

**HyNet North West
Hydrogen Pipeline**

Delivering clean growth

Cadent
Your Gas Network

Design Evolution Report

September 2022

Glossary

Term	Description
Blending	The blending of hydrogen with the existing natural gas supply for use by customers
DCO	Development Consent Order. The consent required for Nationally Significant Infrastructure Projects, of which this Project is one.
EIA	Environmental Impact Assessment. A formal assessment of the environment significance of a proposed development.
HyNet North West	A wider programme of projects to assist with the decarbonisation of the region through the replacement of natural gas with hydrogen, of which this project forms a part.
HAGI	Hydrogen Above Ground Installation. Infrastructure required in places along the pipeline to control the flow and pressure of hydrogen, facilitate connection and/or provide maintenance points.
Hydrogen Production Plant (HPP)	A production plant at Stanlow which will produce hydrogen to be transported by the pipeline to the Hydrogen Storage Facility and to customers.
Hydrogen Storage Facility (HSF)	A storage facility for hydrogen at Inovyn's underground caverns to the south of Northwich. Hydrogen stored in these caverns will be transported by the pipeline to customers.
PEIR	Preliminary Environment Information Report. A report detailing the findings of the preliminary EIA work undertaken.
Preferred Route Optioneering	Third stage of works where specific pipeline route options are considered within the Preferred Route Corridor in order to identify the Preliminary Route Alignment .
Proposed Route Alignment	The route alignment identified following Stage 2 non-statutory consultation and which will form the basis of the DCO application
Preliminary Route Alignment	The preliminary pipeline route alignment identified in the third stage of works, the Preferred Route Optioneering, which will provide the basis of the final pipeline route for the PEIR assessment and the Stage 2 statutory consultation
The Project	The HyNet North West Hydrogen Pipeline Project. The 125km pipeline and supporting HAGIs which are the subject of this report.
Route Corridor Identification / Preferred Route Corridor	Second stage of works where corridors within which a pipeline would run are considered along the Preferred Strategic Option. This will identify a Preferred Route Corridor.
Stage 1 non statutory consultation	Consultation exercise undertaken on the Preferred Route Corridor design in early 2022
Stage 2 statutory consultation	Consultation exercise required by Section 42 of the Planning Act 2008 and scheduled for Autumn 2022.

Term	Description
Strategic Optioneering / Preferred Strategic Option	Initial stage of works to consider strategic layouts for the pipeline route and select a preferred option which will then be used to identify a broad route corridor for the pipeline.

Contents

1.	Introduction	8
1.1	Overview	8
1.2	Purpose of This Report	8
1.3	Background to the Project	9
1.4	Overview of the Proposed Development	13
1.5	Project Team	13
1.6	Structure of the Report	13
2.	Approach to Routeing and Siting	14
2.2	Design Objectives	14
2.3	Principles	14
2.4	Identify Constraints and Beneficial Features	15
2.5	Strategic Optioneering	21
2.6	Route Corridor Identification	21
2.7	Consultation on Preferred Route Corridor	21
2.8	Preferred Route Optioneering / Preliminary Route Alignment Identification	22
2.9	Selection of Proposed Route Alignment	23
2.10	Current stage of work: Preliminary Route Alignment (the PEIR's Preliminary Order Limits)	23
3.	Strategic Optioneering	24
3.1	Introduction	24
3.2	Strategic Options	24
4.	Route Corridor Identification	29
4.2	Western Leg	29
4.3	Northern Leg	31
4.4	Eastern Leg	34
4.5	Southern Leg	35
4.6	Central Hub HAGI	38
4.7	Preferred Route Corridor	38
5.	Preliminary Route Alignment	39
5.2	West Corridor	39

5.3	North Corridor	44
5.4	East Corridor	52
5.5	South Corridor	55
5.6	Central Hub	58
5.7	Northwich Spur	59
5.8	Working compounds: construction, trenchless crossings, material storage areas	60
5.9	The Preliminary Route Alignment	61

6. Next Steps 67

6.1	Stage 2 statutory consultation	67
6.2	Proposed Route Alignment and DCO submission	67

Table 2.1	Anticipated DCO Pipeline Corridor Widths	15
Table 2.2	Key Environmental, Social and Policy Constraints	18
Table 2.3	Key Engineering Constraints	19
Table 3.1	Strategic Options Comparison	27
Table 4.1	Western Leg Options	30
Table 4.2	Southern Leg Options	36
Table 5.1	Rocksavage to Central Hub options	40
Table 5.2	Rocksavage HAGIs	42
Table 5.3	Runcorn Spur	43
Table 5.4	North Corridor Options	46
Table 5.5	Higher Walton HAGI Options	49
Table 5.6	Clock Face HAGI Options	50
Table 5.7	St Helens HAGI Options	51
Table 5.8	South Corridor Options	55
Table 5.9	Vale Royal Locks route options	57
Table 5.10	Central Hub HAGI options	58
Table 5.11	Northwich Spur options	59
Table 5.12	West Corridor Options	62
Table 5.13	North Corridor Options	63
Table 5.14	East Corridor Options	64
Table 5.15	South Corridor Options	65
Table 5.16	Central HAGI Options	66
Table 5.17	Northwich Spur Options	66

Figure 1.1	Fixed Connection Points
Figure 3.1	Strategic Options A-D
Figure 4.1	Initial West Corridor Options
Figure 4.2	West Preferred Route Corridor
Figure 4.3	Initial North Corridor
Figure 4.4	North Preferred Route Corridor
Figure 4.5	Initial East Corridor
Figure 4.6	East Preferred Route Corridor
Figure 4.7	Initial South Corridor Options
Figure 4.8	Preferred South Corridor Options
Figure 4.9	Central Hub HAGI Search Area
Figure 4.10	Preferred Route Corridor
Figure 5.1	West Corridor: Preliminary Route Alignment
Figure 5.2	Runcorn / Rocksavage HAGI Options
Figure 5.3	Runcorn / Rocksavage Spur (A&B)
Figure 5.4	North Corridor: Preliminary Route Alignment
Figure 5.5	Higher Walton Route Options
Figure 5.6	Higher Walton HAGI Options and Spur
Figure 5.7	Clock Face HAGI Option and Spur
Figure 5.8	St Helens HAGI Option and Spur
Figure 5.9	Warrington Spur Route Options
Figure 5.10	East Corridor: Preliminary Route Alignment
Figure 5.11	Warburton HAGI Option and Spur
Figure 5.12	Partington HAGI Option and Spur
Figure 5.13	East Block Valves

Figure 5.14	South Corridor: Preliminary Route Alignment
Figure 5.15	Vale Royal Locks Route Options
Figure 5.16	South Block Valves
Figure 5.17	Central Hub HAGI Options
Figure 5.18	Northwich Spur Option
Figure 5.19	Preliminary Route Alignment

1. Introduction

1.1 Overview

- 1.1.1 The HyNet North West Hydrogen Pipeline Project (hereafter 'the Project') is a proposal by Cadent Gas Ltd to construct and operate the UK's first 100 percent hydrogen pipeline network at scale. It will deliver hydrogen - a clean energy source - to multiple industrial customers and power generators and it will take hydrogen to potential gas blending points for introduction into the existing natural gas network.
- 1.1.2 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. By achieving this, the HyNet North West programme will create and maintain thousands of local jobs, enabling long-term sustainability for businesses and supporting financial security for communities across the region. It is possible that further hydrogen pipelines will be built across the North West region to support the wider supply of hydrogen to homes and industrial customers.
- 1.1.3 The Project includes the design, construction, operation and maintenance of approximately 125km of new pipeline to distribute hydrogen to industry and to support the potential blending of hydrogen into the existing natural gas network. Hydrogen Above Ground Installations (HAGIs) are also required to control the flow and pressure of hydrogen at key points along the proposed pipeline.
- 1.1.4 Cadent has obtained a section 35 Direction dated 05 July 2022 from the Secretary of State for Business, Energy and Industrial Strategy. This confirms that the Project (save for the pipeline spurs) is of national significance and is to be treated as development for which development consent is required. Cadent therefore intends to submit an application for an order granting development consent for the Project pursuant to the Planning Act 2008; this application is likely to include the pipeline spurs as associated development.

1.2 Purpose of This Report

- 1.2.1 The purpose of this report is to present the outputs of the routeing and siting study (referred to as the Preferred Route Optioneering process and comprising the third stage of design work) which has been undertaken to identify the project boundary in which the pipeline and connection spurs would be located, referred to as the Preliminary Route Alignment. This boundary also includes the potential locations for the HAGIs, block valves and working compounds required along the pipeline route. The findings of the study have been used to identify the boundary of the Project for use in the Preliminary Environmental Impact Report (PEIR). This boundary has also been used to support the Stage 2 statutory consultation exercise under Section 42 of the Planning Act 2008, which commences in September 2022.
- 1.2.2 This Report also sets out the work carried out on Strategic Options (the initial stage of design work) and identifying the Preferred Route Corridor (the second

stage of design work) which was presented at and consulted on at Stage 1 non-statutory consultation.

1.3 Background to the Project

Need for the Project

- 1.3.1 The use of hydrogen as a substitute for natural gas is seen by the Government as a means by which the UK can progress towards the decarbonisation of heat and ultimately achieve its stated objective of achieving net zero by 2050. This is evidenced by the number of recent policy documents and strategies which together demonstrate the need for hydrogen as a replacement for natural gas and hence the need for the Project. To supply customers in the North West there is a requirement to provide a new, dedicated hydrogen pipeline. Further details on the wider development options and alternatives considered during the design process are included in **Chapters 3-5** of this report.
- 1.3.2 The Government's commitment to hydrogen is set out within the Ten Point Plan for a Green Industrial Revolution which was published in November 2020. This plan aims to make the UK a global leader in green technologies recognising that supporting such innovation can deliver significant numbers of new jobs and support the UK to ultimately address its climate change commitments. Point 3 of the Plan is to 'drive the growth of low carbon' and also contained within the Plan is the government aim of delivering 5GW of low carbon hydrogen production capacity by 2030. This Ten Point Plan was accompanied by the National Infrastructure Strategy also published in November 2020 and it was followed by the Energy White Paper, 'Powering our Net Zero Future', December 2020. In this latter document government recognises that setting a net zero target as a means of reducing the effects of future climate change requires investment and innovation. The document also refers to the delivery of a greener energy system, to include low carbon hydrogen.
- 1.3.3 In March 2021 government produced an Industrial Decarbonisation Strategy to explain how industry can decarbonise in line with net zero, while remaining competitive and without pushing emissions abroad. This was followed by the UK Hydrogen Strategy in August 2021 and consultation on a UK Low Carbon Hydrogen Standard. The strategy establishes the case for low carbon hydrogen and the role of hydrogen in meeting net zero, stating that it will play an important complementary and enabling role alongside clean electricity in decarbonising the UK's energy system. There is recognition that hydrogen is suited to use in a number of sectors where electrification is not feasible or is too costly, and where other decarbonisation options are limited. Examples cited include the generation of high temperature heat such as in industrial furnaces and this reflects how the hydrogen transported by the Project would sometimes be used.
- 1.3.4 In order to support the introduction of hydrogen networks across the UK, the Government has introduced fiscal incentives and promoted partnership. Published in October 2021 the Government's Net Zero Strategy: Build Back Greener provides policies and proposals to keep the UK on track to meet its carbon budgets and aims to deliver the 5GW of hydrogen production capacity by 2030

referenced above (with the expectation this could increase to 10 or 17GW by 2035 depending upon the role of hydrogen for heat). Key policies include the establishment of the Industrial Decarbonisation and Hydrogen Revenue Support (IDHRS) scheme to fund new hydrogen and carbon capture, part of which includes provision of £240m of government co-investment for low-carbon hydrogen production. Under the heading of 'Industry' there is also a direct reference to the HyNet programme, which along with the East Coast Clusters is cited as acting as an economic hub for green jobs.

- 1.3.5 Also in October 2020¹ government confirmed that the HyNet programme and East Coast Clusters had been confirmed as Track 1 clusters for the mid-2020s subject to final decisions being made by ministers. This announcement referenced the government's Ten Point Plan and to its support to Carbon Capture Utilisation and Storage (CCUS). Furthermore, in August 2022 government announced 20 shortlisted projects to proceed to the due diligence stage of the Phase 2 Cluster Sequencing process. These included six related HyNet projects. Although HyNet's carbon capture sits outside of this Project both announcements are an important step towards the realisation of a low carbon hydrogen supply into the Project's proposed pipeline network.
- 1.3.6 The British Energy Security Strategy April 2022 aims to improve energy efficiency reduce imports (of natural gas and oil) and accelerate the transition to renewables and other forms of low carbon energy. It recognises that in meeting net zero the UK might require a quarter of the gas currently used but amongst other measures encourages the use of hydrogen as an alternative. The Strategy announced government plans to accelerate targets for the production of hydrogen doubling the 5GW by 2030 set out in the Net Zero Strategy to one which seeks to achieve 10GW over the same timescale.
- 1.3.7 In summary, government has identified hydrogen as one of the alternative fuel sources necessary to support the decarbonisation of industry and its wider commitments to achieving net zero by 2050. Already since 2020 it has doubled the target for the production of hydrogen and has identified the HyNet programme as one of the hydrogen hubs to be encouraged and supported in the UK. In addition to the environmental benefits of decarbonisation government recognises that the introduction of new technologies can act as a spur to economic development through the creation of 'green' jobs.
- 1.3.8 There is a clear need for projects which will transport hydrogen from the place(s) of production to industrial customers and possible residential customers through future blending. This need is most clearly summarised within emerging government planning policy. Paragraph 3.4.16 of the draft Overarching National Policy Statement for Energy EN-1 (September 2021) states:
- "There is an urgent need for all types of low carbon hydrogen infrastructure to allow hydrogen to play its role in the transition to net zero."*
- 1.3.9 Having established the need for low carbon hydrogen the next step is to understand the requirement for such a project in the North West and the form that it should take.
- 1.3.10 The Industrial Decarbonisation Strategy referred to above is supported by an Industrial Cluster's Mission. This aims to create a net-zero cluster by 2040 and a

low-carbon cluster by 2030. It identifies the six largest industrial clusters by emissions which include 'Merseyside', each being positioned as key areas for low carbon products and technologies.

- 1.3.11 This Project sits squarely within the Merseyside Cluster, the cluster itself being characterised by a concentration of large-scale industrial customers of natural gas. Regional support for the decarbonisation of this cluster can be found in the work being undertaken by local authorities, enterprise partnerships and local industry to develop an integrated industrial hydrogen cluster in the North West.
- 1.3.12 Whilst there is a clear need to support the decarbonisation of large-scale industrial customers there is also an opportunity to begin the process of reducing the amount of natural gas used in the domestic gas market. The UK Hydrogen Strategy notes the UK Government is working with the Health and Safety Executive (HSE) to assess the potential to blend hydrogen and whilst current domestic appliances are unable to operate solely on hydrogen trials have taken place into the blending of hydrogen into the domestic supply (including by Cadent at Keele University). An opportunity exists to deliver blending with this Project.
- 1.3.13 A hydrogen network requires a number of elements for its operation. These include a source(s) of hydrogen gas, the means to transport it to customers and a requirement for storage to enable the balancing of supply and demand. The location of these elements, particularly the start (supply) and end points (customers) have determined the Project's strategic location.
- 1.3.14 Vertex is committed to bringing forward hydrogen production at Essar's Stanlow facility with elements of the design stage for the core production plant supported under BEIS Hydrogen Supply Programme funding. The scheme would see 'blue' hydrogen produced, that is hydrogen produced using energy from fossil fuels, with the carbon dioxide emitted from the fossil fuel use captured and stored. The carbon dioxide capture would occur under the HyNet Carbon Dioxide Pipeline scheme by Liverpool Bay CCS Ltd and a DCO application is expected to be submitted for that pipeline in Autumn 2022.
- 1.3.15 Cadent is currently working with the energy industry to determine additional sources of hydrogen in the North West. The Project proposed will be able to transport all hydrogen (independent of its 'colour') which meets the required quality standards.
- 1.3.16 The industrial customers to be supplied by the Project have signed memorandum's of understanding setting out their requirements for hydrogen as a replacement fuel source for natural gas. They can demonstrate a readiness to connect by 2027 and through their adoption of hydrogen as a fuel source, deliver significant CO₂ savings. Customers were identified initially by members of the wider Hynet consortium informed by EU ETS (Emissions Trading System) data as industrial businesses operating in the proximity to Cadent's developing pipeline network and with a high energy use.
- 1.3.17 The supply, storage and customers, including potential blend points, which drive the location and strategic routeing of the Project are as follows:
- Vertex Hydrogen Production Plant (at Essar Stanlow Refinery) (HPP):

- ▶ The initial source of hydrogen supply to the Hydrogen Pipeline Network (HPN).
- Hydrogen Storage Facility (HSF) (Inovyn, Northwich):
 - ▶ To allow hydrogen to be stored at times of peak supply and released into the HPN to meet demand.
- Carrington Power Station and two potential blending points on the existing Cadent gas network (Partington and Warburton):
 - ▶ To support electricity generation and allow hydrogen to be blended with natural gas and supplied into the wider gas pipeline network to maximise the extent of supply.
- A cluster of industrial operations in St Helens:
 - ▶ To allow hydrogen to be supplied to these customers users as a fuel for their operational requirements.

1.3.18 The HPP will produce the hydrogen required for supply to the pipeline and drives the need for the western leg of the network.

1.3.19 The HSF would use depleted salt caverns for storage. These already have consent for the storage of natural gas (Keuper Underground Gas Storage Facility Order 2017) which the operator intends to amend to enable the storage of hydrogen. Storage enables the efficient running of the network allowing for the delivery of agreed levels of gas to customer during potential periods of downtime at the hydrogen supplier and enabling the network to handle seasonal changes in demand. The requirement for storage and the location of the facility described above together with the existing consent and firm commitment by the operator to amend this consent in favour of hydrogen drives the requirement for a southern leg.

1.3.20 A customer base is essential to the project and the presence of three industrial customers in close proximity to one another at St Helen's and the carbon savings which would result drive the need for the northern leg to the network and are essential to its function. Similarly, the potential to blend into the existing natural gas network at points on Cadent's natural gas network at Warburton and Partington, along with customers at Partington (SAICA, Basell Polyolefins and Carrington Power Station) drive the requirement for an eastern leg.

1.3.21 Outside of the locations described above a number of small, customer clusters have been identified through the work undertaken by the Hynet consortium. Whilst these customers might not drive the requirement for a network leg in their own right, their proximity to each other, to the strategic network which is formed by elements referred to above or to one of the network end points means that they are able to be connected economically. These customers have demonstrated an appropriate level of commitment and have been confirmed by Cadent as forming part of the project on the basis of the CO₂ savings which would result.

1.3.22 The scope of the Project has therefore been developed to be in proximity to the supply, storage and customers locations, to allow connection to likely future demand and to be proportionate to the volume of hydrogen to be produced by the

HPP, the amount of storage available in the HSF and the anticipated future demand for hydrogen.

1.4 Overview of the Proposed Development

- 1.4.1 If constructed, the pipeline would connect to the HPP at Stanlow as a source of hydrogen for onward distribution to the network. Additional, future hydrogen production opportunities are also being developed in the local area.
- 1.4.2 The HPP (western leg), HSF (southern leg), potential blending points and industrial customers at Carrington (eastern leg) and industrial customers at St Helens (norther leg) form the four fixed connection points around which the Project has been developed. The location of these points is shown in Figure 1.1.

1.5 Project Team

- 1.5.1 The project team consists of:
- Cadent Gas Ltd;
 - A lands, environment, consents and stakeholder team, led by Wood Group UK Ltd; and
 - A Front End Engineering Design (FEED) team, led by Wood Group UK Ltd.

1.6 Structure of the Report

- 1.6.1 This report contains:
- Chapter 2: Approach to Routeing and Siting: the methodology for the design work for the Project.
 - Chapter 3: Strategic Optioneering: the work undertaken to identify a general layout for the Project.
 - Chapter 4: Route Corridor Identification: the work undertaken to identify the corridors within the strategic layout, and the HAGIs and spur connections needed (the Preferred Route Corridor).
 - Chapter 5: Preliminary Route Alignment: the work undertaken to identify the preferred route, within the route corridors, within which the pipeline, spur connections, HAGIs, block vales and working compounds will be located (the Preliminary Route Alignment).

2. Approach to Routeing and Siting

- 2.1.1 This chapter provides the methodology of the routeing and siting work that is needed for the HyNet North West Hydrogen Pipeline project.

2.2 Design Objectives

- 2.2.1 The key requirement of the routeing and siting work is that it must allow the following objective of the Project to be met:

“The HyNet North West Hydrogen Pipeline project will transport low carbon hydrogen from the Vertex Hydrogen production site at Stanlow or the Inovyn storage site to identified industrial customers and will provide the opportunity to introduce or convey hydrogen into the existing gas network at Partington and Warburton (the “Customers”). The aim is for the Project to be commissioned in 2027, but it will also be designed with foreseeable future phases, demand and need in mind. In this way, it will support some of the North West’s biggest businesses and employers for years to come, helping the region lead the way in the transition to Net Zero Carbon by 2050”

- 2.2.2 In addition, the Project’s selected design must be:

- technically and economically fit for purpose;
- able to receive the relevant consents;
- able to be safely constructed; and
- safe to operate.

- 2.2.3 In order to be technically and economically fit for purpose, the Project design must include flexibility around which industrial customers may connect to the Project.

2.3 Principles

- 2.3.1 In principle, the easiest method of laying a pipeline between any fixed points would be to take a direct line between these points. However, constraints are likely to require a direct route line to be amended to avoid or minimise conflict between the pipeline and the constraints. In order to make these amendments, options can be developed and the aim of the routeing and siting work is always to refine any options down to a single route corridor as soon as practically possible in the process. However, alternative corridors may be identified where options to avoid key constraints are available in order to consult on these options and ensure the most appropriate option is selected. It may be appropriate to take multiple options into a consultation process.

- 2.3.2 Decisions at all stages of the design evolution process involve a balance of relevant considerations including taking into account the views of engineering and consenting professionals, the advice on the routeing of natural gas pipelines in National Policy Statement EN-4 and other relevant policy, and the results of

stakeholder or consultee representations. Where appropriate decisions made at previous stages are back-checked as a more detailed understanding of previous decisions develops.

Corridor widths

2.3.3 The width of the route corridors within the final DCO proposals will depend on the diameter of the pipeline being installed. This will vary across the Project with current expectations being for pipelines of 10-18" diameter in the North Corridor, up to 30" in the east Corridor and up to 42" in diameter in the West and South Corridors. The spurs would range from 8-12" through public highways, up to 24" on the Runcorn / Rocksavage Spur.

2.3.4 Except within a highway, each pipeline will have a construction working area (also known as a Right of Way (ROW)) on both sides of the proposed route, and there will also a Limit of Deviation (LoD) around the proposed pipeline route. The LoD provides a reasonable and proportionate buffer zone to micro-site the pipeline if necessary during construction. Taking into account the LoDs and the construction working widths, a corridor width for each diameter of pipeline can be calculated.

Table 2.1 Anticipated DCO Pipeline Corridor Widths

Pipeline diameter	LoD	Construction working width	Total corridor width
42"	60m	44m (22m each side of pipeline)	104m
30"	60m	36m	96m
16-18"	50m	30m	80m
12" and below	Up to adopted highway boundary	Up to adopted highway boundary	Up to adopted highway boundary

2.3.5 All corridors will need to be wider in certain places to accommodate construction compounds, mitigation measures or access points for example. The principle of the routing work however will be to refine all of the corridor options considered down to these identified widths for the final DCO proposals.

2.4 Identify Constraints and Beneficial Features

2.4.1 From the consenting perspective, the Project has received a Direction from the Secretary of State which states that it should be considered as a Development Consent Order application under Section 35 of the Planning Act 2008. The relevant legislation in the Planning Act 2008 therefore requires that the overall decision on the DCO must be in compliance with Section 105 of the Planning Act 2008, and therefore have regard to:

- Any local impact report;
- Any matters prescribed by regulations; and

- *Any other matters which the decision maker considers to be both important and relevant to the decision.*

2.4.2 The letter accompanying the Direction states that “[...] *when [the Secretary of State] considers any eventual application for development consent, he will decide how much weight to give the National Policy Statements at that stage.*” It is considered that the National Policy Statements will constitute an important matter in the consideration of the DCO application for the Project.

2.4.3 National Policy Statement EN-4 provides “*Factors influencing site selection by the applicant*” in relation to oil and gas pipelines. This section is proposed to be retained in materially the same form in the draft new EN-4 (paragraphs 2.19.7 – 2.19.10 in both). These factors have been taken into account in identifying the topics for consideration in the site selection process, as described below, along with the other relevant assessment principles and policy in EN-4 and in EN-1. It is noted that the draft new EN-4 states: “*The need for low carbon hydrogen infrastructure is established in Section 3.4 of EN-1. The guidance that follows in this NPS has been drafted in respect of, and has effect only in relation to, natural gas infrastructure. It does not have effect for hydrogen infrastructure, but may contain information that is important and relevant to the Secretary of State’s decision on applications for hydrogen infrastructure.*”

2.4.4 A range of topics and constraints can be identified from reviewing these National Policy Statement as well as policy documents at a national level, and those documents which form the Local Development Plans, which will be considered within the consenting process. These include:

- Air Quality
- Biodiversity and Geodiversity
- Civil and military aviation and defence interests
- Coastal change
- Pollutants (dust odour, light etc)
- Flood risk
- Historic Environment
- Landscape and Visual
- Green infrastructure
- Noise and Vibration
- Socio-economic
- Traffic and transport
- Green Belt
- Local Wildlife Sites
- Mineral Safeguarding Areas
- Development Allocations

- Local Geological Sites
- Tree Preservation Orders (TPOs)
- Public Rights of Way, and National recreational routes.

2.4.5 Constraints can also be identified in relation to safe construction and operation, and viable design:

- Cost
- Ground conditions and unstable ground
- Densely populated areas:
- Existing / future built developments
- Overhead power lines
- Mineral / mining extraction / landfill sites
- Active/dormant landslips
- Rock at/near surface
- Areas of potential unexploded ordnance/unexploded bombs
- Steep slopes
- Major highway crossings
- Rail line crossings
- Major watercourse crossings
- Buried services
- Overhead lines
- Access (temporary and permanent).

2.4.6 These issues and constraints are considered to provide an appropriate coverage of the regulatory and legislative matters which will be relevant to the design and consenting processes for the Project. The assessment of constraints/issues has a bearing on the identification of strategic options, routeing and design and on the Development Consent Order (DCO) determination. A number of the topic areas considered are relevant for both environment and engineering considerations, or for multiple environmental topic areas.

2.4.7 A range of designations, policy allocations and features relating to the issues can then be identified and mapped into a GIS system for use in the study.

Consenting

2.4.8 For this Project, the features in **Table 2.1** have been identified as being of relevance to the consenting process. The majority could be seen as routeing constraints, however the Green Belt is considered differently (as described in paragraphs 2.4.10-2.4.14).

Table 2.2 Key Environmental, Social and Policy Constraints

Topic	Constraint
Air Quality	Urban areas Special Protection Areas (SPA) Special Areas of Conservation (SAC) Ramsar sites National Nature Reserves (NNR) Sites of Special Scientific Interest (SSSI)
Biodiversity and Geodiversity	Special Protection Areas (SPA) Special Areas of Conservation (SAC) Ramsar sites National Nature Reserves (NNR) Sites of Special Scientific Interest (SSSI) Local Nature Reserves (LNR) Priority habitats Ancient woodlands Tree Preservation Orders (TPOs)
Civil and military aviation and defence interests	Ministry of Defence land
Coastal change	N/A
Pollutants (dust, odour, light etc)	Urban/built up areas Public Rights of Way and cycle paths
Flood risk	Flood zones 2 and 3
Historic Environment	Historic battlefields Registered parks and gardens Scheduled Ancient Monuments World Heritage Sites Listed Buildings Conservation Areas Historic Landscapes (Wales)
Landscape and Visual	Areas of Outstanding Natural Beauty No National Parks within study area
Green infrastructure	Green Belt (see paragraphs 2.4.10-2.4.14) National Trust land Country parks Public access land (Countryside and Rights of Way Act)
Noise and Vibration	Urban areas Special Protection Areas (SPA) Special Areas of Conservation (SAC) Ramsar sites National Nature Reserves (NNR) Sites of Special Scientific Interest (SSSI) Public Rights of Way and cycle paths
Socio-economic	National cycle routes National/Regional walking routes Areas of public recreation/open space

Topic	Constraint
Traffic and transport	N/A: National policy is related to traffic generation issues rather than constraints to be avoided. Minor and residential roads would however be avoided in the design process.

Engineering

- 2.4.9 From an engineering perspective, the routeing exercise starts with constraints, particularly those which cover more extensive areas of land or which would give rise to substantial levels of difficulty or cost for a pipeline to be routed through.

Table 2.3 Key Engineering Constraints

Topic	Constraints
Ground conditions	Geo-hazards (i.e. major faults/seismic issues) Karstic features (i.e. limestone caves, sink holes) Marshland or peat type soils Topography (steep forward or side slopes)
Densely populated areas	Settlements Suburban Areas (therefore maximising rural land) Note: these areas are defined in IGEM/TD/1 pipeline code by population density
Existing / future, built developments	Planning permissions/applications Planning policy designations Landowner option agreements Outdoor leisure facilities
Overhead power lines	Parallel running with overhead power lines
Minerals / mining extraction / landfill sites	Historic, present and future planned activity Deep and shallow mining Shafts Spoil heaps Opencast high walls Contaminated land

Hydrogen Above Ground Infrastructure and the Green Belt

- 2.4.10 The designations, constraints and issues used in the identification of the pipeline route are generally considered to be relevant for the identification of HAGI locations as well as the actual pipeline location. The one exception to this is the Green Belt
- 2.4.11 The construction of a pipeline development generally favours the use of rural land to avoid the constraints posed by built up areas, such as existing utilities,

residential properties and community facilities. Green Belt designations cover substantial extents of the potential development area and due to the location of the supply, storage and customer connection points, the Green Belt is a designation and constraint which cannot be avoided either by the pipeline route or some of the HAGI requirements.

- 2.4.12 As the pipeline itself is a buried structure with the land above it being re-instated following its installation, which avoids the appearance of any permanent features within the landscape and ensuring that any disturbance to existing features is temporary in nature, the pipeline could usually be developed in general compliance with Green Belt policy. This is on the basis that it can be demonstrated to be an 'engineering operation' which preserves the openness of the Green Belt and does not conflict with the purposes of including land within it and so is not inappropriate development in the Green Belt for the purposes of the NPPF (see paragraph 150 of NPPF).
- 2.4.13 HAGIs however need to be considered in greater detail, as they primarily contain pipelines located both above and below ground, plus associated equipment to manage the pipelines operation. A HAGI would be a permanent piece of infrastructure visible in the landscape resulting in impacts arising from the land lost to development. Due to the nature of the Project, it will not be possible for all HAGIs to be located outside of the Green Belt. Therefore where a HAGI is required in the Green Belt, an assessment will be undertaken on the specific need for the HAGI and on different location options for its placement. The significance of impact will depend on the scale and nature of each HAGI and the particular characteristics of the landscape in the locations being considered for HAGI siting. In this way, the number of HAGIs proposed in the Green Belt will be kept to the absolute minimum required and the proposed locations will be selected to minimise the impact on the Green Belt purposes. This assessment work will be used to analyse the Route Corridors identified to ensure that their proposed routes do not lead to any substantial Green Belt issues.
- 2.4.14 Green Belt designations would therefore not be considered in the initial Strategic Optioneering work but would be introduced later in the process when considering the potential locations for HAGIs along the corridors. The corridor selection would be revisited and checked once the location of the HAGI locations have been identified.

Classification of Features

- 2.4.15 The constraints identified above in section 2.3 are plotted using a GIS system to build a 'heatmap'. The heatmap identifies highly constrained areas and areas with significant constraints, which should be avoided if possible. It is however important to note that the constraints may not in themselves become a critical barrier to the appropriateness of a corridor (and subsequent route) because all of the design decisions ultimately are a matter of balance between all relevant constraints and factors.

2.5 Strategic Optioneering

- 2.5.1 The Strategic Optioneering stage involves the consideration of strategic layouts for the pipeline route and the selection of a preferred option which will then be used to identify a route corridor for the pipeline.
- 2.5.2 Auto-routing software can therefore be used with the heatmaps to identify potential strategic options for the pipeline routes. These options are then reviewed by engineering and consenting teams to ensure they are relevant and to determine the Preferred Strategic Option.

2.6 Route Corridor Identification

- 2.6.1 Using the Preferred Strategic Option identified at the previous stage, route corridors can be created between the fixed points identified in **Chapter 1**. These corridors could be broad (e.g. 1+km wide) and could accommodate multiple potential pipeline route alignments within them. The corridors aim to identify linear areas of land through which the pipeline would run, using the principle that the corridors would seek to avoid constraints unless the benefit of doing so would be disproportionate e.g. the length of the pipeline would increase significantly to route around the constraint resulting in additional costs and impacts not justified by the impact on the constraint which could be avoided. The corridor widths are not fixed at this stage so that corridors could widen in places where route options need to be accommodated or narrowed in response to specific pinch points between identified constraints. The Route Corridor would include search areas of HAGIs to provide an indication of where these facilities would be required along the Route Corridor.
- 2.6.2 The route corridor identification must therefore consider the nature of the individual constraints identified and their value or sensitivity, and what residual effects there may be where the route and these constraints overlap. For example, from an engineering perspective the route corridor identification considers aspects that affect both the constructability and operation of the pipeline. These may include:
- Suitability of access for both construction and operation.
 - Minimisation of construction challenges (i.e. reduction of front/side slope or optimisation of drainage).
 - Minimising of number of crossing and locations, including other utilities.
 - Consideration of landowner activities (i.e. ongoing farming activities).
- 2.6.3 The work is both desk and site based, with site work allowing desk-based research and considerations to be confirmed in the field, resulting in Preferred Route Corridor(s) for the Project.
- ## 2.7 Consultation on Preferred Route Corridor
- 2.7.1 The Preferred Route Corridor identified are presented within the Stage 1 non-statutory consultation exercise to allow stakeholders (including members of the

public) the opportunity to comment on their location. The results of the consultation exercise influences the corridors being taken forward, alongside ongoing technical assessment. The results of the consultation are provided in the Non-Statutory Consultation Report¹ on the project website.

2.8 Preferred Route Optioneering / Preliminary Route Alignment Identification

- 2.8.1 Within the methodology previously published for the Stage 1 non-statutory consultation exercise, the intention was for this stage to produce a 'Preferred Route Option'. However, the work to date still includes a degree of optionality in the corridors identified and it is therefore not considered appropriate to refer to the results as a 'preferred' route option. The term Preliminary Route Alignment has therefore been used for this stage of the works.
- 2.8.2 A route optioneering study, where defined route options through the corridors are identified, is undertaken next.
- 2.8.3 Although the earlier phases of work would have avoided many of the constraint features identified in **section 2.3**, there could be places within the corridors where it has not been possible to avoid every constraint. Where constraints do exist within the corridors, expert advice from the environmental and engineering teams is to examine how a pipeline could be routed to avoid, or minimise its impact on, these features whilst maintaining a viable project.
- 2.8.4 The representations received during the consultation on the Preferred Route Corridor are also be taken into account at this point.
- 2.8.5 Using both the expert advice and the consultation responses, the wider route corridors are narrowed down to a more defined route, although in places where constraints remain the corridor may need to be drawn to a wider extent, to allow space for flexibility or mitigation as the routeing work progresses.
- 2.8.6 Where HAGIs, block valves or working compounds are required, a similar process to the pipeline routeing work is undertaken, with locations within the corridors identified for these components which seek to avoid or minimise any conflict with the engineering and consenting issues identified. For certain features, options are identified and these will be reviewed and refined to narrow down the alternatives.
- 2.8.7 The Preliminary Route Alignment is the result of the above exercise, it and would include locations, or options, for all of the components and would also include the access points needed from the public highway to facilitate the construction of the Project.
- 2.8.8 The Preliminary Route Alignment identified is used within the PEIR to allow a preliminary assessment of the environment effects to be undertaken, and it is used within the Stage 2 Statutory (Section 42) consultation exercise. The assessment results and representations received on both the PEIR and the Stage 2 Statutory

¹ <https://www.hynethydrogenpipeline.co.uk/assets/images/downloads/Cadent-HyNet-NSC-CFR-Final.pdf>

consultation exercise are then used in the following stage of works, refinement down to a Proposed Route Alignment.

2.9 Selection of Proposed Route Alignment

- 2.9.1 Using the preliminary environmental assessment work, representations made to the Stage 2 Statutory consultation exercise and ongoing detailed engineering and environmental assessment work, the Preliminary Route Alignment is then refined further to a Proposed Route Alignment. The Proposed Route Alignment would be a corridor representing the corridor widths identified in Section 2.2 and within the corridor it would include proposed locations for all of the HAGIs, Block Valves, working areas and all other requirements of the Project. The Proposed Route Alignment would be examined within the final Environmental Impact Assessment and would be the formal development boundary used within the DCO application.
- 2.9.2 Following on from the earlier stages of work, the Proposed Route Alignment would have avoided constraints wherever possible, taking into account the advice on the routing of natural gas pipelines in National Policy Statement EN-4. Where it is not practicable to avoid all constraints then mitigation is recommended to minimise the impact on/from those constraints.

2.10 Current stage of work: Preliminary Route Alignment (the PEIR's Preliminary Order Limits)

- 2.10.1 For clarity, within the methodology described in this chapter (specifically section 2.4 to 2.9), the Project has completed sections 2.4, 2.5, 2.6 and 2.7. The results of this work is described in **Chapters 3, 4 and 5**.
- 2.10.2 The methodology identified in Section 2.8 has been completed for use in the PEIR and the Stage 2 Statutory consultation process. As noted in Section 2.8 there are a number of issues still under consideration and this optioneering exercise has not progressed to the point where it is possible to identify a "Preferred Route Alignment" as was previously identified in the methodology published for the Stage 1 non-statutory consultation exercise. There is still work needed to reduce the route corridor width in certain locations and to work through some optionality that remains in places.
- 2.10.3 The route that is identified within this report has therefore been identified as the Preliminary Route Alignment and provides the route which is assessed in the PEIR as the Preliminary Order Limits.

3. Strategic Optioneering

3.1 Introduction

3.1.1 As the principle behind pipeline routeing is to get from the identified connection points in the most efficient way possible, the Strategic Optioneering identifies route options that the eventual pipeline could follow to reach these connection points. As identified in Figure 1.1, the connection points are:

- the Hydrogen Production Plant (HPP) at Stanlow;
- the Hydrogen Storage Facility (HSF), south of Northwich;
- the potential blending points at Partington and Warburton; and
- identified industrial customers in St Helens, Runcorn, Warrington, Carrington, Northwich and Lea Green (*Clock Face Spur*).

3.2 Strategic Options

Strategic Options: Discounted

3.2.1 A number of potential strategic options were discounted from more detailed consideration as there were clear reasons why they would not be a viable option for this Project. These included the use of existing or unused pipelines, routeing in rivers or other waterways, routeing directly next to transport links or routeing directly next to current pipelines.

3.2.2 The reasons that these options were discounted were because some of the existing infrastructure is not in a location compatible with the Project's start and end points and that some of this infrastructure has its own safety stand-off distances within which third-party works should be minimised. In addition the construction of the hydrogen pipeline could disrupt the continued operation of the existing infrastructure. Where infrastructure has been in situ for a number of years, it may pass through areas which have since been developed or are now environmentally constrained such that the routeing of a second parallel pipeline may not be the appropriate option. Existing pipelines, such as those carrying natural gas cannot be repurposed without disrupting existing supplies to customers whilst any redundant pipes would have been designed and constructed to standards and conditions which may not be suitable for the transportation of hydrogen.

3.2.3 Notwithstanding the above constraints the strategic options which have been taken forward do in some cases follow existing infrastructure corridors in the broader sense.

Strategic Options: Taken Forward

- 3.2.4 The employment of the methodology described in sections 2.4 and 2.5 identified four strategic alternatives, which the Project team evaluated. The term 'leg' is used to describe the land between the fixed points. The four strategic options are shown in **Figure 3.1 A-D**.

Strategic Option A: X Layout

- 3.2.5 As can be seen in **Figure 3.1A**, connecting the defined end points produces an 'X' shaped layout west-east and north-south, with all legs running through a central hub location.
- 3.2.6 In this layout, the western leg follows the M56 corridor between Stanlow and Frodsham, avoiding constraint features to the north (wind turbines and waste sites), built-up areas and related listed buildings to the south. The leg would then pass a number of listed building and ancient woodlands features to reach a central hub location.
- 3.2.7 The northern leg follows largely open land between the built-up areas of Halton and Widnes in the west, and Warrington in the east, from the central area to St Helen's. Whilst there are isolated constraint features through this path (TPOs, ancient woodland, waste sites and listed buildings) they are not sufficiently widespread as to prevent a pipeline being developed. From the boundary between Warrington and St Helens a pipeline would then need to pass through built-up areas, which cannot be avoided due to the urban nature of this location.
- 3.2.8 The eastern leg passes between Lymm and the M56, avoiding some ancient woodland and TPO features to the north. It provides a fairly direct connection between Partington and the central hub location.
- 3.2.9 A direct route between the hydrogen storage area south of Northwich and the central hub location is not possible due to the town of Northwich being located directly between the two points. Two alternatives for the southern leg of an X layout were therefore identified. The first (Alternative 1) runs around the western and southern extents of the town and avoids ancient woodland and SSSI features in this area. The second (Alternative 2) runs around the northern and eastern extents, avoiding TPO, ancient woodland and SSSI features. Alternative 2 does pass over a waste site identified to the east of Northwich, but this is a deep waste storage facility in the salt caverns in this location and at this strategic stage it was assumed that it would not be affected by a close-to-surface level pipeline.

Strategic Option B: H Layout

- 3.2.10 Strategic Option B seeks to connect the western clusters of connection points with the north cluster, and the south cluster with the east cluster. A central connection would then join these two legs. This layout is shown on **Figure 3.1B**.
- 3.2.11 The western leg would follow the M56 corridor between Stanlow and Frodsham (like Strategic Option A), before crossing the Mersey Estuary to the northern cluster. This would pass through the SSSI, SPA and Ramsar designation on the Mersey, but avoids the built-up areas of Speke and Huyton to the west and Runcorn and Widnes to the east.

- 3.2.12 The eastern leg would follow the Option A leg from Partington to a point near the M6 / M56 Lymm interchange, before heading south to the Hydrogen Storage Facility (HSF) south of Northwich. This southern section is relatively unconstrained.
- 3.2.13 The central connection between the two legs would follow elements of the northern leg of Strategic Option A, between St Helen's and the Manchester Ship Canal, before cutting across relatively unconstrained land to join the eastern leg.

Strategic Option C: XH Layout

- 3.2.14 Option C provides a combination of Strategic Options A and B, with the western, northern and eastern legs remaining the same, but the southern leg following the leg from Option B between the Lymm interchange and the HSF south of Northwich. This layout is shown on **Figure 3.1C**.

Strategic Option D: U Layout

- 3.2.15 Option D utilises the western and eastern legs of Strategic Option B but does not provide a central connection. Instead, a connection is provided from the western leg to reach the northern cluster of connections points (following a section of the Option A northern leg) and a west-east connection is provided via a southern leg between Stanlow and Northwich. This layout is shown in **Figure 3.1D**.
- 3.2.16 The southern leg runs from Stanlow, bypassing the built-up area of Helsby to the south before passing to the north of Delamere Forest. The pathway then runs south around Sandiway, avoiding some isolated ancient woodland, SSSI and Ramsar features, before connecting to the HSF.

Comparison of Strategic Options

- 3.2.17 **Table 3.1** sets out a comparison of the four strategic options based on calculations undertaken at the time these options were considered. All four options have been designed to connect to the four connection points identified in Chapter 1 and to allow connections to multiple hydrogen customers along the legs, so that they are not dependent on any one user.

Table 3.1 Strategic Options Comparison

	Option A	Option B	Option C	Option D
Constructability	Single multi-junction central hub	Requires lengthy underground drilling under Mersey Estuary. Two multi-junction central hubs needed.	Two multi-junction central hubs needed.	Require lengthy underground drilling under Mersey Estuary.
Security of supply	Individual legs can be isolated at the central hub.	Isolation can occur at either of the two central hubs	Isolation can occur at either of two central hubs	No central hub locations: isolation is more complex.
Total installed cost	Least expensive of the four options	+£15m over Option A*	+£20m over Option A*	+£22m over Option A*
Pipeline length	99km	95km	96km	112km
Spurs	32km	34km	32km	34km
Environment	No significant constraints that cannot be routed around.	Closer proximity to / disturbance to Mersey Estuary international and national designations. Increased land-take required for central hubs	No significant constraints that cannot be routed around. Increased land-take required for central hubs	Closer proximity to / disturbance to Mersey Estuary designations.

*At the time of the evaluation

Preferred Strategic Option

- 3.2.18 From the comparison of the strategic options shown in **Table 3.1**, Option D was discounted as it
- provides the longest pipeline route;
 - is the most expensive option; and
 - requires a crossing of the Mersey Estuary with either lengthy underground drilling and/or potential disturbance to the SSSI, SPA and Ramsar designations.
- 3.2.19 Option B is discounted due to the Mersey Estuary crossing and also the requirement for two central hubs, further increasing the complexity, cost and land take required for construction and operation.
- 3.2.20 The comparison between Option A and C shows that Option A has a longer route (by 3km), but that Option C would be £20m more expensive. Given that this increased route length of Option A would all be underground pipeline and that the surface land would be restored upon completion of its construction, the following impacts are considered to outweigh any construction related impacts from the increased length of Option A:
- increased permanent land take of the second hub;
 - increased operational complexities for this facility; and
 - increased costs.
- 3.2.21 Option A has therefore been identified as the Preferred Strategic Option.
- 3.2.22 The optioneering work on the Strategic Options, and the Preferred Strategic Option identified, were consulted upon during the Stage 1 non-statutory consultation, with a specific question asked about people's views on this stage of works and whether any additional information was available, in order to confirm the optioneering work undertaken, and the choice of Preferred Strategic Option, was appropriate.

4. Route Corridor Identification

- 4.1.1 Using the Preferred Strategic Option identified in **Chapter 3**, a route corridor selection exercise was undertaken using the methodology outlined in **Chapter 2**. This exercise was undertaken to identify the Preferred Route Corridor which was used for the EIA Scoping Request and that were consulted upon in the Stage 1 non-statutory exercise.
- 4.1.2 The work identified the following corridors, search areas for HAGIs and connection spurs along the Western, Northern, Eastern and Southern legs.
- 4.1.3 Search areas for HAGIs were identified, rather than specific location options, as the corridor identification process was used to discount land which should also be free from constraints and potentially be a suitable location for a HAGI. The precise location of each HAGI would be subject to further design work, and therefore a search area was identified for each HAGI in order to both provide some certainty as to their location but also provide flexibility for the Preferred Route Optioneering stage.

4.2 Western Leg

Pipeline Corridor

- 4.2.1 From the HPP connection point at Stanlow, the western leg is required to achieve two further connections: one to the cluster of customers in the Rocksavage / Weston area of Runcorn, and one to the central hub location (see section 4.6).
- 4.2.2 A straight line route joining up these connections would see a pipeline running parallel to the M56 on its northern side between Stanlow and Rocksavage, and then a route between Rocksavage and the central hub location, which passes between Sutton Weaver to the north and Aston to the south.

Western Leg Options

- 4.2.3 Between Stanlow and Rocksavage, this straight-line corridor (named West 1, shown on **Figure 4.1**) was defined by the M56 to the south, and the industrial developments, the Frodsham Wind Farm and a former landfill in the Ince and Frodsham marshes area to the north. This corridor avoided crossings of the motorway, ran through a flat landscape and avoided the built-up areas of Helsby and Frodsham on the south side of the M56. This corridor did however run through an area of local landscape value, flood risk areas and small amounts of mineral safeguarding land, and also included multiple listed buildings and areas of ancient woodland. An alternative option was therefore considered.
- 4.2.4 The alternative option (named West 2, **Figure 4.1**) crossed the M56 south of Stanlow, before running in a roughly eastern direction between Dunham on the Hill and Helsby and on towards Kingsley. The corridor then passed to the north of Kingsley before running to the central hub location. A spur would need to run north from this option to allow the Rocksavage connection to be made. This would have

started near Kingsley, heading in a northern direction, passing to the east of Frodsham to reach Rocksavage. Between Stanlow and Kingsley, West 2 encountered hilly terrain, an ancient woodland designation and numerous individual listed buildings and it would also have run through multiple areas designated for local landscape value. The spur to Rocksavage would also have run through land at risk of flooding and small amounts of minerals safeguarding areas. The requirement for the spur would also have increased the length of West 2 over West 1 and would have required a longer spur connection from Rocksavage to the Runcorn hub of industrial customers.

4.2.5 A comparison of the two options is provided in **Table 4.1**:

Table 4.1 Western Leg Options

	West 1	West 2
Constructability	Single HAGI: to serve Rocksavage – Runcorn spur Flat topography	Two HAGIs: to serve Rocksavage – Runcorn and Kingsley to Rocksavage spurs Hill topography
Pipeline length	17.9km	20.9km
Rocksavage to Runcorn Spur length	3.9km	4.6km
Historic Environment	Multiple listed buildings and two Scheduled Monuments (SMs) within corridor (but can be avoided by detailed routeing)	Multiple listed buildings and five Scheduled Monuments (SM)s within corridor (but can be avoided by detailed routeing)
Traffic and Transport	Crossings needed: 1no. motorway 1no. A-roads 1no. rail line 1-3no. watercourses 2no. walking trails	Crossings needed: 2no. motorways 1no. A-road 1no. rail line 1no. watercourse 5no. walking trails
Landscape	Within Weaver Valley Area of Special County Value (Part A: Lower)	Within Weaver Valley Area of Special County Value (Part A: Lower) and Helsby and Frodsham Hills Area of Special County Value
Biodiversity	Multiple areas of ancient woodland (but can be avoided by detailed routeing)	Multiple areas of ancient woodland (but can be avoided by detailed routeing)
Flood Risk	Pipeline would run through 8-10km of Flood Zones 2 and 3	Pipeline would run through 1km of Flood Zones 2 and 3

Preferred West Corridor option

4.2.6 Other than for flood risk, the comparison of West 1 and West 2 showed a preference for West 1. During construction it is likely that flood risk impacts on

nearby receptors can be mitigated through dewatering practices and the controlled release of water back into watercourses. During operations existing levels of flood storage capacity would not be lost as the pipe would be underground with the land returning to its baseline status with no increased risk of flooding for other receptors. Flood risk to the pipeline structure itself can be mitigated by the consideration of buoyancy in the design. West 1 was therefore the preferred option.

4.2.7 A corridor was therefore identified along West 1 which stretches up to 1.7km in width in places but takes a mostly direct route between the connection points.

4.2.8 From the initial West 1 corridor identified, further refinement took place to remove land associated with the ancient woodland and around listed building designations associated with Beckett's Wood, Chapel Wood and Aston, from the centre of the corridor. The width of the corridor has also been reduced in places to avoid ancient woodland at Bird's Wood and Blackamoor Wood, and the ancient woodland and SSSI designations at Hatton's Hey Wood, Whittle's Corner and Bank Rough. This corridor would allow a route pathway to be selected through it which can avoid, or substantially reduce impact on, the designations identified within it. The Preferred Route Corridor identified from this refinement work is shown in **Figure 4.2**.

HAGIs

4.2.9 A HAGI is needed at the Rocksavage connection point and therefore a search area was identified within the corridor at this point. To serve potential industrial customers in the Runcorn area, the search area included three parcels of land 1) to the north west of the M56, dissected by the River Weaver; and 2) to the south east of the M56, mainly between the River Weaver and the Weaver Navigation (shown as the Rocksavage HAGI Search Area on **Figure 4.2**). A third search area has also been identified to the north of the Weaver Navigation between the M56 and the A557 (the Runcorn HAGI Search Area shown on **Figure 4.2**). Areas 1 and 2 were almost entirely within Flood Zones 2 and 3 and also contained parts of former landfill sites. Area 3 was outside of the flood risk areas but also contained a former landfill site.

Spurs

4.2.10 In order to provide connections between the HAGIs and the identified industrial customers in the Rocksavage area, pipeline spurs will need to be provided. Options were limited in this area for the spur corridors due to the existing urban nature of much of the land here, so a direct corridor has been identified between the customers. This spur corridor is shown on **Figure 4.2**.

4.3 Northern Leg

Pipeline Corridor

4.3.1 The connection point cluster in St. Helens is made up of two locations, industrial customers in central St Helens, and a single customer at Lea Green Industrial

Park. Between these customers and the connection to the Central Hub, the Northern Leg is also required to achieve one further connection: to industrial customers in the Warrington area. The initial corridor identified from the Route Corridor identification work is shown in **Figure 4.3**, with the refined Preferred Route corridor described below shown in **Figure 4.4**.

- 4.3.2 From the customers in central St Helens, a direct route to the Lea Green Customers is heavily constrained by the existing urban area and a desire to maximise use of the open space between Sutton Heath and Rainhill. A single corridor was therefore identified which followed Sherdley Road and Elton Head Road, before running through the open space between Sutton Heath and Rainhill, to eventually cross the A570 between Micklehead Green and the junction of the A570 with the M62. The section was subsequently refined to narrow this corridor to avoid a housing allocation/planning permission for housing at the former Linkway Distribution Park / Suttons transport site. Additional land was also added to provide a potential option that crosses the A570 at Sherdley Park, to utilise open space in this area before re-joining the corridor in the open space near Micklehead Green and the Lea Green customer.
- 4.3.3 Around the M62, the initial corridor covered a wide stretch of land between the northern side of the M62, the Omega Business Park and Lingley Green in the east, the Manchester to Allerton Junction rail line in the south and the A557 in the west. This section of the corridor was then amended to avoid land within Sutton Manor Woodland from the north of the M62. In addition, land at the Mersey Valley Golf Club and its Local Wildlife Site were removed from the centre of the corridor and the western extent was drawn back from the A557 to reduce land take.
- 4.3.4 Running south to the A56, the route of the corridor was restricted to a relatively direct route through the open space between Cuerdley Cross, Fiddlers Ferry Power Station and Sandymoor to the west, and Penketh and Higher Walton in the east, to the M56. Subsequent refinement of this section saw additional land included around the Birchwood area to help facilitate the connection to Warrington. Land was included around Daresbury to provide optionality in passing this settlement, whilst land was drawn in from the eastern side of Halton, to avoid this settlement. The corridor then runs in a direct line between the M56 to the central hub.

HAGIs

- 4.3.5 Four HAGI search areas were identified along the northern corridor to accommodate five potential HAGIs. All four search areas are shown in **Figure 4.4** and are described below:

St Helens

- 4.3.6 A HAGI search area was located at the northern extent of the corridor to connect to the St Helen's customers. A search area for this was identified immediately adjacent to the customers. This search area is free from all constraints, except for historic landfill sites. However, given the extent of these historic landfills in the local area, and that much of the land associated with these historic landfills

(outside of the search area) has been previously developed, it is not expected to prove to be a major constraint to a HAGI development.

Clock Face and Burtonwood

- 4.3.7 In the Clock Face area, a HAGI will need to be provided to allow a connection to be made to the Lea Green spur customer.
- 4.3.8 A HAGI to service a potential future connection in a northern direction, past Burtonwood and towards Wigan, was also considered.
- 4.3.9 A combined search area for these two HAGIs was identified. This search area contained a number of constraints (a small area of flood risk land at the northern extent, near Lea Green, and a small number of TPO protected trees, one listed building and a small area of historic landfill) all of which would be easily avoided when looking to route the pipeline.

Cuerdley

- 4.3.10 A HAGI was considered close to Cuerdley Cross to serve potential future customers in Widnes.

Higher Walton

- 4.3.11 Near Higher Walton, a HAGI is required to connect to the industrial customers in Warrington. A search area was identified within the corridor, which straddled the Manchester Ship Canal. The northern half of the search area would be the preferred location to allow a connection to run to the north of the canal to join the customers located there. However, the northern part of the search area contained a waste site, local wildlife site and areas of flood risk. The search area south of the Ship Canal was largely free from constraints.

Spurs

- 4.3.12 Three spurs are required from the northern pipeline corridor to industrial customers (shown in **Figure 4.4**). At the northern extent, a short spur would run from the St Helens HAGI to connect the St Helen's customers.
- 4.3.13 At Lea Green, two spur options were identified (to run from the Clock Face HAGI), one running from the main corridor along Eurolink Road and the second running through Chapel Road and then following Lea Green Road. The Eurolink option avoided any constraints. The Chapel Road option contained a number of TPOs, although there was available land within the option to avoid these trees.
- 4.3.14 From the Higher Walton, a spur would need to run east towards Warrington to connect three customers. The spur corridor identified ran to Slutchers Lane, before splitting into two legs. A northern leg that followed the River Mersey and an eastern leg that followed public highways through the Latchford area. Part of the corridor to Slutchers Lane included an area identified as a permitted waste site and there were a number of listed buildings located along the spur corridor, although not to an extent that they could not be avoided.

4.4 Eastern Leg

Pipeline Corridor

- 4.4.1 The connections required on the Eastern Leg include two connections to the existing natural gas network where hydrogen can potentially be blended into the natural gas supply (one at Warburton and one at Partington), and also a connection to an industrial customer at Partington. The corridor identified from the central hub location, was able to follow an almost straight path with only a slight diversion to the south of the Lymm Interchange (where the M62 and M6 cross). This variation also avoided a cluster of ancient woodland and TPO constraints between Lymm and the M62. Other than these constraints, there were isolated listed buildings within the corridor. The corridor was crossed by minerals safeguarding areas, flood risk zones and the proposed line of HS2. However, these constraints are mainly linear in nature and will need to be crossed for any corridor option chosen for the Eastern Leg. The initial corridor from the Route Corridor identification work is shown in **Figure 4.5**, with the refined Preferred Route Corridor described below shown in **Figure 4.6**.
- 4.4.2 The corridor route ran between Higher Whitley and Antrobus in the A559 Northwich Road area, between the Lymm Interchange, Lymm and High Legh around the M6 and M62, before running to the north and passing Warburton and into Partington. It was a maximum of 2.5km in width, narrowing to around 700m where it crosses the A50 and M62.
- 4.4.3 The initial corridor was subsequently amended to avoid ancient woodland at Spud Wood near Lymm, and also Hey Wood near Deansgreen. The corridor was also narrowed between these points to also avoid Deansgreen itself and other properties around Kay Lane and the A56. The corridor was also narrowed to bring the corridor further away from Dunham Massey Park and to avoid the Dunham Massey and Dunham Woodhouses settlements. The corridor also aims to avoid the settlements of Frandley, Antrobus and Arley. A small area of additional land (with no constraints) was added to the corridor near the B5159 Mill Lane.

HAGIs

- 4.4.4 Two HAGIs will be required on the East Corridor, at Warburton and at Partington to service the connections identified. Search areas for both are shown on **Figure 4.6**.

Warburton potential blending point

- 4.4.5 At Warburton, the HAGI search area was located adjacent to the Warburton gas network site. Part of the search area (including the existing gas network site) was covered by a wildlife corridor which runs adjacent to the River Bollin. The remainder of the search area was free from constraints.

Partington HAGI

- 4.4.6 At Partington, the HAGI would be needed to connect to industrial customers and also for a potential blending connection with the natural gas network. The search

area was located at the eastern extent of the corridor, on previously developed land located adjacent to the Partington gas network site. The location was close to proposed industrial developments but otherwise was free of constraints.

Spurs

- 4.4.7 One spur is required from the eastern corridor (shown in **Figure 4.6**): running from the eastern extent of the corridor (and the associated Partington HAGI). There spur would need to be routed to avoid proposed industrial developments in the area.

4.5 Southern Leg

Pipeline Corridor

- 4.5.1 Two corridors were identified on the Southern Leg (as described for Strategic Option A in paragraph 3.2.9). The initial corridors from the Route Corridor identification work for both options are shown in **Figure 4.7**, with the refined Preferred Route Corridor options both shown in **Figure 4.8**.
- 4.5.2 South 1 ran around the west and south of Northwich, taking a route between Acton Bridge, Cuddington, Sandiway and Wharton to the west, and Weaverham, Hartford and Moulton to the east, to reach the HSF. South 1 was approximately 17.5km in length, and was mainly in flat, open fields and crossed:
- 4no. A-roads (A533 twice, A556, A530);
 - 3no. watercourses (River Weaver, Weaver navigation and Trent and Mersey Canal; and
 - 3no. rail lines
- 4.5.3 This corridor also avoided the SSSI and ancient woodland associated with Pettypool Wood and some of the TPO designations around Vale Royal Abbey.
- 4.5.4 The initial corridor was substantially narrowed in the Acton Bridge area to remove the land around Acton Bridge and to draw the corridor away from Weaverham where the corridor crosses Station Road. Minor amendments were also made around Vale Royal Park to move the corridor boundary away from the golf course and additional TPO coverage there. Land was also removed from the corridor around the ancient woodland at Newbridge Wood and the at Weaver Parkway and Vale Royal River Park (caravan site). The corridor was also amended to remove land around Bostock Hall and the listed buildings here and a permitted waste site close to here.
- 4.5.5 South 2 ran around the north and east of Northwich, with the initial corridor passing to the north of Marbury Country Park (and associated TPOs and ancient woodland), between Wincham and Higher Wincham, around Lostock Gralam and Lostock Green and then passing east of Rudheath to reach the HSF. The corridor was close to 19km in length, and was mainly in flat, open fields and crossed:
- 5no. A-roads (A49, A559 three times, A556);

- 3no. B-roads (B5075, B5391, B5082); and
- 1no. rail line.

- 4.5.6 This corridor also avoided, or predominantly avoided, ancient woodland and TPOs at Winnington and Leonard's Woods, and the Plumley Lime Beds scheduled ancient monument and SSSI, to the east of Lostock Gralam. The corridor did pass over the permitted waste operations associated with the salt caverns around Lostock Green and include some TPO designations at Wincham Hall. It also included TPOs located around Comberbach and Greater Budworth although there would have been routes through these designations to avoid them.
- 4.5.7 The corridor route was subsequently amended to take a route that generally runs further to the east of the initial corridor. It passed around Pickmere and then between Lostock Gralam and Plumley. It was located to the east of the salt caverns around Lostock Green and then around Lach Dennis to reach the HSF. This amendment was made to avoid expected buried services associated with the salt caverns. This amended route still included the TPOs around Comberbach and Greater Budworth, but largely avoided the TPOs around Wincham Hall and passed around the Plumley Lime Beds scheduled ancient monument and SSSI. It did include the ancient woodland and TPOs at Winnington and Leonard's Woods.
- 4.5.8 Both South 1 and South 2 passed across areas of minerals safeguarding and flood risk zones. Due to the extent of these designations, it would not be possible to avoid them on either option. In addition, both options would have needed to cross the HS2 route.
- 4.5.9 A comparison of the two options is provided below:

Table 4.2 Southern Leg Options

	South 1	South 2
Constructability	Flat topography	Flat topography
Pipeline length	17.5km	18.6-19km
Historic Environment	Multiple listed buildings and one Scheduled Monuments (SM) within corridor (but can be avoided by detailed routeing)	Multiple listed buildings within corridor (but can be avoided by detailed routeing)
Traffic and Transport	Crossings needed • 4no. A-roads • 3no. watercourses • 3no. rail lines • 3no. walking trails • 2no. national cycle routes	Crossings needed: • 5no. A-roads • 3no. B-roads • 1no. rail line. • 1no. walking trail • 1 national cycle route
Landscape	Within Weaver Valley Area of Special County Value (Part A: Lower and Part B: Middle)	Within Weaver Valley Area of Special County Value (Part A: Lower)

	South 1	South 2
Biodiversity	Multiple areas of ancient woodland (but can be avoided by detailed routeing)	Multiple areas of ancient woodland and one SSSI (but can be avoided by detailed routeing)

4.5.10 From the comparison in **Table 4.2**, it can be seen that there is little substantial difference between the two options. South 1 was slightly shorter and avoided a SSSI designation, whereas South 2 avoided a scheduled monument designation and had fewer recreational route crossings. Due to the similarities, it was considered appropriate to take both options forward to the Stage 1 non-statutory consultation exercise.

4.5.11 A pipeline running through either of these corridors would require a block valve due to the length of the pipeline between the central hub and the HSF. A block valve provides a cut-off point, to isolate a section of pipeline for maintenance, repair or safety reasons.

HAGIs

4.5.12 One HAGI is required at the HSF, and would be part of either the South 1 or South 2 options. Other than a minerals safeguarding area (for deep-lying salt) there were no constraints identified with this HAGI search area, which is shown in **Figure 4.8**.

Spurs

4.5.13 A spur was identified from the South Corridor area to a hydrogen customer at Winnington.

4.5.14 From South 1, a spur corridor (Spur 1 on **Figure 4.8**) was identified that passed through open land between Weaverham and Hartford, and then between Barnton and Winnington to reach the site. This spur included ancient woodland at Beach Hill Wood, part of a permitted waste site north of Wallerscote Road and flood risk zones around the Weaver Navigation and River Weaver. Depending on the exact route chosen for the spur corridor, there could have been up to four watercourse crossings and one A-road crossing.

4.5.15 From South 2, a corridor spur (Spur 2 of **Figure 4.8**) would have passed through Marbury Country Park / Anderton Nature Park to the site. This spur included ancient woodland at Big Wood in the country park, flood risk zones around the Forge Brook, Marbury Brook and Weaver Navigation and the local nature reserve at Anderton Nature Park. Two watercourse crossings would have been needed.

4.5.16 These corridors were subsequently amended to widen around Wallerscote Road, to allow an option to follow the public highway through Winnington and to narrow the corridor through Marbury Country Park / Anderton Nature Park to avoid the Big Wood ancient woodland.

4.5.17 For either of these two spur options a HAGI would have been required within the relevant corridor. Search areas have not been identified for such a HAGI at this stage, as it is likely that any HAGI would be incorporated into the same site as the block valves required within the corridor. Due to the detailed design needed to

identify block valve locations, a HAGI location was to have been considered during subsequent stages should either of these two spurs have been chosen.

- 4.5.18 In order to minimise the number of potential HAGIs needed, two additional spurs were subsequently introduced. Both would run directly from the central hub location thereby utilising this required HAGI, one passing to the north of Barnton and Anderton to reach the site and one running between Barnton and Weaverham (Spurs 3 and 4 respectively on **Figure 4.8**).
- 4.5.19 Spur 3 would have been largely free of constraints until it passes Anderton, where it runs through some of the Anderton Local Nature Reserve and crosses flood risk zones on the Weaver Navigation. Two watercourse crossings would have been needed.
- 4.5.20 Spur 4 would have run between Weaverham and Runcorn, before joining the route of Spur 1 near to Wallerscote Road. This spur option would have crossed flood risk zones and require up to six watercourse crossings.

4.6 Central Hub HAGI

- 4.6.1 Where all four corridors meet a HAGI search area is required to accommodate the Central Hub. The HAGI to be located here will provide a central hub of all four pipelines legs. The four corridors meet around the Dones Green crossroads (the junction of the A553 and A49). A search area (**Figure 4.9**) was identified in this location, mostly to the west of the A49. In the north of the search area there is land within flood risk zones and in the south an area of ancient woodland. Mineral safeguarding areas exist in both the north and south of the search area.

4.7 Preferred Route Corridor

- 4.7.1 **Figure 4.10** shows the Preferred Route Corridor options that were selected for use in the EIA scoping request. They were also consulted upon in the Stage 1 non statutory public consultation exercises in early 2022, along with the HAGI search areas and spur corridors identified to provide connections to customers, in order to confirm that the corridor identification work undertaken, and the Preferred Route Corridor identified, were appropriate.

5. Preliminary Route Alignment

- 5.1.1 The following sections describe how the corridors have been refined from the Preferred Route Corridor identified in **Chapter 4** to form the Preliminary Route Alignment. In general, the land requirement has been narrowed along each corridor to provide more certainty on where the pipeline is to be proposed. Whereas the Preferred Route Corridor consulted on at the Stage 1 non-statutory consultation accommodated multiple pipeline route alignments, the Preliminary Route Alignment mainly comprises a single route alignment. The Project has been positioned further away from certain sensitive receptors, where possible, and to reduce the land take required. In some places, some width or optionality has been retained in the preferred route where work is still ongoing to provide the refinement needed or where working compounds may be needed for the construction stage. This ongoing work includes items such as ground investigation work, discussions with landowners and environmental surveys.
- 5.1.2 The location of the HAGIs are largely determined by the connections needed. This therefore finds some of the HAGIs within Green Belt locations. Each HAGI location options has therefore been reviewed in light of the comments received from the Stage 1 non-statutory consultation comments received, and they have been assessed against Green Belt purposes (**Appendix A**). Further details are provided within the relevant HAGI sections below.
- 5.1.3 Figures are provided to illustrate specific points mentioned below, and a fully detailed set of plans showing the entire Preliminary Route Alignment, including all proposals and options for the pipeline route, HAGIs, Block Valves and Spurs is provided in **Appendix B**. This is a copy of the full set of plans from the PEIR (the PEIR Figure 2.17).

5.2 West Corridor

Pipeline

- 5.2.1 The pipeline will run from the HPP to the Rocksavage area, where a connection spur will run towards Runcorn to supply industrial customers. The corridor will then run to the east to join up with the Central Hub. The Preliminary Route Alignment described below is shown in **Figure 5.1** and in more detail in **Appendix B**.
- 5.2.2 From the Stage 1 non-statutory consultation exercise, comments were received that requested the corridor should consider following either the M56 or the River Weaver and that it should avoid key roads and commuter corridors. The corridor does follow a line adjacent to the M56 from the HPP to Rocksavage, however it is not possible for the pipeline to follow the M56 directly. Neither is it possible for the pipeline to be routed within the motorway itself due to the disruption this would cause both from construction and then potential maintenance in the future. From Rocksavage, the M56 then runs to the north east towards Daresbury and there is limited land available to route a pipeline adjacent to the motorway along this section. Due to the general direction of travel of the corridor, a number of key

roads and commuter route will have to be crossed. However, where this is the case (M56, A5117, A56, A553 and three rail line crossings), these will be constructed as trenchless crossings (tunnelled under the roads and rail lines) to avoid any disruption to customers of these routes.

- 5.2.3 Along the section from the HPP to Rocksavage, the Preferred Route Corridor has been narrowed to keep the route as close to the M56 as possible, to reduce potential impacts on the biodiversity value of the Helsby and Frodsham Marshes and to minimise the land required within areas of flood risk here. In places some width has been retained to allow further investigation of existing services within this area (overhead lines and other pipelines) to ensure that the Project does not impact on those. A number of local access roads/tracks are also included within this section to ensure that appropriate access will be available from the public highway network. One short route option exists around the Hover Force outdoor activity centre, options WP1 and WP2 are shown in **Appendix B, Sheets 3 and 4**.
- 5.2.4 At Rocksavage a wider area has been provided to allow the HAGI and spur connections needed to provide supply to Runcorn. These are discussed in more detail in the respective sections below.
- 5.2.5 The preferred route would then run between Sutton Weaver and Aston, before crossing the West Coast Main Line and connecting with the Central Hub. The original route corridor had an option running south of Aston, however this was discounted due to an increased number of crossings of the River Weaver/Weaver Navigation and the greater extent of flood plain it would cross compared to the Sutton Weaver/Aston option chosen. In addition, the closure of Sutton Hall Golf Club has removed this as a recreational receptor from the preferred route. The reduction in width of this section of the corridor provides greater stand-off distances between features such as ancient woodland (including Beckett's Wood, Bird Wood and a number of smaller woodlands around the West Coast Main Line area).

Table 5.1 Rocksavage to Central Hub options

	North	South
Constructability	1no. crossing of Weaver Navigation needed. Access direct from A56.	2no. crossings of River Weaver needed. Access difficult away from Frodsham area.
Pipeline length	5.5km	5.5km
Traffic and Transport	Major road crossings: 2no. (A557 and A56)	Major road crossings: 1no. (A56)
Biodiversity	Passes through approx. 0.1km of Lower Weaver Valley Woods LWS	Passes through approx. 0.2km of Blackamoor Wood and Coppice LWS
Recreation	None	None

	North	South
Agricultural land	Passes through approx. 3.6km of Grade 2 agricultural land	All Grade 3 or 4
Flood Risk	Passes through approx. 0.4k of flood plain land	Passes through approx. 1.7k of flood plain land
Minerals Safeguarding Area	Passes through approx. 3.4km of MSA.	Passes through approx. 1.1km of MSA.

5.2.6 Both options are the same length and neither would have any impact on recreational facilities. The northern option has only one major watercourse crossing, marginally less impact on local wildlife sites and passes through less land within the flood plain, but has two A-road crossings, passes through Grade 2 agricultural land and through greater extents of minerals safeguarding areas. The southern option has one A-road crossing, only passes through Grade 3 or 4 agricultural land and doesn't have as much of an impact on minerals safeguarding areas, but has two major watercourse crossings, slightly greater impacts on Local Wildlife Sites and runs through greater extent of floodplain.

5.2.7 The construction access for the northern option is good, with direct access from the A56 or Aston Lane. Access for the southern option would be more complicated, involving the creation of access tracks across the wetland areas near Frodsham and extended routes through the northern option to service construction, as it moved towards the Central Hub. Due to the single major watercourse crossing and the favourable construction access, the northern option was chosen as the preferred route. The refinement of this option has then narrowed the potential land take and moved the route further away from a cluster of listed buildings at Aston. A short route options remains for the crossing of the weaver navigation, options WP3 and WP4 are shown in **Appendix B, sheets 5 and 7**.

HAGIs

5.2.8 With the HAGI search areas identified for Rocksavage and Runcorn for the scoping and Stage 1 Stage 1 non-statutory consultation exercise, seven possible HAGI locations were identified. Five were located south of the Weaver Navigation to provide a location for the Rocksavage HAGI and two north of the Weaver Navigation for the Runcorn HAGI (**Figure 5.2**).

RSH1 was located to the south of the River Weaver in land which was free from built development constraints, although it was within flood zones. RSH2 and RSH3 were both located on land between the M56, Weaver Navigation, River Weaver and the Warrington to Chester rail line. RSH3 was located within a flood zone and RSH2 within an area of historic landfill. RSH4 was located adjacent to the Frodsham substation to minimise the length of the Runcorn Spur. RS5 was located on a potential spur option to the west of Frodsham substation and outside of identified flood zones. All five options are within Local Wildlife Sites. Comments were received during the Stage 1 Stage 1 non-statutory consultation exercise which raised concern about ecological features in the area.

Table 5.2 Rocksavage HAGIs

	RSH1	RSH2	RSH3	RSH4	RSH5
Constructability	4no. major crossings: (River Weaver x2, Weaver Navigation, M56)	4no. major crossings: (River Weaver, Weaver Navigation, M56 x2)	4no. major crossings: (River Weaver, Weaver Navigation, M56 x2)	3no. major crossings: (River Weaver, Weaver Navigation, M56) Adjacent to Frodsham sub-station.	4no. major crossings: (River Weaver x2, Weaver Navigation, M56)
Biodiversity	Frodsham, Helsby and Ince Marshes LWS	East Clifton Tip LWS	East Clifton Tip LWS	Frodsham Fields Studies Centre LWS	Frodsham, Helsby and Ince Marshes LWS
Permitted waste site	No	No	No	No	Yes
Historic landfill site	No	Yes	Yes	No	No
Impact on Green Belt²	Moderate	Moderate to Limited harm	Moderate to Limited harm	Limited	Moderate to Limited harm
Agricultural land	n/a	Grade 4	Grade 3	n/a	Grade3
Flood plain	Yes	No	Yes	Yes	No

5.2.9 RSH5 was discounted due to being located within a landfill site with a valid permit and RSH4 due to concerns over operational safety with it being adjacent to the Frodsham sub-station. RSH3 was moved so it was outside of the flood zone and retained as an option, and RSH2 was retained as an option until results of ground investigations on the historic landfill are known. RSH1 is not located within the Green Belt and is also outside of any classified agricultural land. RSH1 has therefore also been retained.

5.2.10 North of the Weaver Navigation, two options were identified outside of the Green Belt for the Runcorn HAGI. Neither option had any particular differences from an environmental perspective and the main difference from an engineering point of view was the need for cut and fill operations for RH1. No comments were received from the Stage 1 non-statutory consultation exercise specifically on the Runcorn HAGI options. RH2 was therefore preferred due to the lack of cut and fill needed in the construction phase. Further work was undertaken which moved this option further to the east as a larger site was required and additional space was available to the east away from an existing gas pipeline.

² Please note that the HAGI location numbers within the Green Belt Assessment in Appendix A are different to the numbers used here.

Runcorn Spur

- 5.2.11 The Runcorn Spur is the only spur on the West Corridor, it runs from the Rocksavage HAGI, in a north-west direction to the Runcorn HAGI and then on to provide connections to Intergeren and The Heath Industrial and Business Park (The Heath). Optionality has been retained to route the Spur between the Rocksavage and Runcorn HAGIs, with options running either to the east or the west of Frodsham sub-station (Options RSp1 and RSp2 shown in **Appendix B, sheet 5**).
- 5.2.12 At Stage 1 non-statutory consultation, the Runcorn Spur was presented as a loop which passed by both customers. Options were therefore created to route to both locations separately (**Figure 5.3A**, Purple (Intergeren) and Orange (The Heath) routes), or to route to Intergeren and then continue on past Weston to connect to The Heath, or alternatively to run through Runcorn Golf Club to The Heath and then down past Weston to connect Intergeren (**Figure 5.3A**, Yellow (the Loop) route).
- 5.2.13 Further discussions with Intergeren clarified that any works through their site would be pursued, consented and delivered by them rather than as part of this project. No comments were received from the Stage 1 non-statutory consultation specifically on this loop option for the Runcorn Spur. Due to uncertainties about whether Intergeren would be willing to continue any connection through their land to join up with The Heath on its western boundary, a further option, named A557, was identified to connect the Heath, which would run west along the A557 and then join The Heath from the west (**Figure 5.3A**, Green (A557) route).

Table 5.3 Runcorn Spur

	Intergeren	The Heath	A557
Constructability	Uncertain. Would need to be delivered by Intergeren.	Topography/ land types are favourable for construction.	Constrained land availability: highway verge and multiple side road crossings.
Pipeline length	4.5km	1.9km (To The Heath only)	3.6km
Historic Environment	None	None	Grade II listed Buildings at Old Hall
Traffic and Transport	Major road crossings: 1no. (A557)	Major road crossings: 1no. (A557)	Major road crossings: 1no. (A557), plus running adjacent to A557
Biodiversity	Spur connection south of Weaver Navigation is within Frodsham, Helsby and Ince Marshes LWS and possibly Frodsham Field Studies LWS	Spur connection south of Weaver Navigation is within Frodsham, Helsby and Ince Marshes LWS and possibly Frodsham Field Studies LWS	Spur connection south of Weaver Navigation is within Frodsham, Helsby and Ince Marshes LWS and possibly Frodsham Field Studies LWS

	Intergen	The Heath	A557
Recreation	None	Within Runcorn Golf Club	None
Historic landfill	Would need to pass through Weston Road and Chesyre's Lane landfills to connect The Heath	Would need to pass through Weston Road and Chesyre's Lane landfills to connect Intergron	Would need to pass through Weston Road and Chesyre's Lane landfills to connect The Heath
Flood Risk	Spur connection south of the Weaver Navigation is all within flood plain land	Spur connection south of the Weaver Navigation is all within flood plain land	Spur connection south of the Weaver Navigation is all within flood plain land

5.2.14 All of the options run through flood plain land and Local Wildlife Sites to the south of the Weaver Navigation. The Heath option would pass through Runcorn Golf Club and disrupt golf opportunities at the course during construction and restoration. There is uncertainty over the deliverability of the Intergron option as this would be in the control of Intergron. The A557 option is constrained alongside the highway and by listed buildings on Heath Road South. It would therefore be difficult to secure appropriate working areas to construct the spur. Both the A557 and utilising the loop option would also see the spur passing through an area of historic landfill.

5.2.15 The A557 option has been discounted due to the constraints on working areas and the historic landfill site. The loop option has also been discounted due to uncertainties over the availability of Intergron land and the historic landfill. The Preliminary Route Alignment is therefore to provide an individual connection to the Heath, with a short spur leading off this to connect Intergron, as shown in **Figure 5.3B**.

5.3 North Corridor

Pipeline route

5.3.1 From the Central Hub, the North Corridor runs in a northwards direction, crossing the M56, then passing Daresbury and Moore before crossing the Manchester Ship Canal and River Mersey. It then heads in a north-western direction, past Cuerdley and Bold Heath before crossing the M62 near Rainhill. The corridor then continues north past Lea Green towards the Pilkington's site in St Helens. North of the Manchester Ship Canal, the Warrington Spur will run to the east to connect industrial customers in Warrington and at Lea Green a spur will connect to a customer at the Lea Green Industrial Park. Following the Stage 1 non-statutory consultation exercise, it was discovered that the location supplied for the connection to the Glass Futures site was incorrect and therefore a spur has been added from the St Helens HAGI to provide this connection. The Preliminary Route Alignment described below is shown in Figure 5.4 and in more detail in Appendix B.

- 5.3.2 Between the Central Hub and the M62 the corridor has been substantially narrowed from the 2km Corridor width shown at Stage 1 non-statutory consultation to a corridor that is a maximum of 500m wide, as the route alignment has evolved. Between the M62 and the A56, the route needs to pass the site which hosts the annual Creamfields festival. It must also consider the built environment associated with the Higher Walton and Moore settlements and designations such as TPOs, ancient woodlands and nature conservation sites. A wide corridor was provided at the Stage 1 non-statutory consultation stage with additional potential routes to the west to provide flexibility in how this could be achieved. These options included for a route shown as NP7 on Figure 5.5 to the west of the main corridor between Sandymoor and Daresbury.
- 5.3.3 Responses to the Stage 1 non-statutory consultation raised concerns about the proximity to residential properties at Daresbury and to the impact on the Creamfields festival site.
- 5.3.4 Further baseline work discovered planning permissions (adjacent to Delph Lane) for housing developments along NP7 (between Sandymoor and Daresbury), which allowed this section of NP7 to be discounted. The remainder of NP7 was then discarded as further work showed that the costs of crossing the Manchester Ship Canal and two rail lines (including the West Coast Mainline) would be more than double some of the other options, due to the distance between the two rail lines and the Canal. The removal of this option also takes the pipeline route further away from existing residential properties at Daresbury.
- 5.3.5 Three options have been retained in this location to provide flexibility in how the pipeline can pass through or around the Creamfields festival site. Work is ongoing with various stakeholders to determine the best location for the pipeline to cross this area. Options NP1, NP2 and NP3 provide alternatives under each of these scenarios depending on the results of this work. NP6 was briefly considered as a means of further bypassing Creamfields but this would have brought pipeline into conflict with Whalton Hall golf course and some TPO designations and was discarded. North of NP1, NP2 and NP3, two options then exist for crossing the West Coast Rail Line (and a local rail line) and the Manchester Ship Canal. Comments were received during the Stage 1 non-statutory consultation stage with regard to the areas around the Moore Nature Reserve and other ecological features in this area. Option NP4 would run through the Moore Nature Reserve for around 500m and also require a permanent land requirement of around 1.5 ha from within the Nature Reserve for a HAGI (option HWH1). NP5 would run across between 250m and 750m of the nature reserve depending on its exact positioning but would not require any permanent land take.

Table 5.4 North Corridor Options

	NP 1	NP 2	NP 3	NP 4	NP 5	NP 6	NP 7
Constructability	1no. crossing of A56	1no. crossing of A56	1no. crossing of A56	1no. crossing or rail lines, 2no. canal crossings. 1,3km extra Spur line required (than NP5)	1no. combined crossing of rail lines and Manchester Ship Canal, 1 no. crossing of Bridgewater Canal.	1no. crossing of A56	2 no. crossing of rail lines (or 1no. lengthy trenchless crossing. 2km extra Spur line required (than NP5).
Biodiversity	None	None	None	0.5km: Moore Nature Reserve LWS	0.25km – 0.75km. Moore Nature Reserve LWS, Upper Moss Side Farm LWS	None	0.7km: Moore Nature Reserve LWS, Manor Park Woodland LWS, Moore meadows LWS
Permitted waste site	None	None	None	None	Adjacent to Arpley landfill site	None	No
Agricultural land	2.7km: Grade 2	0.2km: Grade 2	0.2km: Grade 2	1.4km: Grade 2	1.1km: Grade 2	None	2.7km: Grade 2
Flood plain	None	0.1km	0.1km	2.5km	1.4km	0.1km	2km
Planning permissions	None	None	None	None	None	None	Housing off Chester Road
Land Use	Creamfields Festival Site	Creamfields Festival Site	Creamfields Festival Site	None	None	Walton Hall Golf Club	None
Water source protection zone	SPZ3	SPZ3	SPZ3	SPZ3	SPZ3	None	SPZ2 and 3

	NP 1	NP 2	NP 3	NP 4	NP 5	NP 6	NP 7
Tree Preservation Orders	None	None	None	None	None	Yes. Underbridge Lane	None

Note: NP1, NP2 and NP3 would need to be used in conjunction with either NP4 or NP5. NP6 would need to be used in conjunction with most of NP3 and NP5. NP7 would be a stand alone route.

5.3.7

Options NP1, NP2, NP3, NP4 and NP5 have been taken forward from assessment within the PEIR and to allow representations to be made on these options during the Stage 2 statutory consultation exercise.

- 5.3.8 Continuing north, Stage 1 non-statutory consultation comments were received around the crossing of the River Mersey and the former Sankey (St Helens) Canal, with a request that the proposals did not disturb either of the features. The crossing of both of these features (one single crossing at Fiddler's Ferry Reach) would be a trenchless crossing and no disturbance would occur.
- 5.3.9 In the Bold Heath area, an option north of Bold Heath (Burtonwood), towards the M62 was included in the Stage 1 non-statutory consultation exercise. This option was included to allow an additional HAGI to service potential future connections to the scheme (North of St Helens). No consultation comments were received on the Burtonwood area included. Additional engineering work however concluded that future connections could be serviced from a single HAGI in this area. In addition, the Burtonwood option would have had to pass through or close by a number of TPOs. The Burtonwood option was therefore dropped. The route taken forward runs to the south of Bold Heath and crosses underneath the M62 near Junction 7 at Rainhill.
- 5.3.10 The corridor then runs north past the Liverpool to Manchester rail lines and towards Sutton Heath, and has been narrowed and located to minimise interaction with groundwater source protection zones.
- 5.3.11 The corridor then runs through public highway land along B5204, Sherdley Road and Sutton Heath Road to reach the St Helens HAGI site. Comments were received around the former Linkway Distribution site in this area and potential conflict with a residential development on this land. It should be noted that the selected route is restricted to the public highway in this area to avoid any such conflict.

HAGIs

- 5.3.12 Three HAGIs are now proposed along the North Corridor, at Higher Walton, Clock Face and St Helens. The HAGI search areas identified at Stage 1 non-statutory consultation at Cuerdley and at Burtonwood have been dropped as the potential connections needed from these HAGIs can be serviced by the proposed Clock Face HAGI.

Higher Walton

- 5.3.13 Within the Higher Walton HAGI search area, eight potential HAGI locations were identified (**Figure 5.6**). The high number is due to the multiple route options that pass through this area (**Table 5.4**). One HAGI option was dropped after route option NP7 was discounted, leaving seven to be considered.

Table 5.5 Higher Walton HAGI Options

	HWH1	HWH2	HWH3	HWH4	HWH5	HWH6	HWH7
Constructability	1.25km extra spur length. Restricted construction area	0km extra spur length	1.25km extra spur length	0.7km extra spur length	50m extra spur length. Restricted construction area	0.6km extra spur length	0.7km extra spur length
Biodiversity	Moore Nature Reserve LWS	None	Moore Nature Reserve LWS	None	None	None	None
Permitted waste site	None	None	None	Arpley landfill Site	None	None	None
Agricultural land	Grade 3	Non-agricultural land	Grade 3	Non-agricultural land	Non-agricultural land	Grade 2	Grade 2
Green Belt³	Moderate to Limited	Limited	Moderate to Limited	Moderate to Limited	Moderate to Limited	Moderate to Limited	Moderate

5.3.14 No comments were received on any of the options in the Stage 1 non-statutory consultation. Options HWH1 and HWH2 are being taken forward into statutory consultation on the basis that HWH2 is the closest to the spur connections needed and has fewest constraints. HWH1 and HWH3 would be located on the NP4 pipeline alignment option and have been combined together into a single HAGI site (HWH1) for further consideration.

³ Please note that the HAGI location numbers within the Green Belt Assessment in Appendix A are different to the numbers used here.

Clock Face

5.3.15 Due to the decision to drop the route option at Burtonwood (**paragraph 5.3.9**), the search area at Clock Face, identified at the Stage 1 non-statutory consultation phase, was able to be reduced to an area of land in the vicinity of Junction 7 of the M62. HAGI options CF5, CF6 and CF7 were therefore also able to be dropped (**Figure 5.7**). This decision would allow a single HAGI to be sited, which could serve the Clock Face Spur (previously known as the Lea Green Spur) and also potential future customers in the Widnes area. Four options were then identified within the Junction 7 area: CF1 adjacent to St Helens Linkway and Chapel Lane; CF2 adjacent to Junction 7; CF3 to the south of the M62 adjacent to Jubits Lane; and CF4 adjacent to A57 Warrington Road.

Table 5.6 Clock Face HAGI Options

	CF1	CF2	CF3	CF4
Constructability	Shorter Clock Face spur, but longer spurs to potential Phase 3 connections	Central location between Clock Face connection and potential future Phase 3 connections. 180m from highway for access.	Central location between Clock Face connection and potential future Phase 3 connections. Adjacent to highway for access.	Longer spurs for both Clock Face spur and potential future Phase 3 connections
Agricultural land	Grade 3	Mostly Grade 3 / partially Grade 2	Mostly Grade 2 / partially Grade 3	Grade 2
Green Belt	Moderate to significant harm	Moderate harm	Moderate harm	Moderate to significant harm

5.3.16 No comments were received on any of the options in the Stage 1 non-statutory consultation. Options CF1 and CF4 were discounted due to the impact on the Green Belt.

5.3.17 CF3 was selected as the Clock Face HAGI and has therefore been taken forward for assessment in the PEIR and for Stage 2 statutory consultation. The reason for its selection is that the site is generally unconstrained in terms of environmental designations, benefits from good road access and is located such that it minimises the length of spur pipeline that would be associated with it. The site would also be screened from the north by the M62 motorway.

St Helens

5.3.18 Three HAGI options were identified within the search area at St Helens, all located around Burtonwood Road and all are previously developed land (brownfield) and unconstrained by environmental designations (**Figure 5.8**): SH1 to the north west of the Ravenhead Retail Park; SH2 between the Ravenhead Retail Park and Burtonwood Road; and SH3 adjacent to the Biffa waste site. No comments were received on any of the options in the Stage 1 non-statutory consultation. The main consideration was the location of the HAGI in relation to historic landfill sites.

Although much of the surrounding land is historic landfill and has been successfully developed, suggesting it would not be a significant constraint, SH2 is not located within an historic landfill area but is a brownfield site with existing access to the highway. It has a Historic Environment Record (HER) which designates the site as the former Ravenhead Sanitary Pipe and Brick Works. It has been taken forward as the St Helens HAGI for assessment in the PEIR and for Stage 2 statutory consultation.

Table 5.7 St Helens HAGI Options

	SH1	SH2	SH3
Constructability			
Historic landfill	Yes	No	Yes

Spurs

5.3.19 Three spurs are proposed from the main North Corridor to connect customers.

Warrington Spur

5.3.20 The Warrington Spur will run from either of the HAGI options at Higher Walton (HWH1 or HWH2) in an eastwards direction to connect customers Solvay and Ingevity (single connection) plus Novelis (**Figure 5.6**). The Solvay/Ingevity connection will run adjacent to the Manchester Ship Canal directly into the connection point. The Novelis connection will follow the edge of Moss Wood before crossing the Arpley Meadows/River Mersey area and then following the public highway along Gainsborough Road, Loushers Lane, Station Road, Clearwater Quays and Thelwall Lane to Novelis. This spur no longer runs north to Bank Quay (as was included in the Stage 1 non-statutory consultation) as a connection to the potential customer is to be considered in later potential phases of hydrogen infrastructure development. No comments were received on the Warrington Spur in the Stage 1 non-statutory consultation. The spur has been refined from the Stage 1 non-statutory consultation phase to avoid Listed Buildings, Scheduled Ancient Monuments, Conservation Area, playing fields and a permitted waste site within the previous corridor boundary. It also minimises interaction with flood zones and local wildlife sites.

5.3.21 Two options are available in the Arpley Meadows area and both are taken forward for assessment in the PEIR and for Stage 2 statutory consultation (**Figure 5.9**). WSp1 spur would remain south of the River Mersey and cross under the railway underpass, then proceed as street works, along Eastford Road. WSp1 would then proceed broadly northeast crossing the disused Runcorn and Latchford Canal, then towards the A5060 before proceeding as street works for approximately 4.8km to Novelis. WSp2 would run northeast with a trenchless crossing of the River Mersey, followed by the route turning southeast with a trenchless crossing of the railway, and onto the A5196 (Slutchers Lane / Centre Park Link Road), before

exiting the lane for another trenchless crossing of the River Mersey. The option would then proceed as per WSp1 to Novelis.

Clock Face Spur (previously known as the Lea Green Spur)

- 5.3.22 Two options were considered in the Stage 1 non-statutory consultation for the Clock Face Spur, designed to make a connection to NGF Europe Ltd (**Figure 5.7**). CFS1 ran adjacent to Chapel Lane and then along Lea Green Road to reach NGF Europe Ltd in Lea Green Industrial Park. CFS1 provided a wide corridor to avoid the TPOs along Chapel Lane and the Micklehead Green scheduled ancient monument. CFS2 ran along or adjacent to the St Helens Linkway and Eurolink roads, before joining Lea Green Road as for CFS1. Both options would cross the Pendlebury Brook Local Wildlife Site. No comments were received on either option during the Stage 1 non-statutory consultation.
- 5.3.23 Due to the land available adjacent to Chapel Lane to avoid the TPOs here, and the disruption that would be created on the St Helens Linkway dual carriageway if CFS2 were to be constructed, CFS1 has been taken forward as the Clock Face Spur for assessment in the PEIR and for Stage 2 statutory consultation.

St Helens Spur

- 5.3.24 At Stage 1 non-statutory consultation, the St Helens Spur was a link between the main North Corridor and the adjacent Pilkington UK Greengate Works to allow a connection to be constructed into the works. This connection spur remains, but the spur has also been extended to the east to allow a connection to be made to the Glass Futures site off Langtree Way (**Appendix B, sheet 22**). This additional part of the spur would run from the St Helens HAGI along Burtonhead Road, turn north adjacent to the St Helens Linkway before crossing under the Linkway into Glass Futures. No comments were received on the St Helens Spur in the Stage 1 non-statutory consultation.

5.4 East Corridor

- 5.4.1 From the Central Hub, the East Corridor runs in a north-east direction, to the south of Lower Whitley and Highly Whitley, crossing the A559 and the M6 before passing to the north of High Legh. It then runs north, crossing the M62 before connecting to a HAGI at Warburton Sub-station and then continuing north on the eastern side of Partington to the Partington HAGI. The Preliminary Route Alignment described below is shown in **Figure 5.10** and in more detail in **Appendix B**.
- 5.4.2 Comments received during the Stage 1 non-statutory consultation exercise requested that the route avoided the settlement of Lower Whitley and the woodland to the south of the village. The route taken forward does this by running to the south of both. The route has also been moved away from the settlement boundary of Higher Walton.
- 5.4.3 The route runs to the south of Antrobus Golf Course where two options were considered around Arley and the M6 area. A northern option would have seen the route pass by the southern boundary of the former Stretton Airbase before

crossing the M6 near Crowley Brook. The southern option would see the route pass to the south of Park Moss Wood Local Wildlife Site and then cross the M6 to the north of Crowley Hall. The options would then re-join to the north west of Moss Hall Farm. The southern option runs through a short section of flood plain land east of the M6 but due to it being the shorter route, which would provide a quicker construction programme and less general disruption, the southern option has been taken forward for assessment in the PEIR and for Stage 2 statutory consultation.

- 5.4.4 The route passes to the west and north of High Legh, avoiding High Legh Golf Club and then to the east of Broomedge. A comment was received during the Stage 1 non-statutory consultation about Spud Wood, which is partly protected by a TPO. The original corridor consulted upon in that exercise avoided Spud Wood and the route taken forward continues to avoid it as well.
- 5.4.5 The corridor then passes the Cadent Warburton AGI where a HAGI would be located to provide the opportunity to blend hydrogen into the natural gas network in the future. To the north of here, comments were raised about the proximity of the East Corridor to National Trust land, primarily property in and around the Dunham Massey estate. The preferred route has been chosen further away from the Dunham Massey estate to reduce any potential effects on the National Trust land or property holdings.
- 5.4.6 As the corridor approaches Partington a number of relevant comments were made about the proposed housing development associated with the Partington East area of the New Carrington Masterplan. In relation to this, the route has considered a number of planning permissions relating to the Masterplan, and the proposed plots for future development, with the route taken forward running between the proposed built up areas. Comments were also received in relation to this area (and the Warburton area) over the Carrington and Warburton Mosses, areas of carbon rich soils. Unfortunately, the East Route cannot avoid these Mosses completely so discussions have been held, and will continue, with local consultees to minimise the impact of the pipeline through this area. Engineering solutions relating to the depth of the pipeline in these areas are also being considered.

HAGIs

- 5.4.7 Two HAGIs have been identified in the East Corridor, at Warburton and at Partington. The Warburton HAGI would facilitate potential blending into the natural gas network at the Warburton gas network site. The Partington HAGI would provide a connection to a customer at Carrington Power Station and also facilitate potential blending into the natural gas network at the Partington gas network site.

Warburton

- 5.4.8 A search area for the Warburton HAGI was identified at Stage 1 non-statutory consultation around the Cadent Warburton AGI. Three HAGI options were identified within this search area, immediately adjacent to the west, north and east (**Figure 5.11**). All three options are within the Green Belt, with the western option (W1) also within a wildlife corridor identified in the Local Plan. W1 would be sited to the west of the AGI within a larger area of countryside which provides a strong function in Green Belt terms. Harm to the Green Belt would be moderate to limited.

Pipelines into the existing AGI also pass through this site. W2, to the north, would be located within a more open area of countryside giving rise to moderate to significant harm to the Green Belt. An existing pipeline runs through part of the site. The selected option W3 is a site that is more contained visually, with potentially better access than W2 and with a potential for limited harm to the Green Belt. It is free of any existing gas pipelines. W3 has therefore been taken forward as the Warburton HAGI for assessment in the PEIR and for Stage 2 statutory consultation.

Partington

- 5.4.9 The search area for the Partington HAGI included land within the employment area of the New Carrington Masterplan close to the existing Cadent Partington gas infrastructure/AGI to allow the opportunity for a connection here to accommodate the future blending of hydrogen into the natural gas network. Three potential HAGI locations were initially identified within this area (**Figure 5.12**), although further examination of proposals for industrial development showed that there was limited space for the HAGI in between the Project plots. The preferred HAGI location has therefore been chosen within this space to avoid conflict with wider built development proposals (**Appendix B, sheet 33**).

Block Valves

- 5.4.10 The East Corridor requires one block valve to support maintenance or pipeline isolation purposes. Three options have been identified (**Figure 5.13**), EBV1 is located in an agricultural field with hedgerows at its edges. It is approximately 1.1km to the northeast of the M6 and adjacent to Moss Lane.
- 5.4.11 The locations for EBV2 and EBV3 are in agricultural fields approximately 30m southwest and northeast respectively of the A50 (Warrington Road), to the rear of established trees and hedgerows. All three options are taken forward for assessment in the PEIR and for Stage 2 statutory consultation.

Spurs

- 5.4.12 Three spurs are proposed on the East Corridor, a short spur from the Warburton HAGI into the Warburton sub-station site and two from the Partington HAGI. The Partington Spurs would connect customers at SAICA and Basell Polyolefins and provide opportunity for blending with the natural gas network at the Partington sub-station. A connection will also be made with Carrington Power Station within or adjacent to the HAGI.

Warburton Spur

- 5.4.13 The Warburton Spur is a short length of pipeline, around 200m long, which leads from within the Warburton HAGI directly into the adjacent existing Warburton gas infrastructure/AGI to allow the opportunity for a connection to accommodate the future blending of hydrogen into the natural gas network (**Appendix B, sheet 31**).

Partington Spurs

- 5.4.14 The Partington Spurs are shown in **Appendix B, sheet 33**. One spur would run north from the Partington HAGI to connect the Basell Polyolefins site.
- 5.4.15 The connections to the existing Cadent Partington AGI and SAICA would both run to the west of the Partington HAGI, following spaces between the existing and proposed built development.
- 5.4.16 Carrington Power Station will also be connected to the Project at Partington but via a connection to the HAGI rather than via a Spur.

5.5 South Corridor

- 5.5.1 Of the two corridor options presented at Stage 1 non-statutory consultation for the South Corridor, South 1 was selected as the preferred corridor. This corridor runs south from the Central Hub, to the west of Bartington and to the east of Acton Bridge before crossing the West Coast Main Line and running to the east of Cuddington and Forest Hill Quarry. Options then exist to south of the Hartford A556 bridge to the west of Davenham before the Corridor turns east and passes south of Moulton to connect to the HSF HAGI near the A530. The Preliminary Route Alignment described below is shown in **Figure 5.14** and in more detail in **Appendix B**.
- 5.5.2 During Stage 1 non-statutory consultation, comments were received both supporting and objecting to both South 1 and South 2 around Northwich, with no clear preference from the representations received as to which option was preferred. The Corridor identified for South 2 included slightly more ecological designations, including one SSSI at Plumley Lime Beds, although there was space within both options to avoid any such features. From an engineering point of view, the options were also very similar with the main difference being that South 2 would potentially have a constricted crossing point with HS2 due to nearby TPOs and the Plumley Lime Beds SSSI. Both options ran through areas allocated for minerals safeguarding and flood plain land.

Table 5.8 South Corridor Options

	South 1	South 2
Constructability	12 major road/rail/water courses to be crossed, although 3 could be crossed with one single trenchless crossing.	TPO and SSSI constraints within the area where HS2 needs to be crossed. 9 major road/rail/watercourses to be crossed. Passes over a greater extent of the Inovyn brinefields with increased underground services to avoid.
Ecology	Local Wildlife Sites, TPOs and ancient woodland, particularly around the Vale Royal Area	TPOs, ancient woodland and Plumley Lime Beds SSSI around Comberbach and Lostock Gralam
Permitted Waste Sites	None	Landfill storage within underground brinefields

- 5.5.3 The comparison of both options did not show many differences between the two alternatives. However, due to the presence of the Plumley Lime beds SSSI, the potential for increased underground services and infrastructure related to the brinefields along Option B, and the difficulties this could create during construction, Option A was selected as the preferred corridor.
- 5.5.4 The route taken forward therefore runs south from the Central Hub, crossing the Trent and Mersey Canal and the Weaver Navigation to the west of Bartington. This route avoids a crossing of the River Weaver to the east of Bartington, which would impact on recreational businesses including Woodbine Cottage caravan park and Acton Bridge boating club. The route then passes to the east of Acton Bridge and runs along the western side of the B5142 until it crosses the West Coast Main Line to the west of the A49. This crossing is preferable to a crossing to the east of the A49 as it avoids a stretch of pipeline running adjacent to the West Coast Main Line and a constrained working area due to the rail line.
- 5.5.5 The route then crosses the A49 and avoids the existing Forest Hill Quarry and its approved northern extension on the west, passing between areas of TPO at Littledales Gorse and Forest Hill. The route then crosses the A556 and passes around Sandiway Golf Club to the east, before four options are identified to cross the Weaver Navigation in the area around the Vale Royal Locks and the Vale Royal Cut.
- 5.5.6 These four options (SP1 to SP4) are shown in **Figures 5.15**. SP1 runs east, south of Hartford, towards Davenham, before turning southeast for a trenchless crossing of the West Coast Mainline. The option would cross an area of ancient woodland (Heys Wood), which would require a trenchless crossing to avoid impact on this feature.
- 5.5.7 SP2 runs southeast to a single trenchless crossing of the Weaver Navigation and the West Coast Mainline near Vale Royal Locks.
- 5.5.8 SP3 and SP4 run further south via the eastern edge of the golf club at Vale Royal Park and an area with a number of TPOs. SP3 would have a single trenchless crossing of the Weaver Navigation and West Coast Mainline starting south of Hulses Island. This crossing would go beneath the ancient woodland at Eaton Bank Wood and other deciduous broadleaved woodland.
- 5.5.9 SP4 runs further south crossing Mill Lane / Bradford Road and the belt of established deciduous broadleaved woodland, using an open cut trench. A trenchless crossing of the Weaver Navigation would be undertaken near Bradford Road with the pipeline continuing to a second trenchless crossing of the West Coast Mainline. This option could also be undertaken as a single trenchless crossing.
- 5.5.10 SP1, SP2 and SP3 all continue southeast between the West Coast Mainline to the west and Moulton to the east, avoiding the Scheduled Ancient Monument near Moultonbank Farm. South of Moulton these options head east towards Jack Lane and the A533. SP4 also heads east at this point.

Table 5.9 Vale Royal Locks route options

	SP1	SP2	SP3	SP4
Constructability	Difficult crossing of River Weaver, with steep banks and woodland on either side.	Constrained space to cross River Weaver/ Weaver Navigation and West Coast Main Line, or could be done as a longer, single trenchless crossing.	Lengthy trenchless crossing needed if impacts on Vale Royal Golf Club and associated, scheduled ancient monument and TPOs are to be avoided	Potentially the longest of the four options. Retains requirement to cross West Coast Main Line and River Weaver. Comes closer to residential properties and still requires the lengthy trenchless crossing referred to for SP3.
Biodiversity	Heys Wood ancient woodland and LWS (could be avoided by trenchless crossings)	Weaver Valley LWS and TPOs (could be avoided by trenchless crossing)	Rookery Wood and Weaver Valley LWS, TPOs (could be avoided by trenchless crossing)	Rookery Wood and Weaver Valley LWS, TPOs (could be avoided by trenchless crossing). Newbridge Wood ancient woodland and LWS can be avoided within corridor
Permitted waste site	None	Arpley landfill Site	None	None
Agricultural land	Grade 3	Non-agricultural land	Non-agricultural land	Grade 2

5.5.11 To the south of Moulton, the route runs to the east, passing south of Bostock Green. This brings the route across a stretch of Grade 2 agricultural land approximately 600m wide. This could be avoided by routing north of Bostock Green but this is likely to bring the pipeline into greater extents of floodplain line around the River Dane. The route then continues east to cross the A530 to connect to the HSF HAGI. In this area, to the east of Moulton, the route passes across mineral safeguarding areas relating to salt and brine extraction. As these minerals are at depth, and the route avoids existing ground level infrastructure, no minerals sterilisation is expected to occur.

5.5.12 All four options will be included in statutory consultation.

Hydrogen Storage Facility HAGI

5.5.13 The only HAGI along the South Corridor is the HSF HAGI which is located within an area already consented for gas storage to the east of the A530. The HSF HAGI location is fixed by operational requirements of the storage facility.

Block Valve

5.5.14 The South Corridor requires a block valve for maintenance and isolation purposes. Five block valve options have been identified (**Figure 5.16**) and are included in statutory consultation. Options SBV1 and SBV2 are located in fields to the north and south of the A556 (Chester Road) respectively. SBV3 is located in a field to the east of Whitegate Lane; note that this option would only be possible on route option SP1. SBV4 is located further south in a field to the west of Whitegate Lane and is applicable to route options SP2 to SP4. SBV5 is located to the west of an established belt of trees at Jack Lane after the route options SP1 to SP4 converge.

5.6 Central Hub

5.6.1 Within the search area for the Central Hub HAGI, five options were identified for a potential HAGI location (**Figure 5.17**). Options CHH1, CHH2, CHH4 and CHH5 were located north of the A533 with option CHH3 located to the south. A number of comments were received during the Stage 1 non-statutory consultation in relation to land to the south of the A533, with issues raised such as the Dutton Dean ancient woodland, potential land stability issues around the Trent and Mersey Canal and the sloping topography of the land. Whilst the slope in this area would not be sufficient to prevent a HAGI being developed and the ancient woodland can be easily avoided, the options north of A533 have fewer constraints.

Table 5.10 Central Hub HAGI options

	CHH1	CHH2	CHH3	CHH4	CHH5
Construction	Close to built development at Woodside Farm	No substantial constraints	No substantial constraints	Proximity to flood plain	No substantial constraints
Flood zones	None	None	None	Adjacent to flood plain	None
Minerals safeguarding area	None	None	MSA surrounds location	Within MSA	None
Green Belt	Moderate to Limited harm	Moderate to Limited harm	Moderate to Significant harm	Moderate to Significant harm	Moderate to Significant harm

5.6.2 Two options have been put forward for assessment in the PEIR and for Stage 2 statutory consultation. These are CHH1 and CHH2. CHH1 is located adjacent to Woodside Farm and CHH2 is partially enclosed by existing vegetation and bunding, and as such they would have a more limited effect upon the Green Belt than the other options. CHH1 is also screened by the farm buildings and associated plant storage area. CHH2 is adjacent to an existing area of hardstanding which could be used for the construction compound. Like CHH1, it has good access via an existing track from the A533.

5.7 Northwich Spur

5.7.1

Four spur options were presented at Stage 1 non-statutory consultation to connect to TATA Chemicals at Winnington (**Figure 5.18**). Spur 2 would have connected from the South 2 corridor option, so when this route option was discounted this spur was also abandoned. Spur 1 would involve a spur running off the Preferred Route Corridor (South 1). Spurs 3 and 4 are spurs which were identified to run directly from the Central Hub to TATA Chemicals. Spur 3 would have involved multiple crossings of the River Weaver and Trent and Mersey Canal, whilst Spur 1 would have had a number of constraints to avoid including Beach Hill Wood ancient woodland, Hartford Golf Club and a permitted waste site to the north of the golf course. Both Spurs 1 and 4 would involve pipelines being laid along the highway. Spur 1 would also have required an additional HAGI to be constructed on the southern corridor to accommodate the spur connection. This would have removed the need for a block valve but the HAGI would have been a more substantial development.

Table 5.11 Northwich Spur options

	Spur 1	Spur 2	Spur 3	Spur 4
Constructability	Requires an additional HAGI on southern corridor. Constrained working areas to avoid constraints.	Option discounted as relates to Option B which has not been taken forward.	No substantial concerns.	Multiple trenchless crossing needed at watercourses.
Flood zones	Grade 3		Mostly Grade 2 / partially Grade 3	Mostly Grade 3 / partially Grade 2
Minerals Safeguarding	Amber		Amber	Amber
Ancient woodland	Beach Hill Wood		None	None
Permitted waste site	North of Hartford Golf Course		None	None
Watercourse crossings	None		2no. (River Weaver and Trent and Mersey canal)	6 no. (multiple crossings of River Weaver and Trent and Mersey canal)
Route in Highway	Leach Drive, Walker Road, Winnington Lane		n/a	Leach Drive, Walker Road, Winnington Lane

	Spur 1	Spur 2	Spur 3	Spur 4
ALC	0.7km Grade 2		2.8km Grade 2	0.8km Grade 2
Recreation	Hartford Golf Club		None	Marbury Country Park / Anderton Nature Park

5.7.2 Due to the need for an additional HAGI for Spur 1 and the proximity to an ancient woodland and permitted waste site, the multiple water course crossing required for Spur 4 and the disruption to the highway for both Spur 1 and 4, these options were discounted. Spur 3 has therefore been taken forward for assessment in the PEIR and for Stage 2 statutory consultation.

5.8 Working compounds: construction, trenchless crossings, material storage areas

5.8.1 Along the Preliminary Route Alignment various construction compounds and working areas will be required, alongside the pipeline construction line, to facilitate the construction works. These will typically involve:

- Construction compounds for trenchless crossings: when trenchless crossings are required to pass underneath certain features along the route (e.g. major roads or watercourses) then a construction compound is required for these works. Both an entry and exit compound will be required, one on either side of the feature, to allow the underground 'tunnel' to be constructed, the pipeline sections to be joined together and then pushed/pulled through the tunnel.
- Material storage areas: compounds will be needed to store equipment and materials needed for the construction workings in particular the pipeline sections, prior to their deployment along the route. These will be located in various positions across the Project to reduce transportation requirements during construction and storage times.
- HAGI construction compounds: As the HAGIs and block valves will involve a similar construction process to a standard built development (rather than the short term, moving construction area for the pipelines) a construction compound will be needed adjacent to the HAGI locations to provide equipment, material and fuel stores, site administration facilities, workers welfare facilities and vehicle parking.

5.8.2 Due to the work undertaken in selecting corridors and routes, it is considered that the locations selected are free from any nationally or internationally important designations/constraints and that any other localised matters have also been minimised. Comments about the pipeline route or HAGI/block valve locations within the Corridors text will also be relevant to these compounds.

5.8.3 All of the proposed locations for these locations are shown in **Appendix B**.

5.9 The Preliminary Route Alignment

- 5.9.1 The Preliminary Route Alignment identified from the work described in **Chapter 5** is shown in **Figure 5.19**, and in greater detail in **Appendix B**.
- 5.9.2 The HAGI assessments for Rocksavage, Higher Walton, Clock Face, Warburton and Central Hub shows that these HAGIs could be accommodated without a significant effect on Green Belt purposes. The overall Preliminary Route Alignment is therefore also considered to be appropriate when considered against Green Belt purposes.
- 5.9.3 It is intended to reduce the whole Preliminary Route Alignment down to a single option for the Proposed Route Alignment to be used in the DCO submission. Consultation feedback on Preliminary Route Alignment, both for where there is and is not optionality, will be important in making this reduction to a single option. The optionality remaining within the Preliminary Route Alignment is described below.

Table 5.12 West Corridor Options

Option	Description
Around Hover Force outdoor activity centre: there is a distance of approximately 300 metres between the centre of each route option, with key factors being considered including proximity to overwintering bird habitats, existing energy infrastructure (i.e. overhead electric lines and wind turbines) and engineering feasibility. Either option would be constructed using 'open cut' techniques.	
WP1	WP1 is the most northerly route and avoids interaction with existing overhead electric lines (see WP2).
WP2	WP2 brings the pipeline closer to a corridor of land already affected by M56 traffic and existing overhead electric lines, thereby reducing disturbance on land closer to the River Mersey. However, this land is often used by birds from the Special protection Area on the river
There are three options identified for the location of the Rocksavage HAGI (RSH1, RSH2 and RSH3).	
RSH1	RSH1 is within an area identified as being at risk of flooding. This could make construction and operational access more difficult. This is why alternative locations (RSH2 and RSH3) have been identified.
RSH2	RSH2 avoids the flood area, thereby providing good access. However, there are potential land contamination concerns.
RSH3	RSH3 is located near to RSH2 in an area of woodland. However, it broadly avoids the flood zone and ground associated with historic landfill.
There are two further pipeline options south east of the Rocksavage HAGI (WP3 and WP4).	
WP3	WP3 would include a trenchless crossing of the Weaver Navigation. It would pass north west of properties on the A56 and then switch south east, with another trenchless crossing of the A56. This option would require two individual crossings which, if technically feasible, could be completed as one larger crossing (see WP4)
WP4	WP4 would head broadly north east with a single trenchless crossing of the A56 and Weaver Navigation. It then passes to the south east of properties on the A56. This option would require one larger trenchless crossing of the A56 and weaver Navigation.
There are two pipeline route options for the crossing of the River Weaver and Weaver Navigation, which are required between the Rocksavage and Runcorn HAGIs (RSp1 and RSp2).	
RSp1	RSp1 reduces the number of more difficult, large diameter pipeline crossings in the area. It could be used in conjunction with RSH3.
RSp2	RSp2 would require a longer single trenchless crossing of both the River Weaver and Weaver Navigation, passing north east of an existing National Grid substation. It would remove the need for RSH1, RSH2 or RSH3, but, overall, requires more difficult, larger diameter pipeline crossings. Assessments are being completed to determine its feasibility.

Table 5.13 North Corridor Options

Option	Description
The preliminary order limits include an area used by Creamfields festival, located north of the M56 and between Hatton and Daresbury. It is intended to mitigate impacts on the operation of the festival site where possible. To do so we have identified various options (NP1, NP2 and NP3) conversations as to how to minimise any potential impacts are ongoing between the festival organisers, the landowner and the project team.	
NP1	NP1 would pass along the western side of the Creamfields festival site, past Daresbury and continues north, parallel to the A56 (Chester Road). It is designed to avoid the key areas of the Creamfields festival site
NP2	NP2 would travel within the Creamfields site and west of Warrington Road. It is designed to avoid the key areas of the Creamfields festival site.
NP3	NP3 would cross Warrington Road and then run parallel on its eastern side. It is designed to avoid the key areas of the Creamfields festival site and avoids the largest area of the festival site overall.
Following the trenchless crossing of the A56, there are two options at Higher Walton (NP4 and NP5) that include the trenchless crossings of the Bridgewater Canal, the West Coast Mainline and the Manchester Ship Canal.	
NP4	NP4 would run through Moore Nature Reserve and an area of flood risk, but to a lesser extent than NP5. It would require individual crossings of the railway line and Manchester Ship Canal. The Higher Walton HAGI option would require a longer spur to reach Warrington customers.
NP5	NP5 would facilitate a HAGI option closer to Warrington customers and would avoid Moore Nature Reserve. It would require individual crossings of the railway line and Manchester Ship Canal. Engineering assessments are ongoing.
There are also two HAGI options at Higher Walton that include the trenchless crossings of the Bridgewater Canal, the West Coast Mainline and the Manchester Ship Canal (HWH1 and HWH2). Each option connects to one of the NP4 or NP5 options on the north side of the Manchester Ship Canal.	
HWH1	This HAGI location option is dependent on pipeline route option NP4 being appropriate. It would require a longer spur line to Warrington customers and would be located within Moore Nature Reserve and an area of flood risk.
HWH2	This HAGI location option is dependent on pipeline route option NP5 being appropriate. It would require a shorter spur line to Warrington customers and would be located outside Moore Nature Reserve and an area of flood risk.
There are two options for the Warrington spur connection to Novelis (WSp1 and WSp2).	
WSp1	WSp1 would remain south of the River Mersey. It would cross under the railway underpass and continue as street works along Eastford Road. It would then proceed broadly north east, crossing the disused Runcorn and Latchford Canal, then toward the A5060, and continue as street works towards Novelis. This option would run along the same corridor as the Warrington Linkway road development.

Option	Description
WSp2	WSp2 would run north east with a trenchless crossing of the River Mersey. It would then turn south east, with a trenchless crossing of the railway, and continue on to the A5196 (Slutchers Lane / Centre Park Link Road). Finally, it would exit the lane before another trenchless crossing of the River Mersey and head towards Novelis.

Table 5.14 East Corridor Options

Option	Description
There are three options that have been identified for the Block Valve installation we need in the east corridor. The first option (EBV1) is off Moss Lane, approximately 1.1km (0.7 miles) northeast of the M6 and is located in an agricultural field. The other two options (EBV2 and EBV3) are in agricultural fields approximately 30 metres southwest and northeast respectively of the A50 (Warrington Road).	
EBV1	This BVI option would be located in an agricultural field with hedgerows at its edges. It is approximately 1.1 kilometres north east of the M6 and adjacent to Moss Lane.
EBV2	This BVI option would be located in agricultural fields south west of the nearby A50 (Warrington Road).
EBV3	This BVI option would be located in an agricultural field north east of the nearby A50 (Warrington Road).

Table 5.15 South Corridor Options

Option	Description
In this area four options for the required trenchless crossings of the Weaver Navigation and West Coast Mainline have been identified, south of the trenchless crossing of the A556 (Chester Road) (SP1, SP2, SP3 and SP4).	
SP1	SP1 would require individual trenchless crossings of the West Coast Mainline and an area of ancient woodland (Heys Wood).
SP2	SP2 would run south east to a long trenchless crossing of the Weaver Navigation and West Coast Mainline, near Vale Royal Locks.
SP3	SP3 would run along the eastern edge of the golf club at Vale Royal Park and an area with a number of Tree Preservation Orders. It would require a single trenchless crossing of the Weaver Navigation and West Coast Mainline. This would start south of Hulses Island as access between the two crossings would be challenging.
SP4	SP4 would also run along the eastern edge of the golf club at Vale Royal Park and an area with a number of Tree Preservation Orders. It would then run further south, crossing Mill Lane / Bradford Road and the belt of established deciduous broadleaved woodland using open cut construction. A trenchless crossing of the Weaver Navigation, near Bradford Road, and the West Coast Mainline, would be required. This option could also be completed as a larger single trenchless crossing of the Weaver Navigation and West Coast Mainline.
There are five options for the Block Valve needed in this area (SBV1, SBV2, SBV3, SBV4 and SBV5).	
SBV1	This BVI option is located in fields to the north of the A556 (Chester Road).
SBV2	This BVI option is located in fields to the south of the A556 (Chester Road).
SBV3	This BVI option is located in a field to the east of Whitegate Lane. This option would only be possible if pipeline route option SP1 is preferred.
SBV4	This BVI option is located further south than SBV1 and SBV2, in a field to the west of Whitegate Lane. It is applicable to pipeline route options SP2, SP3 and SP4.
SBV5	This BVI option is located to the west of an established belt of trees at Jack Lane, after the pipeline route options SP1, SP2, SP3 and SP4 converge.

Table 5.16 Central HAGI Options

Option	Description
The Central Hub is the HAGI at the centre of the proposed pipeline. It will provide a connection and onward distribution point to customers along the south, east and north corridors. Two options for the Central Hub HAGI have been identified.	
CHH1	This Central Hub HAGI option would be located in an agricultural field to the rear of Woodside Farm. This field is generally bound by hedgerows with some existing gaps.
CHH2	This Central Hub HAGI option would be located further north. It would be along an existing hardstanding track leading to an area currently used for storage. The adjacent field has hedgerows and some mature trees at its edges. CHH2 is set back a fair distance from existing public roads, decreasing its visibility.

Table 5.17 Northwich Spur Options

Option	Description
There are two options following the combined trenchless crossing of Marbury Road, Trent and Mersey Canal and Lift Lane (NSp1 and NSp2).	
NSp1	NSp1 would run south to a trenchless crossing of the River Weaver. It would then follow open areas and tracks to, as far as possible, avoid impact on woodland through Anderton Nature Reserve and associated recreational areas.
NSp2	NSp2 would run south east and then south west to avoid existing ponds and areas of mature woodland.

6. Next Steps

6.1 Stage 2 statutory consultation

- 6.1.1 The Preliminary Route Alignment will be used for the Preliminary Order Limits that will be subject to the preliminary assessment of environmental effects contained within the PEIR. It will also be used within the Stage 2 statutory consultation exercise to show consultees the current stage of design. Within this consultation the views of consultees on both the work undertaken to date and on the options that remain in the Preliminary Route Alignment will be important.

6.2 Proposed Route Alignment and DCO submission

- 6.2.1 Following the Stage 2 consultation exercise, the representations received from consultees will be reviewed alongside ongoing engineering and environmental work to make further refinements to the Preliminary Route Alignment. The intention is to refine the pipeline corridors to the widths identified in section 2.3 to provide an alignment for the pipeline, and to identify locations for the above ground elements of the Project. The resulting Proposed Route Alignment which is identified will be used as the proposed Order Limits within the DCO application. This is scheduled for submission in Spring 2023.



Figures

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Figure 1.1
Fixed Connection Points



Key

Option A

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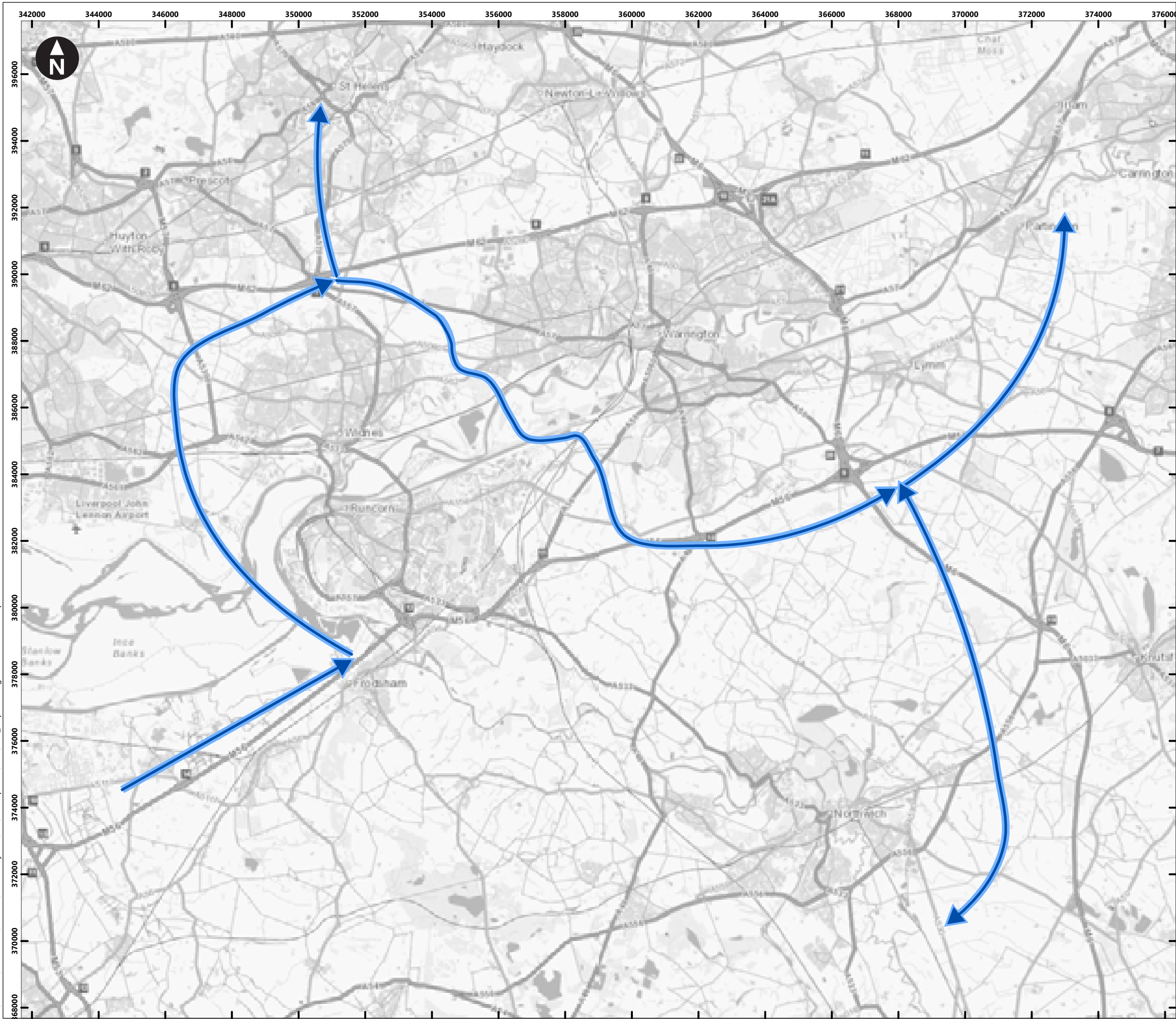
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Figure 3.1A
Strategic Option A
Sheet 1 of 4

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Key

Option B

0 1 2 3 4 5 Kilometers

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Figure 3.1B
Strategic Option B
Sheet 2 of 4

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Key

Option C

0 1 2 3 4 5 Kilometers

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Figure 3.1C
Strategic Option C
Sheet 3 of 4

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Key

Option D

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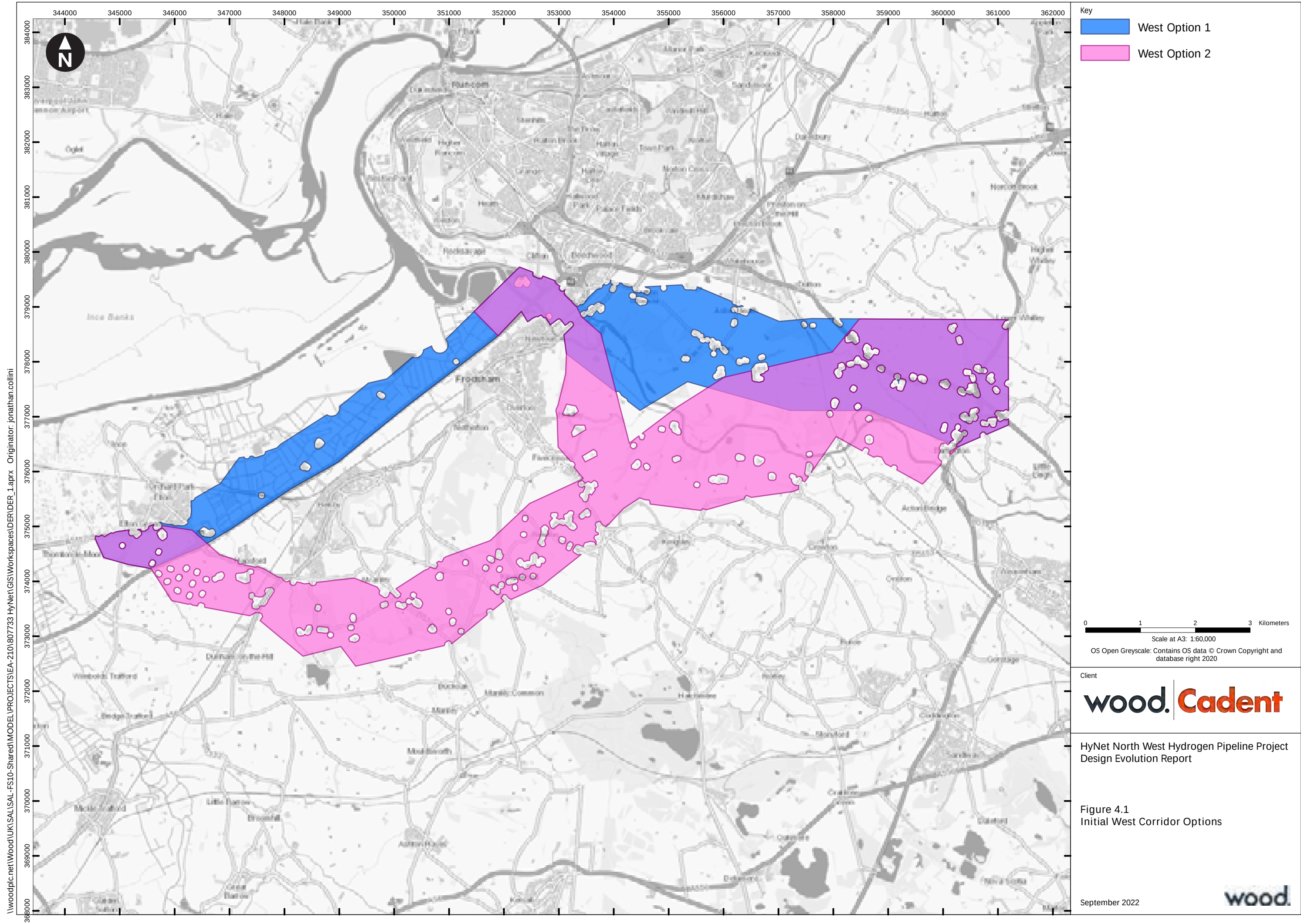
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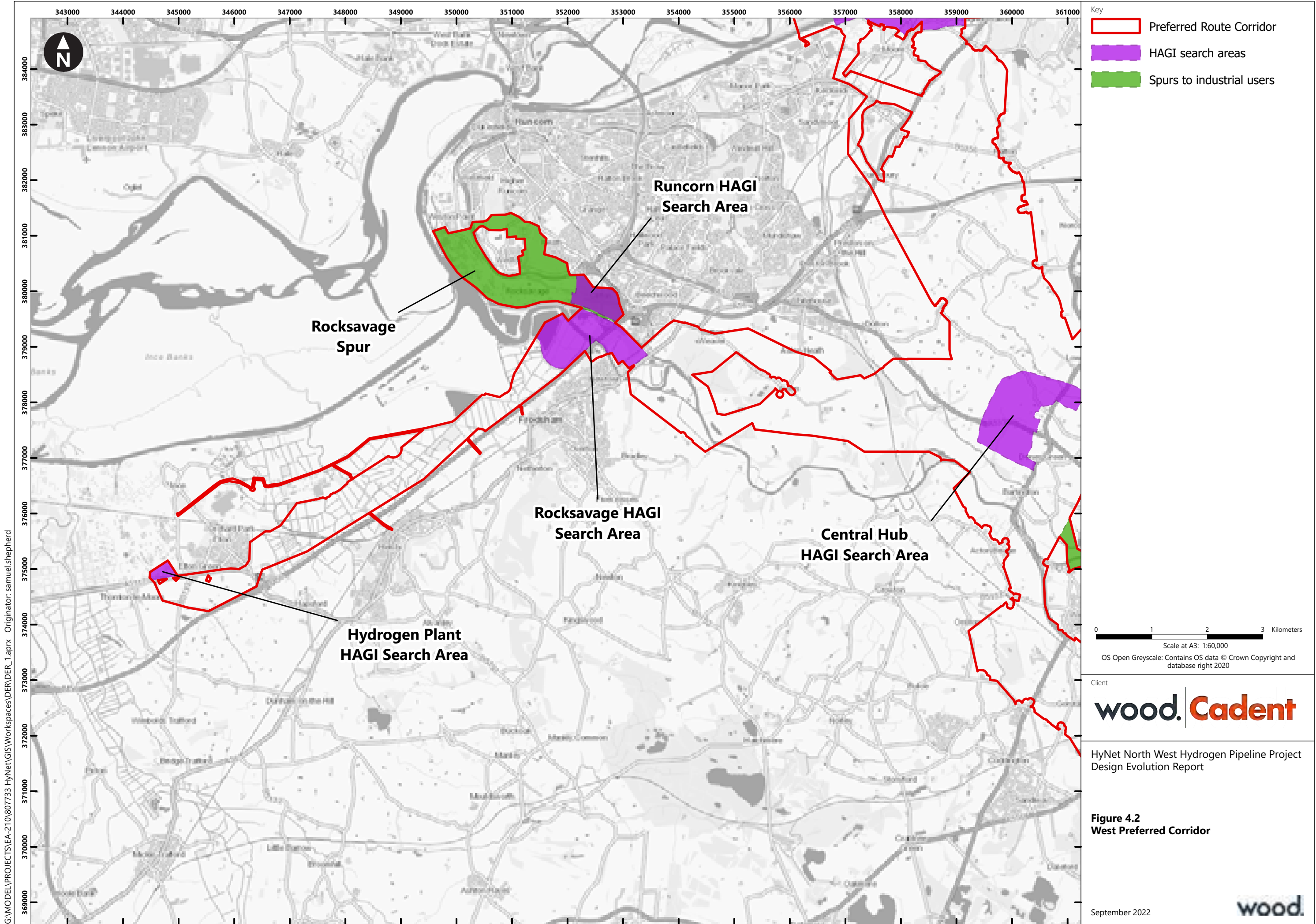
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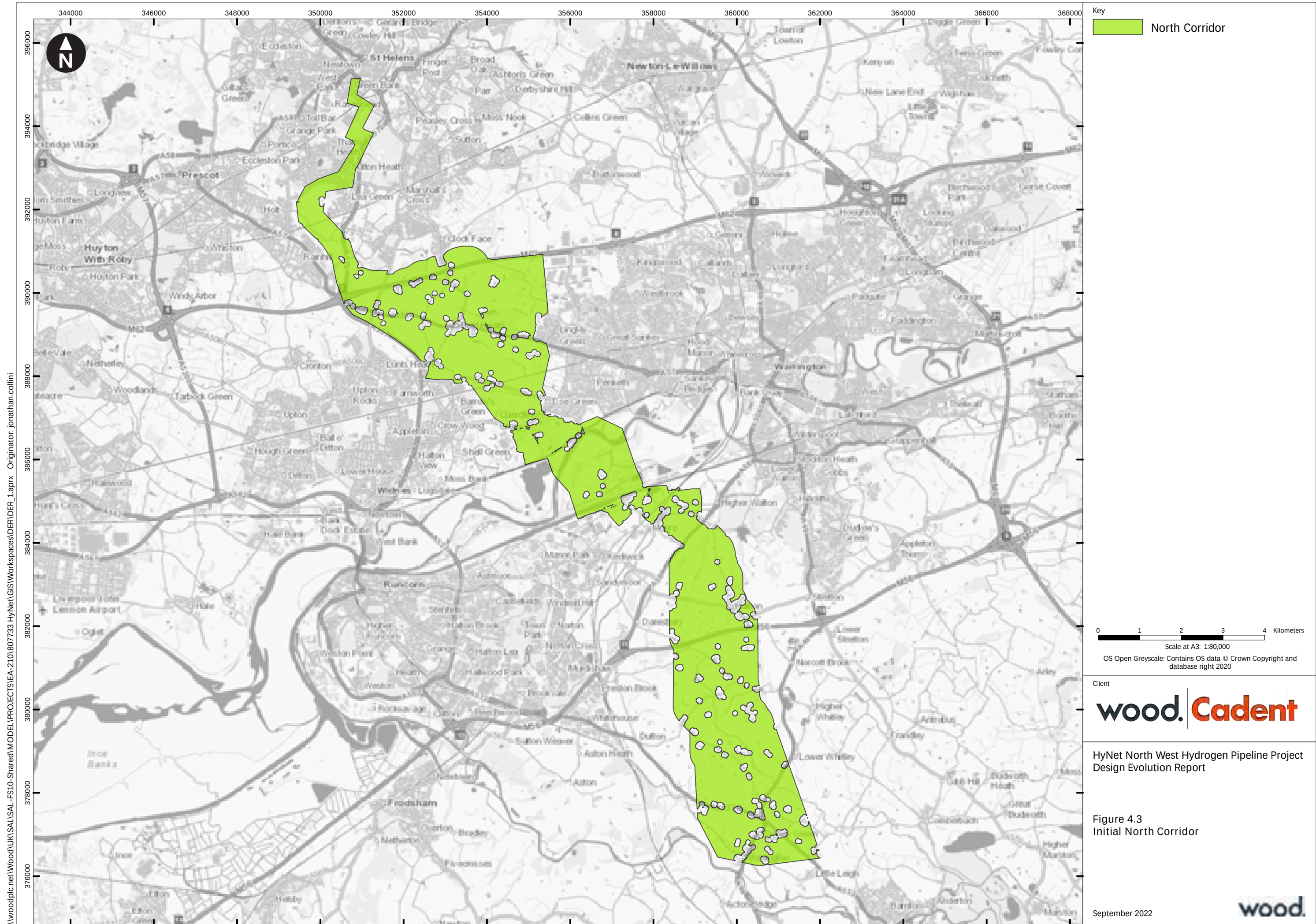
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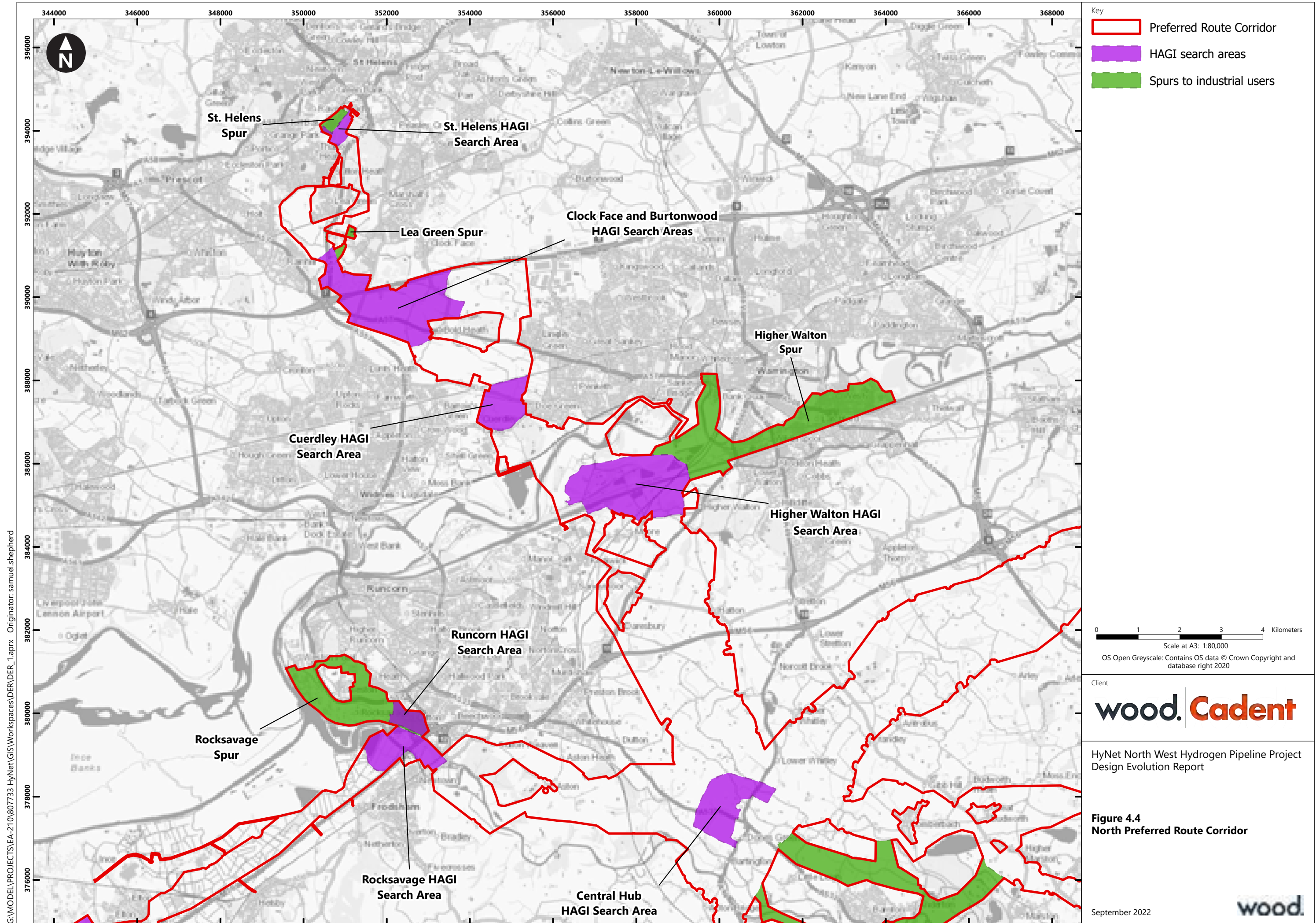
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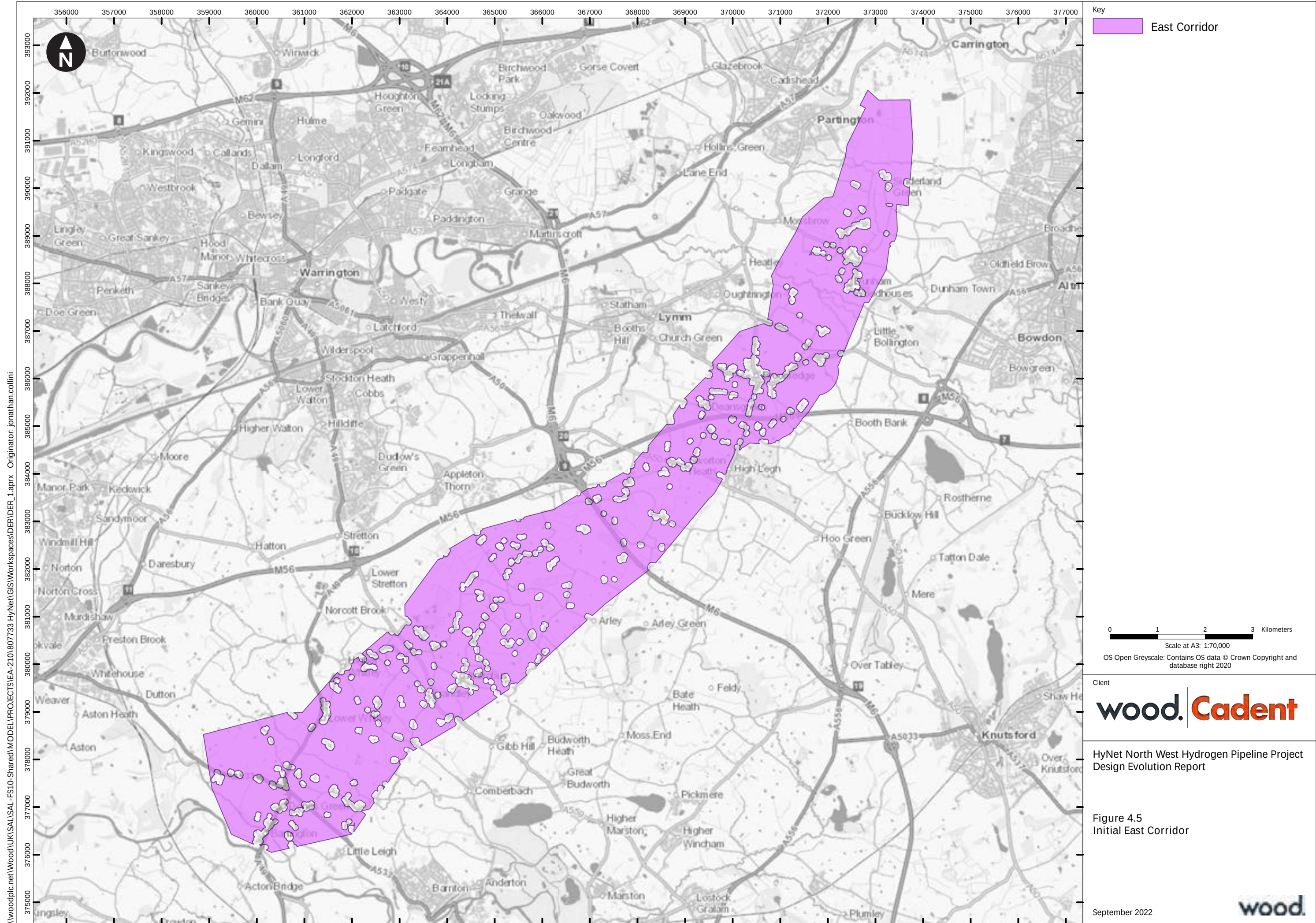
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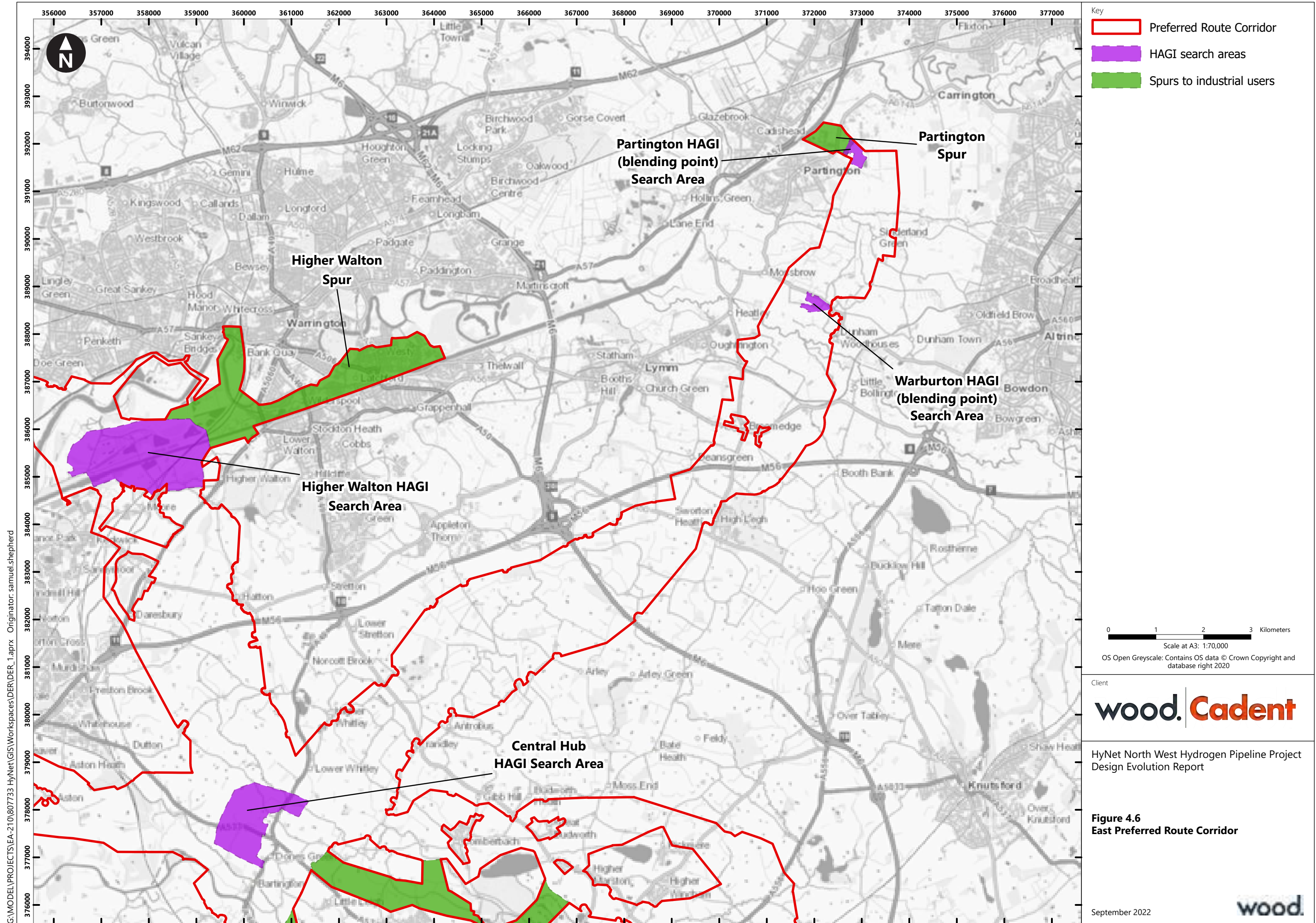


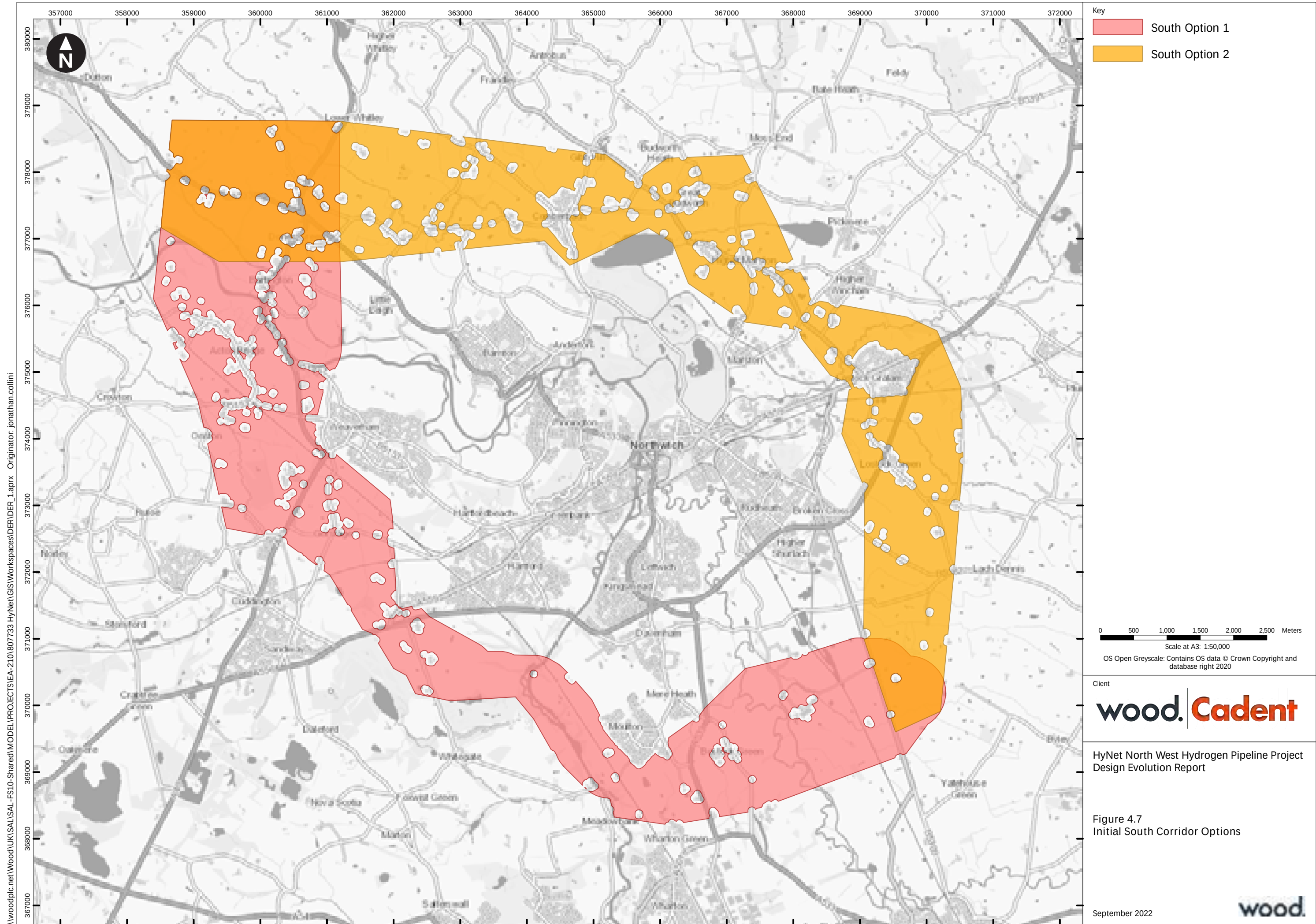




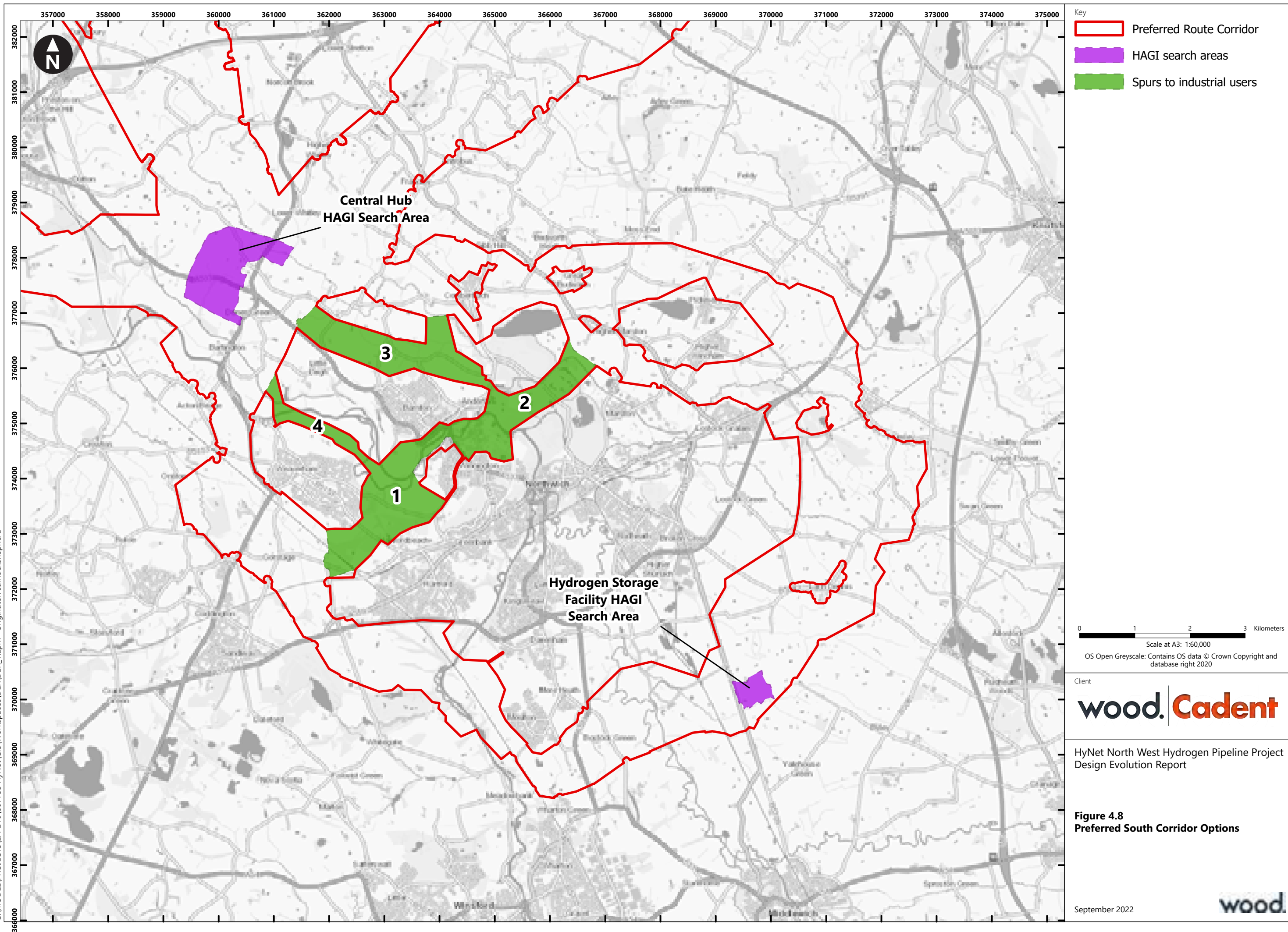


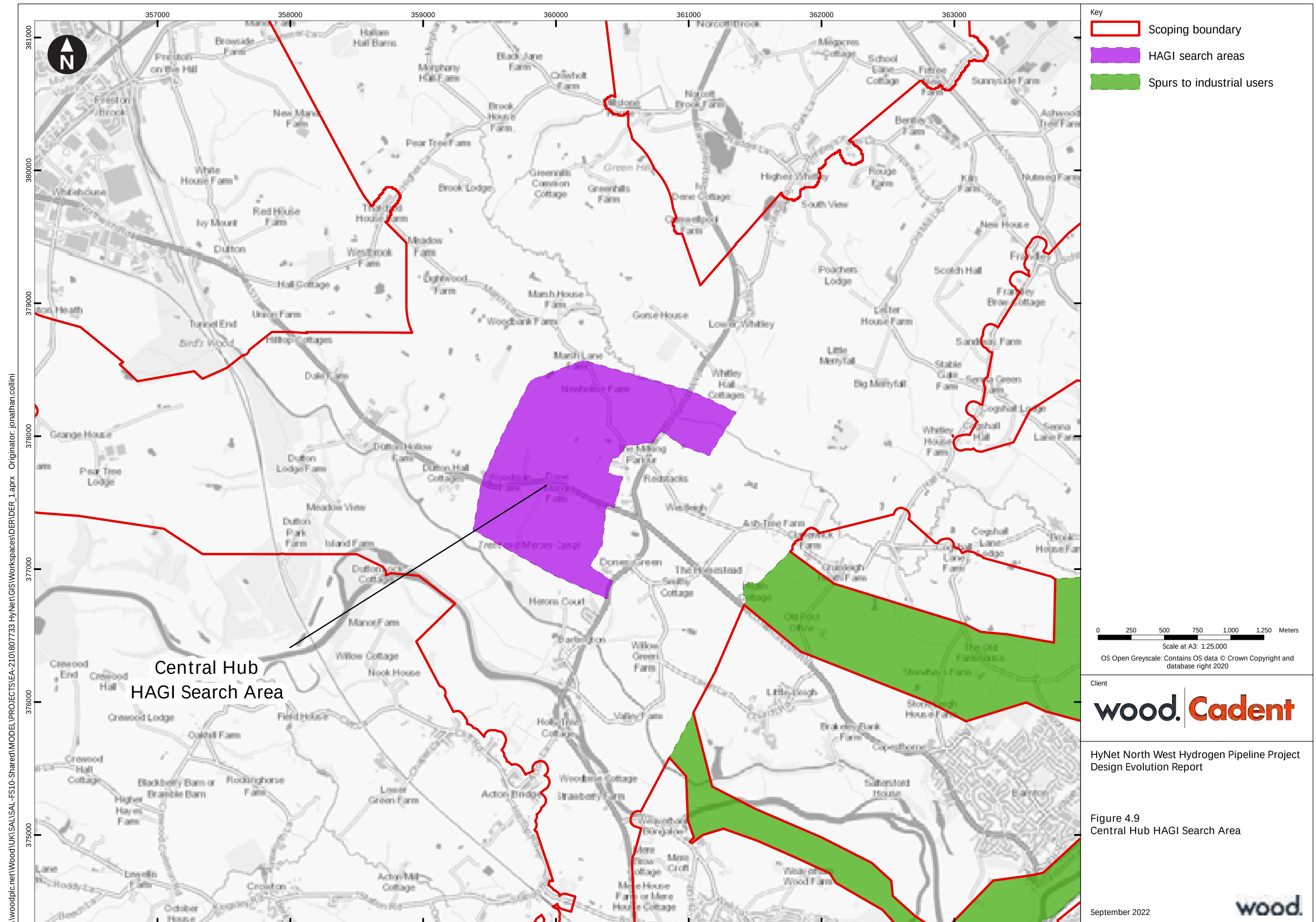




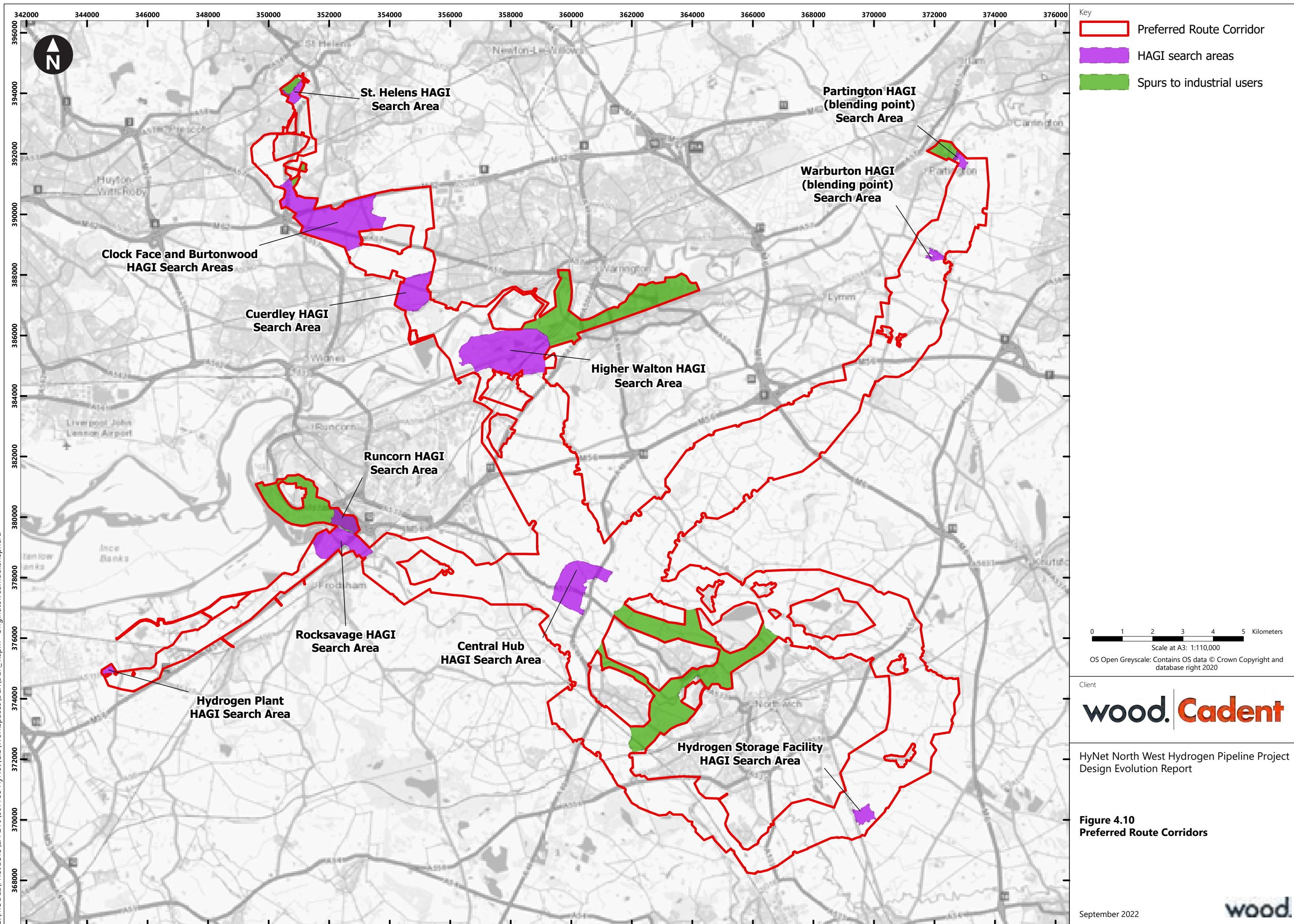


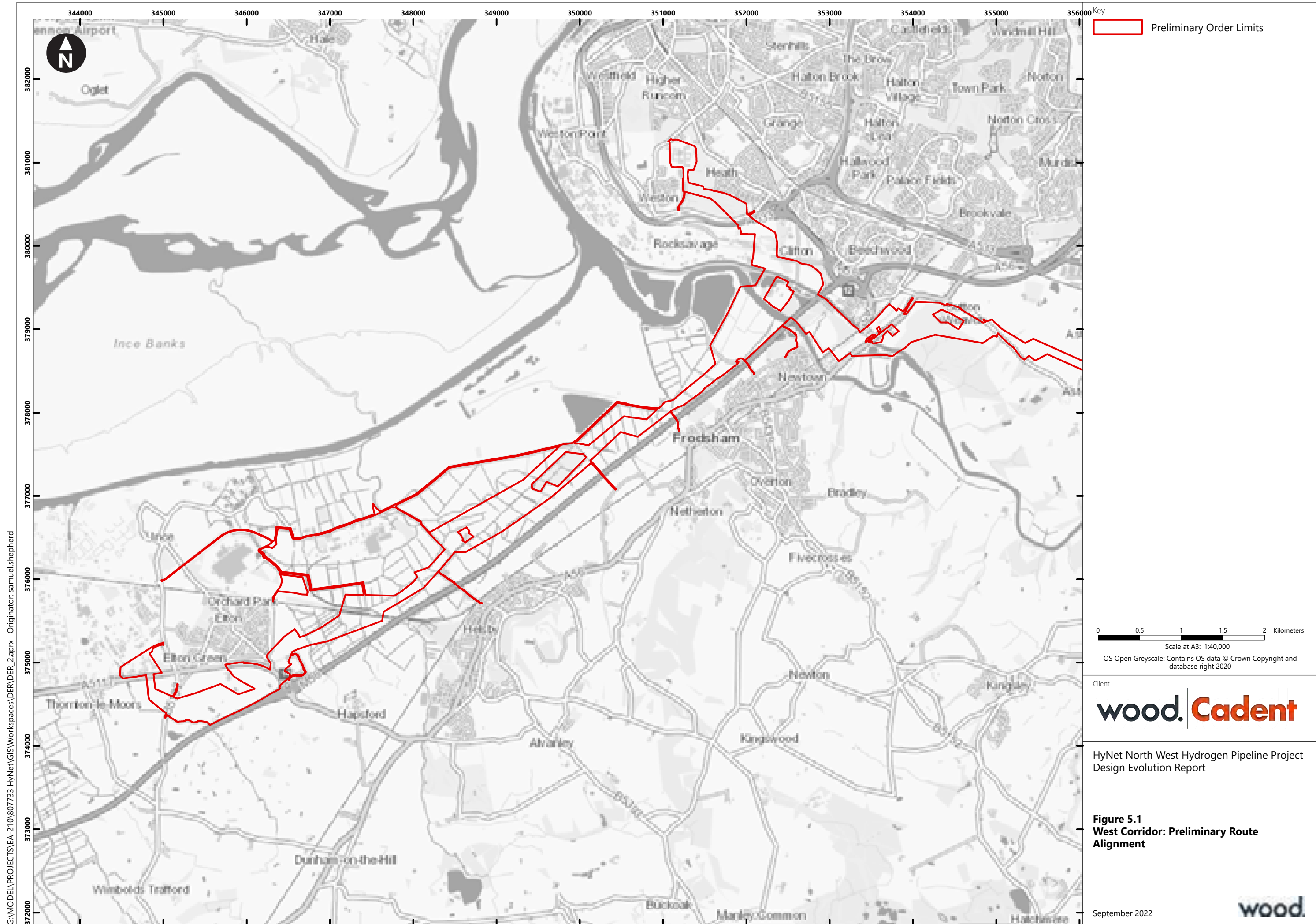
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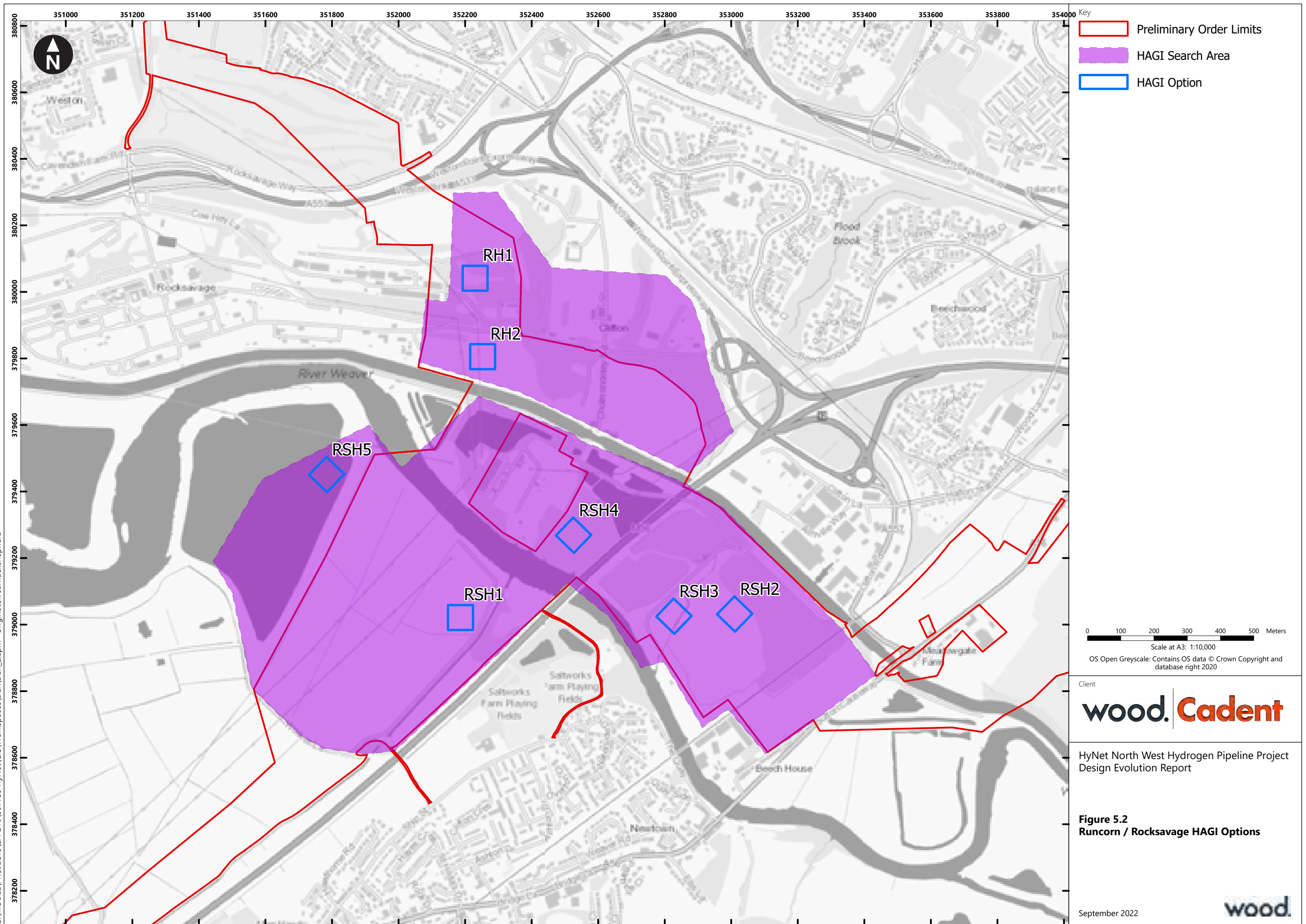


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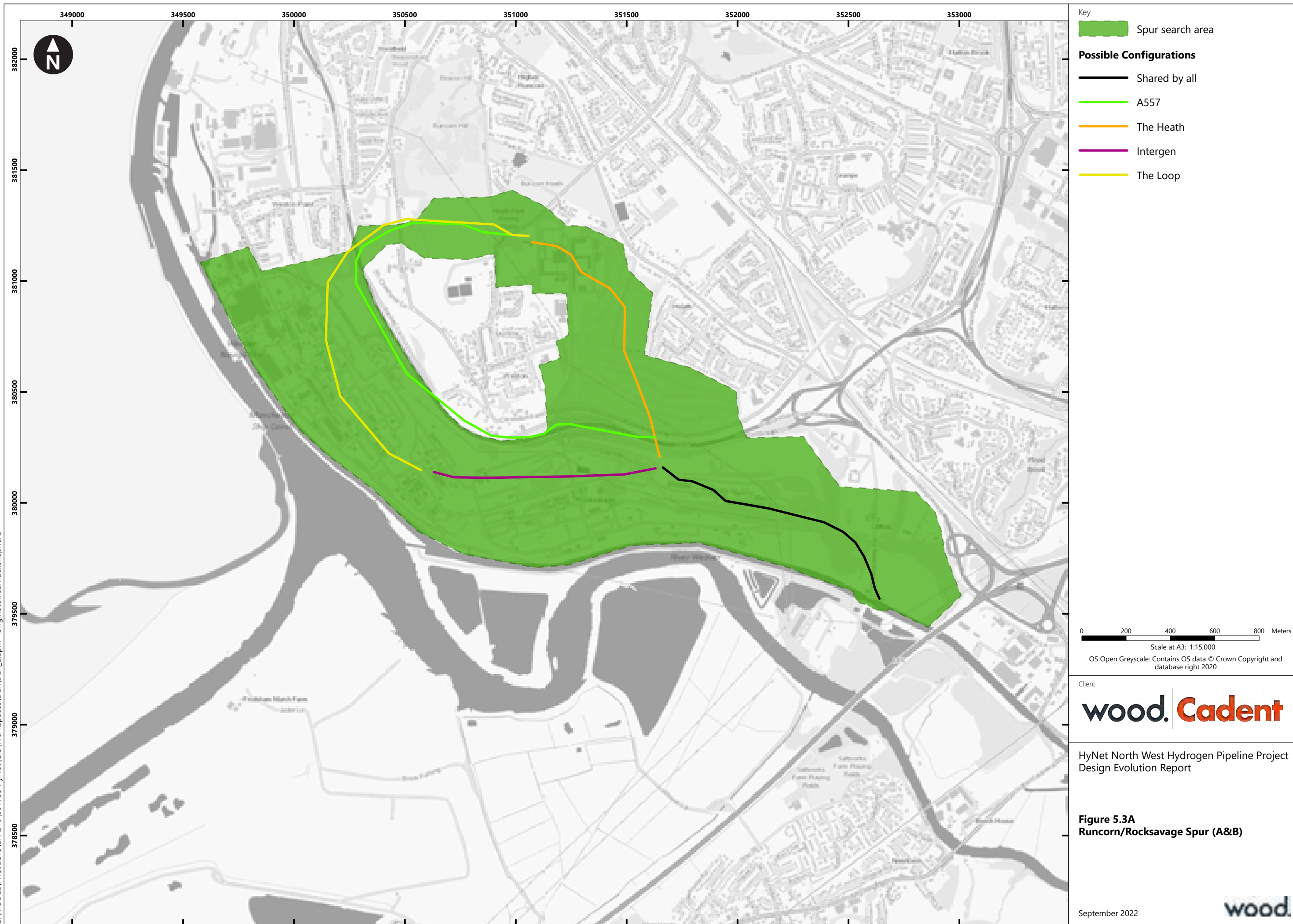




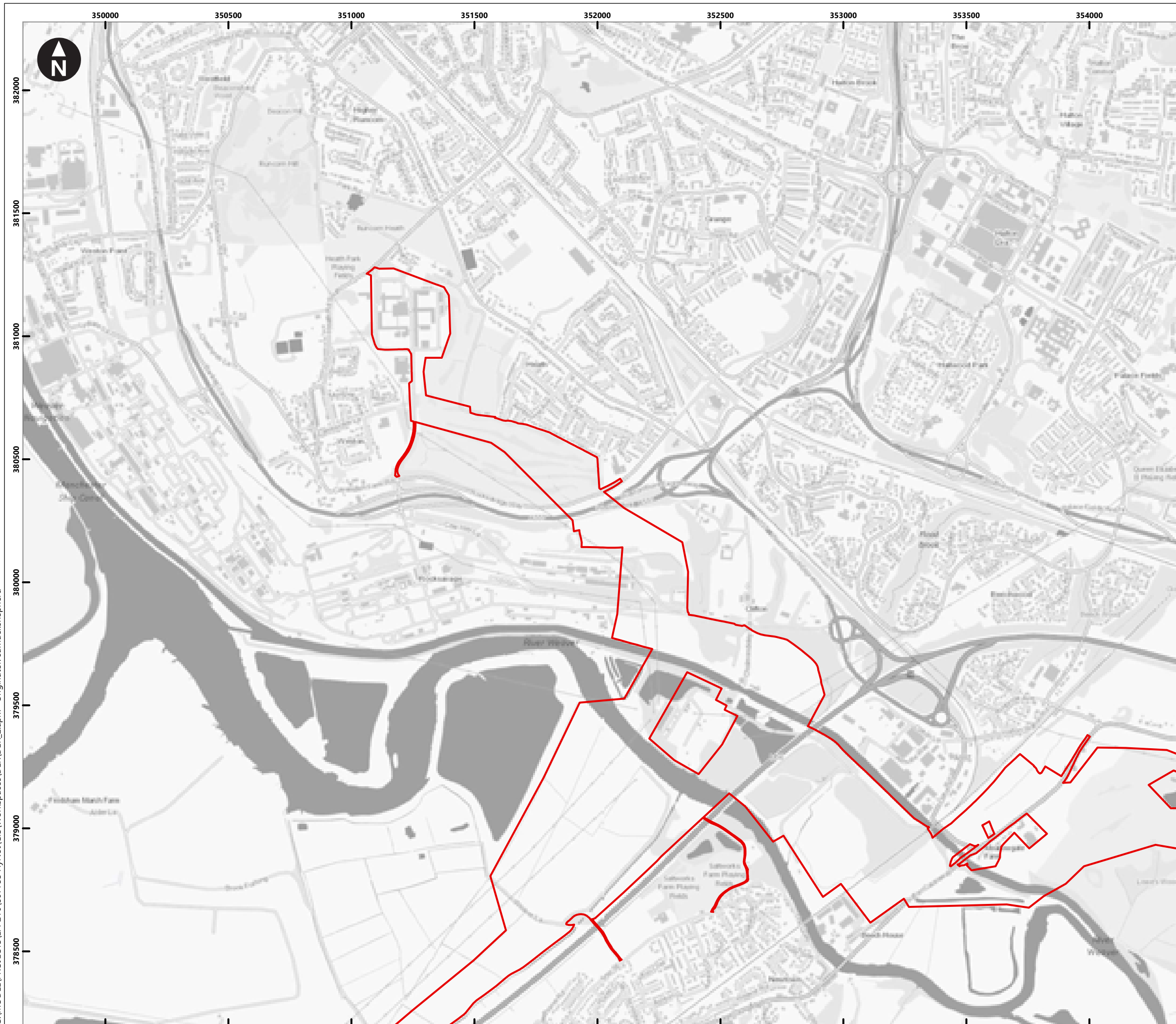
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Key
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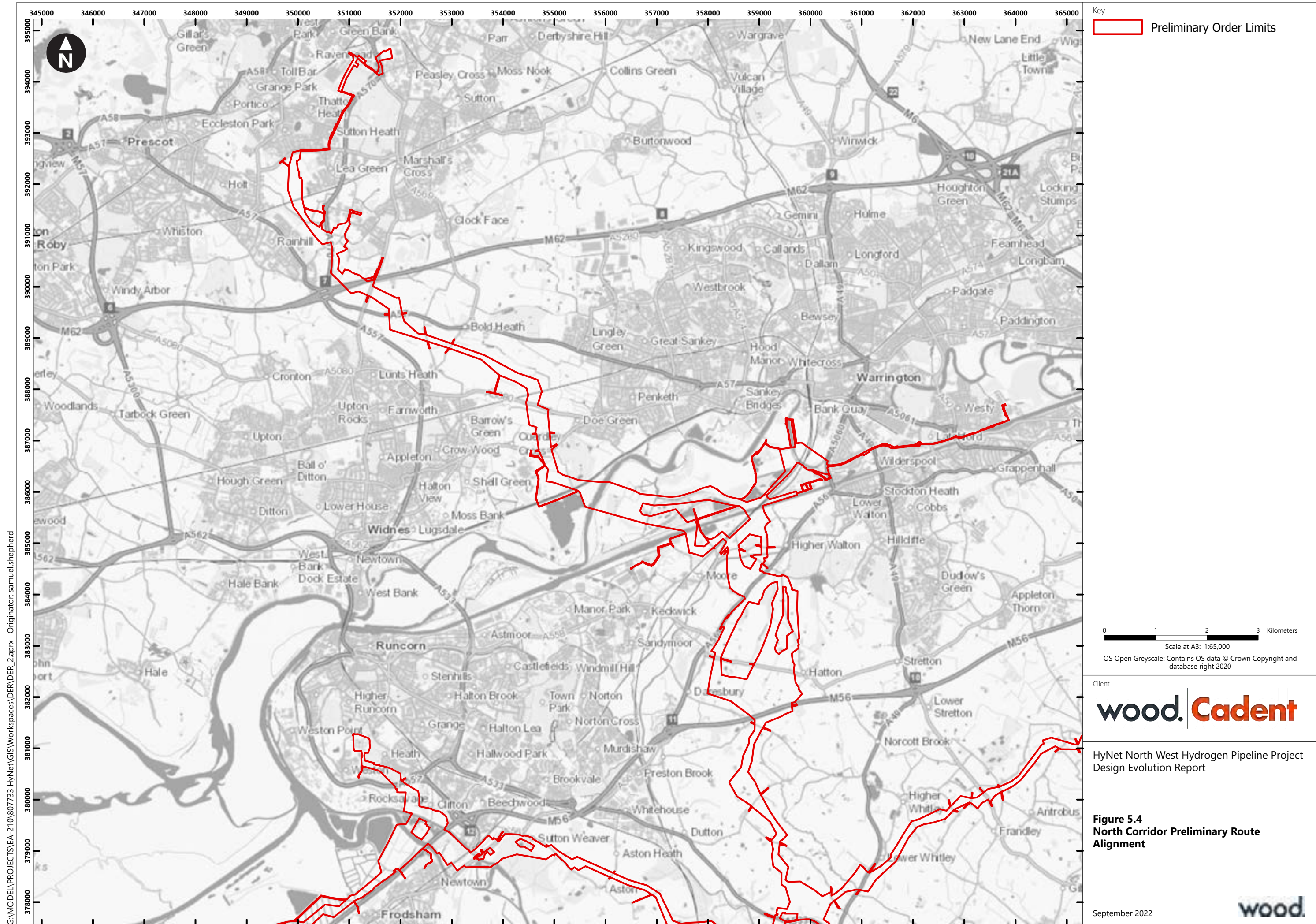
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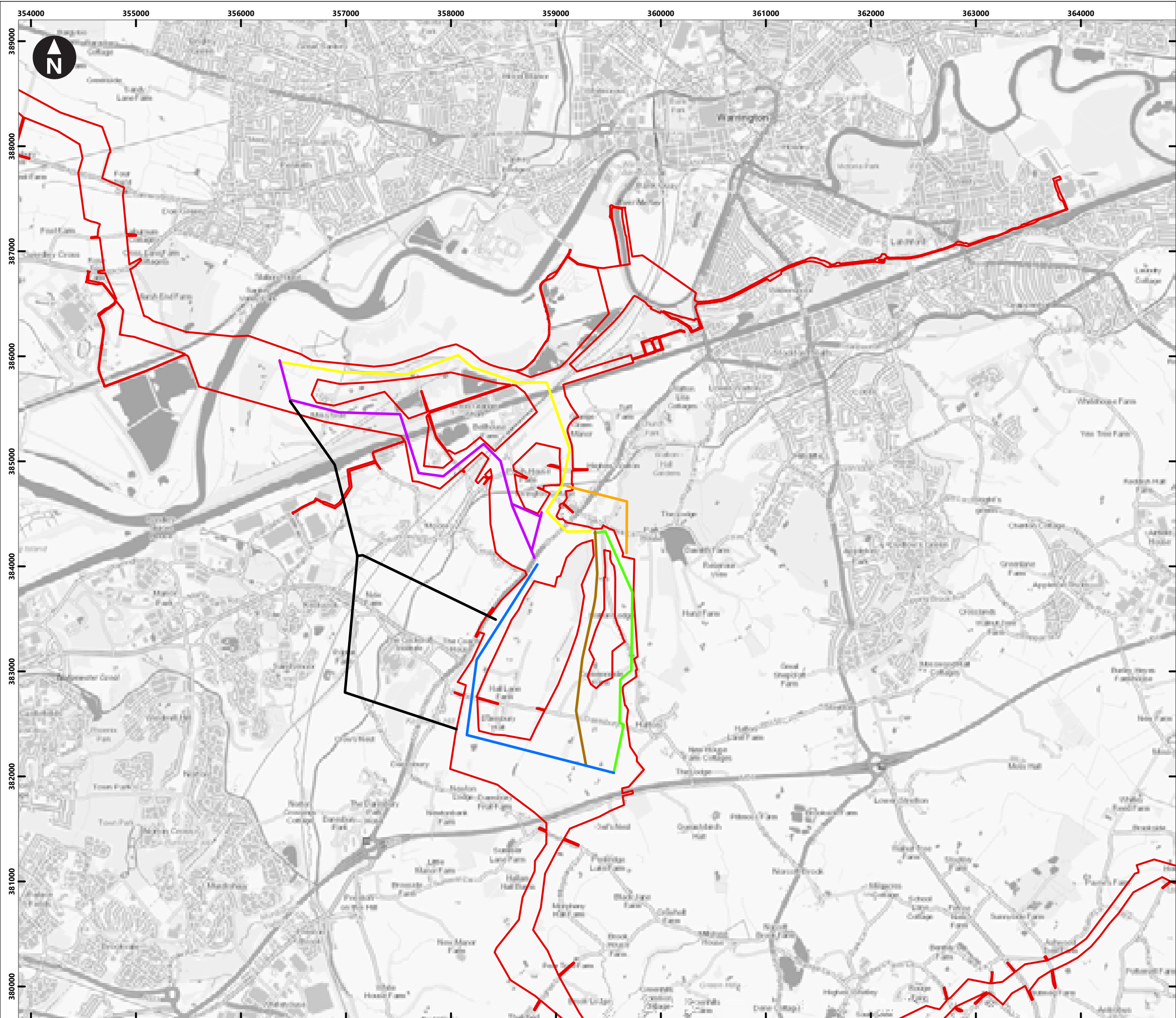
Figure 5.3B
Runcorn/Rocksavage Spur (A&B)

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Key

Preliminary Order Limits

Route Options

- NP1
- NP2
- NP3
- NP4
- NP5
- NP6
- NP7

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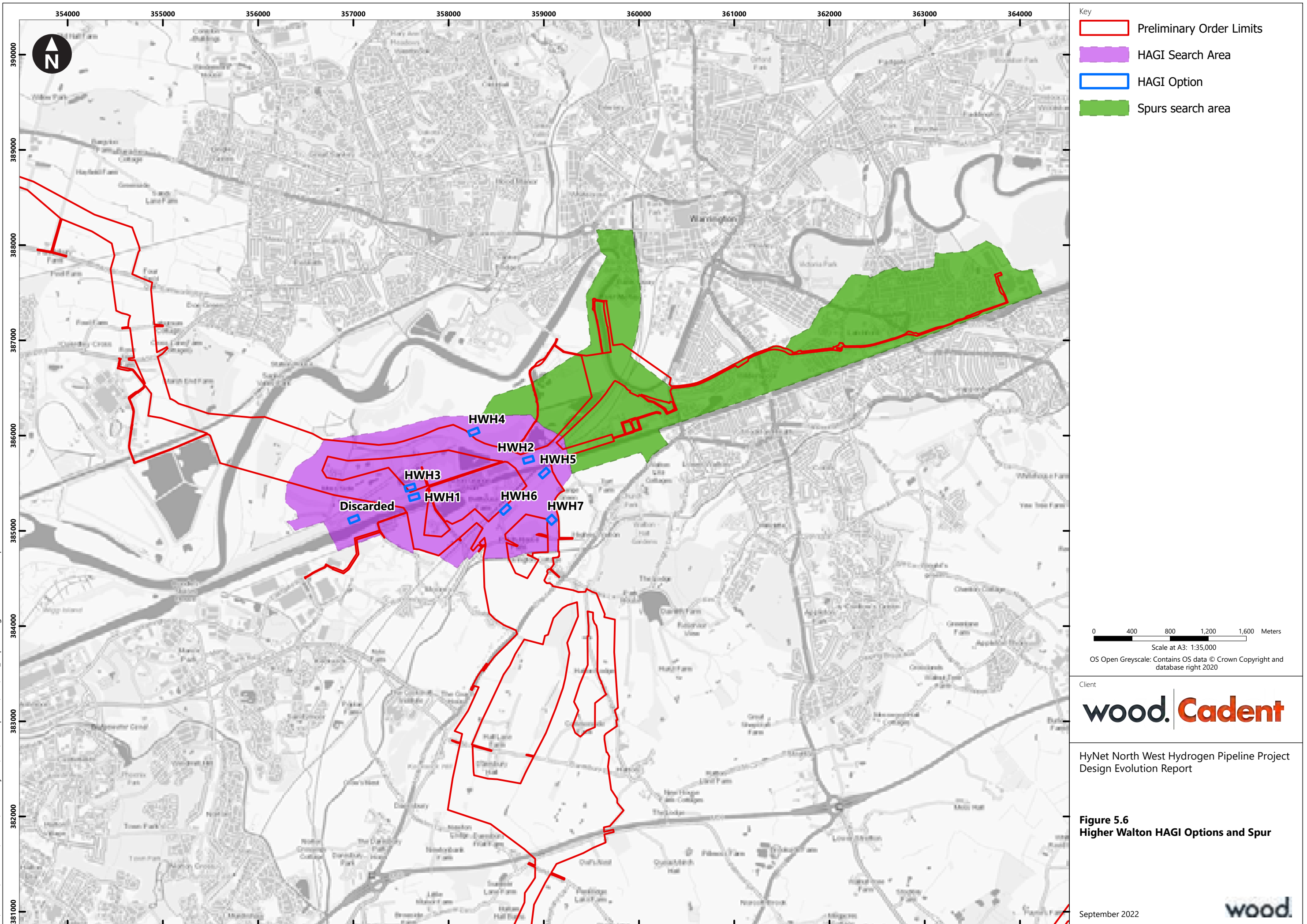
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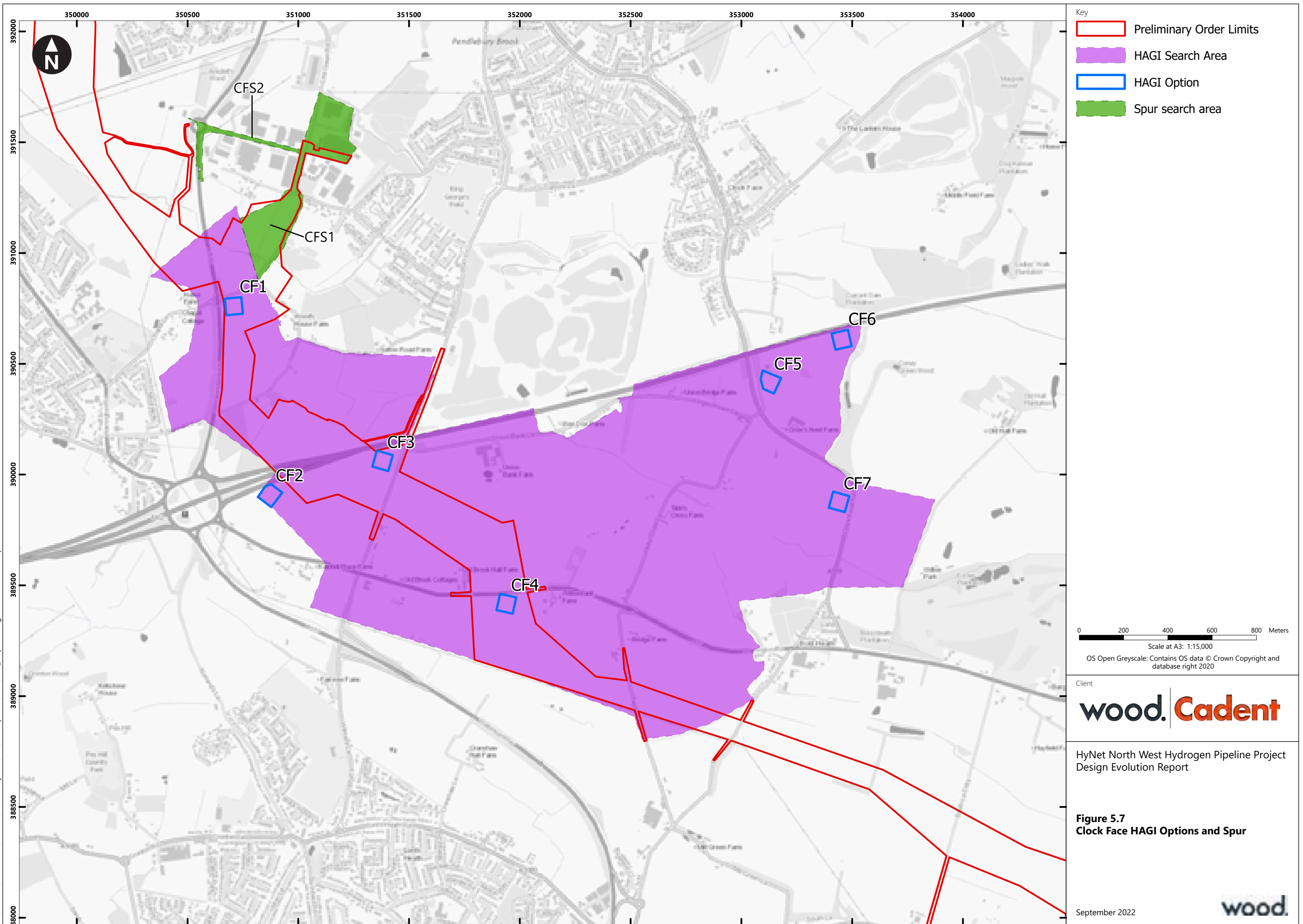
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Figure 5.5
Higher Walton Route Options

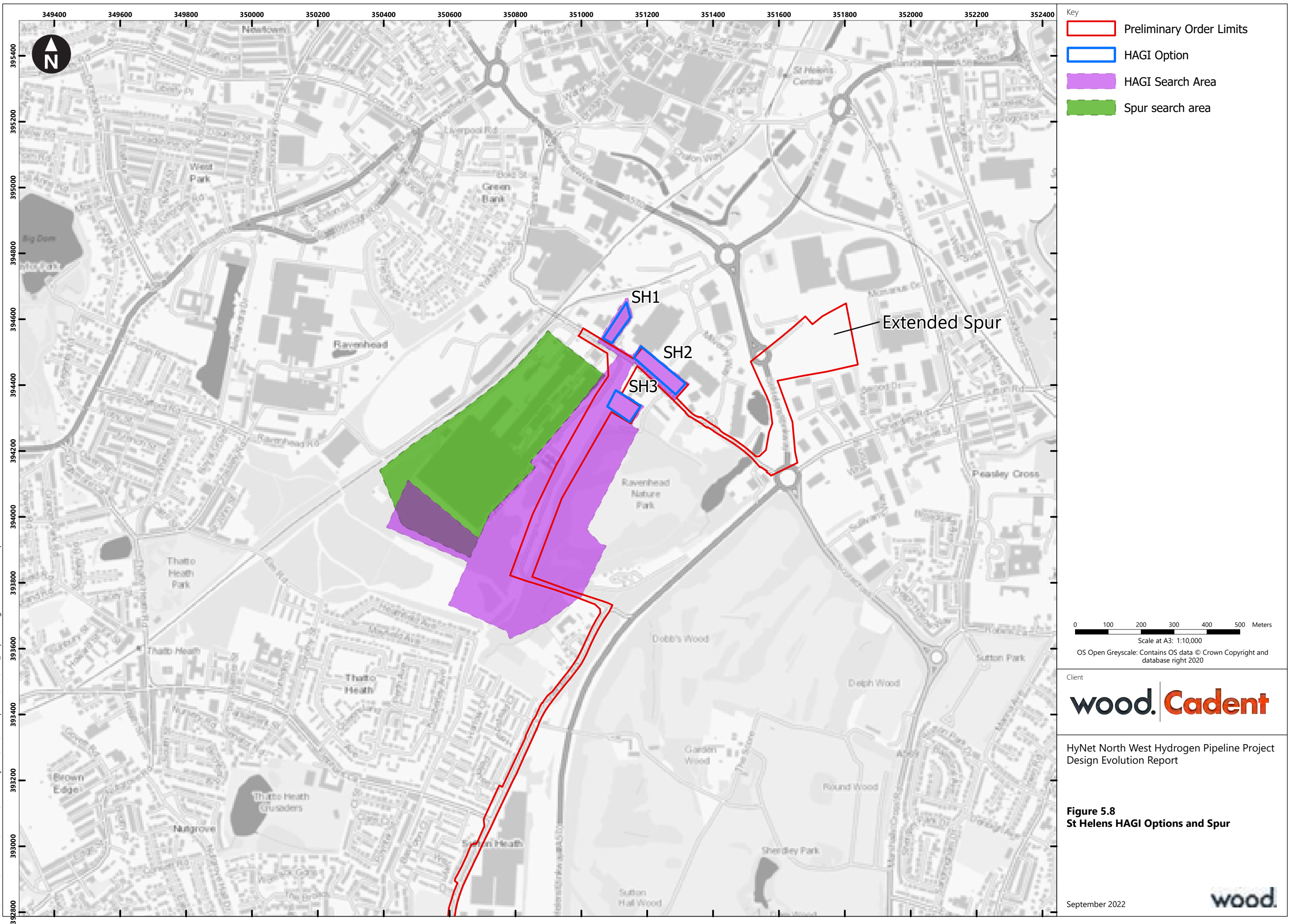
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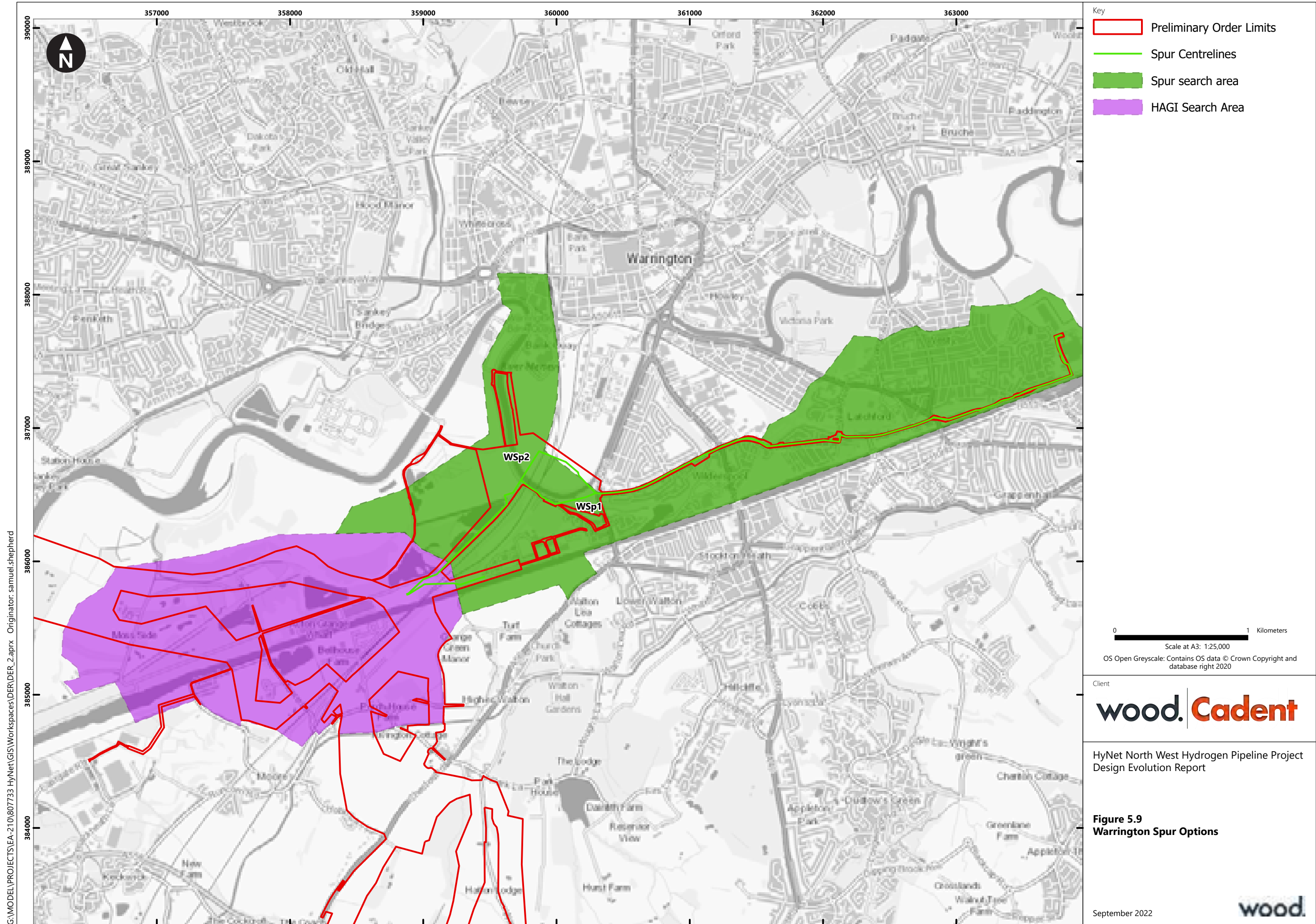


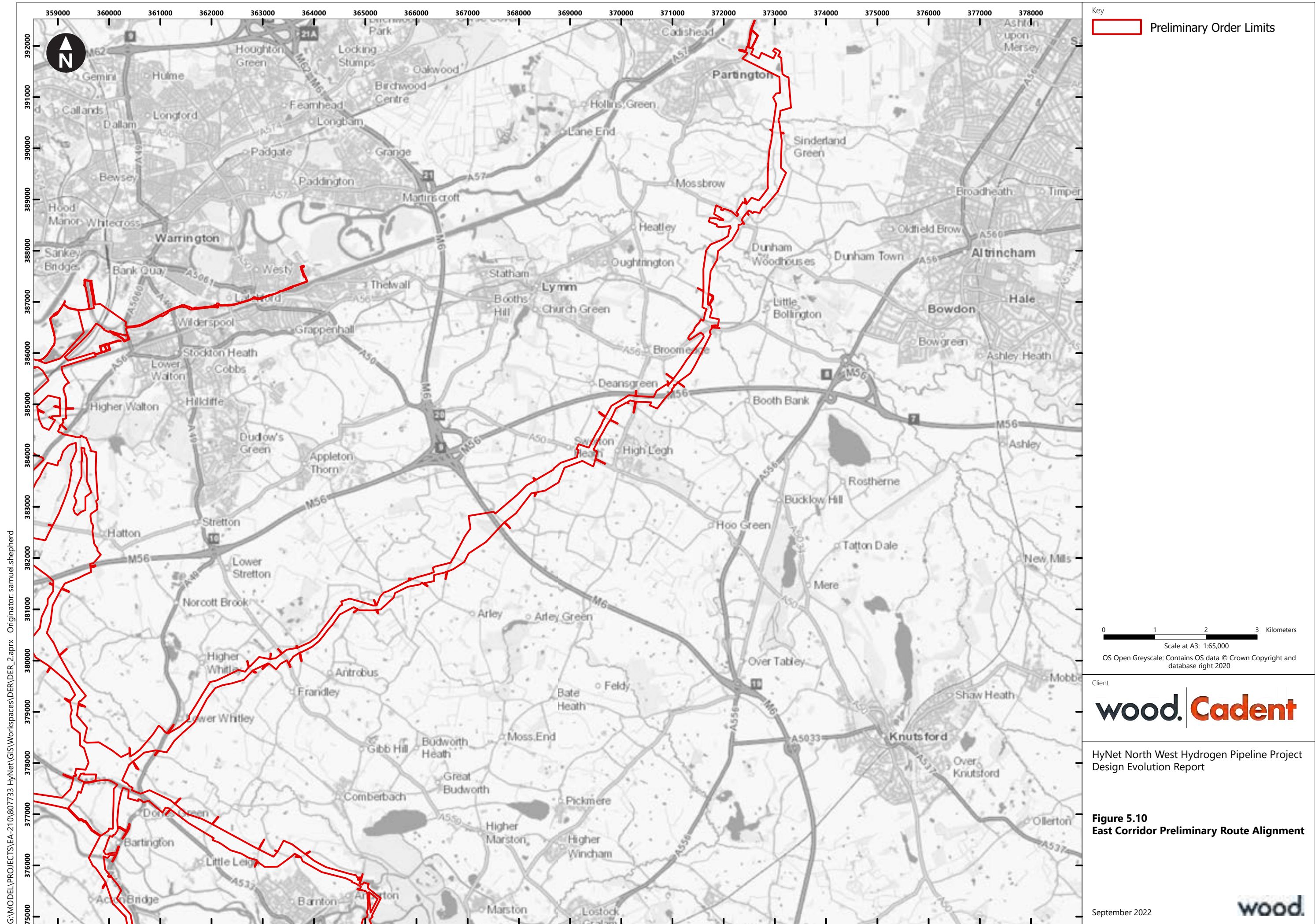
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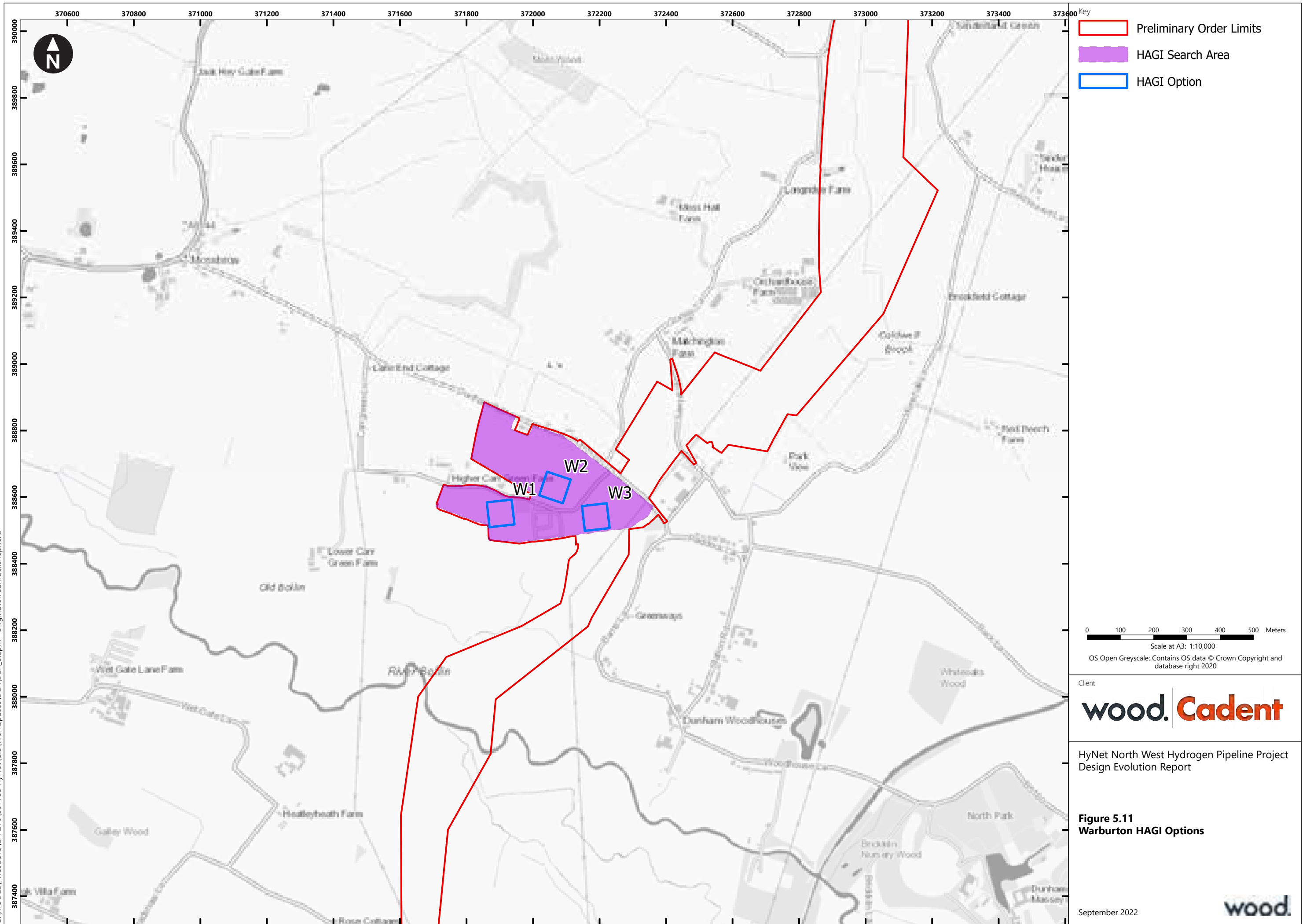
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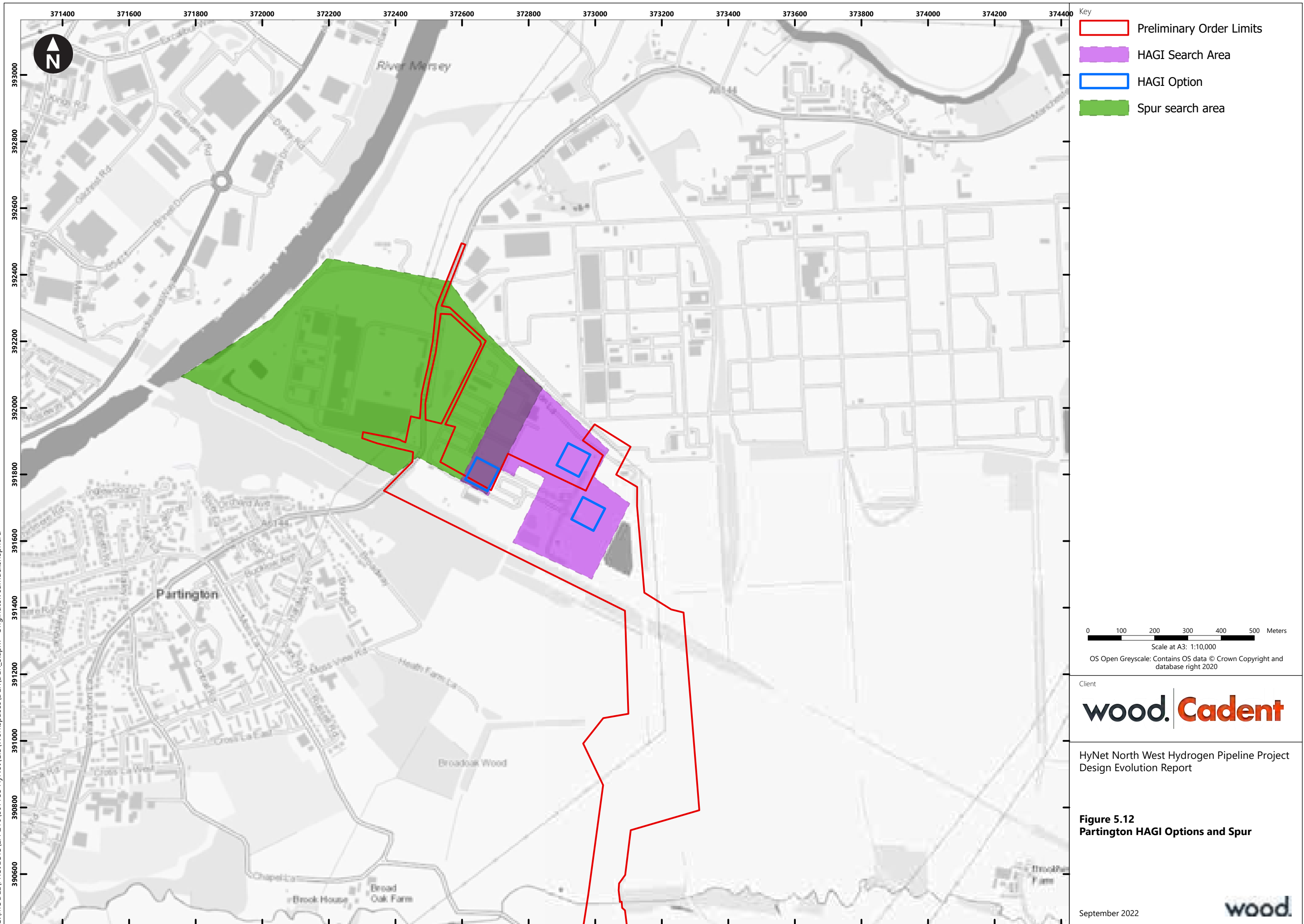


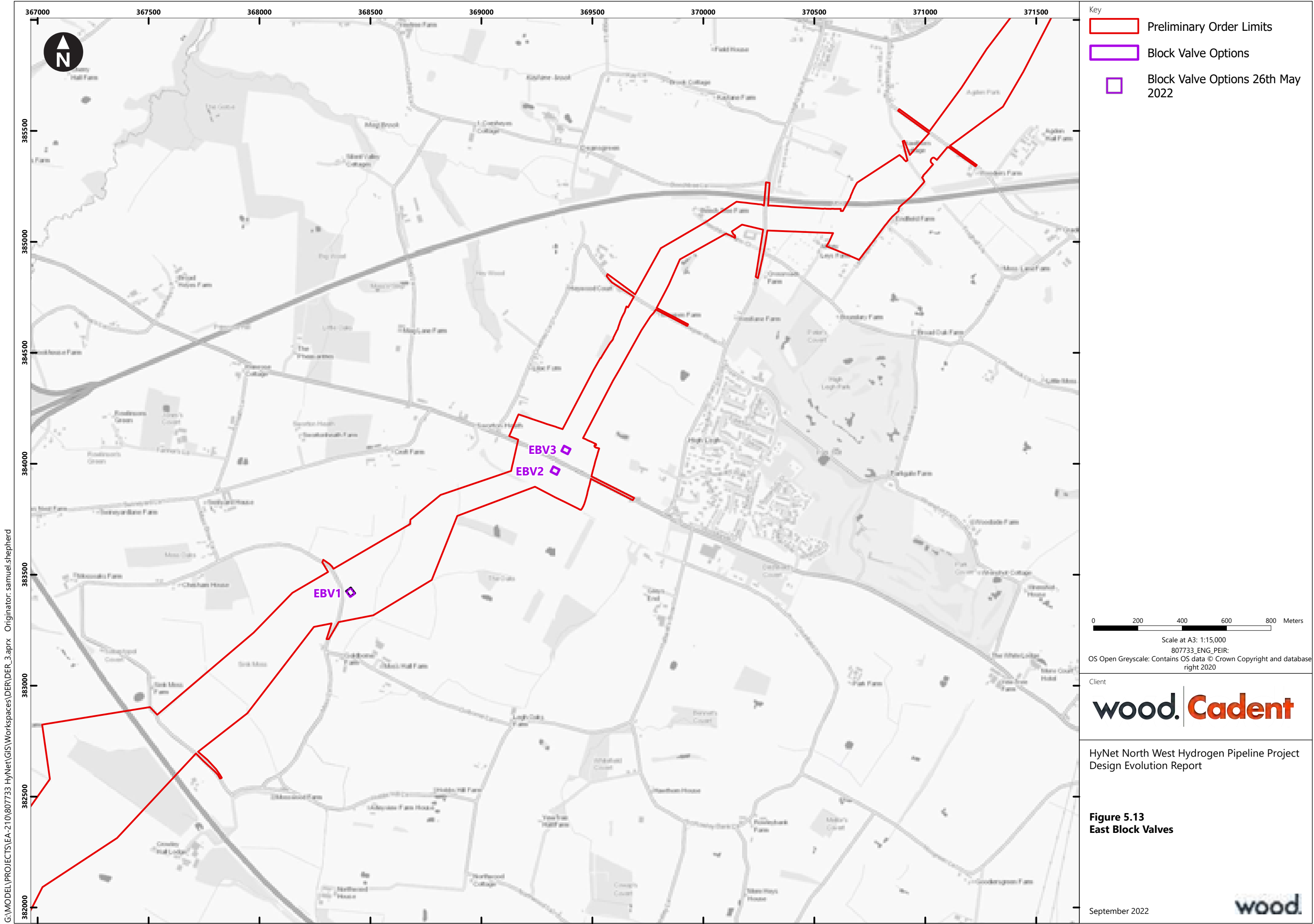


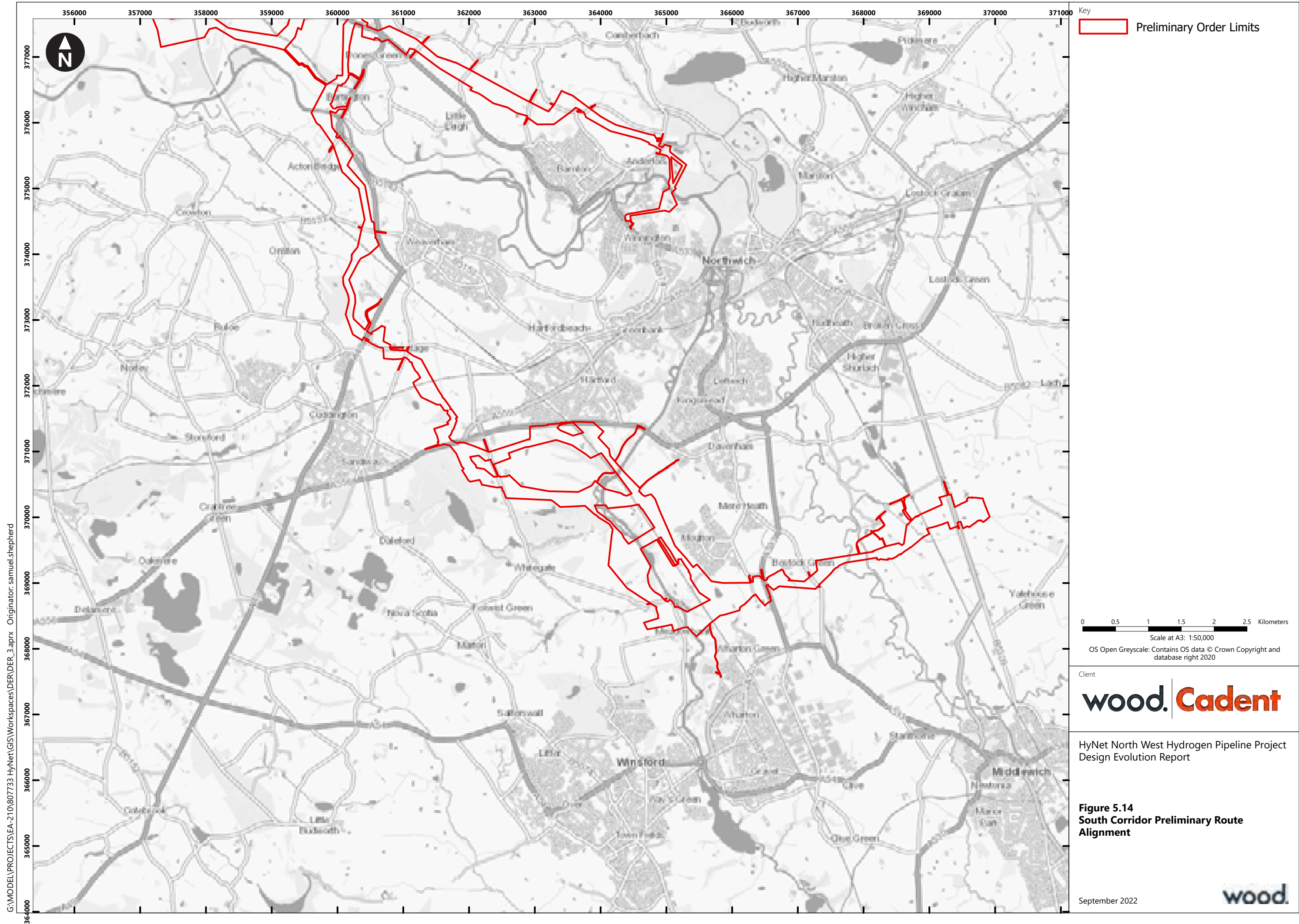
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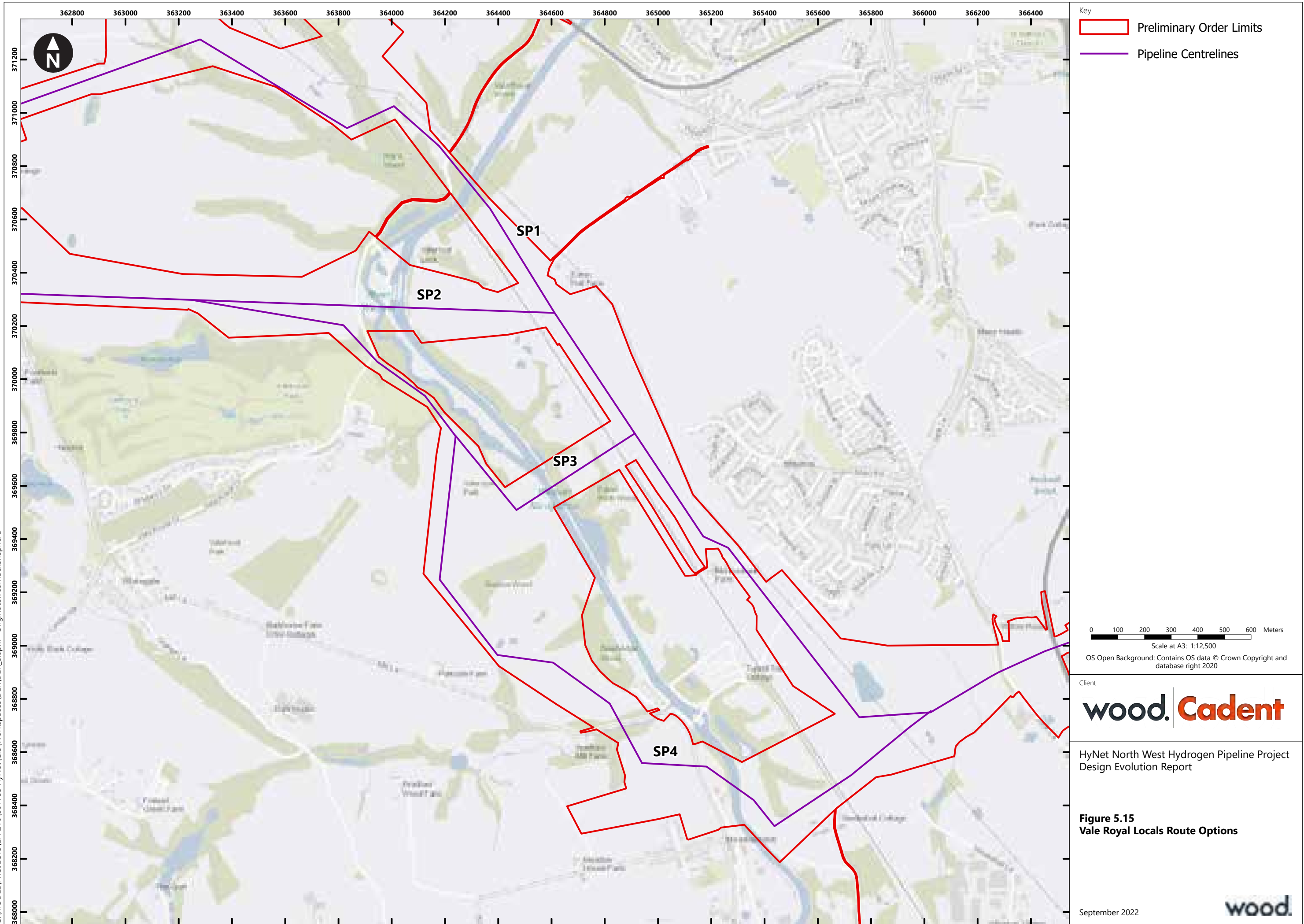
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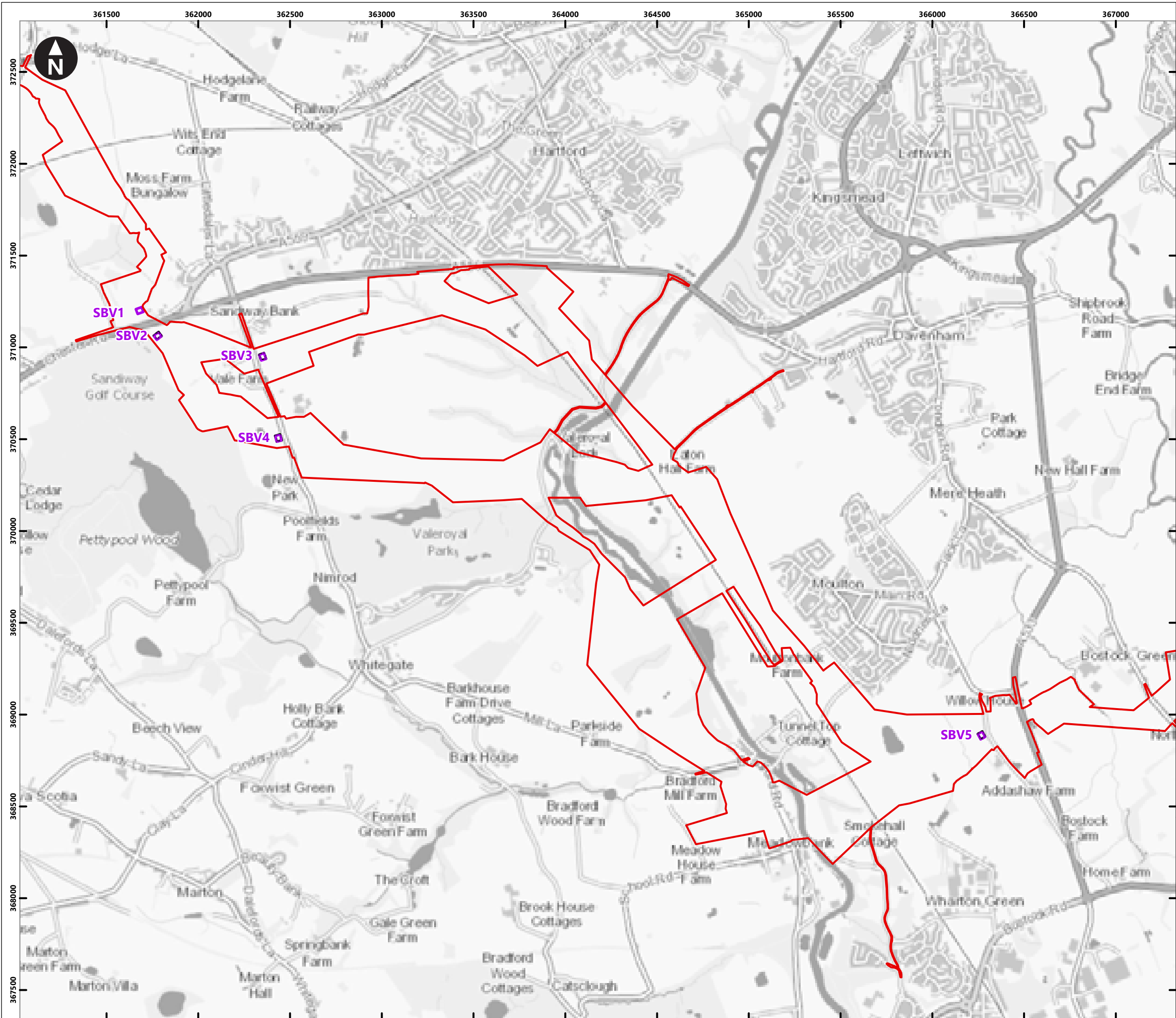




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- Key
- Preliminary Order Limits
 - Block Valve Options
 - Block Valve Options 26th May 2022

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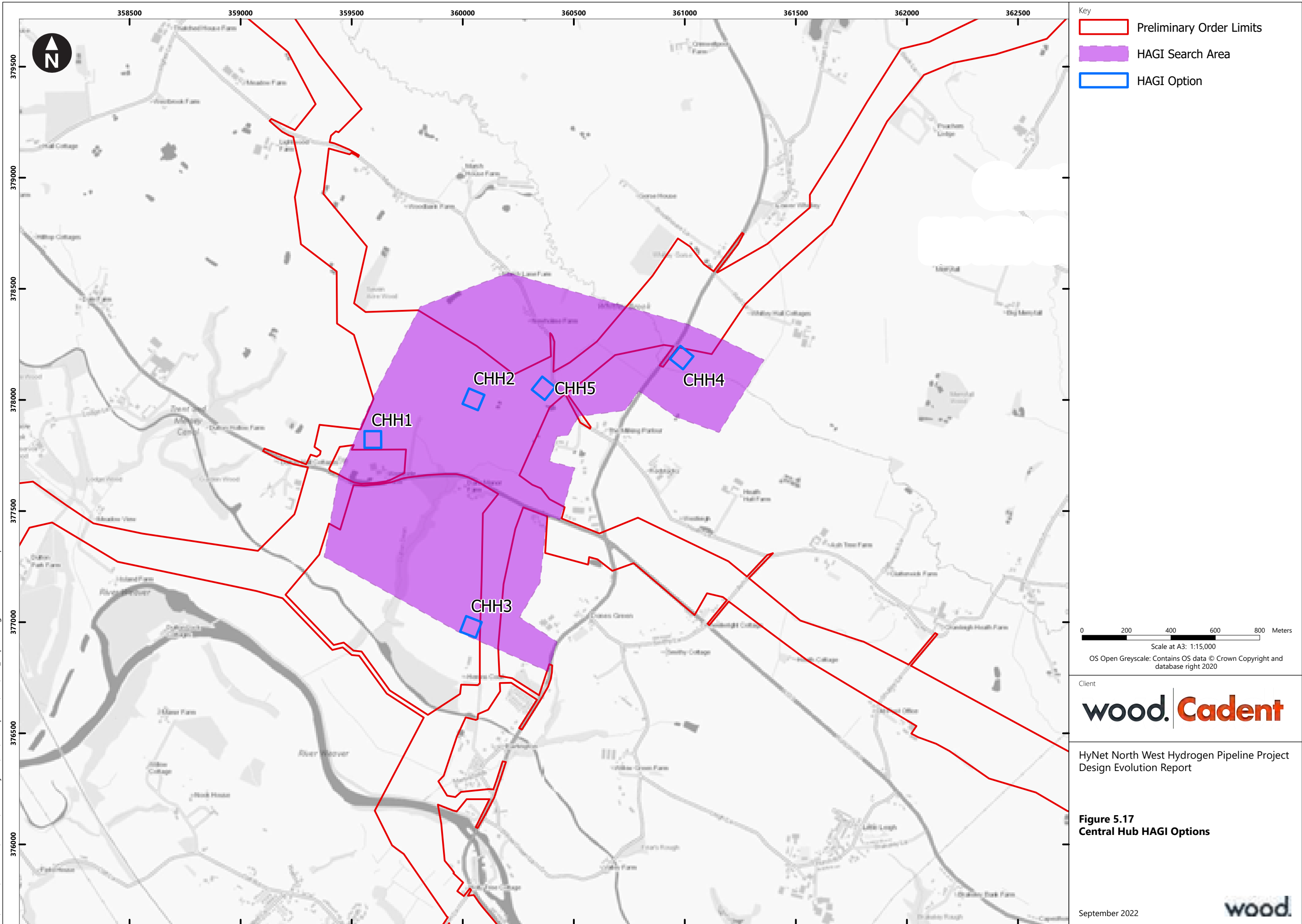
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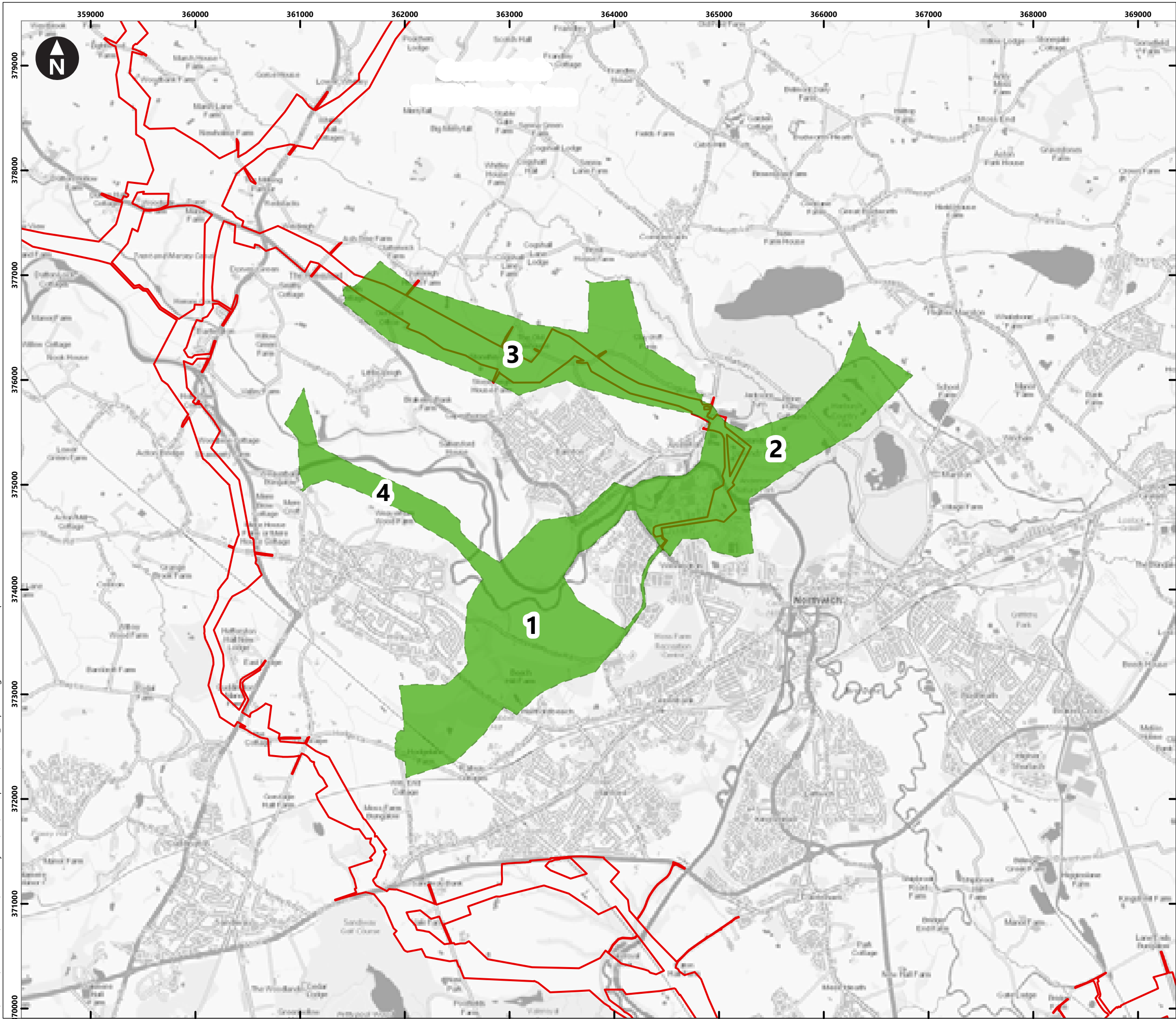
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Figure 5.16
South Block Valves

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Key

- Preliminary Order Limits
- Spurs search area

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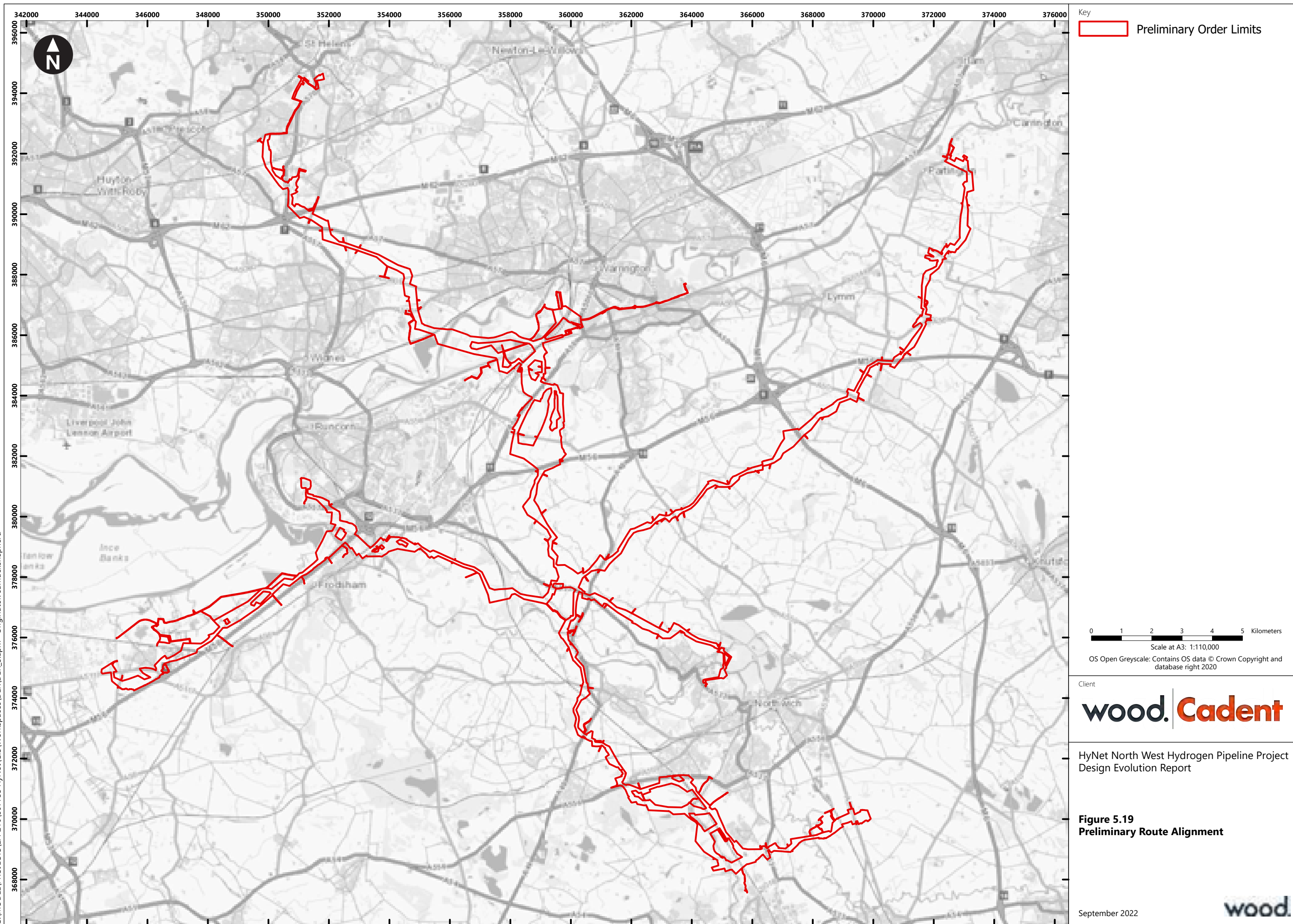
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Figure 5.18
Northwich Spur Option

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