HyNet North West Hydrogen Pipeline

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Appendix 13A

Peat Desk Study

September 2022

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Executive summary

Purpose of this report

Wood Group UK Limited (Wood) have been commissioned by Cadent Gas Limited ("the Applicant") to prepare a Peat Desk Study in support of the proposed HyNet North West Hydrogen Pipeline Project ('the Project'). This report has been produced for the purpose of presenting the findings of a desk-based review of site information in relation to the presence of peat within the Preliminary Order Limits (red line boundary) as of August 2022. The Project has been scoped to inform the Environmental Impact Assessment (EIA) and a Preliminary Environmental Impact Report (PEIR) is currently in production.

The Project is located in the north west of England and includes the local authority areas of Cheshire West & Chester, Cheshire East, Halton, Trafford, Warrington and St Helens. It passes through various land uses including urban and industrial areas, agricultural land and areas of woodland.

Peat

Peat is an organic material formed by the accumulation of the partially decomposed remains of plant matter and soil organisms, formed over many thousands of years. Peat accumulates where the rate of water supply exceeds the rate of evapotranspiration and drainage, resulting in decomposition of the organic matter being inhibited by waterlogging and decomposition occurring anaerobically.

Where the water supplied to the peat is almost exclusively from precipitation these are referred to as bog peatlands. In addition to bogs, peat may also form in fens, where the water is supplied to the organic matter from mineral rich ground (e.g. the parent material) or surface water (e.g. flooding).

Conclusions

A review of the Cranfield University soil NATMAP has identified four soil associations with peaty characteristics within the Preliminary Order Limits, including Downholland 2, Adventurers' 1, Adventurers' 2 and Turbary Moor. In addition, the British Geological Survey (BGS) information and Natural England Peaty Soils Location (England) data, supplemented by information provided by Cheshire Wildlife Trust and a review of publications relating to peatlands in the relevant regions, reveals that there are seven areas of deep peaty soils within the Preliminary Order Limits, as listed below:

- Frodsham, Ince and Helsby Marshes;
- Halton Moss/Moore;
- Gale Moss/Appleton Thorn;
- Sink Moss;
- Black Moss;
- Carrington Moss; and

- Vale Farm Moss/Unnamed Peatland 1.

Based on the Preliminary Order Limits, with the exception of Halton Moss and Vale Farm Moss, all of the peatlands identified cover all or most of the width of the Order Limits (see **Figure 4**) and as such avoidance is not possible. However, as the desk-based review indicates (see **Section 3.7**), some of the identified areas, notably Carrington Moss, may have had peat removed or damaged during historical activities, which include agriculture for all areas, and waste disposal to ground at Carrington Moss.

Further actions

A ground investigation is being completed in 2022 that includes exploratory excavations within the identified peatlands. This will assist in establishing the presence, depth and thickness of peat in these areas, in addition to providing information on the water table within or in the vicinity of the areas. The investigation scope includes a variety of ground investigation techniques including boreholes, cone penetration tests (CPTs), window sample boreholes and trial pits. This will be based on approximately 250m to 300m spacing within areas of potential deep peaty soils within the Preliminary Order Limits, and exploratory holes will be completed within all areas of possible permanent development (HAGIs and Block Valves). Laboratory testing of peat will be completed and additionally, a peat specialist will attend site during the ground investigation in key areas (including Carrington Moss, and Frodsham, Ince and Helsby Marshes as the largest area of potential deep peat within the Preliminary Order Limits, and where BGS borehole records record peat) to record the condition and physical properties of the peat.

Any further investigation of peat prior to submission of the Environmental Statement (ES) for the Project will be subject to consultation with Natural England and other relevant stakeholders.

As the desk study concludes that it is very unlikely that the Project can avoid all deep peat, it is assumed that peat will need to be handled/excavated during construction of the Project and that some peat will need to be permanently removed. The Project is therefore committed to the use of a Peat Management Plan to ensure that there is systematic consideration of peat management throughout the design and construction phase. There is currently uncertainty over the condition, extent, depth and thickness of peat within the Preliminary Order Limits and as such only a Preliminary Peat Management Plan can be produced. This is presented in **Section 5** of this desk study and the Peat Management Plan will be updated to accompany the Environmental Statement.

Abbreviations

AGI – Above Ground Installation

AOD – Above Ordnance Datum

bgl – below ground level

BGS – British Geological Survey

BV – Block Valve

CEMP – Construction Environmental Management Plan

CWT – Cheshire Wildlife Trust

DTM – Digital Terrain Model

DEFRA – Department for Environment, Food and Rural Affairs

ECoW – Ecological Clerk of Works

ES – Environmental Statement

GWDTE – Groundwater Dependent Terrestrial Ecosystem

HAGI – Hydrogen Above Ground Installation

JNCC – Joint Nature Conservation Committee

HPP – Hydrogen Production Plant

MAFF - Ministry of Agriculture Fisheries and Food

NATMAP - The National Soil Map of England and Wales

OS – Ordnance Survey

RSH - Rocksavage HAGI

PEIR – Preliminary Environmental Information Report

WFD – Water Framework Directive

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1. Introduction

1.1 Background

1.1.1 Wood Group UK Limited (Wood) have been commissioned by Cadent Gas Limited ("the Applicant") to prepare a Peat Desk Study in support of the proposed HyNet North West Hydrogen Pipeline Project (hereafter 'the Project'). The Project is part of the wider HyNet North West programme that will produce, store and distribute hydrogen as well as capture and store carbon from industry in the North West of England and North Wales. The Project comprises permanent Hydrogen Above Ground Installations, Block Valves and around 125km of buried hydrogen pipelines running along four pipeline corridors, referred to in this report as the North, East, South and West Corridors. Spurs area also present to transport smaller volumes of hydrogen to specific customers.

1.1.2 The Project is a Nationally Significant Infrastructure Project (NSIP) under Part 14(1)(f) of the Planning Act 2008 (as amended)[1]. The Applicant intends to submit an application to the Planning Inspectorate for a Development Consent Order (DCO) under Section 37 of the Planning Act 2008. It is currently anticipated that the Project as a whole will be included within the Order Limits, including the spurs which will be included as 'associated development' (in accordance with the Annex to the Secretary of State's Direction under section 35 of the Planning Act 2008). However, where these spurs consist of any lengths of pipeline of less than 7 bar (unit of pressure) these works may be authorised as permitted development pursuant to The Town and Country Planning (General Permitted Development) (England) Order 2015 and subject to screening under The Public Gas Transporter Pipe-line Works (Environmental Impact Assessment) Regulations 1999. In any event, any such areas which may be excluded from the DCO Order Limits in future will, where required, be assessed as part of the cumulative assessment forming part of the full EIA.

1.1.3 This Peat Desk Study is intended to support the PEIR consultation and later DCO application submission for the Project. The extent of the Project, as illustrated in the Preliminary Environmental Information Report (PEIR) and Preliminary Order Limits, is shown on **Figure 1** in **Appendix A**.

1.2 Scope and Purpose

1.2.1 The purpose of this report is to present the findings of a desk-based review of information on the presence of peaty soils (as defined in **Section 2**) within the

[1] Scottish Government (2017) Guidance on Developments on Peatland, Peatland Survey (online). Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2018/12/peatland-survey-guidance/documents/peatland-survey-guidance-2017/peatland-survey-guidance-2017/govscot%3Adocument/Guidance%2Bon%2Bdevelopments%2Bon%2Bpeatland%2B-%2Bpeatland%2Bsurvey%2B-%2B2017.pdf (Accessed August 2022).

Preliminary Order Limits. In the absence of any UK or England specific guidance, this review has been conducted in general accordance with the Scottish Government best practice guide[1], which represents the current best practice for the assessment of peat in the UK. There is no equivalent guidance specifically for England.

1.2.2 The scope of the peat desk study comprises:

- A review of existing desk-based information including geological, soil, hydrological and hydrogeological data for the Preliminary Order Limits.
- A review of available literature relating to peat within the Preliminary Order Limits.
- Provision of conclusions summarising the areas of deep peaty soils[2] identified from desk-based research within the Preliminary Order Limits.
- Provision of recommendations for peat in the context of the Project, including the avoidance of peat, and where this is not possible, the recommended approach to the investigation of areas where deep peaty soils are potentially present to inform the Project design and appropriate peat mitigation measures.

1.3 Project description

1.3.1 The Project includes the construction, operation and maintenance of up to 125km of new pipelines to distribute hydrogen to industry, power stations and opportunities for blending with the existing natural gas network in the North West. The pipeline network would connect to a newly constructed Hydrogen Production Plant at the Vertex Stanlow site as the source of hydrogen for onward distribution through the network. A Central Hub connects the four main pipeline corridors. Branching off from each main corridor there would be spurs - smaller pipelines - that form the connections to customers identified as part of the Project. The Preliminary Order Limits are shown in **Figure 2** in **Appendix A**.

1.3.2 The pipelines that make up the network would vary in diameter between approximately 66” and 42” dependent on which corridor or spur they are on. Two main types of pipe expected to be used are Carbon Steel (CS) and Polyethylene (PE) pipes. The pipeline would be buried along the entire route apart from short sections within secure compounds at locations where HAGIs and Block Valves are required. It is currently envisaged that ten HAGIs and two Block Valves would be required at points along the network.

1.3.3 The HAGIs and BVs take the form of above ground compounds and the hydrogen pipeline will otherwise be routed below ground. The details of these features are still to be confirmed, however indicative locations based on information available at the time of writing are described below. The Pipeline would be constructed predominantly using open cut techniques; where open cut is not practicable trenchless crossing techniques will be used at key locations including motorways and major highways, rail, rivers (typically those classed as main rivers, but some may be ordinary watercourses) and canals.

[2] These are defined in **Section 2** of this report.

1.3.4 A summary description of the above aspects of the Project for each corridor and the spurs is provided below:

- West Corridor: The West Corridor of the Preliminary Order Limits would start at the Hydrogen Production Plant HAGI (HPP HAGI) at Stanlow with the pipeline running approximately 9.7km northeast to the Rocksavage HAGI and then approximately 9.7km southeast to the Central Hub HAGI. The pipeline would be High Pressure and diameter is anticipated to be 42". The West Corridor is typically characterised by open fields with hedgerows and tree lines separating them. The pipeline would be between approximately 1.5km and 2km from the Mersey Estuary SPA and Ramsar at the nearest point. The West Corridor includes eleven trenchless crossings. The HPP HAGI would be located within the south-easterly extent of the Essar Stanlow site, approximately 30m north of the A5117 and 180m west of Pool Lane.
- North corridor: The North Corridor of the Preliminary Order Limits would start at the Central Hub HAGI with the High Pressure pipeline running approximately 9.2km north to the Higher Walton HAGI and then approximately 9.7km northwest to the Clock Face HAGI. The corridor continues broadly north for 6.4km to the St Helens HAGI, which would be an Intermediate Pressure pipeline. The pipeline diameter on the North Corridor is expected to be between 10" to 18". The North Corridor is typically characterised by open fields with hedgerows and tree lines separating them before Sutton Heath, where the route is more typically adjacent to residential areas and proceeds to the more industrial setting around Ravenhead. The North Corridor includes fourteen trenchless crossings. The proposed location for the Clock Face HAGI is in an agricultural field bound by the M62 approximately 20m to the north and the B5419 approximately 30m to the east (both measured to the nearest point). The proposed location of the St Helens HAGI is an area of open grass and scrub directly off Burtonhead Road and to the rear of the Ravenhead Retail Park. There are two options for the location of the Higher Walton HAGI.
- East Corridor: The East Corridor of the preliminary Order Limits would start at the Central Hub HAGI with the Pipeline running approximately 18km northeast to the Warburton HAGI. The Pipeline would then continue northeast for approximately 3.7km to the Partington HAGI. The pipeline diameter is expected to be 30" and High Pressure. A Block Valve is expected to be required between the Central Hub HAGI and Warburton HAGI, three options are under consideration. The Warburton HAGI would be located adjacent to the existing Cadent Above Ground Installation (AGI) facility at Carr Green Lane. The HAGI would be approximately 20m southeast from the B5160 (Dunham Road) in a field with existing established hedgerows and trees. The Partington HAGI would be located west of the junction of Ashton Road and Townsend Farm Lane on an existing disused brownfield site. To the south and east there are extensive belts of established trees including those along the disused railway line. To the north-northwest, there is a more open industrial setting towards the industrial facilities of Partington and Carrington. The East Corridor is typically characterised by open fields with hedgerows and tree lines separating them and includes six trenchless crossings.

- South corridor: The South Corridor of the Preliminary Order Limits would start at the Central Hub HAGI with the pipeline running approximately 17.9km south to the Hydrogen Storage Facility (HSF). The Pipeline is expected to be High Pressure and 42" diameter. The HSF and associated infrastructure are subject to a separate consent application by Inovyn, and are not considered in this report. The Project considered in this report involves provision of the Pipeline to supply the site, a HAGI and an access road. The HAGI would be located approximately 250m to the east of the A530 in a field currently bounded by hedgerow and mature trees. The South Corridor includes five options for the location of the South Block Valve, and also includes fourteen trenchless crossings.
- Runcorn/Rocksavage Spur: The Runcorn/Rocksavage Spur would start at the Rocksavage HAGI and run north to the Runcorn HAGI. From the Runcorn HAGI there would be two spurs routed broadly northwest to connect the following customers: Intergen (Rocksavage), and The Heath Industrial and Business Park. The Runcorn/Rocksavage Spur would also facilitate a connection to Inovyn, Runcorn for which the pipeline connection would be provided by the customer. This Rocksavage HAGI to Runcorn HAGI spur would include approximately 1.3km of 24" diameter pipeline and two trenchless crossings. There would be an approximately 0.4km 24" High Pressure spurline from Runcorn HAGI to Intergen (Rocksavage), with no major crossings required. There would also be a Medium Pressure spurline from Runcorn HAGI to the Heath Industrial and Business Park of 2.2km. This spurline leaves Runcorn HAGI in a westerly direction, turning northwest before it crosses the A557 then traverses west through Runcorn Golf Course and before turning north to connect to the customers at Heath Industrial and Business Park.
- Warrington Spur(s): The Warrington Spur(s) would be approximately 6km in length. This would start at the Higher Walton HAGI and run northeast for with a High Pressure 8" spurline to provide connection to the following customers: Solvay, Warrington (shared single connection with Ingevity), and Ingevity, Warrington (shared single connection with Solvay). A second spurline of 10" diameter Medium Pressure pipeline would run to the railway with two options this area, prior to the onward street works connection to the following user: Novelis, Warrington.
- Clock Face Spur: The Clock Face Spur starts the Clock Face HAGI and runs northeast to connect to the following user: NGF Europe Ltd. This Medium Pressure spur would include approximately 4.8 km of 8" diameter pipeline through areas of fields adjacent to Chapel Lane and continue into the existing industrial area along Lea Green Road. There would be one major trenchless crossing.
- St Helens Spur: The St Helens Spur(s) start at the St Helens HAGI and connect to the following customers: Pilkington UKs Greengate Works, and, Glass Futures. The Intermediate Pressure 8" diameter spurline to Pilkington UK's Greengate Works would run along Burtonhead Road to the northwest for approximately 0.25 km. The Medium Pressure Glass Futures 8" diameter spurline would run along Burtonhead Road with Ravenhead Nature Park to

the southwest then turn north with one major trenchless crossing of the A570 (St Helen's Linkway) to the Glass Futures site to the north of Sherdley Road Industrial Estate. This would be approximately 0.85km of spurline.

- Warburton Spur: The Warburton Spur starts at the Warburton HAGI and runs approximately 0.2km west to connect to the existing Cadent AGI on Carr Green Lane to facilitate Hydrogen Injection Blending (HIB) of the hydrogen supply into the wider gas supply. This Spur is expected to be a 12"" diameter pipeline. No trenchless crossings are required.
- Partington Spur: The Partington Spur(s) start at the Partington HAGI within a disused industrial area and connect to the following customers: SAICA, Partington, Partington Cadent AGI, and Basell Polyolefins. The Partington Spur would also facilitate a connection to Inovyn, Runcorn for which the pipeline connection would be provided by the customer. The 8" High Pressure spurline to SAICA would be 0.6km in length and travel north west along an existing road and would require a single major trenchless crossing of the A6144 to connect to SAICA. The High Pressure spurline would run northwest to the existing Cadent AGI at Partington and is expected to be approximately 0.3km and up to 18" diameter pipeline. This would facilitate HIB of the hydrogen supply into the wider gas supply. The High Pressure spurline to Basell Polyolefins would run north for approximately 0.4km and is expected to be up to 18" diameter.
- Northwich Spur: The Northwich Spur starts at the Central Hub HAGI and runs to the southeast to connect to the following customer: TATA Chemicals, Winnington. This Intermediate Pressure spur would include approximately 8 km of 16" diameter pipeline and include four trenchless crossings.

1.4 Sources of Information

1.4.1 The following sources of information have been used in this desk study:

- British Geological Survey (BGS) Onshore GeoIndex including borehole records.
- DEFRA MAGIC map, checked July 2022.
- Digital Ordnance Survey mapping, checked July 2022.
- Publicly available aerial photography, checked July 2022.
- Cranfield University NATMAP soil mapping.
- Natural England Open Data Geoportal Peaty Soils Location (England), 2013.
- HyNet Scoping consultation response from Cheshire Wildlife Trust[3], March 2022.

[3] Cheshire Wildlife Trust (2022) Letter: 'Re: HyNet North West Hydrogen Pipeline Initial Consultation, of 11 March 2022'.

- Information provided by Friends of Carrington Moss, including Carrington Moss presentation[4], checked May 2022.
- University of Salford (2019) Historic Environment Assessment, GMSF Land Allocations, Trafford, GMA45 New Carrington, Appendix 2 (Archaeological Resource), Client: Trafford Council, Technical Report: Anthony Lee & Rachael Reader.[5]

1.5 Assumptions and Limitations

1.5.1 The following assumptions and limitations apply to the contents of this peat desk study:

- This desk study has been prepared and written in the context of the project layout, guidance and literature sources available at the time of writing. New information, improved practices and changes in guidance or significant alterations to the layout may necessitate a re-interpretation of the conclusions in whole or in part after its original submission.
- No site walkover or ground investigation has been undertaken during the course of this desk study. The conclusions and recommendations provided herein are based solely on the information provided by the sources listed in **Section 1.4** above.

[4] Friends of Carrington Moss (undated). Carrington Moss: The largest natural capital asset in Trafford. (online) Available at: https://friendsofcarringtonmoss.files.wordpress.com/2022/02/220224-carrington-moss-summary.pdf (Accessed May 2022)

[5] University of Salford (2019). Historic Environment Assessment GMSF Land Allocations, Trafford GMA45 New Carrington Appendix 2 (Archaeological Resource). (online) Available at: https://www.greatermanchester-ca.gov.uk/GMCAFiles/PFE/Supporting%20documents/10.09%20Site%20Allocations%20-%20Trafford/JPA33%20New%20Carrington/10.09.03%20-%20JPA33%20-%20Historic%20Environment%20Assessment%20-%20Appendix%202%20Archaeological%20Resource.pdf. (Accessed May 2022).

2. Peat

2.1.1 Peat is an organic material formed by the accumulation of the partially decomposed remains of plant matter and soil organisms, formed over many thousands of years. Peat accumulates where the rate of water supply exceeds the rate of evapotranspiration and drainage, resulting in decomposition of the organic matter being inhibited by waterlogging and decomposition occurring anaerobically.

2.1.2 Where the water supplied to the peat is almost exclusively from precipitation these are referred to as bog peatlands. In upland terrain, bog peatlands are commonly referred to as blanket bogs as they tend to develop over large expanses of undulating ground blanketing the terrain. In lowlands (such as within the study area) bog peatlands are referred to as raised bogs, as they tend to be raised (or domed) slightly above the surrounding terrain. These types of bogs typically form on wet floodplains, topographic basins or develop from the infilling of ponds with organic matter. In general, raised bogs fed solely by precipitation tend to be nutrient poor and unable to support as diverse a range of habitats and species as upland blanket bogs.

2.1.3 In addition to bogs, peat may also form where the water is supplied to the organic matter from mineral rich ground (e.g. the parent material) or surface water (e.g. flooding). In these instances, fen peatlands are formed typically where there is a continuous or regularly high groundwater level or where surface water flooding is common. Fen peatlands often form within or on the edges of river and coastal floodplains as well as large waterbodies such as lakes. Land management practices, such as drainage ditching and water pumping, often result in lowering of groundwater levels, drying, compaction and degradation of the peat.

2.1.4 In England the following criteria are used to distinguish deep peaty-soils from shallow peaty-soils and mineral soils (JNCC, 2011[6]):

- **Mineral soils**: soils with an organic horizon <0.1m thick;
- **Shallow peaty soils**: soils with an organic surface horizon greater than 0.1m but less than 0.4m in thickness, and an organic matter content exceeding 20%; and
- **Deep peaty soils**: a peaty soil as defined above, with a depth greater than 0.4m.

2.1.5 There are two distinct types of peat, termed acrotelmic and catotelmic peat. The interface between the two layers is controlled by the position of the water-table. The upper layer of the peat (the acrotelm) is typically fibrous and comprises the living and partially decomposed peat forming plant matter. The thickness of the acrotelm is typically controlled by seasonal variations in the water-table that creates cycles of aerobic and anaerobic conditions near the surface. The catotelm

[6] Joint Nature Conservation Committee (2011) Report No. 445, Towards an assessment of the state of UK Peatlands, April 2011. (online) Available at: https://hub.jncc.gov.uk/assets/f944af76-ec1b-4c7f-9f62-e47f68cb1050 (Accessed May 2022).

is situated below the minimum average depth of the water-table (Evans and Warburton, 2010). This results in permanent anaerobic decomposition of the plant matter and the formation of less fibrous amorphous peat.

2.1.6 As a result of their position, fen peatlands can often receive alluvial or marine sediments resulting in them becoming banded or buried beneath a thick layer of clay and silt deposited by flooding.

3. Site Setting

3.1 Site description

3.1.1 The Project is located in the north-west of England and includes the local authority area of Cheshire West & Chester, Cheshire East, Halton, Trafford, Warrington and St Helens. It passes through various land uses including urban and industrial areas, agricultural land and areas of woodland, between the largest settlements in the area including Ellesmere Port, Runcorn, Warrington, St Helens and Northwich.

3.2 Published Geology

Pedology

3.2.1 The National Soil Map of England and Wales (NATMAP) published by Cranfield University has been obtained for the Project and is summarised in **Table 3.1** and shown in **Figure 3** in **Appendix A**.

Table 3.1 Summary of the soil NATMAP

Soil Association ID	Soil Association Name	Approx. % coverage within the POL	Soilscapes Classification	Soil Characteristics
551d	Newport 1	8.3	Freely draining slightly acid sandy soils	Deep well drained sandy and coarse loamy soils.
561b	Teme	0.3	Freely draining floodplain soils	Deep stoneless permeable silty soils.
712f	Crewe	2.8	Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils	Slowly permeable seasonally waterlogged reddish clayey and fine loamy over clayey soils, often stoneless.
U711m	Salop	45.7	Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils	Slowly permeable seasonally waterlogged reddish fine loamy over clayey, fine loamy and clayey soils
851b	Downholland 2	12.9	Loamy and sandy soils with naturally	Deep stoneless clayey or calcareous

Soil Association ID	Soil Association Name	Approx. % coverage within the POL	Soilscapes Classification	Soil Characteristics
			high groundwater and a peaty surface	silty soils, mainly with a humose surface horizon.
U551a	Bridgnorth	1.3	Freely draining slightly acid sandy soils	Well drained sandy and coarse loamy soils over soft sandstone.
U811b	Conway	6.5	Loamy and clayey floodplain soils with naturally high groundwater	Deep stoneless fine silty and clayey soils variably affected by groundwater.
U821b	Blackwood	13.7	Naturally wet very acid sandy and loamy soils	Deep permeable sandy and coarse loamy soils.
U711n	Clifton	0.1	Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils	Slowly permeable seasonally waterlogged reddish fine and coarse loamy soils and similar soils with slight seasonal waterlogging.
812b	Wisbech	2.2	Loamy and clayey soils of coastal flats with naturally high groundwater	Deep stoneless calcareous coarse silty soils.
551b	Cuckney 1	3.5	Freely draining slightly acid sandy soils	Well drained sandy and coarse loamy soils, often over soft sandstone.
1024a	Adventurers' 1	1.0	Fen peat soils	Deep peat soils.
1024b	Adventurers' 2	0.5	Fen peat soils	Deep peat soils over variable subsoils, usually sandy sometimes gravelly.

Soil Association ID	Soil Association Name	Approx. % coverage within the POL	Soilscapes Classification	Soil Characteristics
541r	Wick 1	0.1	Freely draining slightly acid loamy soils	Deep well drained coarse loamy and sandy soils locally over gravel.
U1021	Turbary Moor	1.1	Raised bog peat soils	Deep earthy peat soils.

Notes
POL – Preliminary Order Limits

3.2.2 The soil NATMAP identifies the following soil associations with peaty characteristics within the route corridors:

- Downholland 2 within the West and North Corridor;
- Adventurers' 1 and Adventurers' 2 in the East Corridor; and,
- Turbary Moor within the East Corridor.

3.2.3 A review of Natural England's Peaty Soils Location (England) data reveals that there are seven areas of deep peaty soils within the Project area as summarised in **Table 3.2** below and **Figure 4** in **Appendix A**. As outlined in the table, the approximate total area of peaty soils identified within the Project area is 249.8ha.

3.2.4 The names of the identified peaty soil locations have been assigned based on review of OS mapping and available literature and have been cross-referenced with peatland areas identified by Cheshire Wildlife Trust (CWT) referenced in their HyNet Scoping response letter '*Re: HyNet North West Hydrogen Pipeline Initial Consultation, of 11 March 2022'*.

3.2.5 CWT identify 10 peatland areas within the Scoping boundary however three of these are now outside the Preliminary Order Limits and will therefore not be affected by the Project. These additional areas correspond to areas of deep peaty soils identified by Natural England and comprise Moss Wood, Littledale's Gorse and Holford Moss, they are shown on **Figures 4** and **6** of this report to show their location in relation to the Preliminary Order Limits.

3.2.6 The seven areas of peatland identified by CWT that are within the Preliminary Order Limits correspond to areas of deep peaty soils identified by Natural England and were identified by CWT as: Frodsham, Ince and Helsby Marshes, Moore, Appleton Thorn, Sink Moss, Blackmoss, Carrington Moss, and Unnamed Peatland 1 (see **Figure 4**).

Table 3.2 Summary of Peaty Soils Locations

Corridor	Area Name	Approximate total size of peaty soil area (ha)	Approx. area within the POL (ha) / % of peaty soil area within the POL	Description
West	Frodsham, Ince and Helsby Marshes	1,505.7	218 / 14.5%	Located between the settlements of Elton, Frodsham and the River Weaver.
North	Halton Moss (aka Moore)	168.0	1.7 / 0.01%	Located on the south side of the Manchester Shipping Canal between Manor Park, Keckwick and Moore.
East	Gale Moss (aka Appleton Thorn)	350.6	1.9 & 10.4 (total 12.3) / 3.5%	Located approximately 2.7km south of M6 junction 20A crosses the corridor in two locations at Park Moss Farm/Gale Moss and adjacent to Barbers' Lane.
	Sink Moss	103.7	22.3 / 21.5%	Located on the northeast side of the M6 approximately 1.5km south of junction 20A and encircled by Moss Lane.
	Black Moss (aka Blackmoss)	135.5	7.3 / 5.4%	Located approximately 200m north of the Trans Pennine Trail at Dunham Woodhouses.
	Carrington Moss	397.2	18.6 / 4.7%	Located at and adjacent to the Partington HAGI and extending a further 2.8km east to Sale.
South	Vale Farm (aka Unnamed Peatland 1)	2.2	2.2 / 100%	Located approximately 475m southwest of the A556/A559 junction

Notes
POL – Preliminary Order Limits

3.2.7 The names of the peat bogs and fens given in **Table 3.2** have been carried through the rest of this desk study.

Superficial Geology

3.2.8 British Geological Survey (BGS) mapping indicates that the Project area is underlain by a mix of Glacial Till, Glaciofluvial Sheet Deposits, Tidal Flat Deposits, Alluvium, the Shirley Hill Sand Formation and Peat. In addition, several large areas of thin or absent deposits are also shown. The compositions of the deposits are described as follows:

- Glacial Till comprises a mixture of clay, sand, gravel and boulders of varying lithology.
- Tidal Flat Deposits comprise clay, silt and sand with layers of gravel and peat deposited in the tidal zone of the River Mersey estuary.
- Glaciofluvial Deposits comprise sand and gravel.
- Shirley Hill Sand Formation comprises moderately-well to well sorted, fine-grained sand with peat layers in the lower part of the formation.
- River Terrace Deposits comprise sand and gravel commonly with lenses of silt, clay or peat.
- Alluvium comprises recent deposits of clay, silt, sand and gravel but can contain layers of peat (which generally will not meet the description of deep peaty soils).

3.2.9 The BGS digital geology map of superficial geology is presented as **Figure 5a** in **Appendix A**.

Table 3.3 Summary of Superficial Geology

Corridor	Formation	Approx. coverage within the POL[1]	Description
West	Tidal Flat Deposits	229.7ha	Identified west of the settlement of Elton to the tidal limits of the River Weaver. These deposits encompass Ince/Frodsham Marshes to the north of the M56. While not recorded as peat these deposits are more likely that the others to contain significant thicknesses of peat.
North	Tidal Flat Deposits	134.4ha	Identified along the tidal limits of the River Mersey.
East	Peat	45.2ha	Peat is identified in three locations along the corridor at:

Corridor	Formation	Approx. coverage within the POL[1]	Description
			Gale Moss/Appleton Thorn (4.3ha), ~1.2km southwest of the M6; Sink Moss (22.3ha), adjacent to the northeast of the M6; Carrington Moss (18.1ha), at and to the east and south of the Partington HAGI.
South	Peat	2.2ha	Peat is identified near Vale Farm (2.2ha) approximately 475m southwest of the A556/A559 junction.

Notes
POL – Preliminary Order Limits

Solid Geology

3.2.10 BGS mapping indicates that the route corridors are underlain as follows:

- **West Corridor** – the Chester, Kinnerton and Wilmslow Formations of sandstone underlie the western half of the corridor. The Tarporley Siltstone Formation comprising siltstone, mudstone and sandstone is identified centrally in the location of the Rocksavage HAGI. Between the Rocksavage HAGI and the Central Hub the corridor is shown to be underlain by the Bollin Mudstone Member.
- **North Corridor** – the southern portion of the corridor from the Central Hub to the Higher Walton HAGI is underlain by the Bollin Mudstone Member, Tarporley Siltstone Formation, Wilmslow Sandstone Formation and the Helsby Sandstone Formation. Between the Higher Walton HAGI and Clock Face HAGI the bedrock geology is predominantly the Wilmslow Sandstone Formation. The bedrock geology between the Clock Face HAGI and the St Helens HAGI is dominated by the Chester and Kinnerton Formations of sandstone. In the far north of the corridor the Etruria Formation of mudstone, sandstone and conglomerate and the Pennine Middle Coal Measures of mudstone, siltstone and sandstone are also identified.
- **East Corridor** – the majority of the corridor is underlain by Bollin Mudstone Member which underlies the route between the Central Hub and the M56 crossing as well as subcropping in the far north of the route. In the far north of the route beyond the M56 the corridor is underlain by sub-crops of the Tarporley Siltstone Formation, Helsby Sandstone Formation, Northwich Halite Member and the Wilmslow Sandstone Formation.
- **South Corridor** – the majority of the corridor is underlain by Bollin Mudstone Member which underlies the route between the Central Hub and the settlement

of Moulton. In the far south of the route corridor the Northwich Halite Member and Sidmouth Mudstone Formation are identified.

3.2.11 The BGS digital geology map of solid geology is presented as **Figure 5b** in **Appendix A**.

Previous Investigations

BGS borehole records

3.2.12 A search of the BGS GeoIndex has been performed to identify borehole records within and near the bogs and fens listed in **Table 3.2** above. A summary of the review is provided in **Table 3.4** below and the borehole locations are shown on **Figure 5c** in **Appendix A**.

Table 3.4 Summary of borehole records

Corridor	Name	BGS Record Reference	Description
West	Frodsham, Ince and Helsby Marshes	SJ47NE113 SJ47NE103 SJ47NE105 SJ47NE8/A-H SJ47NE9A-N SJ47NE4 SJ47NE99 SJ47NE115 SJ47NE119 SJ47NE81 SJ47NE19 SJ47NE20 SJ47NE21 SJ47NE44 SJ47NE97 SJ47NE98 SJ47NE3 SJ47NE45 SJ47NE80 SJ57NW15/A-J SJ57NW17/A-C SJ57NW16/A-D SJ57NW100 SJ57NW101	The previous records indicate that peat is likely to be present at the surface and/or below a thick layer of clay and silt across much of the marshes. At the surface, peat was recorded at thicknesses of between 0.1m and 3.2m. This is typically underlain by silty clay. In most borehole records a thick horizon of peat was encountered beneath clay, silt or sand stratum at depths between 0.2m and 3.0m below ground level (bgl) with peat thicknesses ranging between 0.6m and 4.2m. In a limited number of borehole records, a second and third layer of peat were recorded at thicknesses of between approximately 0.4m and 0.9m. In general, the peat layers are typically underlain by further silt and clay layers overlying Glacial Till at depths between 2.6m and 16.5m bgl.
North	Halton Moss/Moore	SJ58SE1308 SJ58SE1305	The borehole records indicate that the ground conditions comprise topsoil over

Corridor	Name	BGS Record Reference	Description
			sand, clay and silt. No peat is recorded in either of the borehole records.
East	Gale Moss/Appleton Thorn	-	There are no borehole records within close proximity of the corridor.
	Sink Moss	SJ68SE63 SJ68SE45 SJ68SE46 SJ68SE44 SJ68SE43 SJ68SE41 SJ68SE42 SJ68SE85 SJ68SE62 SJ68SE61 SJ68SE40	A series of borehole and trial pit records associated with the M6 identified peat in one location (SJ68SE63). The peat was encountered beneath 0.3m of topsoil comprising clay to a depth of 0.65m bgl.
	Black Moss	-	There are no borehole records within close proximity of the corridor.
	Carrington Moss	SJ79SW70 SJ79SW56 SJ79SW30 SJ79SW31 SJ79SW32 SJ79SW33 SJ79SW42 SJ79SW29 SJ79SW28 SJ79SW27 SJ79SW34 SJ79SW24 SJ79SW23	The borehole records reveal that surface and subsurface peat is likely to be present at Carrington Moss. At the surface, peat was encountered to depths ranging between 0.30m and 2.74m bgl Where subsurface peat was encountered, this was situated beneath a thin layer of made ground, soil and sand typically 0.15m to 0.61m in thickness. The peat ranged in thickness between 0.91m and 3.35m in thickness.
South	Vale Farm Moss/Unnamed Peatland 1	-	There are no borehole records within close proximity of the corridor.

Other sources

3.2.13 An internet search identified a publicly available report which includes a plan showing collated data on peat depths at Carrington Moss. The report from 2003,

by University of Salford[7] is a Historic Environment Assessment for an area of land in Carrington which partially is intersected by the Preliminary Order Limits.

3.2.14 This report refers to sources of information on the peat depth and extent at Carrington Moss as follows:

- A wetland survey (reported in Hall et al, 1995) comprising a series of transects and auger samples across agricultural land at Carrington Moss.
- Historical borehole data held by the BGS.
- Other geotechnical information. More recent planning applications have attached geotechnical information, including work by ARUP in 2016 (copy not appended to the University of Salford report, therefore not reviewed for this Peat Desk Study) which has inferred the thickness of the peat. There is also data from intrusive investigations at the former Partington Gas Works by Sirius Geotechnical in 2018 (copy not appended to the University of Salford report, therefore not reviewed for this Peat Desk Study).
- The recorded peat thickness only (not depth to peat) was plotted on a figure for the report, and the figure shows peat thicknesses ranging from 1.3m to 2.7m within Carrington Moss and within the Preliminary Order Limits. No information on peat condition is included.

3.3 Topography

3.3.1 Topography is considered in this section, in relation to the potential for peat to be present in hollows or basins, and areas of land with flat or low slope angles. A summary of the topography is provided below.

3.3.2 The Ordnance Survey (OS) Terrain 50 Digital Terrain model (DTM) indicates that the Project area is situated at an elevation of between approximately 1m and 87m above Ordnance Datum (AOD). The lowest elevations are generally situated around the River Mersey estuary at Frodsham, Ince and Helsby Marshes, at the point crossed by the North Corridor and along the floodplain of the River Weaver. The highest elevations are located generally along the North Corridor between the M56 crossing and the A56.

3.3.3 The Ordnance Survey mapping indicates that the topography of the corridors is generally gently rolling and with large areas of almost completely flat terrain with no discernible promontories. A slope angle analysis reveals that slopes across the corridors range between 0 and 11 degrees with the flattest ground shown across the Frodsham, Ince and Helsby Marshes. There are also large areas of almost completely flat ground with a slope angle less than 1 degree identified at Sink Moss, Black Moss, Halton Moss, Carrington Moss, Gale Moss/Appleton Thorn and to the north of the Bridgewater Canal in the East Corridor. In the South Corridor Vale Moss is located within an area of almost flat ground with slope angles around

[7] University of Salford (2019) Historic Environment Assessment, GMSF Land Allocations, Trafford, GMA45 New Carrington, Appendix 2 (Archaeological Resource), Client: Trafford Council, Technical Report: Anthony Lee & Rachael Reader.

1 degree but is bound to the south by steeper ground with slope angles ranging up to 6 degrees.

3.4 Hydrology

3.4.1 The Project extends over multiple Environment Agency Main Rivers, ordinary watercourses and canals. The key Main Rivers within the Project are the Weaver, Dane, Manchester Ship Canal (classed as a Main River in parts), Bollin and Mersey. Alongside these are also the Smoker, Sinderland, Whittle, Sutton, Sankey, Hardshaw, Crowton, Gale, Puddinglake, Forge, Cuddington, Dog Clog, Wade, Peckmill, Arley, Keckwick, Cogshall and Padgate Brooks. Each of these Main Rivers has associated tributaries and multiple ordinary watercourses draining into them, including the Bogart Brook.

3.4.2 While there are a number of small ponds within the Project, there are no lakes which are classed as Water Framework Directive (WFD) waterbodies. The Project does intersect lakes, such as Budworth Mere and Pickmere, and there are a number of lakes downstream of the Project or within the surface water catchment that may be affected by the Project.

3.4.3 The canals within the Project are the Sankey Canal, Bridgewater Canal, Trent and Mersey Canal, Weaver Navigation and the Manchester Ship Canal.

3.5 Hydrogeology

3.5.1 Hydrogeology is considered in relation to the potential for areas of peat to be present in areas of low permeability superficial deposits and bedrock. A summary of hydrogeology is provided below.

3.5.2 The Defra MAGIC Aquifer Designation Map identifies the Bollin and Sidmouth Mudstone, Tarporley Siltstone and Helsby and Wilmslow Sandstone as Secondary B Aquifers. These are mainly lower permeability layers that may store and yield limited amounts of groundwater. The bedrock geology underlying the North Corridor and West Corridor is identified as a Principal Aquifer, which is associated with the Wilmslow, Helsby and Kinnerton Sandstone Formations and to the north by the Wilmslow, Kinnerton and Chester Sandstone Formations.

3.5.3 The Aquifer Designation Map also identifies that there are Secondary A and Secondary (undifferentiated) aquifers within superficial drift deposits throughout the Project. The superficial deposits beneath and to the southwest of Northwich and including a band running along the River Weaver are predominantly a Secondary A Aquifer, which comprise of permeable layers that can support local water supplies and may form an important source of base flow to rivers. The area to the north-east of Northwich and the area north of the River Mersey is predominantly classed as a Secondary Undifferentiated Aquifer, which is a designation assigned in places for which it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the deposits.

3.5.4 There are five Water Framework Directive (WFD) groundwater bodies which intersect the Project, which includes the Wirral and West Cheshire Permo-Triassic Sandstone aquifer; the Weaver and Dane Quaternary Sand and Gravel aquifer;

the Manchester and East Cheshire Permo-Triassic Sandstone Aquifer; the Lower Mersey Basin and North Merseyside Permo-Triassic Sandstone aquifers; and the Sankey and Glaze Carboniferous aquifer.

3.6 Designated sites

3.6.1 Some peatland habitats are protected by national or international designations for biodiversity conservation.

3.6.2 A review of Natural England data reveals that there are no statutory designated sites within the Project.

3.7 Other Information: Literature review

3.7.1 Literature review completed to inform this desk study provides some further information on the peat, and on the historical land uses, of some of the identified areas of deep peaty soils, as summarised below:

- Gale Moss/Appleton Thorn: The Soil Survey Special Survey No.15 says of Gale Moss: “Appleton, Stretton and Gale Mosses (SJ 640824, 350 ha) are developed in shallow depressions in till. They are drained by Gale Brook into the River Weaver. ... Peat 75 cm thick (range 40-150 cm) has developed over stoneless silty clay overlying loamy sand.”
- Sink Moss: The Soil Survey Special Survey No.15 says of Sink Moss: “*Only limited deposits of peat were found on the 80 ha of Sink Moss (SJ 680830). The soils here are alluvial and have humose topsoils and thin buried peat layers*”. Leah, M.D., Wells, C.E., Appleby, C. and Huckerby, E. (1997) records Sink Moss being in full cultivation by 1847.
- Black Moss: The Soil Survey Special Survey No.15 says of Black Moss: “*Black Moss (SJ 745890,150 ha) along Caldwell Brook carries a mixture of Adventurers', Blackland and Sulham soils, all in arable cropping. There is an average thickness of 45 cm of peat over sand. Topsoils and upper subsoils are moderately acid.”*
- Carrington Moss: The Soil Survey Special Survey No.15 describes Carrington Moss as having peat accumulated in slight depressions in glaciofluvial gravels along the Mersey valley, and its dome-shape may be the result of the form of the underlying mineral surfaces rather than it being a raised bog in the strict sense. Peat cutting is recorded and the survey says of Carrington Moss: “*Carrington Moss (300 ha) is cultivated apart from a small nature reserve under birch and hazel woodland. The soils are Adventurers' and Westhay series with a small area of Isleham soils where the peat thins at the edges. The average thickness of peat is 1.3 m*”. The Cheshire Lines Railway crosses the southwest of the Moss and it is reported in Hall *et al* (1995) that attempts were made to drain around 81 hectares of land on the western edge of the Moss. Carrington Moss is also recorded in Hall *et al* (1995) to have been used for ‘nightsoil’ disposal (sewage from Manchester city) with the surface ‘delved’ then nightsoil spread at rate of 60 tons per 0.4 ha between 1885 and c.1910. A road was laid in the late 1880s running east to west with crossroads, and a two-foot (0.6m)

gauge track was constructed along the roads to enable distribution over the moss (this track was removed by 1940 as nightsoil disposal ceased around 1910 with improvements to sewage facilities in the city). It is recorded that 'nightsoil' could contain other wastes including broken ceramics, glass fragments and ash. Field boundaries were created, and open drains excavated (1.8m wide by 2.7m deep) in fields adjoining the roads. As reclamation of the Moss continued, the site was let to farmers from 1887, and the entire moss was leased for cultivation by 1899. The area north of the Moss was industrialised from the 1800s onwards, including a paper mill and a gasworks. Industrial developments have extended southwards over time into the moss, however most of it has remained under arable cultivation. Hall *et al* (1995) records a survey of the Moss comprising 22 cores spread across the moss, these found peat cover across the Moss, generally between 1m and 2m in thickness, with peat having been destroyed at the northern and western edges, and a small amount removed in the east. It is hypothesised in Hall *et al* (1995) that the site originally had <4m thickness of peat and that agricultural activity has removed 1.5 to 2m of peat on average. The peat was described as quite badly humified (strongly to almost completely decomposed) but with sufficient preservation to allow for detailed palaeoecological analysis, the findings of which are summarised in the publication.

4. Conclusions & Further Actions

4.1 Conclusions

4.1.1 A review of the available information reveals that there are seven areas of peat within the project area as summarised in **Table 4.1** below and as shown in **Figure 6** in **Appendix A**.

Table 4.1 Summary of peat within the Project

Corridor	Name	Total size (ha)	Approx. area within POL (ha)	Type	Description
West	Frodsham, Ince and Helsby Marshes	1,505.7	218	Fen peatland	Located between the settlements of Elton, Frodsham and the River Weaver in the west of the corridor. Previous records indicate that peat is likely to be present at the surface and/or below a thick layer of clay and silt across much of the marshes. Peat thicknesses of between 0.1m and 4.2m have been recorded. The Rocksavage RSH1 HAGI and Runcorn HAGI are located within this area.
North	Halton Moss	168.0	1.7	Fen peatland	Located on the south side of the Manchester Shipping Canal between Manor Park, Keckwick and Moore within an area that has been heavily developed. Previous investigation records indicate no peat is present, though further investigation will be required to prove the presence or absence of peat.

Corridor	Name	Total size (ha)	Approx. area within POL (ha)	Type	Description
East	Gale Moss/Appleton Thorn	350.6	1.9 & 10.4 (total 12.3)	Fen peatland	Crosses the corridor in two locations approximately 2.7km south of M6 junction 20A. There is no available ground investigation information on the presence or thickness of peat.
	Sink Moss	103.7	22.3	Fen peatland	Located on the northeast side of the M6 approximately 1.5km south of junction 20A. A single previous investigation indicates that peat is present beneath a shallow mineral topsoil comprising clay. A Block Valve option is partially located within the north-eastern extent of this area.
	Black Moss	135.5	7.3	Raised bog	Located approximately 200m north of the Trans Pennine Trail at Dunham Woodhouses. There is no available ground investigation information on the presence or thickness of peat.
	Carrington Moss	397.2	18.6	Raised bog	The proposed Partington HAGI is located within this area. Previous investigation records indicate that surface and subsurface peat is likely to be present at thicknesses ranging between 0.30m and 3.35m bgl. As noted in **Section 3.7**, literature review reveals that peat within Carrington Moss is likely to have been

Corridor	Name	Total size (ha)	Approx. area within POL (ha)	Type	Description
					damage and partially removed as a result of historical waste disposal and agricultural activity. This may have resulted in the complete loss of peat forming vegetation however this will need to be confirmed by site survey.
South	Vale Farm Moss/Unnamed Peatland 1	2.2	2.2 / 100%	Fen peatland	Located approximately 475m southwest of the A556/A559 junction. There is no available ground investigation information on the presence or thickness of peat.

Notes
POL – Preliminary Order Limits

4.1.2 Based on the Preliminary Order Limits, with the exception of Halton Moss and Vale Farm Moss, all of the bogs and fens identified cover all or most of the width of the corridors and as such avoidance is not probable. However, as the desk based review indicates (see **Section 3.7**), some of the identified areas, notably Carrington Moss, may have had peat removed or damaged during historical activities, which include agriculture for all areas, and waste disposal to ground at Carrington Moss. This could mean that in some areas where peat is mapped the Project may not encounter it, however without ground investigation data to confirm this, it is assumed that peat is present within the mapped bogs and fens.

4.2 Further actions by the Project to address effects on peat

4.2.1 A ground investigation is being completed in 2022 that includes exploratory holes within the peat bogs and fens identified in **Table 4.1**. This will assist in establishing the presence, depth and thickness of peat in these areas, in addition to providing information on the water table within or in the vicinity of the areas. Given the frequent presence of mineral soils overlying peat, traditional peat probing is unlikely to be a successful survey technique, or it may lead to erroneous results. The investigation scope therefore includes a variety of ground investigation techniques including boreholes, cone penetration tests (CPTs), window sample boreholes and trial pits. The investigation will be based on approximately 250m to 300m spacing in areas of potential deep peaty soils within the Preliminary Order

Limits, and exploratory holes will be completed in all areas of possible permanent development (HAGIs and Block Valves).

4.2.2 In each of the seven locations where potential for deep peaty soils has been identified, one to two samples of peat from each area will be obtained and submitted for the following laboratory testing, under full chain of custody, for bulk density, moisture content, total organic carbon, and pH.

4.2.3 Additionally, a peat specialist will attend site during the ground investigation in key areas (including Carrington Moss, and Frodsham, Ince and Helsby Marshes as the largest area of potential deep peat within the Preliminary Order Limits, and where BGS borehole records record peat) to record the condition and physical properties of the peat in accordance with the Modified Von Post classification, as outlined in Hobbs (1986) to assist in identifying the quantity of peat that is likely to be suitable for reinstatement/restoration. Peat characteristics to be recorded include the H (humification), B (water content), F (fine fibres), R (coarse fibres) W (wood) and (N) shrub remnants.

4.2.4 Any further investigation prior to submission of the Environmental Statement (ES) for the Project will be subject to consultation with Natural England and other relevant stakeholders. The ground investigation should provide sufficient information on the ground conditions within the potential deep peat areas to determine whether peat probing or hand augering will be suitable for any follow-on survey required, or if other peat survey techniques, such as non-intrusive geophysical survey, may be more viable.

4.2.5 The ground investigation data, and EIA consultation process, will be used to define the potential effects of the Project on peat and to inform suitable measures that can be taken by the Project to avoid, mitigate or compensate effects on peat.

4.2.6 As the desk study concludes that it is very unlikely that the Project can avoid all deep peat, it is assumed that peat will need to be handled/excavated during construction of the Project and that some peat will need to be permanently removed. The Project is therefore committed to the use of a Peat Management Plan to ensure that there is systematic consideration of peat management throughout the design and construction phase. There is currently uncertainty over the condition, extent, depth and thickness of peat within the Preliminary Order Limits, as such only a Preliminary Peat Management Plan can be produced. This is presented in the following section.

5. Preliminary Peat Management Plan

5.1 Introduction

5.1.1 This section sets out a Preliminary Peat Management Plan for the Project, which is to be developed as further information becomes available, and also through consultation with key stakeholders such as Natural England, the Environment Agency and local interest groups. An updated (second) Peat Management Plan will be included with the Environmental Statement (ES) based upon information obtained from the ground investigation and any other relevant information, which is obtained following submission of the PEIR.

5.1.2 One of the main purposes of a Peat Management Plan is to estimate the peat mass balance for the Project by estimating the volumes of peat extraction and reuse. At this stage in the Project there is insufficient information to define the peat balance, for excavated peat, versus restored peat, or the final destinations of the peat. This Preliminary Peat Management Plan therefore sets out the principles and measures to be applied by the Project to consider, avoid or minimise effects on peat, but does not set out the peat balance. The updated Peat Management Plan for the ES will include details of the Project that impact on peat, a peat mass balance and intended uses/destinations for excavated peat with the intention of avoiding/minimising a surplus of peat following restoration of the Project.

5.2 Peat management principles

5.2.1 General principles for peat management are provided in published Scottish Environment Protection Agency (SEPA) guidance '*Developments on Peat and Off-site Uses of Waste Peat*'[8]. Although this guidance applies only in Scotland, and was developed for windfarm projects, there is no equivalent guidance in England and the guidance can be applied to all types of development on peat. The SEPA peat management hierarchy in relation to excavated peat, is summarised as follows for the Project:

- Prevention – prevent or minimise peat excavation/disturbance through considered design, to avoid or minimise temporary or permanent built infrastructure within areas of peat. Where avoidance is not possible, minimise excavation of peat using engineering solutions, and minimising the footprint of temporary and permanent development within peat.
- Re-Use/Reinstatement – reuse extracted peat close to its original location in the reinstatement or restoration of temporary infrastructure or other features e.g., road verges or borrow pits. Peat may also be used where appropriate to improve or restore peatland habitats.

[8] SEPA (2017) SEPA Guidance, Developments on Peat and Off-Site Uses of Waste Peat, WST-G-052, version 1 (online). Available at: https://www.sepa.org.uk/media/287064/wst-g-052-developments-on-peat-and-off-site-uses-of-waste-peat.pdf (Accessed August 2022).

- Recycle/Recover/Treat – while the priority should always be to prevent and reuse peat on site, there may be situations in which there will still be a surplus of excavated peat. Where demonstrated that it is suitable for use, peat, may be blended, dewatered or treated to improve its properties to support re-use on site.
- Temporary storage – store the peat temporarily during construction prior to reuse in onsite reinstatement or restoration activities.

5.2.2 The design of the Project will evolve throughout the EIA in response to consultations with stakeholders, desk studies, field surveys, ground investigation and technical assessments undertaken by a range of disciplines in support of the EIA, taking into consideration the peat hierarchy.

5.2.3 This includes exploring the potential for reuse of peat for peatland habitat restoration within and outside the Preliminary Order Limits through consultation with relevant stakeholders, including Natural England, Cheshire Wildlife Trust and the Environment Agency.

5.3 Construction activities and effects

5.3.1 The following construction activities associated with the Project either will or could require the stripping of peat and peaty soils, to the formation level of the infrastructure, or potentially down to the underlying substrate, which may be deeper:

- Peat excavation will be needed for trenched pipeline laying. The maximum trench depth required is ~2.4m bgl, and the volume of in situ material to be removed from the trench for the largest diameter pipeline (42”) is ~1.7m^3 per 1m length of trench. Where the pipeline route goes through peat, removal of peat below 2.4m bgl may be needed to provide a suitable foundation for the pipeline, however this can potentially be avoided though the use of engineering solutions e.g., use of a raft layer of geotextile or geogrid and use of other bedding material to spread the load.
- Peat excavation may be required at temporary access tracks/haul routes and laydown areas. The potential to construct floating roads or use other engineering solutions to avoid excavation will be investigated.
- Peat excavation may be required at hard standings associated with temporary construction compounds.
- Some permanent elements of the Project are in areas with potential for deep peat, these comprise Runcorn HAGI, Rocksavage HAGI option RSH1 (but not options RSH2 and RSH3), Partington HAGI (though this area is noted to be brownfield and some or all peaty soils may have been removed) and a Block Valve (option site at north-eastern edge of Sink Moss). If peat is present in these areas, there is potential for peat disturbance and/or permanent removal to be required e.g., for foundation excavations.

5.3.2 Other construction activities that have the potential to disturb peat include:

- Trafficking of plant and machinery over areas underlain by peat and peaty soils.
- Laydown of materials (including excavated peat and mineral soils) on peat and peatland vegetation (if present, ecological surveys to date have not identified any peat habitat, however these surveys are still ongoing at the time of writing).
- Reinstatement of peat and peaty soils and/or other re-vegetation activities to reinstate or relocate peat e.g., for peat habitat restoration outside the Preliminary Order Limits.

5.3.3 These activities have the potential to cause a range of effects during construction and operation including loss of integrity and vegetation, drying, erosion, oxidation and interruption of the peat hydrology. Due to the previous and ongoing use of the land for agricultural purposes, some of the above effects on peat are already likely to have occurred due to changes to the land drainage regime, removal of peat and peat vegetation, damage to peat through use of farm machinery, mixing of peat with other soils/imported waste materials or 'improvement' by addition of lime.

5.4 Minimising peat excavation

5.4.1 At present, there is limited information on the presence, extent, depth and thickness of peat, and the information reviewed for this desk study indicates that the identified areas of deep peat cover all or most of the width of the Preliminary Order Limits, meaning that the pipeline generally cannot avoid them. For most of the affected permanent development features, including some HAGIs and a Block Valve, there is potential to avoid peat by selecting other options, though this selection process will also have to take into account other environmental and engineering constraints.

5.4.2 Opportunities for the Project to avoid peat, in accordance with the peat hierarchy, will be explored further as key information, notably the ground investigation findings, becomes available, and the decisions made will be recorded in the ES.

5.5 Peat reuse

5.5.1 Details of how excavated peat can be reused/reinstated within the Preliminary Order Limits are not yet possible to define due the uncertainty over peat condition, peat depth/thickness and other ground condition aspects such as the depth of the water table. Potential for peat reuse/reinstatement will be explored, with consideration of other conditions such as the presence of archaeological remains, which may require further investigation, as more information becomes available to inform the updated Peat Management Plan and the assessment of the effects of the Project on peat in the ES. The suitability of peat for reuse will be determined considering the peat characteristics outlined below.

Suitability of peat for reuse

5.5.2 The characteristics of the excavated peat (e.g., fibrosity and water content) will determine its suitability for reuse, with the wettest most amorphous peat generally being the least suitable.

5.5.3 Acrotelmic peat/peat soils – when stripped with the vegetation, intact turves of acrotelmic peat or peaty soils will potentially be suitable for surface reinstatement.

5.5.4 Fibrous catotelmic peat – this peat is most suitable for reinstatement beneath the replaced acrotelm. It may also be suitable for use as a surface layer, with careful site selection and management to control erosion and encourage vegetation recovery (e.g., seeding, translocation of vegetation).

5.5.5 Amorphous peat – peat of this type will only be suitable for reinstatement of excavations beneath a surface vegetation layer. Other potential use of this could be in restoration beneath an acrotelmic layer e.g., to create conditions to support development of a mire habitat.

5.6 Temporary peat storage

5.6.1 The selection of temporary peat storage locations will consider the environmental constraints, including avoidance of sensitive peatland habitats and nearby watercourses. In addition, stockpiles will be designed to include measures that avoid instability of the stockpiles and run-off of peat laden sediment into watercourses. As far as possible, excavated peat from pipeline trenches will be temporarily stored adjacent to the excavation or re-used immediately for restatement elsewhere.

5.6.2 **Table 5.1** provides generally criteria for the selection of suitable temporary peat storage areas.

Table 5.1 Temporary storage criteria

Suitability	Criteria
High	• Within the Preliminary Order Limits and less than 75m from proposed infrastructure (to minimise extent of construction envelope). • More than 50m from watercourses. • Avoiding groundwater dependent terrestrial ecosystems (GWDTEs) and other sensitive habitats.
Moderate	Defined in the same way as High but GWDTEs and other sensitive habitats are present.
Low	Areas which do not meet one or more of the defined criteria (excluding the presence of GWDTEs).

Notes
POL – Preliminary Order Limits

5.6.3 For the Project, key considerations will be the distance from watercourses and the definition of suitably located and designed temporary peat storage areas within the Preliminary Order Limits, noting that in some instances mineral soils may also be excavated from the same location (e.g., where these overlie peat) and will require separate segregated storage. The appointed Contractor will develop a programme of works to estimate the volume of peat that will require temporary storage at any one time. The amount of storage space and the exact location and dimensions of the temporary storage stockpiles will be determined on site during construction.

5.6.4 Further information on the anticipated volume of peat to be excavated and requiring storage for reinstatement/reuse will be provided in the Peat Management Plan for the ES.

5.6.5 The following general principles governing temporary peat storage areas and peat stockpile stability will be applied for the Project:

- Peat storage and stockpiles will not be positioned adjacent to any active ditches or gullies (within 25m).
- No storage or stockpiling will occur within a 50m buffer zone of any watercourse.
- Peat will not be stored on active bog vegetation (to be determined by the ECoW/equivalent, in consultation with a suitably experienced peatland ecologist where necessary).
- Peat turves and stockpiles will be regularly managed and inspected throughout their lifetime to ensure maintenance of stockpile stability and integrity.
- Temporary drainage of peat stockpiles will be inspected regularly to ensure that it is fit for purpose, that runoff from stockpiles is being appropriately managed and mitigated and that it is not draining directly into any watercourse.

5.6.6 Measures to manage and treat site run-off and prevent erosion during peat stripping and stockpiling works will be set in place through a series of specific control measures relating to surface water management. The Peat Management Plan will therefore interact with the Construction Phase Drainage Plan for the Project, which is a commitment in the PEIR.

5.6.7 Other considerations for peat storage include the following:

- Where stripped peat can be re-used, this will take place as soon as possible as the construction progresses to minimise or avoid storage.
- Consideration will be given to the requirement for, and the design of, purpose-built peat storage areas to maintain peat in a suitable condition for reinstatement within the Preliminary Order Limits (or elsewhere).
- Consideration will be given when placing peat in temporary storage areas to the potential for unwanted mixing of peat/peaty soils with other materials/soils to occur, and where necessary peat will be stored on a geotextile to avoid this.

5.6.8 The number and locations of temporary peat storage areas will be chosen to minimise the distance that stripped and excavated peat would have to be transported both at the time of excavation and at the time of

replacement/restoration, although it is likely that some peat will need to be transferred longer distances (or disposed of as waste) given the linear nature of the Project and limitations to the opportunities for peat reuse at the original excavation.

5.6.9 The appointed Contractor will ensure that each storage location is assessed by an Environmental Engineering team that will typically include a geotechnical engineer, Ecological Clerk of Works (EcoW) and the Site Environmental Manager. Each location's suitability will be assessed in terms of its proximity to the source of peat, environmental impact, safety, constructability and whether special mitigation measures will be required. These may include specifically orientating the stockpile, levelling/benching, bunding to contain stored materials and site-specific drainage to ensure that runoff waters are sufficiently controlled, as part of the wider Construction Phase Drainage Plan for the Project.

5.6.10 Depending on the duration of storage and prevailing weather conditions during storage, peat turf conditions will be maintained by regular watering, as determined by regular inspections by the appointed person (typically the EcoW).

5.7 Protection of in situ peat

5.7.1 The Preliminary Order Limits have already taken into account constraints relating to sensitive areas of peatland habitat, which it is likely to avoid entirely (to be confirmed by ecological survey), however the peat desk study indicates that it cannot avoid deep peat.

5.7.2 The layout and locations of access routes, temporary compound locations, laydown and working areas will be considered regarding peat in advance of construction so that these are clearly delimited throughout the construction phase to ensure that peat compaction and damage in areas not directly involved in the works is avoided.

5.7.3 The construction works will be phased to ensure that peat at surface is stripped ahead of mineral subsoil.

5.8 Stripping and excavation of peat

5.8.1 During peat and soil stripping, handling and temporary stockpiling, all efforts will be made to prevent unnecessary trafficking over peat. Appropriate scale plant will be used, such as 360^{o} diggers rather than bulldozers. Double handling will be avoided as much as possible, and a planning and monitoring programme will be in place to ensure that peat and mineral soil are not mixed.

5.8.2 Where required, separate stockpiles will be created for peat and mineral soil. Documentation and physical control measures will be set in place to prevent accidental mixing and to ensure that peat and mineral soils are appropriately segregated. Peat and soil management plans will be used in conjunction with other materials management planning (including contaminated or potentially contaminated materials) for the Project.

5.8.3 To minimise damage to peat during stripping activities, detailed procedures will be adopted for heavy plant access, stripping and handling/transport of surface, intact, peaty turf and subsurface wetter peat. Antecedent moisture conditions are critical for this, and peat stripping and handling will not take place if there are heavy rainfall conditions. Rainfall quantities and soil/peat wetness conditions considered to be cut-off thresholds for cessation of soil/peat stripping/handling works will be agreed in advance of any works occurring between the appointed Contractor and all stakeholders, including the relevant environmental regulators.

5.8.4 Peat stripping and excavation will generally follow the methodologies recommended for mineral soil by Ministry of Agriculture Fisheries and Food (MAFF) (2000) and the Department for Environment Food and Rural Affairs (DEFRA) (2009). However, peat is a very different material compared to mineral soils. For example, it is recognised that subsurface wet peat lacks strength. As a result, the stripping and excavation method(s) to be used will be agreed in advance. The suitable plant, depth and scale of excavation will depend on the depth, consistency and condition of the peat at each location. The general rule should be that the largest possible turf should be stripped, which allows it to remain intact.

5.9 Methods of temporary peat storage

5.9.1 Methods of temporary peat storage will follow two general approaches which are outlined below and should be confirmed/developed as further information on peat condition becomes available. There will be one method for storage of surface peat turves with intact vegetation and one method for the storage of ‘loose’ excavated sub-surface peat.

Storage of surface peat turves

5.9.2 In all locations where there is an organic surface layer, the organic layer with the vegetation turf will be stripped to a depth of up to 0.5m in areas of peat and to the depth of the substrate in peaty soil.

5.9.3 The size of peat turves will be as large as possible to maintain an intact vegetation turf, typically the turves will be between 0.5m to 1.0m square. The turves will be transferred intact, using for example, the bucket of the excavator, to their temporary storage location where they will be stored, with vegetation upright, in a single layer on geotextile material. Laydown on geotextile is required to ensure that underlying vegetation and peat is protected as much as possible from the effects of temporary storage.

Storage of catotelmic peat

5.9.4 Where excavation of catotelmic peat is necessary, it is likely to have little strength (depending on its water content and fibrosity) and could be very wet, or if shallow, could be relatively dry, even during winter months. If excavated peat has a low water content (which can be qualitatively assessed by performing a hand squeeze test and von Post classification) and intact consistency, temporary storage will be

in stockpiles up to a maximum height of 2m. A summary of the stockpiling method for with a low water content (e.g., B0-1) peat is provided below:

- **Step 1** – The peat will be loose tipped in heaps to a maximum height of 2m starting at the furthest point in the storage area and working back toward the access point. To avoid compaction, no machinery (even tracked plant) will traverse the stockpile.
- **Step 2 –** The surface of the stockpile will be lightly tamped and smoothed off with the bucket of an excavator to reduce rainwater infiltration.

5.9.5 Should excavated catotelmic peat be very wet (B2-3), this will be stored in a purpose-built bunded location. Each bunded storage area will be designed with a settling pond to control run-off and infiltrated rainwater and enable sediment retention. Each settling pond will be designed with appropriate filtration treatment facilities prior to connection into a suitable surface water drainage scheme. It will also be regularly inspected and maintained with peat sediment returned to the stockpile as necessary. If significant erosion of the storage area is observed, it should be covered to protect it from further erosion by heavy rainfall and frost during the winter months.

5.9.6 The viability of peat reuse after storage depends on how appropriately it has been stored. It is anticipated that wet peat, stored correctly, for the shortest possible duration will have retained most of its original moisture content when the time comes to re-use it. In addition, correct storage is required to prevent adverse environmental impacts such as runoff of sediment to watercourses.

5.10 Stockpile inspection and corrective actions

5.10.1 Measures in the updated Peat Management Plan with the ES will include guidance for regular inspections of peat storage and stockpile conditions to ensure that all environmental requirements are being met throughout the construction phase.

5.10.2 There will be frequent, routine and regular inspections of peat in all stockpiles and temporary storage areas as part of the Peat Management Plan audit process, responsibly for implementing this will fall to the appointed Contractor. The inspections will assess in situ peat physical conditions, integrity of containment, temporary drainage conditions and confirm that stockpile design and management is adequate e.g., to prevent erosion. In addition to regular planned inspections, assessments should also take place following any large rainfall events.

5.10.3 Should any problems be observed during regular visual inspections of peat stockpiles, this will invoke implementation of an appropriate corrective action which will be recorded and monitored for effectiveness. Types of corrective actions will include, but will not be limited to:

- modification of temporary drainage;
- additional or modified bunding;
- incorporating of sediment fencing if required;
- light re-grading to correct any areas of surface erosion; or

- where necessary covering with geotextile (that does not prevent rainwater infiltration).

5.11 Peat reinstatement methods

5.11.1 At this stage, the objectives of peat reinstatement within the Preliminary Order Limits (or potentially beyond this boundary) are not yet known, and as such reinstatement methods will be developed in the Peat Management Plan to accompany the ES.

5.11.2 Peat handling and placement during reinstatement activities should be carried out during periods of dry weather to avoid an increased risk of run-off carrying sediment in to nearby watercourse. In addition, peat handling and placement should also be avoided during periods of prolonged dry weather or drought in summer. Wherever practicable, these activities will be scheduled to take place during spring and early autumn conditions.

5.12 Implementation and monitoring

5.12.1 The implementation of the Peat Management Plan will require certain key responsibilities to be assigned to defined roles. These will be defined in more detail in the updated Peat Management Plan to accompany the ES.

5.12.2 Effective delivery of the Peat Management Plan will require appointed persons to carry out supervision and quality control of peat stripping, stockpiling and restoration work, and in situ peat inspections of temporary storage/stockpiling areas and peat conditions in restored areas. A Peat Specialist will be consulted for assessment of any technical peat issues, including siting of temporary peat storage areas and peat restoration methods.

5.12.3 A series of checklists and reports will be established to control and record updated Peat Management Plan activities, particularly the results of peat inspections.

5.12.4 The scheduling of Peat Management Plan audit activities will be developed in the CEMP.

5.12.5 The documentation and database to be used to log and chronicle the origin, handling, transport, storage/stockpiling, inspections and final peat reuse will be developed in detail by the Contractor prior to the start of construction. A written procedure for peat stripping and storage/stockpiling will form part of the Construction Method Statement.

5.12.6 As construction activities proceed, the updated Peat Management Plan will indicate locations and quality of in-situ peat and peaty soils: particularly the depth of peat, together with schedules of actual volumes of peat stripped and expected after-use. Documentation will identify the person(s) responsible for supervising and overseeing peat management during the works.

5.12.7 A system for reporting non-compliances will be established by the appointed Contractor and reported via the Peat Management Plan auditing procedure so that corrective actions are identified and implemented promptly.

5.12.8 Toolbox talks will be used regularly to ensure that all staff are aware of the Peat Management Plan and applicable peat handling and protection procedures. The toolbox talks will be site-specific, discussing peat conditions at the specific working areas.

5.12.9 An indicative list of possible toolbox talks is provided in **Table 5.2** below.

Table 5.2 Toolbox talk topics

Example Tool Box Talk topics
Why peat resources need to be protected. Site restrictions and good practice activities to protect peat resources.
Planning peat management. Access and egress routes.
Peat stripping. Why segregation of peat and mineral soil is important.
Peat reinstatement. Why and how.

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Appendix A
Figures

345000
350000
355000
360000
365000
370000
375000
395000
390000
385000
380000
375000
370000
N
North Corridor
East Corridor
West Corridor
Northwich Spur
South Corridor
Key
Preliminary Order Limits
0 1 2 3 4 5 Kilometers
Scale at A3: 1:110,000

Client
wood. Cadent
HyNet North West Hydrogen Pipeline Project
Preliminary Environmental Information Report
Appendix 13A - Agriculture
Figure 1
Project boundary
September 2022
wood.
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345000
350000
355000
360000
385000
380000
375000
N
Manchester Ship Canal
M56
River Weaver
West Corridor
Key
Preliminary Order Limits
Pipeline Centrelines
Spur Centrelines
River
Canal
Block Valve Location Options
HAGI Location Options
0
1
2 Kilometers
Scale at A3: 1:57,000

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Preliminary Environmental Information Report
Appendix 13A - Agriculture
Figure 2.1
Project route corridors
September 2022
wood.
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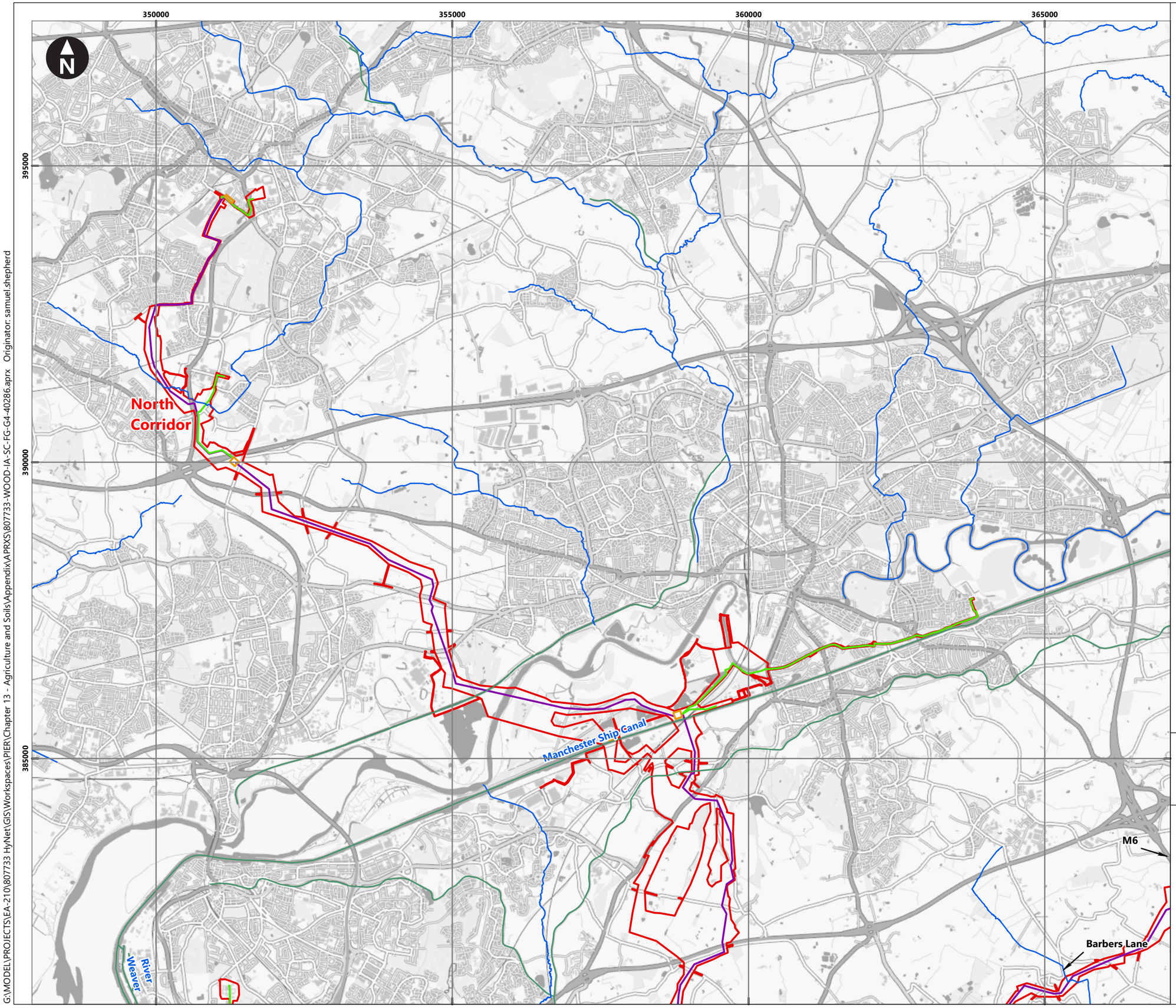

Key

- Preliminary Order Limits
- Pipeline Centrelines
- Spur Centrelines
- River
- Canal
- Block Valve Location Options
- HAGI Location Options

0 1 2 3 Kilometers

Scale at A3: 1:61,000

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Figure 2.2
Project route corridors

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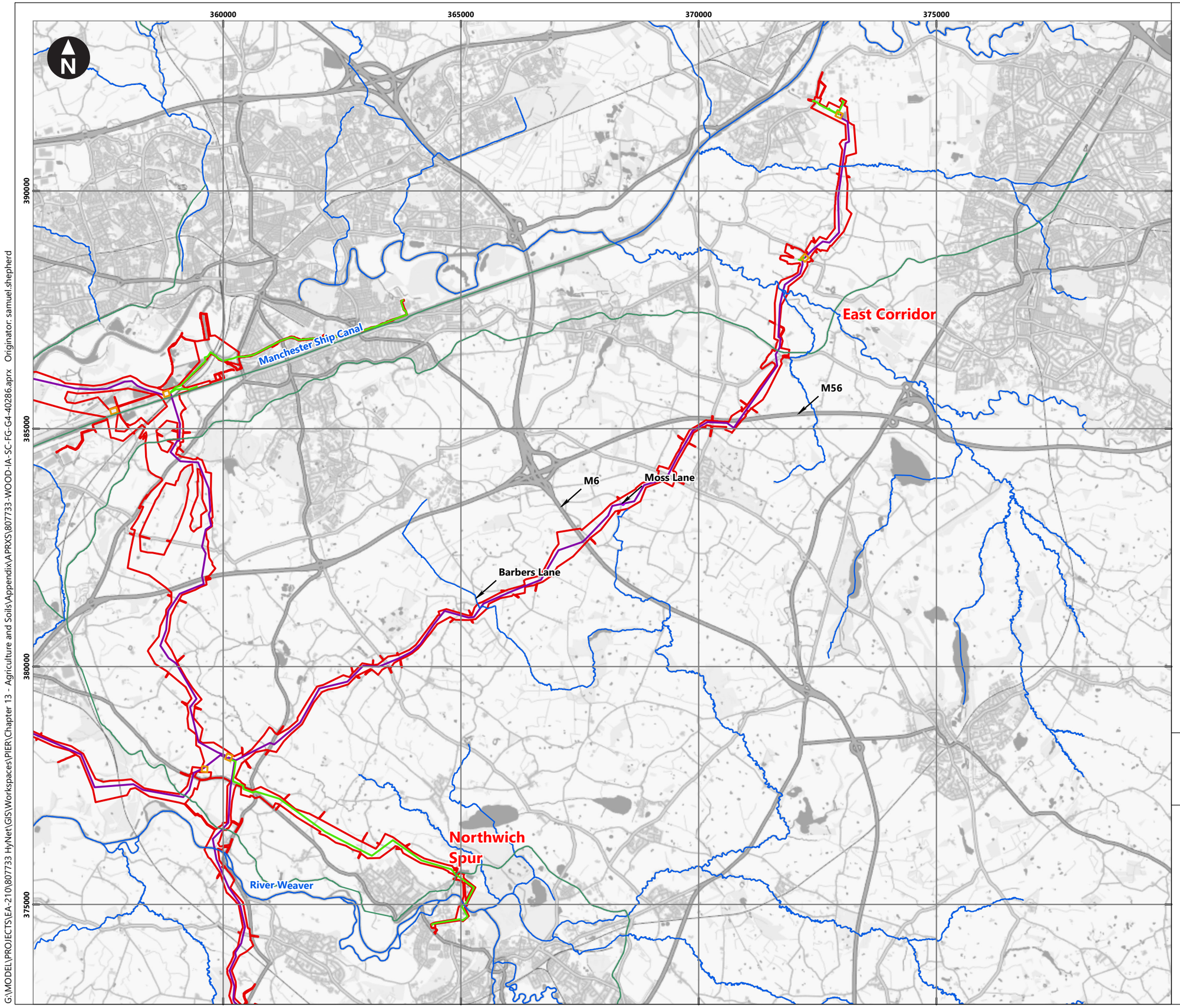

Key

- Preliminary Order Limits
- Pipeline Centrelines
- Spur Centrelines
- River
- Canal
- Block Valve Location Options
- HAGI Location Options

0 1 2 3 Kilometers

Scale at A3: 1:76,000

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Figure 2.3
Project route corridors

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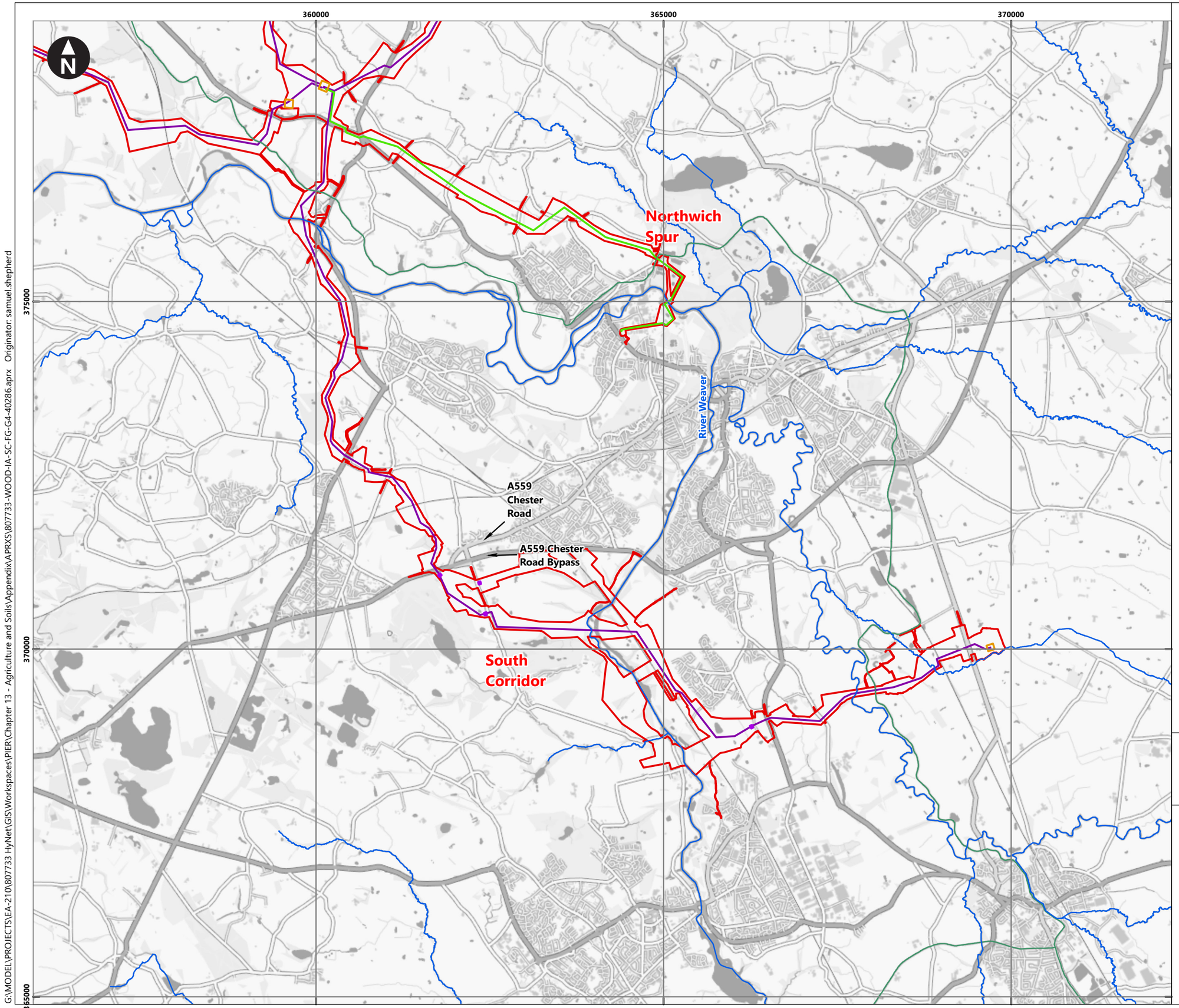

Key

- Preliminary Order Limits
- Pipeline Centrelines
- Spur Centrelines
- River
- Canal
- Block Valve Location Options
- HAGI Location Options

0 1 2 Kilometers

Scale at A3: 1:52,000

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Figure 2.4
Project route corridors

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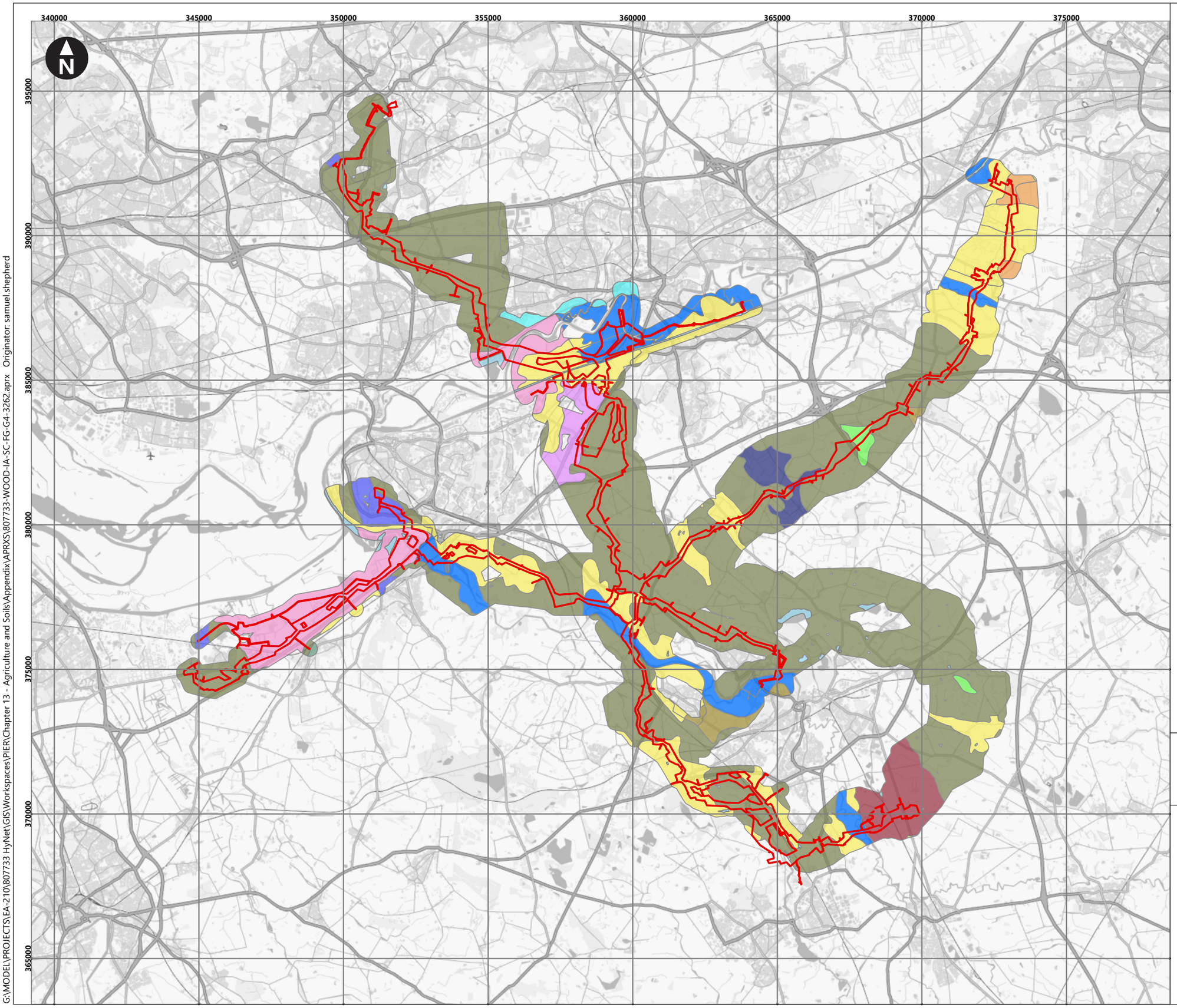

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Key

Preliminary Order Limits

National Soil Map

MU Name	Soil Type
Canal, Lake + River	Body of water
Adventurers' 1 + Altcar 1	Fen peat
Adventurers' 2	Fen peat over glaciofluvial drift Tertiary and Cretaceous sand
Blackwood, Newport 1 + Crannymoor	Glaciofluvial drift
Wick 1	Glaciofluvial or river terrace drift
Downholland 2 + Wisbech	Marine alluvium
Bridgnorth	Permo-Triassic and Carboniferous reddish sandstone
Bromsgrove	Permo-Triassic and Carboniferous sandstone and siltstone
Cuckney 1	Permo-Triassic reddish sandstone
Turbary Moor	Raised bog peat
Crewe	Reddish glaciolacustrine drift and till
Clifton and Salop	Reddish till
Rufford	Reddish till and glaciofluvial sand
Conway + Teme	River alluvium

0 1 2 3 4 5 6 Kilometers

Scale at A3: 1:125,000

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Figure 3
National Soil Map of England and Wales (NATMAP)

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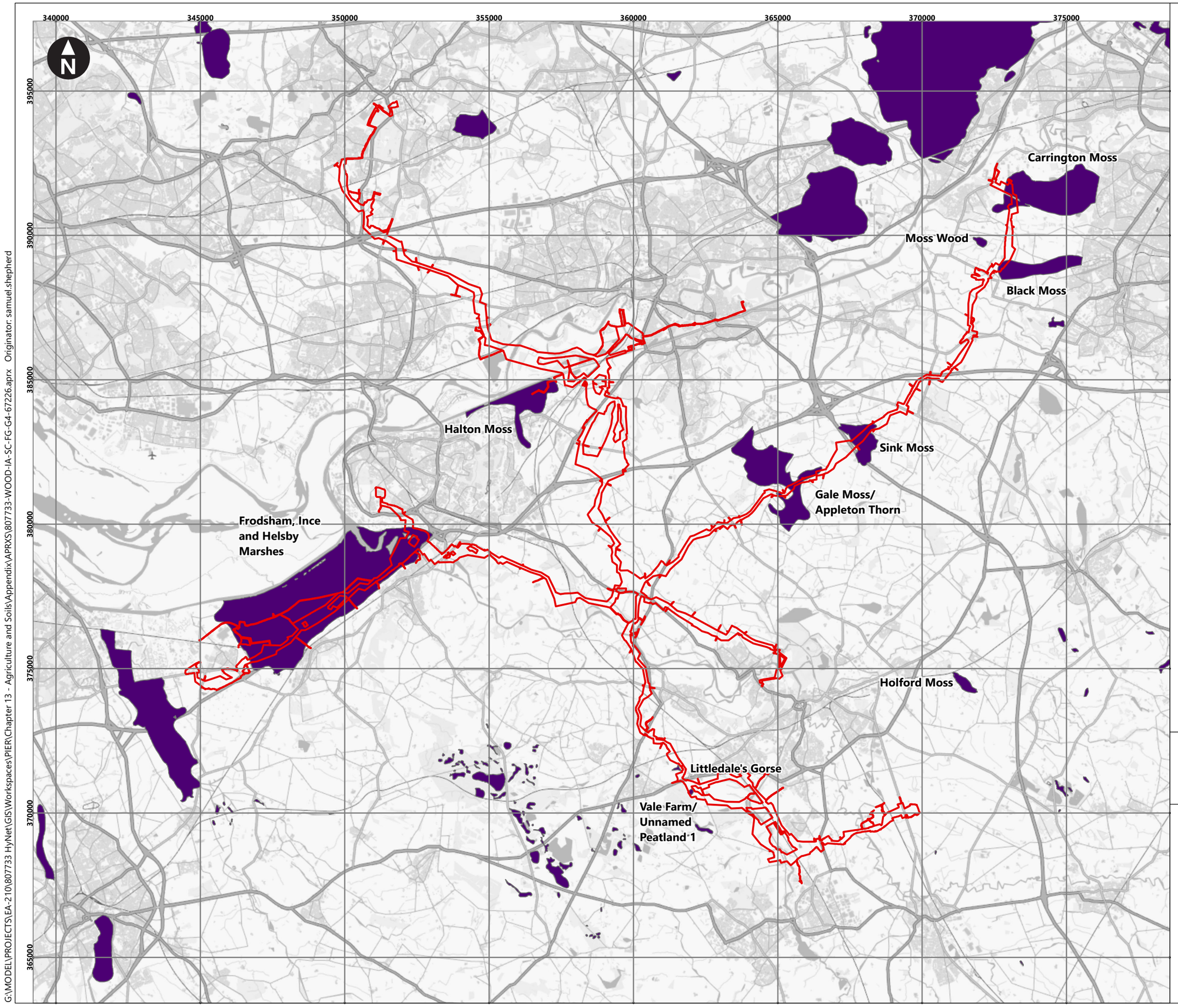

Key

Preliminary Order Limits

Peaty Soils

Deep Peaty Soils

0 1 2 3 4 5 6 Kilometers

Scale at A3: 1:125,000

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Figure 4
Peaty Soils (Natural England Data)

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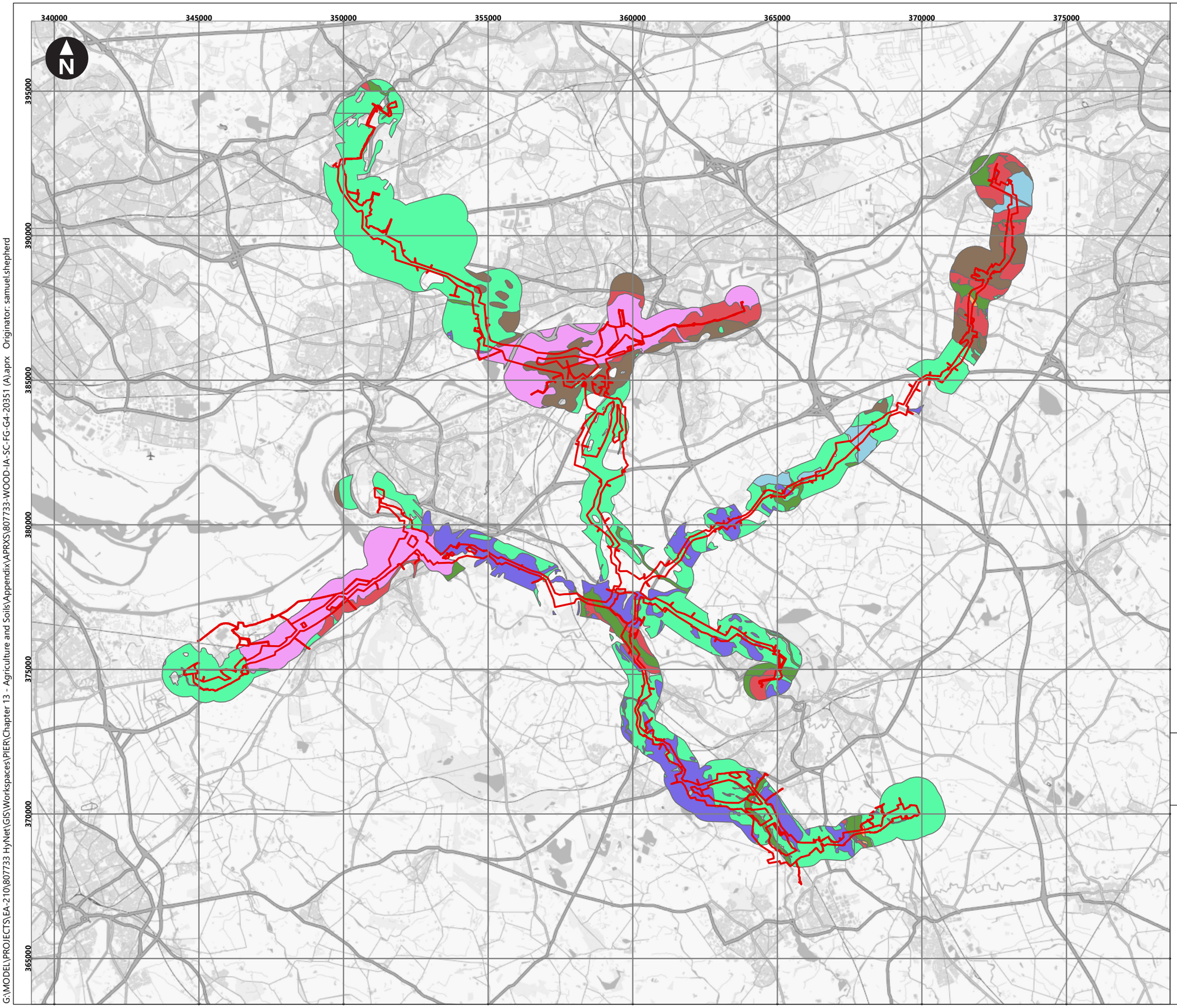

Key

Preliminary Order Limits

Superficial Geology

- ALLUVIUM
- GLACIOFLUVIAL DEPOSITS, DEVENSIAN
- GLACIOFLUVIAL SHEET DEPOSITS, DEVENSIAN
- PEAT
- RIVER TERRACE DEPOSITS (UNDIFFERENTIATED)
- RIVER TERRACE DEPOSITS, 1
- SHIRDLEY HILL SAND FORMATION
- TIDAL FLAT DEPOSITS
- TILL, DEVENSIAN

0 1 2 3 4 5 6 Kilometers

Scale at A3: 1:125,000

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Figure 5a
Superficial Geology

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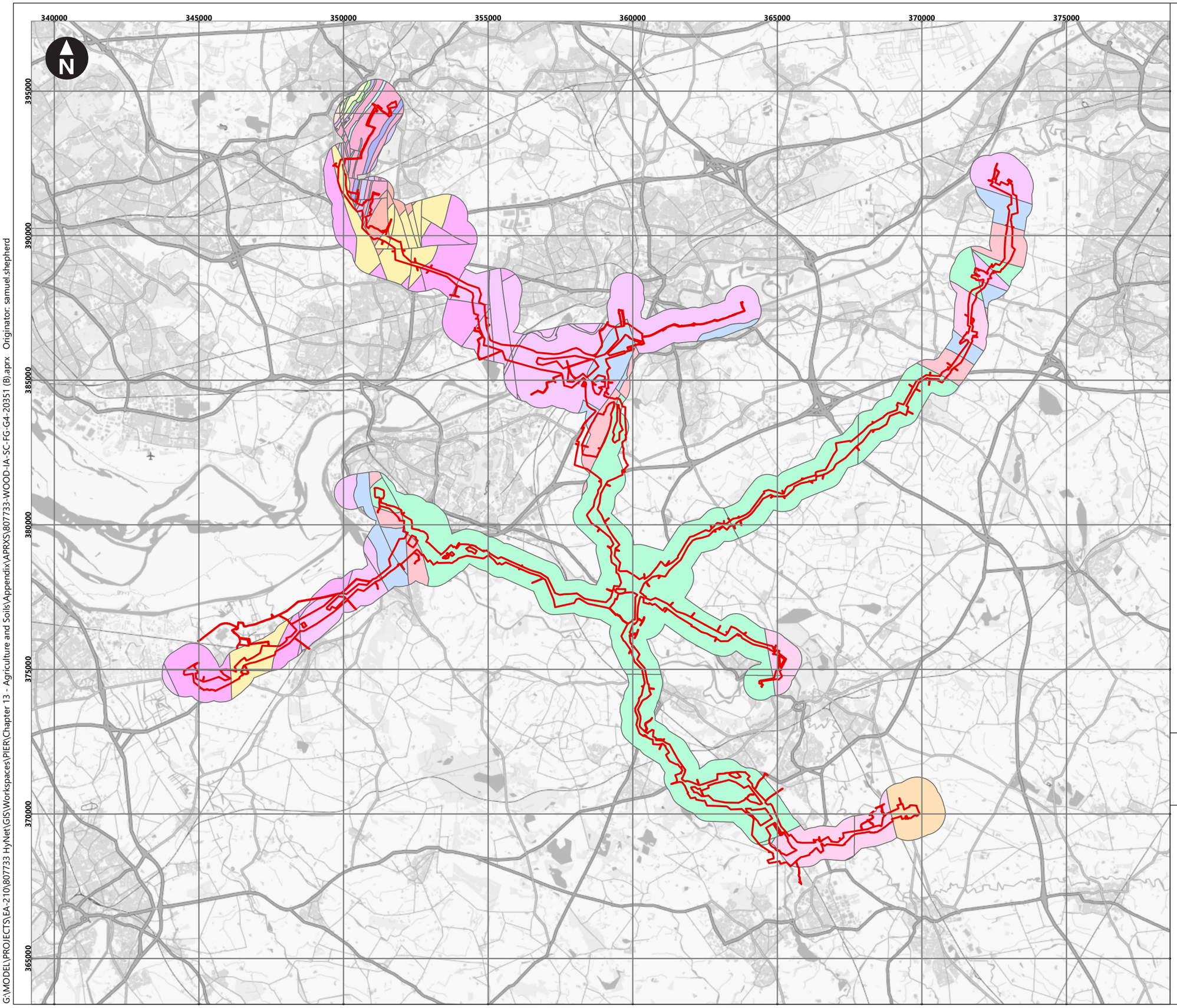

Key

Preliminary Order Limits

Solid Geology

- BOLLIN MUDSTONE MEMBER - MUDSTONE
- CHESTER FORMATION - SANDSTONE, PEBBLY (GRAVELLY)
- ETRURIA FORMATION - MUDSTONE, SANDSTONE AND CONGLOMERATE
- HELSBY SANDSTONE FORMATION - SANDSTONE, PEBBLY (GRAVELLY)
- KINNERTON SANDSTONE FORMATION - SANDSTONE
- NOB END ROCK - SANDSTONE
- NORTHWICH HALITE MEMBER - HALITE-STONE AND MUDSTONE
- PEMBERTON ROCK - SANDSTONE
- PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE
- PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- PENNINE LOWER COAL MEASURES FORMATION - SANDSTONE
- PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- PENNINE MIDDLE COAL MEASURES FORMATION - SANDSTONE
- RAVENHEAD ROCK - SANDSTONE
- SIDMOUTH MUDSTONE FORMATION - MUDSTONE
- TARPORLEY SILTSTONE FORMATION - SILTSTONE, MUDSTONE AND SANDSTONE
- WILMSLOW SANDSTONE FORMATION - SANDSTONE

0 1 2 3 4 5 6 Kilometers

Scale at A3: 1:125,000

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Figure 5b
Solid Geology

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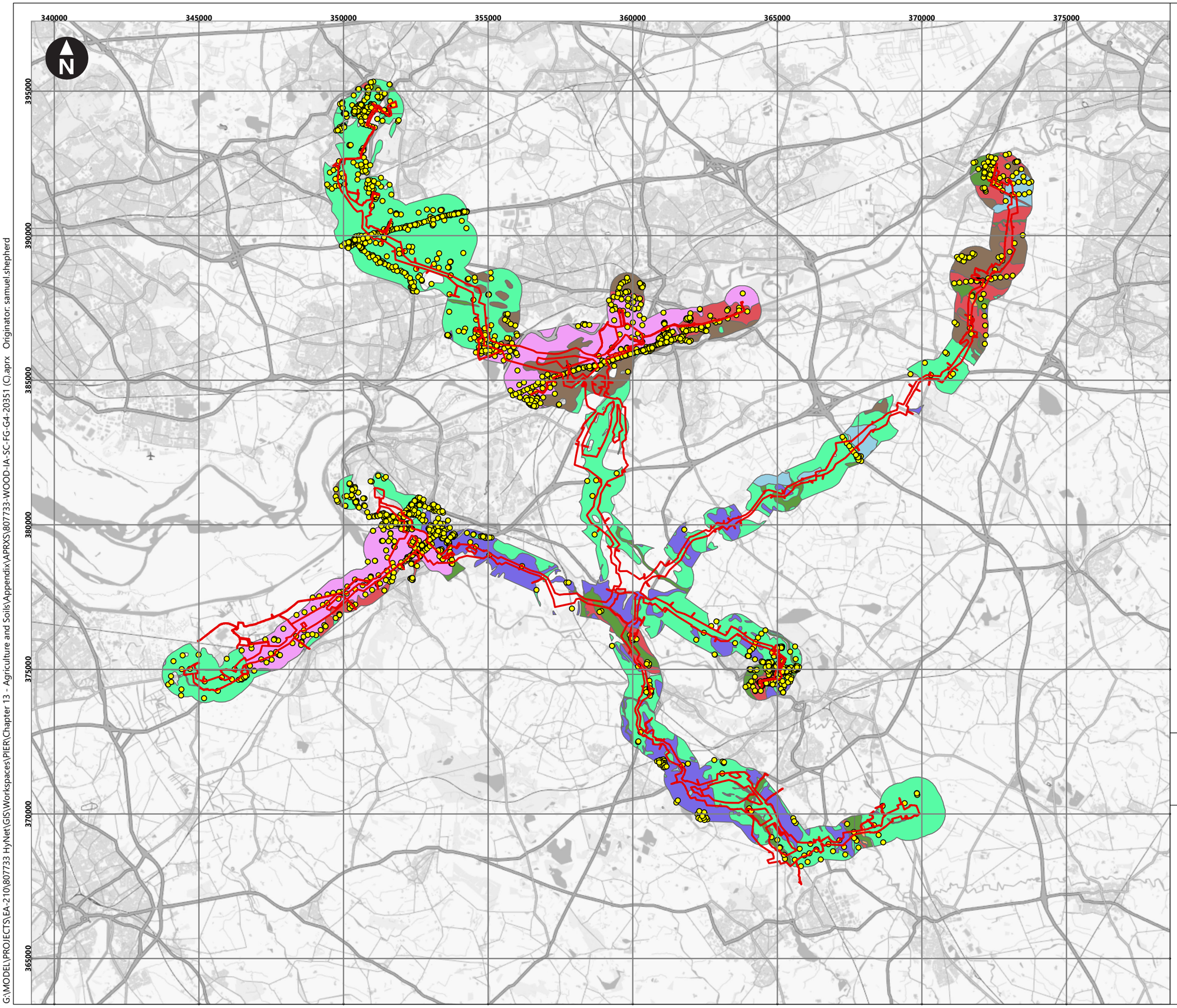

Key

- Preliminary Order Limits
- BGS Boreholes

Superficial Geology

- ALLUVIUM
- GLACIOFLUVIAL DEPOSITS, DEVENSIAN
- GLACIOFLUVIAL SHEET DEPOSITS, DEVENSIAN
- PEAT
- RIVER TERRACE DEPOSITS (UNDIFFERENTIATED)
- RIVER TERRACE DEPOSITS, 1
- SHIRDLEY HILL SAND FORMATION
- TIDAL FLAT DEPOSITS
- TILL, DEVENSIAN

0 1 2 3 4 5 6 Kilometers

Scale at A3: 1:125,000

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Figure 5c
BGS Borehole records within the study area

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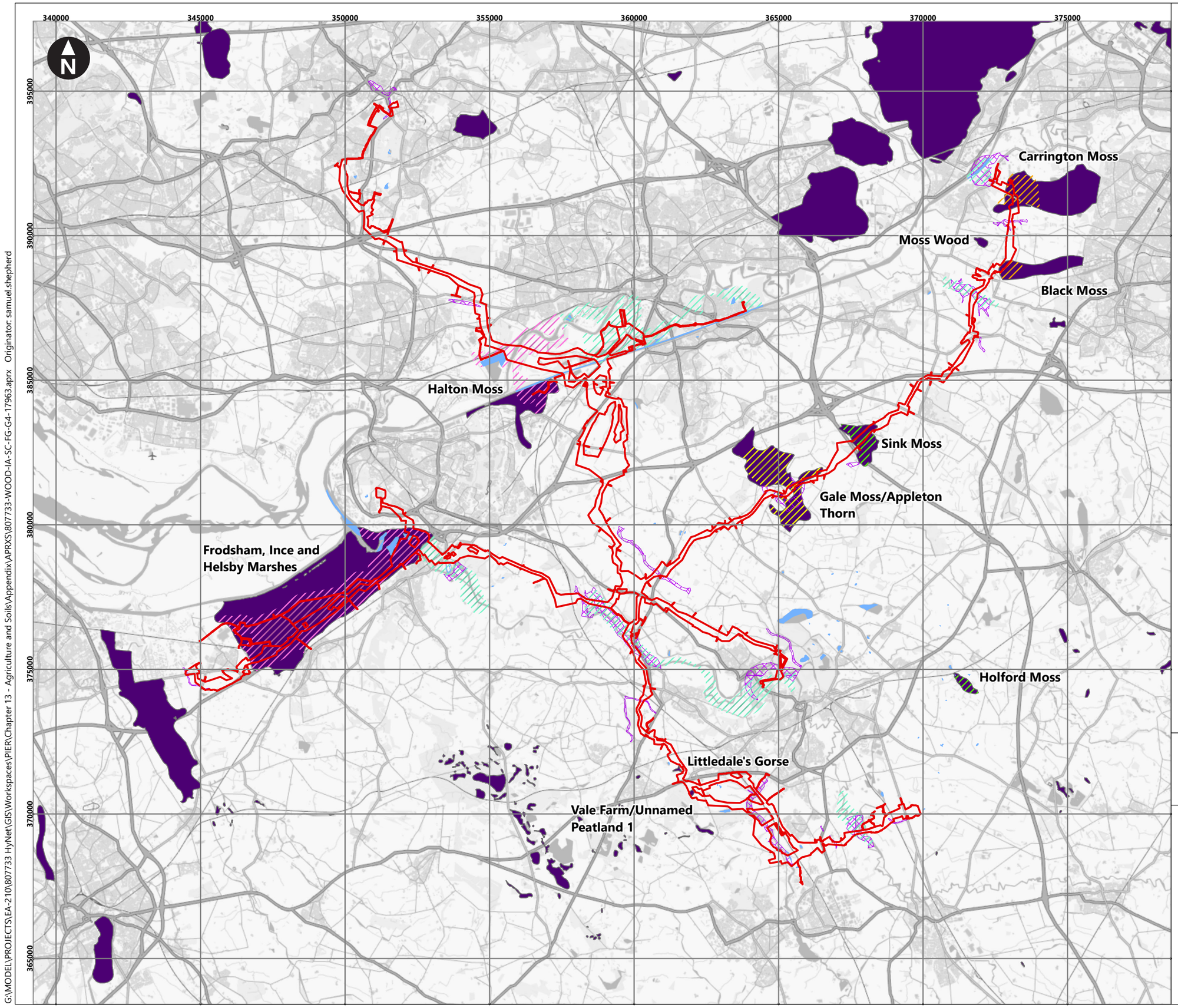

Key

Preliminary Order Limits

Soil Type

Source: Cranfield University, NATMAP - National Soil Map

Body of water

Fen peat

Fen peat over glaciofluvial drift Tertiary and Cretaceous sand

Marine alluvium

Raised bog peat

River alluvium

Superficial Geology

Source: BGS 1:50,000 scale geology mapping

ALLUVIUM

Peaty Soils

Source: Natural England

Deep Peaty Soils

0 1 2 3 4 5 6 Kilometers

Scale at A3: 1:125,000

Client

wood. | Cadent

HyNet North West Hydrogen Pipeline Project
Preliminary Environmental Information Report
Appendix 13A - Agriculture

Figure 6
Areas of Peat identified by Desk Study

September 2022

wood.

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