows will be repaired in the autumn with a double staggered row of mixed species quicks.
- If made ground is identified a verification report will be required post restoration in areas using Unit 6 soils. This should detail:
  - The location from which the soils were originally excavated, the bund that they were stored in, how long the soils were stored for and where in the subsection they have been reused. Records of volumes are also required.
  - Results of the annual stockpile reviews, including details of any soils that required removal from site during storage.
  - Photographs of the works.
  - Test results and confirmation that the soils are suitable for reuse.
  - Details of any soils deemed unsuitable for use during restoration and how they were managed.
  - Details of any soils imported for restoration purposes.

[7] 133735_2A-EWR-OXD-XX-DR-L-015003

12. Aftercare

On completion of the restoration works the soils will be in a fragile condition and all work should be geared towards stabilising the soil structure and establishing a strongly growing crop to ensure the best chance of a successful and sustainable restoration. During aftercare, all use of herbicides will be in compliance with Defra 'Code of Practice for Using Plant Protection Products' (2006).

Prior to disturbance the soils were low in phosphorus and potassium (Index 1) and, at pH 6.3 had a pH suitable for grassland (see Appendix D).

During aftercare, all use of herbicides will be in compliance with Defra 'Code of Practice for Using Plant Protection Products' (2006).

The responsibility for undertaking the aftercare programme and the work required should be agreed between the Alliance and the farmer. A typical example of the work required is provided below.

12.1 Year 1

The field should be restored to pasture or species rich grassland as required by the farmer, as soon as possible after reinstatement of the soils. The field should be limed, fertilised and sprayed with herbicide as necessary to maximise grass growth. Fertiliser should be applied at suitable rates to ensure that soil nutrient levels are sufficient for the growing crop. The soils should be resampled for major nutrients at the time of restoration if time permits, otherwise the pre-working sample results should be used to determine the fertiliser requirements.

At the end of the first year of cropping the land should be checked by a soil scientist for settlement and any hollows should be infilled by scraping back the topsoil and infilling the hollows with subsoil, before reinstating the scraped-back topsoil.

The drain discharge points should be checked to ensure they are still clear of vegetation or silt.

12.2 Year 2 - 5

The site should be monitored each year by the agreed person, to check the condition of the soil and grass and amelioration work undertaken as necessary. This work is likely to include filling of any settlement hollows, subsoiling to improve soil structure and grass patching areas of poor growth once any drainage issues have been addressed.

13. Records

13.1 Soil Records and Audits

As stated within the report under the SMP there should be a record kept of the following:

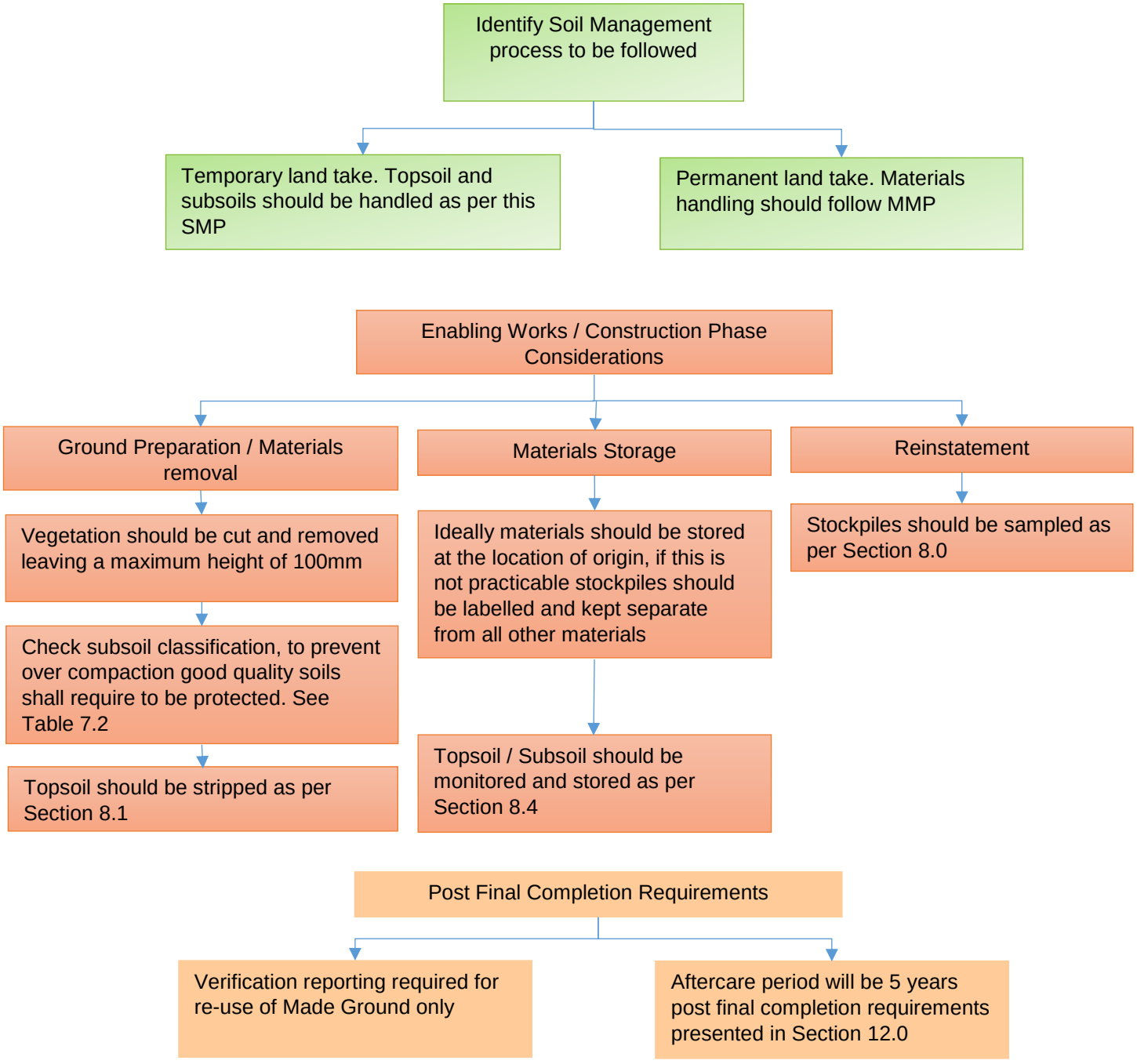
- Soil stripping and stockpiling locations to be tracked and mapped (as detailed in Section 8.2)
- The tracker should include any existing drainage features identified during stripping (Section 8.3)
- The soil type and volumes should be recorded for each bund (Section 8.4)
- An annual review of the stockpiles should be undertaken ensuring that the materials are stored in line with this SMP (Section 8.4)

14. Review Schedule

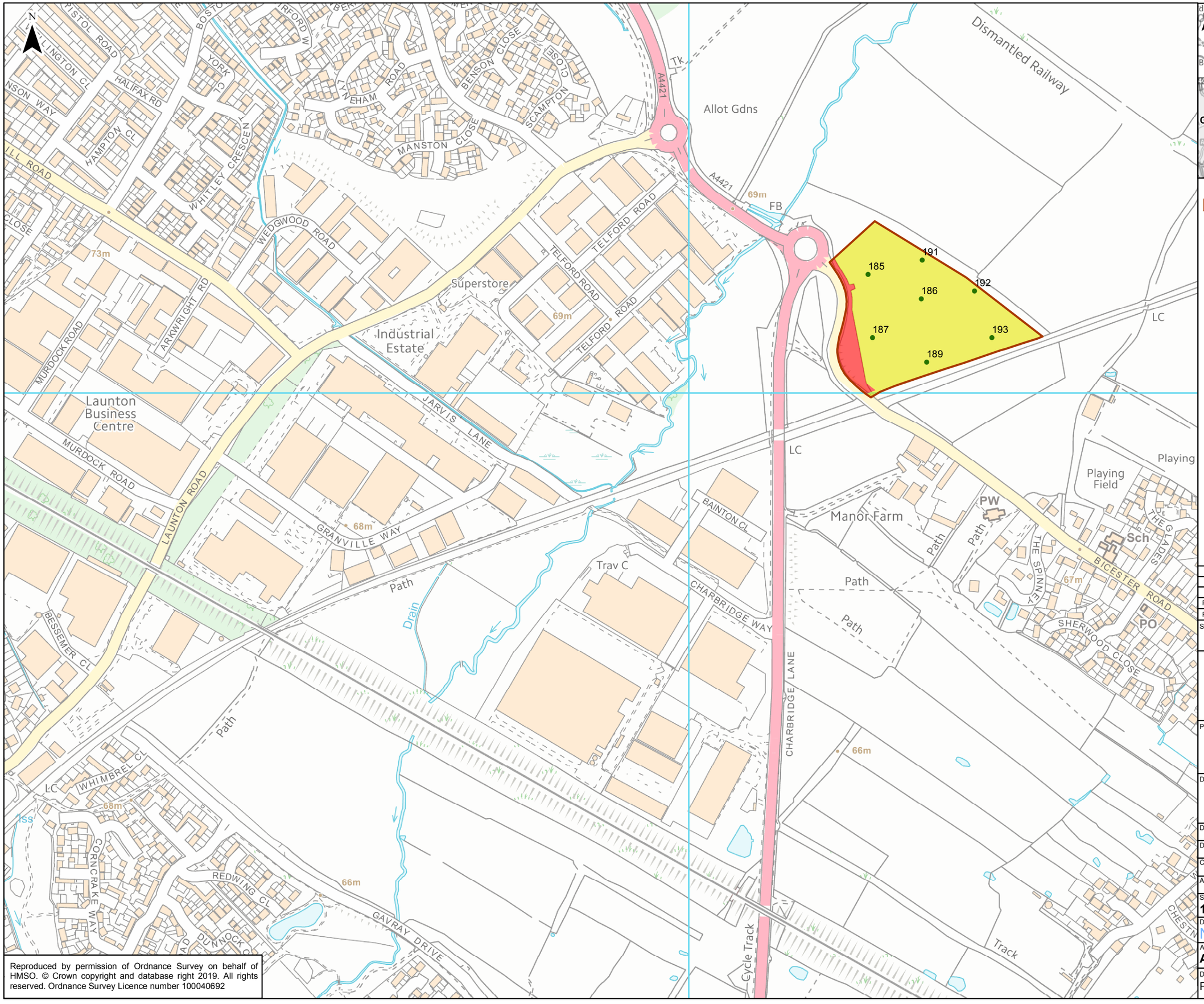
The annual review should be completed under the guidance of the Section Environmental Manager on a yearly basis and reported to the client. Reusing topsoil and subsoil materials on site and storing in the locality for reuse, where possible, follows the VfM approach required in the PAA and the core principles presented in the Alliance Charter.

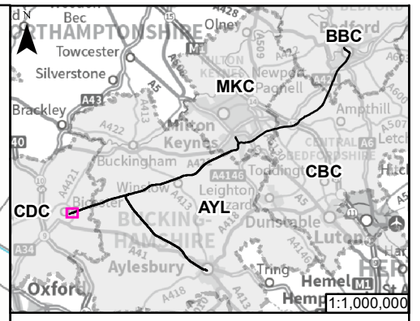
Although this report should be reviewed annually it should also be updated in instances where additional land is leased for the storage of materials or plant. This will ensure that the land restoration requirements are met which shall be a stakeholder requirement as well as that within the EWR principles. The update of this report shall be the responsibility of the Environmental Manager responsible for the Section of the works, either 2A, 2B or 2C.

Appendix A. Quick Guide


Identify Soil Management process to be followed
Temporary land take. Topsoil and subsoils should be handled as per this SMP
Permanent land take. Materials handling should follow MMP
Enabling Works / Construction Phase Considerations
Ground Preparation / Materials removal
Vegetation should be cut and removed leaving a maximum height of 100mm
Check subsoil classification, to prevent over compaction good quality soils shall require to be protected. See Table 7.2
Topsoil should be stripped as per Section 8.1
Materials Storage
Ideally materials should be stored at the location of origin, if this is not practicable stockpiles should be labelled and kept separate from all other materials
Topsoil / Subsoil should be monitored and stored as per Section 8.4
Reinstatement
Stockpiles should be sampled as per Section 8.0
Post Final Completion Requirements
Verification reporting required for re-use of Made Ground only
Aftercare period will be 5 years post final completion requirements presented in Section 12.0

Appendix B. Soil Resource Drawing





PROJECT EXTENTS
COMPOUND BOUNDARY
AUGER POINTS

SOIL RESOURCES

SOIL UNIT 4
SOIL UNIT 6

0 50 100 150 200 Metres

Rev	Date	Description of Revisions	Dsnd	Chkd	Appr
P01	11/03/19	Reduced size of A1 compound bndy	HM	RS	SR

Status: WIP - APPROVE
Suitability: S0

EWR Alliance
Connecting People

Project
EAST WEST RAIL WESTERN SECTION
PHASE 2

Drawing Title
FIGURE 1
SOIL RESOURCE - COMPOUND A1

Designed	Paul Taylor	Signed	Date 27/03/2019
Drawn	Paul Taylor	Signed	Date 27/03/2019
Checked	Rosemary Peel	Signed	Date 27/03/2019
Approved		Signed	Date

Scale(s): 1:5,000
ELR & Project Chainage: N/A
Design Package Risk Classification: NORMAL
Sheet: 1 of 66
Alternative Reference: Alternative_Ref
Revision: P01
Drawing Number: PW NUMBER DDP

Sheet Size A3 297 x 420

Appendix C. Soil Descriptions

Compound A1

Schedule of auger borings and soil pit

Soil pit at auger point 186

Compound	Grid reference / horizon depth (mm)	Soil description
A1	460311, 223151	**Land use:** Grass. **Land ID: 6862**
	0-200	Dark greyish brown medium clay loam with common rusty root mottles.
	200-470	Yellowish brown heavy clay loam with common ochreous mottles. Very compact.
	470-620	Yellowish brown sandy clay loam with common ochreous mottles. Firm – impossible to structure.
Comments:		

Auger borings

Profile number	Horizon depth (mm)	Soil description
185		**Land use:** Grass. **Land ID: 6862**
	0-220	Dark grey brown clay loam, slightly organic, stoneless.
	220-550	Grey brown heavy clay loam, common ochreous mottles, stoneless.
	550 – 1000	Grey clay, abundant ochreous mottles and Manganese concretions, stoneless.
Comments:		
186		**Land use:** Grass. **Land ID: 6862**
	0-200	Dark grey brown medium clay loam, slightly organic. Occasional root mottles, stoneless. Medium moderate subangular blocky
	200-470	Yellow brown heavy clay loam, common ochreous mottles, stoneless. Massive and compact.
	470 – 750	Yellow brown sandy clay loam, common ochreous mottles and Manganese concretions, stoneless. Too dry to assess soil structure.
	750 – 1000	Grey clay, abundant ochreous mottles, stoneless.
Comments:		
187		**Land use:** Grass. **Land ID: 6862**
	0-200	Dark grey brown medium clay loam, slightly organic, stoneless.
	200-310	Brown medium clay loam, common ochreous mottles, Stoneless. Very firm and dry.
	310+	Too dry to auger.
Comments:		
188		Number omitted

Profile number	Horizon depth (mm)	Soil description
189		**Land use:** Grass. **Land ID: 6862**
	0-260	Dark grey brown medium clay loam, slightly organic. Occasional root mottles, stoneless.
	260-560	Brown medium clay loam, common ochreous mottles, stoneless.
	560 – 700	Brown heavy clay loam, common ochreous mottles and Manganese concretions, stoneless.
	700 – 820	Yellow brown heavy clay loam, gritty, common ochreous mottles, stoneless.
	820 – 1000	Grey clay, abundant ochreous mottles, stoneless.
Comments:		
191		**Land use:** Grass. **Land ID: 6862**
	0-190	Dark brown medium clay loam, slightly organic, stoneless.
	190-380	Brown medium clay loam, common ochreous mottles, few stones.
	380 – 550	Brown heavy clay loam, common ochreous mottles and Manganese concretions, stoneless.
	780 – 1000	Grey clay, abundant ochreous mottles, stoneless.
Comments:		
192		**Land use:** Grass. **Land ID: 6862**
	0-210	Dark grey brown medium clay loam, organic, stoneless.
	210-300	Yellow brown medium clay loam, common ochreous mottles, stoneless. Very firm and dry.
	300+	Too dry to auger.
Comments:		
193		**Land use:** Grass. **Land ID: 6862**
	0-200	Dark grey brown medium clay loam, slightly organic, few ochreous root mottles, stoneless.
	200-530	Brown medium clay loam, common ochreous mottles, few stones.
	530 – 670	Brown heavy clay loam, common ochreous mottles and Manganese concretions, stoneless.
	670-1000	Grey clay, abundant ochreous mottles, stoneless.
Comments:		

Appendix D. Laboratory Analysis – BS3882

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Tel. : 01789 416933

K474

Please quote the above code for all enquiries

Client : 1010266

Distributor : 1010266

Sample Matrix : Agricultural Soil

Laboratory Reference
Card Number 77890/18

Date Received 24-Sep-18
Date Reported 26-Sep-18

SOIL ANALYSIS REPORT

Laboratory Sample Reference	Field Details			Index			mg/l (Available)		
	No.	Name or O.S. Reference with Cropping Details	Soil pH	P	K	Mg	P	K	Mg
536311/18	1	**EWR-COMPOUND A1** *No cropping details given*	**6.3**	**1**	**1**	**3**	**15.2**	**106**	**147**

If general fertiliser and lime recommendations have been requested, these are given on the following sheets.
The analytical methods used are as described in DEFRA Reference Book 427
The index values are determined from the DEFRA Fertiliser Recommendations RB209 9th Edition.

Released by Joe Cherrie On behalf of NRM Ltd Date 26/09/18

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DATE	26th September 2018
SAMPLES FROM	1010266
SAMPLED BY	1010266
Report reference	77890/18

SIMON MCMILLAN
RSK ADAS LTD
ALCESTER RD
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Fax:

Fertiliser Recommendations

The phosphate and potash recommendations shown below, are those required to replace the offtake and maintain target soil indices. The larger recommended applications for soils below target index will allow the soil to build up to this target index over a number of years. Not applying fertiliser to soils which are above target index will allow the soil to run down over a number of years to the target index.
The recommendation should be increased or decreased where yields are substantially more or less than that specified. The amount to apply can be calculated using the expected yield and values for the offtake of phosphate and potash per tonne of yield given in the RB209 9th edition.
All recommendations are given for the mid-point of each Index.
Where a soil analysis value (as given by the laboratory) is close to the range of an adjacent Index, the recommendation may be reduced or increased slightly taking account of the recommendation given for the adjacent Index. Small adjustments of less than 10 kg/ha are generally not justified.
Don't forget to deduct nutrients applied as organic manures.
For Nitrogen recommendations please refer to the RB209 9th edition or seek advice from an FACTS qualified adviser.
Target Indices:
Arable, Forage, Grassland and Potato Crops: P Index 2, K Index 2-
Vegetables and Bulbs: P Index 3, K Index 2-
Fruit Vines and Hops: P Index 2, K Index 2, Mg Index 2
(Note: Cider apples respond to K Index 3, Mg Index 3)
A lime recommendation is usually for a 20cm depth of cultivated soil or a 15cm depth of grassland soil. Where soil is acid below 20 cm and soils are ploughed for arable crops, a proportionately larger quantity of lime should be applied. However, if more than 10 t/ha is needed, half should be deeply cultivated into the soil and ploughed down, with the remainder applied to the surface and worked in.
For established grassland or other situations where there is no, or only minimal soil cultivation, no more than 7.5 t/ha of lime should be applied in one application.
In these situations, applications of lime change the pH below the surface very slowly. Consequently, the underlying soil should not be allowed to become too acidic because this will affect the root growth and thus limit nutrient and water uptake, which will adversely affect yield.

Field Name / Ref / Soil Type	*Last Crop / Next Crop*		*P2O5*	*K2O*	*MgO*	*Lime (Arable)*		*(Grass)*
EWR-COMPOUND A1	**Not Given / Not Given**	*Units/Acre*				*T/Ac*	**1.1**	**0**
536311 /		*Kg/Ha*				*Te/Ha*	**2.8**	**0**

Fertiliser recommendations are based on **(Ninth Edition - 2017).** If a nutrient is deficient and no recommendation is given, either no recommendation is given in RB209 or we have insufficient data to give a recommendation. Apply Lime to the nearest half Ton / Tonne.
NRM is a UKAS accredited laboratory to ISO/IEC 17025:2005

Appendix E. Laboratory Analysis - Baseline Geochemical Data

Envirolab Job Number: 18/07655

Client Project Name: Drayton

Client Project Ref: EWR

Lab Sample ID	18/07655/1	18/07655/2	18/07655/3	18/07655/4					Units	Method ref
Client Sample No	A1-185	A1-185	A1-193	A1-193						
Client Sample ID	EWR	EWR	EWR	EWR						
Depth to Top	0.10	0.50	0.10	0.50						
Depth To Bottom	0.20	0.70	0.20	0.70						
Date Sampled	18-Sep-18	18-Sep-18	18-Sep-18	18-Sep-18						
Sample Type	Soil	Soil	Soil	Soil						
Sample Matrix Code	4E	5	4E	5						
% Stones >10mm$_A$	<0.1	<0.1	<0.1	<0.1					% w/w	A-T-044
pH$_D$[M#]	6.27	7.18	7.28	7.48					pH	A-T-031s
Ammonium / Ammoniacal Nitrogen as NH4$_D$	7.22	0.77	6.64	<0.26					mg/kg	A-T-033s
Sulphate (acid soluble)$_D$[M#]	960	350	840	310					mg/kg	A-T-028s
Cyanide (free)$_A$[M#]	<1	<1	<1	<1					mg/kg	A-T-042sFCN
Cyanide (total)$_A$[M#]	<1	<1	<1	<1					mg/kg	A-T-042sTCN
Phenols - Total by HPLC$_A$	<0.2	<0.2	<0.2	<0.2					mg/kg	A-T-050s
Sulphide$_A$	<5	<5	<5	200					mg/kg	A-T-S2-s
Loss on ignition (550degC)$_D$	10.9	7.5	9.3	5.0					% w/w	A-T-030s
Fraction of organic carbon$_D$[#]	0.0362	0.0046	0.0278	0.0049					N/A	A-T-032 FOC
Arsenic$_D$[M#]	4	4	3	6					mg/kg	A-T-024s
Boron (water soluble)$_D$[M#]	1.2	<1.0	<1.0	1.7					mg/kg	A-T-027s
Cadmium$_D$[M#]	0.8	0.8	0.7	1.2					mg/kg	A-T-024s
Copper$_D$[M#]	24	21	11	19					mg/kg	A-T-024s
Chromium$_D$[M#]	35	31	36	21					mg/kg	A-T-024s
Chromium (hexavalent)$_D$	<1	<1	<1	<1					mg/kg	A-T-040s
Lead$_D$[M#]	65	18	21	11					mg/kg	A-T-024s
Mercury$_D$	<0.17	0.30	0.22	<0.17					mg/kg	A-T-024s
Nickel$_D$[M#]	14	10	19	65					mg/kg	A-T-024s
Selenium$_D$[#]	2	2	<1	1					mg/kg	A-T-024s
Vanadium$_D$[M#]	56	27	56	23					mg/kg	A-T-024s
Zinc$_D$[M#]	76	51	72	110					mg/kg	A-T-024s
TPH total (>C6-C40)$_A$[M#]	37	<10	41	<10					mg/kg	A-T-007s
E-Coli (Faecal Coliforms)$_A$	<10	<10	<10	<10					cfu/g	Subcon Mercian
Intestinal Enterococci (Faecal Streptococci/Faecal Enterococci)$_A$	<10	<10	10	<10					cfu/g	Subcon Mercian
Asbestos in Soil (inc. matrix) ^										
Asbestos in soil$_A$[#]	NAD	NAD	NAD	NAD						A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A						

Envirolab Job Number: 18/07655

Client Project Name: Drayton

Client Project Ref: EWR

Lab Sample ID	18/07655/1	18/07655/2	18/07655/3	18/07655/4					Units	Method ref
Client Sample No	A1-185	A1-185	A1-193	A1-193						
Client Sample ID	EWR	EWR	EWR	EWR						
Depth to Top	0.10	0.50	0.10	0.50						
Depth To Bottom	0.20	0.70	0.20	0.70						
Date Sampled	18-Sep-18	18-Sep-18	18-Sep-18	18-Sep-18						
Sample Type	Soil	Soil	Soil	Soil						
Sample Matrix Code	4E	5	4E	5						
PAH-16MS										
Acenaphthene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Acenaphthylene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Anthracene$_A^{M\#}$	<0.02	<0.02	<0.02	<0.02					mg/kg	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04					mg/kg	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04					mg/kg	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	<0.05	<0.05	<0.05	<0.05					mg/kg	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	<0.05	<0.05	<0.05	<0.05					mg/kg	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	<0.07	<0.07	<0.07	<0.07					mg/kg	A-T-019s
Chrysene$_A^{M\#}$	<0.06	<0.06	<0.06	<0.06					mg/kg	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04					mg/kg	A-T-019s
Fluoranthene$_A^{M\#}$	<0.08	<0.08	<0.08	<0.08					mg/kg	A-T-019s
Fluorene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01					mg/kg	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03					mg/kg	A-T-019s
Naphthalene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03					mg/kg	A-T-019s
Phenanthrene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03					mg/kg	A-T-019s
Pyrene$_A^{M\#}$	<0.07	<0.07	<0.07	<0.07					mg/kg	A-T-019s
Total PAH-16MS$_A^{M\#}$	<0.08	<0.08	<0.08	<0.08					mg/kg	A-T-019s

REPORT NOTES

General:
This report shall not be reproduced, except in full, without written approval from Envirolab.
All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,
E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Appendix F. Geochemical Testing Suite

Appendix G. Scheme Re-Use Criteria

Final Derived Re-use Number

Inorganics	Level of assessment (Most conservative of EQS, DWS or Haz Threshold)	Soil Re-use Criteria (mg/kg)	Max Reported Soil Concentration (mg/kg)**	Leachate Re-use Criteria (mg/l)	Max reported Soil Leachate Concentration (mg/l)
Total Sulphate as SO4	Level 2 (further assessment not required)	230,117	200,000	11,543	3,800
Ammonium as NH4	Level 2 (EQS Only)	127.9	51.00	18.0	10
Metals					
Arsenic	Level 2 (hazardous substance)	305	360.00	0.23	0.05
Boron	Level 2 (further assessment not required)	1,536	64.00	46.17	0.37
Cadmium	Level 4	59.5	2.90	0.25	ND
Chromium (hexavalent)	Level 2 (hazardous substance)	8.10	ND	0.23	ND
Chromium	Level 2 (further assessment not required)	1,137.54	660.00	0.22	0.01
Copper	Level 4	13,012	430.00	44.09	0.06
Lead	Level 2 (hazardous substance)	614	735.00	0.23	0.01
Mercury	Level 2 (hazardous substance)	0.99	0.90	0.00046	ND
Nickel	Level 2 (further assessment not required)	4,184	95.00	0.92	0.02
Selenium	Level 3	8.53	18.00	0.89	0.02
Vanadium	Level 3	501	150.00	3.55	0.01
Zinc	Level 2 (further assessment not required)	21,508	1,750.00	3	0.06
Iron*	Level 2 (further assessment not required)	7,481	Not tested	9.23	9.00
Manganese*	Level 3	223	Not tested	4.43	2.10
Monoaromatics					
Benzene	Level 2 (hazardous substance)	0.05	ND	0.05	Not tested
Toluene	Level 2 (hazardous substance)	0.57	ND	0.18	Not tested
Ethylbenzene	Level 2 (hazardous substance)	0.12	ND	0.05	Not tested
p & m-xylene	Level 2 (hazardous substance)	0.88	ND	0.14	Not tested
o-xylene	Level 2 (hazardous substance)	1.01	ND	0.14	Not tested
Petroleum Hydrocarbons					
TPH-CWG - Aliphatic >EC5 - EC6	Level 2 (hazardous substance)	8.07	ND	0.46	Not tested
TPH-CWG - Aliphatic >EC6 - EC8	Level 2 (hazardous substance)	31.50	ND	0.46	Not tested
TPH-CWG - Aromatic >EC5 - EC7	Level 2 (hazardous substance)	2.82	ND	0.46	Not tested
TPH-CWG - Aromatic >EC7 - EC8	Level 2 (hazardous substance)	4.08	ND	0.46	Not tested
TPH-CWG - Aromatic >EC8 - EC10	Level 2 (hazardous substance)	13.89	ND	0.46	Not tested
TPH-CWG - Aromatic >EC10 - EC12	Level 2 (hazardous substance)	20.69	7.20	0.46	Not tested
TPH-CWG - Aromatic >EC12 - EC16	Level 2 (hazardous substance)	39.07	64.00	0.46	Not tested
Napthalene	Level 4	90.23	3.00	4.38	Not tested

***No existing soil data for these parameters**

****** Within Route Section 2A, 2B and 2C**

Appendix H. Soil Strip and Store Record Cards

East West Rail Phase 2 - Record of Soil Storage (Incl. Annual)

Site:	Weather:	Date of visit:

Location / grid ref / site ref			
Bunds			
Location of soil origin			
Machinery used for stockpiling			
Height of bund (m)[1]			
Width of bund (m)	**At Base:**	**At Top:**	
Length of bund (m)			
Surface formed to shed water?	Yes / No (circle)		
Evidence of erosion / slumping?	Yes / No (circle)	If Yes, record concerns below	
Significant rainfall in last 24 hrs?	Yes / No (circle)	Detail:	
Vegetation type / cover / condition/nesting birds/drains[2]			
Soils			
Soil Unit recorded?	Yes / No (circle)		
Soil Type recorded?	Yes / No (circle) type - Topsoil / Upper Subsoil / Lower Subsoil		
Soil Volume recorded?	Yes / No (circle) quantity if recorded:		
Protected from trafficking or dumping?	Yes / No (circle)	If No, record concerns below	
Soil description	***Topsoil***	***Subsoil***	
Age of soil store			
Soil texture (standard textures)			
Stones (% and type)			
Foreign objects (% and type)			
Evidence of anaerobism?[3]			
Conclusion			
Are bunds in an acceptable condition?	Yes / No (circle)	If No, record concerns below and outline remedial work required	
Approved:		**Signature:**	

[1]This section is to be completed when the bund has been completed. 10% reduction should be applied to allow for settlement which shall take several months.

[2]Confirmation of grass seed establishment required, percentage cover to be included.

[3]To be confirmed during the final inspection prior to topsoil reinstatement. Two or 3 trial holes to be dug along the length of the bund, if materials are noted as being grey with a strong sulphurous odour the stockpiles shall require aeration. Advice to be sort from a soil scientist.

East West Rail Phase 2 - Record of Soil Stripping

Site:	Weather:	Date of visit:

Location / grid ref / site ref						
Area (Ha or m^2)						
Location of stockpile(s)						
Soil Unit(s) affected						
Machinery used for stripping						
Machinery used for carting						
Type of alnd use - Grass / Arable etc. on-site (type and condition)						
Significant rainfall in last 24 hrs?	Yes / No (circle)	Detail:				
Surface soil condition[1]	Liquid	Plastic	Moist/friable	Moist/firm	Dry friable	Dry firm
(tick)						
Soil description	***Topsoil***			***Subsoil***		
Depth of strip / horizon condition (use descriptions above)						
Soil texture (standard textures)[2]						
Stones (% and type)[3]						
Foreign objects (% and type)[4]						
Evidence of compaction?[5]						
Root abundance and size						
Condition for stripping	acceptable / not acceptable			acceptable / not acceptable		
Drains located Yes / No (circle)						
Location grid ref. [6]						
Flowing?	Yes / No (circle)	***Approx. flow volume:***		**Direction:**		
Size (diameter mm)		***Angle of pipe:***				
Type e.g. clay, plastic	plastic / clay - round / clay - horseshoe / stone					
Permeable fill present?	Yes / No (circle)	***Depth below surface:***		***Type:***		
Pipe integrity	intact / collapsed or broken					
Silt content	clear / < third / half / two thirds / full					
Can the work proceed?	Yes / No (circle)	***Concerns:***				
Approved:		**Signature:**				

[1]To be completed by the Materials Engineering Team. At or below the plastic limit on site? Samples to be taken to the lab for plasticity and moisture content analysis. Soil characteristics as defined by the Agricultural and Horticulutral Development Board.

[2]Soil texture as defined by the Agricultural and Horticultural Development Board.

[3]Based on visual inspection. Type of stone e.g. flint or quartz etc.

[4]Made ground or anthropogenic material e.g. tile, brick, pottery fragments etc.

[5]E.g. solid layers.This will be important at the restoration stage. Photos to be taken as evidence.

[6]Surveys currently being performed by the Materials Engineering Team.