2. The Project

2.1 Background to and Need for the Project

2.1.1 The UK Government has set legally binding net-zero carbon dioxide (CO_2) emissions targets in response to the global climate emergency. This means that by 2050, any CO_2 emissions to the atmosphere must be offset by equivalent emissions removal.

2.1.2 This Preliminary Environmental Information Report is for the HyNet North West Hydrogen Pipeline Project ('the Project'). This is an integral part of the wider HyNet North West programme and the associated removal of emissions described in **Chapter 1: Introduction, Section 1.2**. Further information on the legislative and policy drivers for the Project are outlined in **Chapter 4: Legislation and Planning Policy**.

2.1.3 The HyNet North West programme is being developed in stages, as is necessary and appropriate for the commercial deployment of hydrogen technology. The Project comprises one of the elements of the wider HyNet North West programme. The elements of the wider programme include:

- Production of hydrogen by Vertex Hydrogen at the Hydrogen Production Plant (located at Stanlow Refinery);
- Development of Carbon Capture and Storage (CCS) infrastructure for capture, transport and storage of carbon dioxide from the Hydrogen Production Plant (as well as existing and new build industrial facilities) by Liverpool Bay CCS Ltd; and
- Development of a Hydrogen Storage Facility (HSF) by Inovyn at underground storage caverns in Cheshire to allow for fluctuations in demand.

2.1.4 The Project is of a scale and location in proportion and proximity to the above elements. The aim is to commission the Project for operation in 2027.

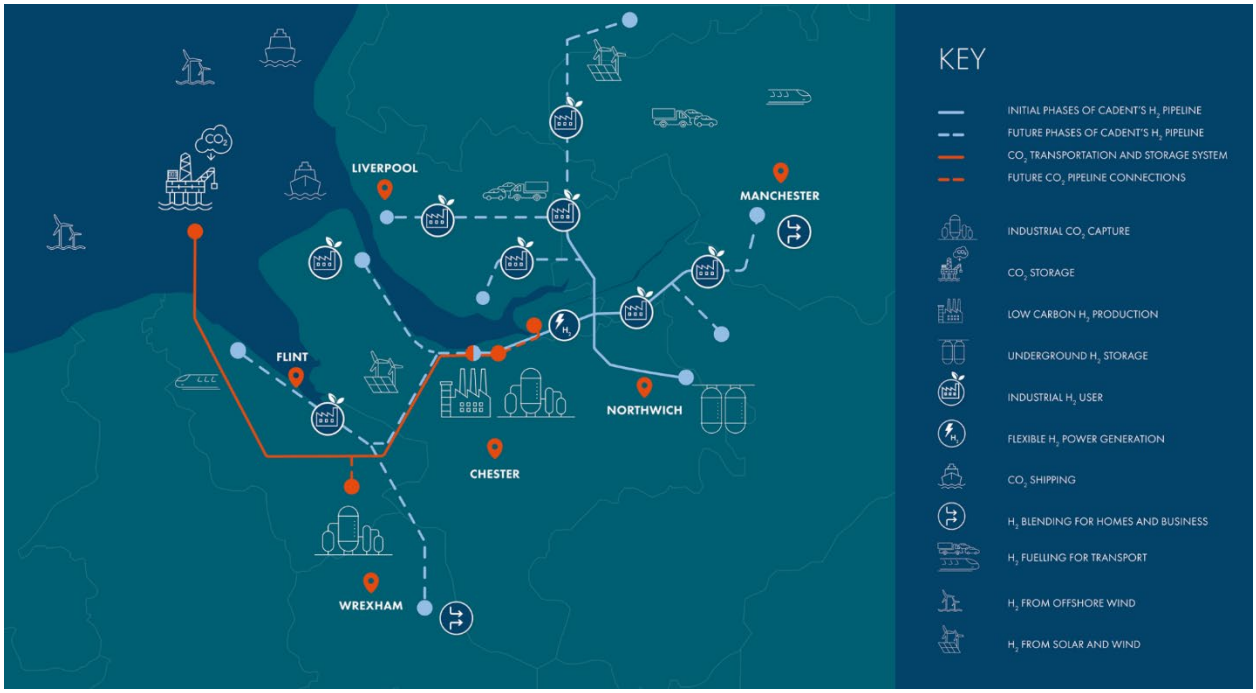
2.1.5 The Project is being designed with foreseeable future phases and usage in mind and the potential to accommodate hydrogen from other sources in the area including sources of blue and green hydrogen.

2.1.6 The key objective of the Project is as follows:

"*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.*"

2.1.7 **Figure 2.1** illustrates the pipeline (labelled 'Initial Phases of Cadent's H_2 Pipeline') element of the Project in the context of the wider HyNet North West programme. This includes illustration of potential future phases of the wider programme. Further detailed description of the Project is provided in **Section 2.4.**

Figure 2.1 Illustration of the wider HyNet North West programme (Source: https://hynet.co.uk/about/).



Note: the figure above is an illustrative representation of the wider HyNet North West programme only. For the HyNet North West Hydrogen Pipeline Project, please refer to **Section 2.4** and the accompanying figures with this PEIR.

2.2 Consideration of Options and Routeing

Introduction

2.2.1 Schedule 4 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017[1] (the EIA Regulations) states that an ES should include:

"*A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects*.".

2.2.2 **Section 2.2** provides an overview of the options and routes considered, and how decisions have been made on those preliminary alignment and options selected,

[1] UK Government (2017). Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended). (Online) Available at: https://www.legislation.gov.uk/uksi/2017/572/contents (Accessed December 2021).

with further details provided within the Design Evolution Report, which has been published as part of the statutory consultation exercise.

Strategic Options

2.2.3 Strategic Options were developed to allow the identification of connection routes between the following defined end points, which the Project needs to connect to:

- Hydrogen Production Plant (at Stanlow Refinery):
  - The initial source of hydrogen supply to the Hydrogen Pipeline Network (HPN).
- Hydrogen Storage Facility (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 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 as a fuel for their operational requirements.

2.2.4 In addition, a number of other industrial customers in the vicinity that wish to be supplied with hydrogen as a fuel for their operational requirements have been identified. The Project is required to facilitate connections to those customers via spurs from the main pipeline route.

2.2.5 Illustrative representations of Strategic Options A-D are provided on **Figures 2.2 A-D**.

Strategic Option A

2.2.6 Strategic Option A forms an ‘X’ shaped configuration, with a central hub (where a junction of the different pipeline sections is located) near to the A553/A49 junction and four sections run out from here: west to Stanlow, north to St Helens, east to Partington and Warburton and south to the Hydrogen Storage Facility. Two alternatives were considered for the southern leg due to the location of Northwich between the Central Hub and the Hydrogen Storage Facility.

Strategic Option B

2.2.7 Strategic Option B forms an ‘H’ shaped configuration. The western leg would run from Stanlow to Frodsham, and the north across the Mersey Estuary to St Helens. The eastern leg would run from Partington, south past Warburton to a location near to Junction 20 of the M6 and then south to the Hydrogen Storage Facility. A central connection section would join the western and eastern legs from near Junction 20 of the M6 to a location near junction 7 of the M62.

Strategic Option C

2.2.8 Strategic Option C is formed from a combination of Strategic Option A and B, with the western, northern and eastern legs being the same as for Strategic Option . The connection to the hydrogen storage facility utilises the option provided in Strategic Option B, with a leg running from near Junction 20 of the M6 to the storage facility.

Strategic Option D

2.2.9 Strategic Option D forms a roughly 'U' shaped configuration, with a western leg running from Stanlow to St Helens across the Mersey Estuary (with a spur off towards Warrington), a southern leg running from Stanlow to the Hydrogen Storage Facility and an Eastern leg from Winsford to Carrington.

Preferred Strategic Options

2.2.10 Each of the Strategic Options has been reviewed against criteria which include considering the following specific issues: the likely length of the pipeline; major road/rail/river crossings (and associated cost, constructability and environmental issues); proximity to population (and associated routeing or connection considerations); conflict with key policy and environmental constraints and the ability for the network to accommodate future expansion in later stages of the wider HyNet North West programme. Each Strategic Option had both positive and negative considerations, however Strategic Option A was chosen as the most appropriate option on the basis that:

- Strategic Option B and D both involved crossings of the Mersey Estuary with the environmental implications of work within or closer to the Special Protection Area (SPA) and Ramsar designations (shown on **Figure 5.1**) and the additional cost from longer sections of large diameter pipeline and difficulty of long-distance drilling required to create the pipeline route.
- Strategic Option C would require an additional hub site, which adds complexities and cost to the construction of the development and requires additional land take

Route Corridor Identification

2.2.11 Within the preferred Strategic Option A, route corridors were then developed to support the EIA Scoping exercise. These followed the direct line routes between connection points where possible, with spur lines identified where needed to make the actual connections. The route corridor boundaries were then drawn to avoid or minimise impacts on items such as built-up areas or identified environmental or construction constraints, such that a pipeline within that route corridor could feasibly be consented and developed. Each route corridor was then considered in more detail with the boundaries refined where possible to further improve the construction viability and minimise any potential impacts.

2.2.12 Within Strategic Option A, single corridors were identified within which the North and East route corridors would be located (**Figures 2.4** and **2.5**), and two options for both the West and South route corridors, were identified (**Figures 2.3** and **2.6**). Spur line options at Runcorn/Rocksavage on the West route corridor and at Northwich, from the Central Hub or South route corridor were also identified

Figures 2.7 and **2.8**). The other spur lines which are needed only contained single corridors and no options.

West Route Corridor

2.2.13 The West Route Corridor (**Figure 2.3**) consisted of:

- West 1: A route running from Stanlow, crossing the M56 to the north of Frodsham, then running to the central hub.
- West 2: A route running from Stanlow and crossing the M56 before heading towards Dunham on the Hill, and then running to the central hub. This route would require a spur running from the corridor to the east of Frodsham, to provide a connection into customers based to the south of Runcorn.

2.2.14 Although the West 1 had increased areas of flood risk, due to the greater pipeline length, flatter topography and greater presence of heritage assets and locally important landscape designations along West 2, West 1 was selected as the most appropriate option to take forward to stage 1 non-statutory consultation.

South Route Corridor

2.2.15 The South Route Corridor (**Figure 2.4**) consisted of:

- South 1: running from Winsford around the southern and western extents of Northwich to connect with the central hub.
- South 2: running from Winsford around the eastern and northern extents of Northwich to connect with the central hub.

2.2.16 Neither corridor provided an obvious preference from an environmental perspective, with the south/west corridor containing slightly more heritage assets, but slightly fewer recreational and ecological assets. From a constructability perspective, South 2 was around 1km longer and although both corridors would cross the HS2 route, the South 1 crossing point was preferrable, being flat, open fields. The South 2 corridor would cross close to the A556 and in an area with some Tree Preservation Orders (TPOs) and Ancient Woodland. In the addition, the South 2 corridor would pass over more land and infrastructure associated with the salt caverns/extractions around Northwich. Due to there being no substantial preference for either corridor, pipeline corridors were developed along both corridors and were taken forward for the Stage 1 non-statutory consultation.

Runcorn/Rocksavage Spur

2.2.17 The Runcorn/Rocksavage Spur (**Figure 2.7**) is needed to connect the West pipeline with industrial customers at Intergen and The Heath Industrial and Business Park. The corridors for this spur consisted of:

- Intergen: the spur would run from the Runcorn HAGI west into the Intergen site and then continue west through other privately owned industrial land, before turning north to reach The Heath.
- The Heath: the spur would run from the Runcorn HAGI in a north west direction through Runcorn Golf Club to The Heath. It would then continue south-west into the Intergen site.

2.2.18 Whilst the Intergen corridor would only require one crossing of the A557 (compared to two crossings for The Heath option) and would avoid Runcorn Golf Club, the Intergen option would be reliant on land being available within the Intergen site to continue the pipeline onto The Heath. Due to disruption this may cause with operations at Intergen it was necessary to maintain both corridors into the non-statutory consultation.

Northwich Spur

2.2.19 The Northwich Spur (**Figure 2.8**) is required to connect Tata Chemicals in Northwich with the pipeline. Four corridors were developed, two leading directly from the Central Hub and two leading from the South Corridor corridors:

- Spur 1: running from the South 1 corridor option in the Gorstage area in a north east direction between Weaverham and Hartford Beach towards Tata.
- Spur 2: running from the South 2 corridor option in the Higher Marston area in a south-west direction across Marbury Country Park towards Tata.
- Spur 3: running from the Central Hub in a south east direction past the eastern side of Barnton and Anderton before running towards Tata.
- Spur 4: running from the Central Hub in a south-east direction to the north of Weaverham before running north-east towards Tata.

2.2.20 All four corridors were included in the non-statutory consultation.

Stage 1 Non-statutory Consultation

2.2.21 The Route Corridors described in paragraphs 2.2.13-2.2.20 (described in the Design Evolution Report as the Preliminary Route Corridors), were identified for the non-statutory consultation exercise event which ran from January to March 2022 and were sufficiently broad (up to a maximum of approximately 2.5km in places) in order for preliminary route alignments to be considered within them. A summary of how the feedback from the Stage 1 non-statutory consultation has shaped the development of the Project is described below (more detail is contained in the Design Evolution Report).

Preliminary Route Alignment/Preliminary Order Limits

2.2.22 Following the Stage 1 non-statutory consultation exercise, the representations received and ongoing engineering and environmental work allowed the corridors to be refined in places to provide a more defined corridor, and for route alignments to be identified within the corridors. The Preliminary Route Alignment subsequently identified (see Design Evolution Report for details) has therefore formed the Preliminary Order Limits which are described and assessed with this PEIR.

West Corridor

2.2.23 Comments received on the West Route Corridor (**Figure 2.3**) from the non-statutory consultation highlighted potential constraints within the Route Corridor (areas of flooding, topography south of the A553 and Runcorn Golf Club on the Runcorn/Rocksavage Spur).

2.2.24 An alignment has been selected around the Sutton Weaver and north of Aston area due to a lower number of water course crossings and a smaller area of flood plain than a route that passed to the south of Alston. In other areas of the West Corridor, particularly between Stanlow and Rocksavage, it has not been possible to avoid flood plain land completely and this matter is therefore addressed further in **Chapter 7** of the PEIR. The land to the south of the A553 was not taken forward as a location for the Central Hub and therefore will only be used for pipeline route and related construction activities where the topography is not a substantial constraint.

2.2.25 On the Runcorn/Rocksavage Spur, comments were received on The Heath option, raising concerns that Runcorn Golf Club would have to close. The spur line would run the golf course here and will take a number of holes of use for a temporary period of time during construction. This may lead to the Golf Club having to close, or partially close, during the construction works and until the restoration work on the holes affected has returned them to a usable condition. We are in the process of commencing discussions with the Club to discuss our proposals. However, the alternative Intergen route corridor would not be feasible due to it running through operational industrial land and the safety issues and disruption to activities which would arise. The Heath route corridor has therefore been taken forward (to Stage 2 statutory consultation and included in this PEIR) as the proposed spur.

North Corridor

2.2.26 Between the M56 and the River Mersey in the North Route Corridor (**Figure 2.4**), two specific corridors were included in the non-statutory consultation (**Figure 2.4a**) to consider the best option for passing a number of constraints in this area: the Creamfields Festival site, built development associated with the Higher Walton and Moore settlements and designations such as TPOs, Ancient Woodlands and nature conservation sites. On the western boundary, a route corridor was shown as NP7 on **Figure 2.4a** was included, plus a widened corridor in the eastern part of the corridor to allow routes to be considered within it. NP7 was between Sandymoor and Moore/Daresbury.

2.2.27 Responses to the non-statutory consultation raised concerns about the proximity to residential properties at Daresbury and to the impact on the Creamfields festival site.

2.2.28 Further baseline work discovered planning permissions (adjacent to Delph Lane) for housing developments along NP7 (between Sandymoor and Daresbury). Engineering work on the NP7 option also identified 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. AS NP7 was also close to properties in the Daresbury area, it was therefore dropped from the corridor.

2.2.29 Options remain within the North Corridor, described in **Section 2.4**, to route appropriately past the Creamfields site.

East Corridor

2.2.30 Comments from the non-statutory consultation raised a number of concerns about the East Route Corridor (**Figure 2.5**) and how it could affect features such as

National Trust owned land, proposals for new housing near Partington, Warburton and Carrington Mosses and the settlement of Lower Whitley. One comment was also received that the pipeline should follow the HS2 corridor to avoid Broomedge.

2.2.31 The East Corridor described in **Section 2.4** shows that the route has been drawn further away from National Trust land at Dunham Massey, to avoid Lower Whitley, to route through planned developments at Partington and to minimise effects on the two Mosses. It is not possible to utilise the HS2 route due to safety issues that could arise from their proximity and conflicting construction schedules. However, the East Corridor has been drawn away from Broomedge.

South Corridor

2.2.32 Comments from the non-statutory consultation raised concerns about South Route Corridor (**Figure 2.6**) over the historic/existing salt and brine mines and on the interaction with the HS2 route. Specific support was received for both South 1, due to there being fewer wildlife designations along the route compared to South 2, and for South 2, due to the there being fewer watercourse crossing along this option.

2.2.33 The South 2 route corridor would have contained a greater length of pipeline running above the salt and brine mines found in this area, and their associated buried infrastructure which includes other pipelines and cables. South 1 was therefore considered to provide a more viable construction route corridor. Some of the wildlife designations identified along South 2 could have been avoided by the detailed routeing work. However, due to the presence of the salt/brine mines and the proximity to some of these wildlife designations, South 2 was discarded and South 1 was taken forward.

Northwich Spur

2.2.34 As the South 1 route corridor was dropped, then the Northwich Spur 2 route (**Figure 2.8**) was no longer available. Comments from the non-statutory consultation raised concerns around various environmental designations along the different spur routes, although some comments noted that there was space within the spur routes to avoid these designations during the detailed routeing works. Comments also raised the presence of the Anderton Boat Lift, a Scheduled Monument, close to Spur 3. Further consideration of the spur routes concluded that Spur 3 would be the preferable route to take forward. Spur 1 would pass through an area of ancient woodland, permitted waste site and Hartford Golf Club. It was also likely to require an additional HAGI to connect to the main pipeline. Spur 4 had substantially more watercourse crossings (Six compared to two on Spur 3) and subsequently passed through greater extents of flood plain land as well. Both Spurs 1 and 4 would have seen pipeline laid in the local highway network. Although Spur 3 does pass close to Anderton Boat Lift and through sections of Marbury Country Park/Anderton Nature Park, the proposed route has been drawn further away from the boat lift and the temporary nature of impacts should mean that any impacts are minimised.

Hydrogen Above Ground Installations

HAGI Search Areas

2.2.35 Within the Preferred Route Corridors, search areas for Hydrogen Above Ground Installations (HAGIs) were also identified in the non-statutory consultation exercise. These were located at points on the pipeline network where connections are required. The locations reflect the decision to avoid key designations or constraints where possible.

2.2.36 There were few specific comments received during the non-statutory consultation exercise about the location of HAGIs within these search areas. Objections were received to the Rocksavage and Runcorn HAGI search areas in general due to ecological designations in this area, suggestions made that HAGIs should avoid ecological designations in other search areas and to the siting of HAGIs in Green Belt land. General comments were also made that HAGIs would be useful in other locations outside of the Project. As these general comments related to connections that are not feasible as part of this project, or would be longer term potential future connections, they have not been considered further here,

2.2.37 The comments received were used alongside other engineering and environmental work to identify specific HAGI options within the search areas and these have been assessed to produce the locations and options identified in **Section 2.4**.

2.2.38 These options have sought to avoid all ecological designations wherever possible or to provide options which minimise the potential effects on the designations. Where a HAGI would be within the Green Belt (Rocksavage, Higher Walton, Clock Face, Warburton and Central Hub), the HAGI and any associated land take for construction is being kept to a minimum and siting considers the Green Belt purposes. Further detail on the HAGIs in the Green Belt and how the Green Belt Assessment has shaped the corridor routeing and HAGI sitings is provided within the Design Evolution Report.

2.2.39 As noted above, other locations that were suggested for HAGIs were mainly requests for HAGIs that could serve other connection points or areas that are outside of the scope of this Project. One comment on the Partington HAGI search area did however suggest a location within the Carrington industrial area would be more appropriate as it is a brownfield site and it would minimise groundworks in the open countryside. However, the Partington search area is already within brownfield land and a location within Carrington would still need a pipeline through open countryside to reach it. Such a location would also result in a longer length of pipeline and as such there are not considered to be any benefits from a Carrington location.

Rocksavage and Runcorn HAGI options

2.2.40 Within the West Route Corridor, seven HAGI options were considered (**Figure 2.9**) in the Rocksavage and Runcorn area. Five options south of the Weaver Navigation to allow connection to the Runcorn/Rocksavage Spur and two options north of the Weaver Navigation, on the Runcorn/Rocksavage Spur, to provide a connection to the different industrial customers. Options RSH4 and RSH5 were discarded to the south of the Weaver Navigation due to their proximity to the

Frodsham Substation and location within a restored landfill site respectively. Option RSH3 to the east of the M56 was moved to be outside of an area of historic landfill. RSH1, RSH 2 and the revised RSH3 have been taken forward into this PEIR. North of the Weaver, RH 1 was ruled out as topographically challenging, with RH2 carried forward as the preferred option, re-positioned slightly to the east to accommodate a change in the preferred route of the Runcorn/Rocksavage Spur.

2.2.41 HAGI options (RSH1, RSH2 and RSH3) are therefore being taken forward as HAGI options for the Rocksavage HAGI and RH2 for the Runcorn HAGI.

Higher Walton HAGI options

2.2.42 Eight HAGI location options were considered in the Higher Walton area to provide a connection point to the Warrington spur. The high number of options considered was due to the multiple route options identified in this area between the M56 and River Mersey (**Figure 2.10**). One option was discarded after the NP7 route option was dropped and HW4 was discarded as it was within a licensed landfill site. Options HW5, HW6 and HW7 were also discarded due to their location south of the Manchester Ship Canal and the need for additional crossings (by the Warrington Spur line) of the rail lines and canal.

2.2.43 The Higher Walton HAGI options therefore include HW2 to the east and to the west HWH2 was combined with HWH1 to be taken forward as a single HAGI option (known as HWH1). These two options are required due to the routeing options identified.

Cuerdley HAGI – now discounted

2.2.44 A HAGI search area was identified at Cuerdley as a potential facility to provide connections for future expansion of the hydrogen network (**Figure 2.11**) and three options were initially identified within this area. However, further examination showed that the Clock Face HAGI could accommodate this potential facility and therefore the Cuerdley option was dropped and is not being taken forward as a HAGI.

Clock Face and Burtonwood HAGI options (Burtonwood – discounted)

2.2.45 A cojoined search area for Clock Face and Burtonwood was identified (**Figure 2.12**) which covered a large amount of land between Bold Heath, the M62 at Crows Nest Farm, junction 7 of the M62 and the A557/Chapel Lane junction. Within this area, a single option at A557/Chapel Lane (CF1) and three HAGI options near to junction 7 (CF2 CF3 and CF4) were identified for potential Clock Face HAGI locations, and three options near to Crows Nest Farm (CF5, CF6 and CF7) were identified as the potential Burtonwood HAGI locations.

2.2.46 The Clock Face HAGI was to serve the Lea Green connection and to allow potential future connections to be made, with the Burtonwood HAGI to provide potential future connections. Further work identified that a single HAGI in the Clock Face search area could provide the connections to the Lea Green connection plus the potential future connections for both Clock Face and Burtonwood. The Burtonwood search area/HAGI options CF5, CF6 and CF7 were therefore able to be discounted.

2.2.47 The assessment of the four Clock Face HAGIs identified CF3 as the option to take forward, as CF1 and CF4 both raised issues with the Green Belt and access for CF2 from the highway was not as good as for CF3.

St Helens HAGI options

2.2.48 Three HAGI options were identified in St Helens to provide connections to serve industrial customers in this location (**Figure 2.13)**. Two of these options (SH1and SH3) were found to be within areas of historic landfill.

2.2.49 Option SH2 has therefore been selected as the St Helens HAGI option.

Warburton HAGI options

2.2.50 Three HAGI options were considered at Warburton to allow a connection to be made to the natural gas network (**Figure 2.14**). W1 is located within a Local Wildlife Site and both W1 and W2 are situated close to existing pipeline serving the natural gas network.

2.2.51 Option W3 was therefore selected as the Warburton HAGI option.

Partington HAGI options

2.2.52 Three options were also initially considered at Partington to allow a connection to the natural gas network and to industrial customers (**Figure 2.15**). However, due to planned development in this area these three options could not be pursued, and a different location was identified within the search area which was free from constraints and the footprint of the planned development.

2.2.53 This new option was taken forward as the Partington HAGI option.

Central Hub HAGI options

2.2.54 Within the Central Hub five options for a HAGI were considered. This HAGI would provide the connection point between each of the four corridors and also connect the Northwich spur to the network (**Figure 2.16**). Options CHH3, CHH4 and CHH5 were discarded due to potential impacts on the Green Belt, Options CHH3 and CHH4 being within, or close to minerals safeguarding areas and Option CHH4 close to an area of flood risk.

2.2.55 CHH2 has been moved slightly to the north to provide sufficient space for the associated working areas and construction compounds needed around the HAGI.

2.2.56 CHH1 and the amended CHH2 have therefore been taken forward as the Central Hub HAGI options.

Block Valve options

2.2.57 On the East Corridor three options for a Block Valve have been identified and are discussed further in **Section 2.4**. All three options are being taken forward as the East Corridor Block Valve options.

2.2.58 Within the South Corridor, five options for a Block Valve have been identified and are discussed further in **Section 2.4**. All five options are being taken forward as the South Corridor Block Valve options.

Other Consultation Responses on Route Corridors

2.2.59 A number of other comments were received through the non-statutory consultation exercise which provided potential suggestion to alternative routes that were applicable to the scheme as a whole. These included suggestions that the pipeline should following existing infrastructure corridors such as the M56, the Manchester Ship Canal, the route of existing or redundant pipelines or that it could re-purpose redundant pipelines. Largely due to viability and safety issues around the construction or operation of a pipeline, these options are not feasible for substantive lengths of the proposed pipeline. Working in or adjacent to motorways, canals or existing pipelines raises safety concerns over the structural integrity of existing infrastructure, traffic collision risks or working in and around water. Re-purposing pipelines for hydrogen use would also have been difficult as not all pipelines would be constructed to the standards required for hydrogen transportation or in the correct locations. Some concerns were also raised about the proposed route crossing or developing in proximity to infrastructure of these types, due to concerns over damage to existing features and subsequent safety issue arising. Where the proposed pipeline does need to cross, or comes close to, other utility lines or transport infrastructure, the design accommodates all relevant safety measures that are identified in UK legislation and guidance.

2.2.60 Other generic comments raise concerns about impacts from either the pipeline or from HAGIs on local communities or on environmental matters. The entire design of the pipeline is taking into consideration the potential impacts for both construction and operations on local residents and the environment. Further details on how these matters are being assessed, avoided or minimised where possible or where mitigation is being proposed to manage any issues which could occur is provided within the topic chapters of this PEIR (**Chapters 5** to **18**). This detailed assessment will continue to DCO submission where a full assessment of all identified matters will be included within the ES.

Remaining options within Preliminary Order Limits

2.2.61 Where options remain within the Preliminary Order Limits identified in this PEIR they are described in the project proposals (**Section 2.4**) and consultation brochure. The inclusion of these options will mean they can be assessed in the PEIR and be subject to public consultation at the Stage 2 statutory consultation. The result of these activities and ongoing engineering design work will help to guide the final choice of the options.

2.3 Design envelope approach for PEIR

2.3.1 In order to establish the scope of environmental assessment, the PEIR adopts a parameter-based design envelope approach, having regard to the Planning Inspectorate's Advice Note Nine (The Planning Inspectorate, 2018[2]). The ES will do the same. This approach, known as the 'Rochdale Envelope' Approach, is employed "*where the nature of the Proposed Development means that some*

[2] The Planning Inspectorate (2018). Advice Note Nine: Rochdale Envelope (Version 3). (Online) Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-nine-rochdale-envelope/ (Accessed December 2021).

details of the whole project have not been confirmed" and "*flexibility is sought to address uncertainty.*"

2.3.2 Assessing the Project using this design envelope approach means that the assessment will consider a maximum design scenario which allows flexibility to make design decisions in the future that cannot be finalised at the time of publication of this PEIR, or for the Development Consent Order (DCO) Application in due course.

2.3.3 The use of this approach for the PEIR enables the Environmental Impact Assessment (EIA) to be based on a description of the location, design and size of the Project that is suitable to allow a preliminary assessment of its likely significant environmental effects, and includes the information reasonably required to enable a properly informed response to the consultation. Further details are provided in **Chapter 4**.

Order Limits

2.3.4 **Figure 2.17** (and **Figure 1.1**) illustrate the proposed Preliminary 'Order Limits', which is the presently anticipated maximum extent of land in which the Project may take place. The Preliminary Order Limits cover the entire area within which development could take place, as understood at this stage of project design. As well as the permanent features (including the pipeline, HAGIs and Block Valves) these include areas to account for temporary construction works including compounds, accesses and other temporary works including drainage.

2.3.5 At this stage of the project design the Preliminary Order Limits include optionality for certain infrastructure elements at certain locations, including the route of the pipeline and location of HAGIs and Block Valves (see **Section 2.4** for further details). This is to allow design flexibility for the following reasons:

- to take account of ongoing engineering development;
- to allow for refinement based on the findings of planned geotechnical, topographical, walkover and utility surveys
- to allow for design changes in light of on-going environmental surveys and assessment; and
- to take account of feedback received through engagement, including through consultation events with the public, key stakeholder meetings and discussions with landowners.

2.3.6 The Preliminary Order Limits that informed this PEIR were determined by taking into account factors including key connection points to the Hydrogen Production Plant at Vertex Stanlow, the Inovyn Hydrogen Storage Facility, required HAGIs, gas network blending points and the spurs to connect to identified industrial customers. The design of the Project and Preliminary Order Limits will also be further refined and evolve through the EIA process based on the further information to be collected that is outlined above.

2.3.7 This is expected to include narrowing of the Order Limits and application of limits of deviation, tailored to the different pipeline diameters. Indicative widths of the

Order Limits and limits of deviation to be applied at the application stage are provided in **Table 2.1** for typical open cut sections of pipeline.

Table 2.1 Indicative limits of deviation for pipeline

Pipeline size	Pipeline diameter	Indicative width of Order Limits	Indicative limits of deviation
Very large	36 – 42”	104m	60m
Large	24 – 30”	96m	60m
Medium	16 – 18”	80m	50m
Small	6 - 12’’	Within the highway boundary (including verges)	Within the highway boundary (including verges)

2.3.8 As detailed further in **Section 2.5**, limits of deviation will vary due to the requirements of trenchless crossings and HAGIs. The refinement of the design will include HAGIs, Block Valves and also refinement of optionality.

2.3.9 It is currently anticipated that the Project as a whole will be included within the Order Limits, including the spurs which will be included as ‘associated development’ (in accordance with the Annex to the Secretary of State’s Direction under section 35 of the Planning Act 2008).

2.4 Development Proposals

Introduction

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

2.4.2 The EIA Scoping Opinion[3] also required that the scenario for decommissioning be considered as part of the Project. See **Section 2.7** for further information.

[3] The Planning Inspectorate (2022). Scoping opinion Proposed: HyNet North West Hydrogen Pipeline Project Case Reference: EN060006. (online) Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN060006/EN060006-000019-EN060006%20-%20Scoping%20Opinion.pdf (Accessed August 2022).

2.4.3 The pipelines that make up the network would vary in diameter between approximately 6” and 42” dependent on which corridor or spur they are on. Two main types of pipe expected to be used are Carbon Steel (CS) and Polyethylene (PE) pipes. The pipeline would be buried along the entire route apart from short sections within secure compounds at locations where HAGIs and Block Valves are required. It is currently envisaged that ten HAGIs and two Block Valves would be required at points along the network. The description of a typical HAGI and a Block Valve is provided in **Section 2.4** with further details on operation provided in **Section 2.6**.

2.4.4 The pipeline would be constructed predominantly using open cut techniques; where open cut is not practicable trenchless crossing techniques will be used at key locations including motorways and major highways, rail, rivers (typically those classed as main rivers, but some may be ordinary watercourses) and canals. These techniques are described in **Section 2.5**.

2.4.5 A Crossing Schedule is provided in **Appendix 2A** and illustrated in **Figure 2.18** which includes the location and grid reference, the type of feature being crossed and whether this would be an open cut or trenchless crossing. Note, due to the linear nature of the corridors and spurs on the Project and also the features being crossed, some features may be crossed more than once.

2.4.6 The following description highlights the location of the anticipated trenchless crossings required on each corridor or spur. For full details of features that would be crossed including minor roads, tracks, drains/streams and utilities please refer to **Appendix 2A** and **Figure 2.18**.

2.4.7 In some locations it has been necessary to retain optionality (e.g., route options for complex trenchless crossing locations and sites for HAGIs and Block Valves) at this stage. These options will be subject to further analysis and design development through ground investigation, environmental surveys and landowner/stakeholder consultation.

2.4.8 Where optionality remains, these are detailed in the following descriptions. The assessment of optionality is described in the technical chapters of this PEIR. The optionality for the route, HAGIs and Block Valves will be refined as part of the ongoing design, assessment and consultation process, with the refined design presented in the DCO application and assessed in the accompanying Environmental Statement.

Central Hub HAGI Options

2.4.9 The Central Hub HAGI is the common connection point on each Corridor, for which there is two options which are described below.

2.4.10 The Central Hub HAGI Options (CHH1 to CHH2) are shown in **Figure 2.17**, Sheet 9. CHH1 is located approximately 160m north of the A553 (Northwich Road) in an agricultural field to the rear of Woodside Farm. The field is generally bound by hedgerows with some existing gaps.

2.4.11 CHH2 is further north and approximately 380m from the A553 along an existing hardstanding track leading to an area of hardstanding used for storage and the adjacent field that is with hedgerows and occasional mature trees at the edges.

West Corridor

2.4.12 The West Corridor of the Preliminary Order Limits (**Figure 2.17**, Sheet 1 to 9) would start at the Hydrogen Production Plant HAGI (HPP HAGI) at Stanlow with the pipeline running approximately 9.7km northeast to the Rocksavage HAGI and then approximately 9.7km southeast to the Central Hub HAGI. The pipeline would be High Pressure and diameter is anticipated to be 42".

2.4.13 The West Corridor is typically characterised by open fields with hedgerows and tree lines separating them. The pipeline would be between approximately 1.5km and 2km from the Mersey Estuary SPA and Ramsar at the nearest point. The West Corridor includes eleven trenchless crossings as outlined in **Table 2.2**.

2.4.14 The HPP HAGI (see **Figure 2.17**, Sheet 1) would be located within the south-easterly extent of the Essar Stanlow site, approximately 30m north of the A5117 and 180m west of Pool Lane.

2.4.15 There are three options for the location of the Rocksavage HAGI described in paragraphs 2.4.17 to 2.4.19.

Table 2.2 West Corridor Trenchless Crossings

West Corridor – Hydrogen Production Plant HAGI to Central Hub HAGI		
Section	Crossing Type	Crossing Name
Hydrogen Production Plant HAGI to Rocksavage HAGI	Road (A)	A5117
	Road (A)	A5117
	Rail	Ellesmere Port to Warrington Line
Rocksavage HAGI to Central Hub HAGI	River	River Weaver
	Road (M)	M56 Motorway Viaduct
	Rail	Chester to Manchester Line
	River	Weaver Navigation
	Road (A)	A56
	Rail	West Coast Main Line
	River	Trent and Mersey Canal

West Corridor – Hydrogen Production Plant HAGI to Central Hub HAGI		
	Road (A)	A533

Options within the West Corridor

2.4.16 There are two pipeline route options (Option WP1 and WP2, see **Figure 2.17**, Sheet 3 to 4) around the Hover Force Outdoor Activity Centre. These are approximately 300m apart from the centre of each option with key factors to consider in confirming which option to use including proximity to overwintering bird habitats and engineering feasibility. Either option would be constructed using open-cut techniques.

2.4.17 There are three options identified for the location of the Rocksavage HAGI (Option RSH1, RSH2 and RSH3, see **Figure 2.17**, Sheet 5). RSH1 is located in an agricultural field approximately 100m north of the M56 at the nearest point and 150m southwest the centre of the River Weaver.

2.4.18 RSH2 is located on land bound by the M56 approximately 300m to the northwest, 220m from the centre of the River Weaver to the southwest, 180m from the Weaver Navigation to the northeast and 150m from the railway viaduct to the southeast. RSH3 is also located on the same area of land but is in an area of woodland with the M56 approximately 30m to the northwest.

2.4.19 There are two further pipeline options (Option WP3 and WP4, see **Figure 2.17**, Sheet 5) southeast of the Rocksavage HAGI. The options split following the trenchless crossing of the Chester to Manchester Line railway. WP3 runs northeast from here and includes a trenchless crossing of the Weaver Navigation, passes north west of properties on the A56 and then switches southeast with another trenchless crossing of the A56. WP4 heads broadly northeast with a single trenchless crossing of the A56 and the Weaver Navigation and passes to the southeast of the properties on the A56. At Sutton Hall, both options could proceed north or south of this Grade I Listed Building.

North Corridor

2.4.20 The North Corridor of the Preliminary Order Limits (**Figure 2.17**, Sheet 9 to 22) would start at the Central Hub HAGI with the High Pressure pipeline running approximately 9.2km north to the Higher Walton HAGI and then approximately 9.7km northwest to the Clock Face HAGI. Following design reviews, the two potential HAGIs identified in the EIA Scoping Report[4] at Cuerdley and Burtonwood have been removed from the Project with their future pipeline connection points and infrastructure included at the Clock Face HAGI; this reduces the overall footprint of the HAGIs. The corridor continues broadly north for 6.4km to the St

[4] Cadent Gas Limited (2022). HyNet North West Hydrogen Pipeline Project EIA Scoping Report (online). Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN060006/EN060006-000006-EN060006%20-%20Scoping%20Report.pdf (Accessed August 2022).

Helens HAGI, which would be an Intermediate Pressure pipeline. The pipeline diameter on the North Corridor is expected to be between 10” to 18”.

2.4.21 The North Corridor is typically characterised by open fields with hedgerows and tree lines separating them before Sutton Heath, where the route is more typically adjacent to residential areas and proceeds to the more industrial setting around Ravenhead. The North Corridor includes fourteen trenchless crossings as outlined in **Table 2.3**.

2.4.22 The proposed location for the Clock Face HAGI (**Figure 2.17**, Sheet 20) is in an agricultural field bound by the M62 approximately 20m to the north and the B5419 approximately 30m to the east (both measured to the nearest point).

2.4.23 The proposed location of the St Helens HAGI (**Figure 2.17**, Sheet 22) is an area of open grass and scrub directly off Burtonhead Road and to the rear of the Ravenhead Retail Park.

2.4.24 There are two options for the location of the Higher Walton HAGI, described in paragraph 2.4.28 to 2.4.30.

Table 2.3 North Corridor Trenchless Crossings

North Corridor – Central Hub HAGI to St Helens HAGI		
Route Section	Crossing Type	Crossing Name
Central Hub to Higher Walton HAGI	Road (M)	M56
	Road (A)	A56
	River	Bridgewater Canal
	Rail	West Coast Main Line
	River	Manchester Ship Canal
Higher Walton HAGI to Clock Face HAGI	River	River Mersey
	Rail	Skelton Junction to Ditton Junction Line
	Road (A)	A562
	Road (A)	A5080
	Rail	Manchester and Allerton Junction Line
	Road (A)	A57
Clock Face HAGI to St Helens HAGI	Road (M)	M62
	Road (A)	A570
	Rail	Liverpool to Manchester Railway

Options within the North Corridor

2.4.25 The Scoping red line boundary included an area used by the Creamfields Festival that lies north of the M56 and between Hatton and Daresbury. During non-statutory consultation and engagement with the event organisers, it was agreed the pipeline route would avoid, where possible, the festival site. There are three options at the Creamfields site (Option NP1, NP2 and NP3, see **Figure 2.17** Sheet 11 to 12).

2.4.26 Option NP1 runs to the west of the Creamfields site past Daresbury and continues north parallel to the A56 (Chester Road), Option NP2 between the east of the Creamfields site and Warrington Road to the east with Option NP3 crossing Warrington Road and then running parallel on its eastern side.

2.4.27 Each option includes open cut construction and crossing of Daresbury Lane, followed by a number of fields with hedgerows and trees, and each end at the trenchless crossing point of A56 (Chester Road) south of Higher Walton. The options avoid Ancient Woodland (Outer Wood and Rows Wood) and Halton Borough Council Local Wildlife Site.

2.4.28 Following the trenchless crossing of the A56 there are two options at Higher Walton (Option NP4 and NP5, see **Figure 2.17**, Sheet 12 to 13) that include the trenchless crossings of the Bridgwater Canal, the West Coast Mainline and the Manchester Ship Canal. Each option connects onwards to one of two Higher Walton HAGI location options on the north side of the Manchester Ship Canal (HWH1 and HWH2, see **Figure 2.17**, Sheet 13) and re-join towards the crossing of the River Mersey to the west.

2.4.29 Option NP4 runs north-northwest to cross the Bridgwater Canal and West Coast Mainline, approximately 400m south of the Manchester Ship Canal. The option then turns southwest for approximately 600m and then returns north to cross the Manchester Ship Canal and connect to HWH1 on its northern bank. This HAGI option would be located in the south of the Moore Nature Reserve with the Pipeline then proceeding northwest using an open cut trench through this part of the reserve and onwards to the River Mersey.

2.4.30 Option NP5 runs broadly north from the A56, crossing the Bridgwater Canal and fields before reaching a single trenchless crossing point of the Manchester Ship Canal and West Coast Mainline (note, at this point the West Coast Mainline is on a bridge over the canal) and connecting to HWH2. This HAGI option would be located on land north of the Manchester Ship Canal and the southern edge of the Moore Nature Reserve. The Pipeline would then proceed using an open cut trench for approximately 250m to the northern part of the reserve and south of the authorised landfill (3C Waste Limited). Option NP5 would then continue west using open cut trench to the River Mersey crossing.

East Corridor

2.4.31 The East Corridor of the preliminary Order Limits (**Figure 2.17**, Sheet 9, and 25 to 33) would start at the Central Hub HAGI with the Pipeline running approximately 18km northeast to the Warburton HAGI. The Pipeline would then continue northeast for approximately 3.7km to the Partington HAGI. The pipeline diameter is expected to be 30” and High Pressure. A Block Valve is expected to be required

between the Central Hub HAGI and Warburton HAGI, three options are under consideration, as detailed in paragraph 2.4.36 to 2.4.37.

2.4.32 The Warburton HAGI (**Figure 2.17**, Sheet 31) would be located adjacent to the existing Cadent Above Ground Installation (AGI) facility at Carr Green Lane. The HAGI would be approximately 20m southeast from the B5160 (Dunham Road) in a field with existing established hedgerows and trees. While some of the vegetation may need to be removed temporarily for access and pipeline connection and then reinstated, the majority would be maintained as visual screening. A thicker belt of woodland to the south of the HAGI location would provide visual screening for the TransPennine Trail/Bollin Valley Way.

2.4.33 The Partington HAGI would be located west of the junction of Ashton Road and Townsend Farm Lane on an existing disused brownfield site. To the south and east there are extensive belts of established trees including those along the disused railway line. To the north-northwest, there is a more open industrial setting towards the industrial facilities of Partington and Carrington.

2.4.34 The Warburton and Partington HAGIs would connect to existing Cadent AGI facilities to allow potential Hydrogen Injection Blending (HIB) of the hydrogen supply into the wider gas supply. See information on the spurs in paragraph 2.4.69 to 2.4.74 for further information.

2.4.35 The East Corridor is typically characterised by open fields with hedgerows and tree lines separating them and includes six trenchless crossings as outlined in **Table 2.4**. Note, there are no trenchless crossings planned between the Warburton and Partington HAGIs.

Table 2.4 East Corridor Trenchless Crossings

East Corridor – Central Hub HAGI to Partington HAGI		
Section	Crossing Type	Crossing Name
Central Hub HAGI to Warburton HAGI	Road (A)	A49
	Road (A)	A559
	Road (M)	M6
	Road (A)	A50
	Road (M)	M56
	Road (A)	A56

Options within the East Corridor

2.4.36 The East Block Valve options (Option EBV1 to EBV 3) are shown in **Figure 2.17**, Sheet 28 to 29. 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.

2.4.37 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.

South Corridor

2.4.38 The EIA Scoping Report[4] included two options for the South Corridor. Please refer to **Section 2.2** for further commentary on how the design evolved.

2.4.39 The South Corridor of the Preliminary Order Limits (**Figure 2.17**, Sheet 9, and 34 to 41) would start at the Central Hub HAGI with the pipeline running approximately 17.9km south to the Hydrogen Storage Facility (HSF). The Pipeline is expected to be High Pressure and 42” diameter.

2.4.40 The HSF and associated infrastructure is subject to a separate consent application by Inovyn, which will be considered as part of the inter-project cumulative effects assessment in the ES. It has previously received consent for natural gas storage. The Project considered in this PEIR involves provision of the Pipeline to supply the site, a HAGI and an access road. The HAGI would be located approximately 250m to the east of the A530 in a field currently bounded by hedgerow and mature trees.

2.4.41 The South Corridor includes five options for the location of the South Block Valve, described in paragraph 2.4.48 and also includes fourteen trenchless crossings as outlined in Table 2.5.

Table 2.5 South Corridor Trenchless Crossings

South Corridor – Central Hub HAGI to Hydrogen Storage Facility		
Route Section	Crossing Type	Crossing Name
Central Hub HAGI to Hydrogen Storage Facility	Road (A)	A533
	River	Trent and Mersey Canal
	River	Weaver Navigation
	Rail	West Coast Main Line
	Road (A)	A49
	Rail	Mid Cheshire Line
	Road (A)	A556
	River + Canal	Weaver Navigations (Vale Royal Island)
	Rail	West Coast Main Line (Vale Royal Island)
	Road (A)	A533
	River	River Dane
	River	Trent and Mersey Canal
	Rail	Middlewich Branch Line
	Road (A)	A530

Options within the South Corridor

2.4.42 South of the trenchless crossing of the A556 (Chester Road) there are four options (Option SP1 to SP4, **Figure 2.17**, Sheet 38 to 39) for the required trenchless crossings of the Weaver Navigation and the West Coast Mainline.

2.4.43 SP1 runs east towards Hartford 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.

2.4.44 SP2 runs southeast to a single trenchless crossing of the Weaver Navigation and the West Coast Mainline near Vale Royal Locks.

2.4.45 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 Tree Preservation Orders. 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.

2.4.46 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.

2.4.47 SP1, SP2 and SP3 all continue southeast between the West Coast Mainline to the west and Moulton to the east. South of Moulton these options head east towards Jack Lane and the A533. SP4 also heads east at this point.

2.4.48 The South Corridor Block Valve options (Option SBV1 to SBV 5) are shown in **Figure 2.17**, Sheet 37 and 39. Option 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 Option SP1. SBV4 is located further south in a field to the west of Whitegate Lane and is applicable to Options SP2 to SP4. SBV5 is located to the west of an established belt of trees at Jack Lane after the Options SP1 to SP4 converge.

Spurs

Runcorn/Rocksavage Spur

2.4.49 The Runcorn/Rocksavage Spur (see **Figure 2.17**, Sheet 5 to 6) would start at the Rocksavage HAGI and run north to the Runcorn HAGI. From the Runcorn HAGI there would be two spurs routed broadly northwest to connect the following customers:

- Intergen (Rocksavage).
- The Heath Industrial and Business Park.

2.4.50 The Runcorn/Rocksavage Spur would also facilitate a connection to Inovyn, Runcorn for which the pipeline connection would be provided by the customer.

2.4.51 The Runcorn HAGI would be located on land between the Weaver Navigation (approximately 40m south to the centre) and Weaver View (minor road, approximately 30m to the north).

2.4.52 This Rocksavage HAGI to Runcorn HAGI spur would include approximately 1.3km of 24” diameter pipeline and two trenchless crossings as outlined in **Table 2.6**.

2.4.53 There would be an approximately 0.4km 24" High Pressure spurline from Runcorn HAGI to Intergen (Rocksavage), with no major crossings required.

2.4.54 There would also be a Medium Pressure spurline from Runcorn HAGI to the Heath Industrial and Business Park of 2.2km. This spurline leaves Runcorn HAGI in a westerly direction, turning northwest before it crosses the A557 then traverses west through Runcorn Golf Course and before turning north to connect to the customers at Heath Industrial and Business Park.

Table 2.6 Runcorn/Rocksavage Spur Trenchless Crossings

Runcorn/Rocksavage Spur – Rocksavage HAGI to The Heath		
Section	Crossing Type	Crossing Name
Rocksavage HAGI to Runcorn HAGI	River	River Weaver
	Canal	Weaver Navigation
Runcorn HAGI to The Heath Industrial and Business Park	Road (A)	A557 - Rocksavage Way

Options for the Runcorn/Rocksavage Spur

2.4.55 There are two pipeline route options (Option RSp1 and RSp2, see **Figure 2.17**, Sheet 5) for the crossing of the River Weaver and Weaver Navigation that are required between the Rocksavage and Runcorn HAGIs.

2.4.56 RSp1 runs northeast from Rocksavage HAGI and parallel to the M56, passing southeast of the existing National Grid substation that lies between the River Weaver and Weaver Navigation. Two individual trenchless crossings would be undertaken to cross these features.

2.4.57 RSp2 runs broadly north from Rocksavage HAGI to a single trenchless crossing of both the River Weaver and Weaver Navigation, passing northeast of the existing National Grid substation.

Warrington Spurs

2.4.58 The Warrington Spur(s) (see **Figure 2.17**, Sheet 13 to 16) would be approximately 6km in length. This would start at the Higher Walton HAGI and run northeast for with a High Pressure 8" spurline to provide connection to the following customers:

- Solvay, Warrington (shared single connection with Ingevity).
- Ingevity, Warrington (shared single connection with Solvay).

2.4.59 A second spurline of 10" diameter Medium Pressure pipeline would run to the railway with two options (described in paragraph 2.4.61 to 2.4.62 below) in this area, prior to the onward street works connection to the following user:

- Novelis, Warrington.

Options for the Warrington Spurs

2.4.60 There are two options (Option WSp1 and WSp2, see **Figure 2.17**, Sheet 14 to 16 for the connection to Novelis.

2.4.61 Option WSp1 spur would remain south of the River Mersey and cross under the railway underpass then proceed as street works along Eastford Road. The option would then proceed broadly northeast crossing the disused Runcorn and Latchford Canal, then toward A5060 and proceed with street works for approximately 4.8km to Novelis.

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

2.4.63 There would be up to four trenchless crossings as outlined in **Table 2.7**.

Table 2.7 Warrington Spur Trenchless Crossings

Warrington Spur – Higher Walton HAGI to Customers		
Section	Crossing Type	Crossing Name
Higher Walton HAGI to Solvay and Ingevity (shared connection)	Rail	West Coast Mainline/ Chester to Manchester
Higher Walton HAGI to Novelis (Option WSp1)	Rail (underpass) River	West Coast Mainline/ Chester to Manchester River Mersey
Higher Walton HAGI to Novelis (Option WSp2)	Rail River	West Coast Mainline/ Chester to Manchester River Mersey

Clock Face Spur

2.4.64 The Clock Face Spur (see **Figure 2.17**, Sheet 20 to 21) starts the Clock Face HAGI and runs northeast to connect to the following user:

- NGF Europe Ltd.

2.4.65 This Medium Pressure spur would include approximately 4.8 km of 8” diameter pipeline through areas of fields adjacent to Chapel Lane and continue into the

existing industrial area along Lea Green Road. There would be one major trenchless crossing as outlined in **Table 2.8**.

Table 2.8 Clock Face Spur Trenchless Crossings

Clock Face Spur – Clock Face HAGI to NGF Europe Ltd		
Section	**Crossing Type**	Crossing Name
Clock Face HAGI to NGF Europe Ltd	Road (M)	M62

St Helens Spurs

2.4.66 The St Helens Spur(s) (see **Figure 2.17**, Sheet 22) start at the St Helens HAGI and connect to the following customers:

- Pilkington UKs Greengate Works.
- Glass Futures.

2.4.67 The Intermediate Pressure 8” diameter spurline to Pilkington UK’s Greengate Works would run along Burtonhead Road to the northwest for approximately 0.25 km.

2.4.68 The Medium Pressure Glass Futures 8” diameter spurline would run along Burtonhead Road with Ravenhead Nature Park to the southwest then turn north with one major trenchless crossing of the A570 (St Helen’s Linkway) to the Glass Futures site to the north of Sherdley Road Industrial Estate. This would be approximately 0.85km of spurline.

Warburton Spur

2.4.69 The Warburton Spur (see **Figure 2.17**, Sheet 31) starts at the Warburton HAGI and runs approximately 0.2km west to connect to the existing Cadent AGI on Carr Green Lane to facilitate Hydrogen Injection Blending (HIB) of the hydrogen supply into the wider gas supply. This Spur is expected to be a 12”” diameter pipeline. No trenchless crossings are required.

Partington Spur

2.4.70 The Partington Spur(s) (see **Figure 2.17**, Sheet 33) start at the Partington HAGI within a disused industrial area and connect to the following customers:

- SAICA, Partington.
- Partington Cadent AGI.
- Basell Polyolefins.

2.4.71 The Partington Spur would also facilitate a connection to Inovyn, Runcorn for which the pipeline connection would be provided by the customer.

2.4.72 The 8” High Pressure spurline to SAICA would be 0.6km in length and travel north west along an existing road and would require a single major trenchless crossing of the A6144 to connect to SAICA.

2.4.73 The High Pressure spurline would run northwest to the existing Cadent AGI at Partington and is expected to be approximately 0.3km and up to 18” diameter pipeline. This would facilitate HIB of the hydrogen supply into the wider gas supply.

2.4.74 The High Pressure spurline to Basell Polyolefins would run north for approximately 0.4km and is expected to be up to 18" diameter.

Northwich Spur

2.4.75 The Northwich Spur (see **Figure 2.17**, Sheet 9, and 23 to 24) starts at the Central Hub HAGI and runs to the southeast to connect to the following customers:

- TATA Chemicals, Winnington.

2.4.76 This Intermediate Pressure spur would include approximately 8 km of 16” diameter pipeline and include four trenchless crossings as outlined in **Table 2.9**.

Table 2.9 Northwich Spur Trenchless Crossings

Northwich Spur – Central Hub HAGI to TATA Chemicals, Winnington		
Section	Crossing Type	Crossing Name
Central Hub HAGI to TATA Chemicals	Road (A)	A533
	Road (A)	A49
	Minor Road - Canal - Minor Road	Marbury Road - Trent and Mersey Canal - Lift Lane
	River	River Weaver

Options for the Northwich Spur

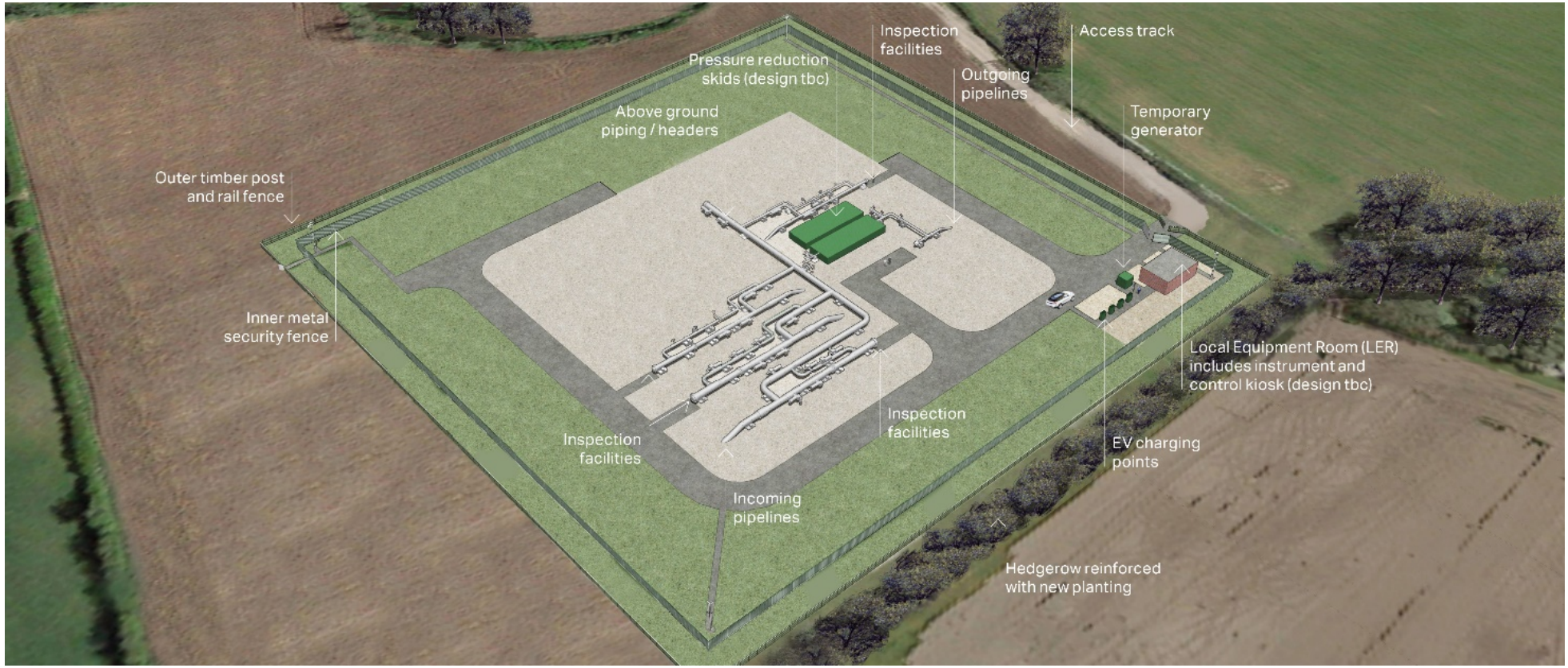
There are two options (Option NSp1 and NSp2, see **Figure 2.17**, Sheet 24) following the combined trenchless crossing of Marbury Road, Trent and Mersey Canal and Lift Lane. Option NSp1 runs south to the trenchless crossing of the River Weaver to follow open areas and tracks and avoiding impacts on woodland as far as possible through Anderton Nature Reserve and associated recreational area. Option NSp2 runs southeast then southwest to avoid the existing areas of more mature woodland and ponds.

HAGIs

2.4.77 The HAGIs are required to control the flow and pressure of hydrogen, provide connections to the network producers, customers and storage and to be able to monitor, operate, maintain and inspect the network during operation.

2.4.78 HAGI sites will include a range of permanent above ground components for which further description is provided under the headings below. The above ground components described will be kept at low level due to the nature of the equipment and to reduce visual impact. This infrastructure would typically be approximately up to 3m in height, subject to final design. Other features including fencing, general telecommunications equipment and lighting may vary as described below. The HAGIs will require connection to the local electrical distribution and telecommunication systems. Alternative sources of power including use of renewables are currently under consideration. An illustrative layout for a HAGI is provided in **Figure 2.19**. A photo of an example above ground installation as part of the existing gas network is shown in **Figure 2.20**.

Figure 2.19 Illustrative HAGI layout



Note: The figure illustrates the types of equipment required and the final equipment and layout at each HAGI will vary.

Figure 2.20 Above ground installation example

2.4.79 The sites would require security fencing, typically 2.4 to 3.6m high with double-leaf access gates for vehicles. Access would be required from the adjacent road network, access tracks or similar. There would also need to be space for maintenance operatives to safely park their vehicle(s) off the highway and open the gates.

2.4.80 The HAGI sites would vary in area but will typically range between 0.5ha to 1.5ha. **Table 2.10** summarises the approximate footprint of the HAGI sites and where options remain as shown in **Figure 2.17**.

Table 2.10 HAGIs and options for consultation

Location	Option reference	Approximate footprint
HPP HAGI	n/a	1 – 1.5ha
Rocksavage HAGI[5]	RSH1, RSH2, RSH3	1 – 1.5ha
Runcorn HAGI	n/a	1 – 1.5ha
Central Hub HAGI	CHH1, CHH2	1 – 1.5ha
Higher Walton HAGI	HWH1, HWH2	1 – 1.5ha
Clock Face HAGI	n/a	1 – 1.5ha
St Helens HAGI	n/a	<1ha
Warburton HAGI	n/a	1 – 1.5ha
Partington HAGI	n/a	1 – 1.5ha
Hydrogen Storage Facility HAGI	n/a	<1ha

2.4.81 For the purposes of the environmental assessment in this PEIR, assessment of HAGI sites up to 2ha have been undertaken to allow for further design

[5] The Rocksavage HAGI may be combined with the facilities at the Runcorn HAGI, this is subject to further design development. A worst-case assessment of two HAGIs has been undertaken for this PEIR.

development including requirements for access, security, and associated landscaping such as planting or bunds to provide screening. HAGIs would generally be unlit except during maintenance or potential breakdown/emergency requirements when permanent task lighting columns (approximately 2-3m high). These lighting columns would only be in use during maintenance or emergency visits.

2.4.82 There is the potential requirement for smaller HAGIs of <0.1ha at the connections to the Customers but within the Preliminary Order Limits, this will be determined prior to the DCO Application and any effects assessed in the ES.

Pressure reduction units

2.4.83 Pressure Reduction Units (PRU) are included within the HAGI footprint and used to control the flow or pressure into the network and consists of above ground components including pipework. Above ground pipework (for PRUs as well as metering and inspection facilities) will vary in diameter with the maximum piping sizes approximately the same diameter as the adjacent buried pipeline, but many of the associated pipes would be much smaller.

2.4.84 The pressure reduction process can result in noise emissions. This is discussed further in **Chapter 10: Noise and Vibration** and consideration given to the requirement for attenuation measures.

2.4.85 A typical PRU will be skid mounted i.e., mounted to a frame at the point of manufacture and delivered to site for connection.

Metering facilities

2.4.86 Metering facilities are required for volume measurements of the hydrogen gas flow for control and fiscal purposes and will be located inside the HPP and HSF HAGIs. As with a PRU, these consist of above ground pipework and components and can be skid-mounted. The facilities are installed above ground along a 15m section of pipeline and measure approximately 4m wide and up to 2.5m in height.

Inspection facilities

2.4.87 Inspection facilities support future in-line inspection (ILI) of the pipeline network. The ILI is undertaken by passing a device known as a ‘pig’ or Inline Inspection Tool through the pipeline which is propelled by the flowing gas without interruption to the gas supply. The facilities include above ground pipework from which to launch and receive the pig as well as operating equipment including valves. Inspection facilities will be located inside the HAGIs.

Instrumentation and Control Kiosks

2.4.88 Instrumentation and Control (I&C) kiosks, to be located within the HAGI compounds, will house the equipment that monitors key parameters (including the flow, pressure and temperature). Field instruments located on pipework will connect the equipment in the kiosk. Signals are sent to an Energy Control Centre via satellite link or similar. The kiosks are typically prefabricated Glass Reinforced Plastic (GRP) units of approximately 2.4m height placed on a concrete base that is cast in situ.

Block Valves

2.4.89 These sites are separate facilities to the HAGIs and would be housed in a compound less than 0.5ha in size, with fencing approximately 2.4m high, an access track, facilities for turning vehicles. and an access gate. Access would be required for maintenance vehicles, typically Light Goods Vehicles (LGV).

2.4.90 The main valve will be in-line with the buried pipeline and some ancillary valves and pipework will be above ground. The valve actuator would extend a short height (approximately 1.5m) above ground. The valves may be operated remotely for which the necessary equipment on site will be housed in an I&C kiosk (similar to those described above).

Cathodic Protection

2.4.91 A Cathodic Protection (CP) system will be required as part of the pipeline system. This protects the pipeline from corrosion by imposing a small electrical current, which inhibits the electrochemical process of corrosion. This requires the placement of Transformer Rectifier (TR) units and groundbeds at strategic locations around the network. These would typically be included at the HAGIs with required electrical supplies or if necessary, they can be installed on the street within a typical telecommunications cabinet.

2.4.92 CP monitoring points would be installed at regular intervals along the pipeline (approximately every 1 - 2km). These are housed within marker posts typically at selected road or footpath crossings and do not require any other above ground infrastructure such as a compound or kiosk.

Marker Posts

2.4.93 Markers would also be required at crossings and field boundaries. CP post and marker posts are small posts, with new posts typically made of plastic and approximately 1m high. Aerial markers are required (to assist in ease of route identification) during aerial surveys of the pipeline and are typically 2m high and made of plastic.

2.5 Construction

2.5.1 The following section provides an overview of the typical form and sequencing of construction for both the pipeline and HAGIs. The pipeline would predominantly be constructed by the open cut installation technique. A range of options are identified for the trenchless crossings and are described in **Section 2.5,** paragraph 2.5.50 to 2.5.65.

2.5.2 The proposed HyNet North West Hydrogen Pipeline would be a multi-diameter pipeline transportation network and as such each section would have a specific working width. For a 42” pipeline the working width would be expected to be up to 36m. **Table 2.11** provides an indicative working width for each diameter of pipeline.

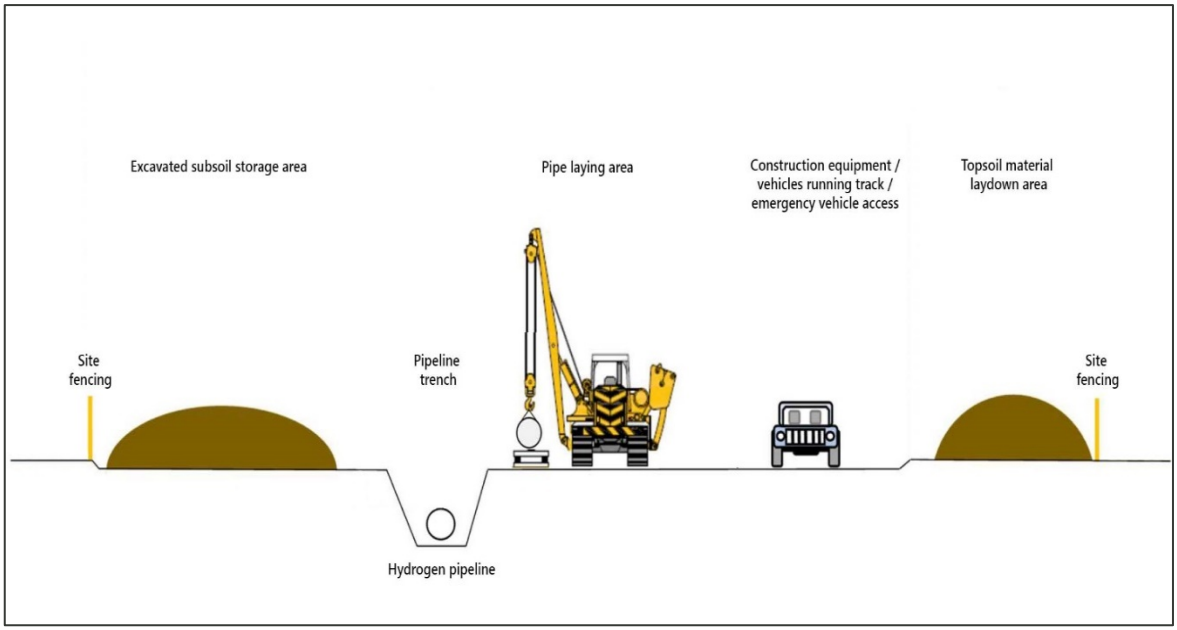
Table 2.11 Indicative working widths for different pipeline diameters

Pipeline diameter range (inches)	Typical construction working widths (m)
36 – 42”	36
24 – 30”	28
16 – 18”	22
6 - 12”*	Within Highway boundary

*** Note: Exception to this is North Corridor which varies from 10-18” diameter pipeline and would generally use the working width applicable for 16-18”**

2.5.3 The working width is divided into work, transport and laydown areas. It typically comprises topsoil and subsoil laydown areas, the trench area, pipe string and construction equipment area and a running track for through access of construction related personnel. A typical cross-section is shown in **Figure 2.21.**

Figure 2.21 Typical layout of a working width for pipe laying



2.5.4 A wider working width, known as a box out section, would be required in some instances e.g., at crossings including trenchless crossings and where the pipeline route changes direction. This is to facilitate safe working, additional spoil storage and equipment laydown. These areas are included in the Preliminary Order Limits.

2.5.5 Temporary construction site accesses have also been identified across the Project and are shown in **Figure 2.17**. There are three categories of access routes, one for all construction traffic including plant and Heavy Goods Vehicles (HGVs), those that are limited to use by Light Goods Vehicles (LGVs) only and accesses at

crossing points (third party assets, rivers, canals, etc) on the pipeline route where access would be needed at installation and reinstatement.

2.5.6 The Preliminary Order Limits have also been developed to include areas for pipe and other material storage ('material storage areas') along the corridors. These are sections of pipe of approximately 12 – 18m in length and are typically stacked using timber separators up to a maximum of 4m high.

Construction phasing and timescales

2.5.7 Construction is expected to commence in late 2024 with commissioning in 2027. The Project would be fully operational by late 2027 or early 2028.

2.5.8 Pipelines are constructed within the pipeline "spread" or temporary working width which is a corridor of land extending along the route. Pipe laying can be likened to a production line with successive activities moving along the spread. Activities include site preparation, pipeline stringing, welding, inspection, laying and testing. Once complete, reinstatement would be undertaken across the temporary working width.

2.5.9 Pipeline construction is generally focused on the spring and summer months (March to September) with an aim to reduce impacts on agricultural land. Based on the current programme, two pipelaying seasons in 2025 and 2026 are expected for the Project. The works for crossings and pipelines in the streets may occur outside the typical pipelaying season and throughout the year. The Applicant will work with consultees e.g., Statutory Nature Conservation Bodies (SNCBs) to determine the timing of sensitive works. It is expected that each corridor would take 12-18 months to construct.

2.5.10 Once a section is prepared the installation of fabricated sections typically advances at 500m to 1km per day. In more congested areas, and when pipe diameter and weights are larger, progress is slower and the advance may be only tens of metres per day.

2.5.11 Independent construction crews would work on the main pipeline spread and, on the road, rail and watercourse crossings. Work crews would be located at several locations at any one time and move forward as the work progresses across the section they are working on. Equally at times during the construction period there would be no active work at particular locations. Each crew would typically have 30 persons and the total workforce would be 200 to 1,000 personnel at any one time.

2.5.12 Different plant and vehicles are required according to the activities of pipe laying, making trenchless crossings, HAGI or Block Valve construction and temporary compounds. These will include plant of varying height such as mobile telescopic and crawler cranes, 360 tracked excavators and side booms for pipelaying. Use of larger equipment such as cranes would be temporary and generally short-term dependent on the task, plant suitability and availability. **Chapter 10: Noise and Vibration** provides indicative information on plant associated with the construction.

2.5.13 Construction of a HAGI typically takes from six to twelve months and may be in progress at any point during the year, subject to any local constraints. Construction of Block Valves would typically take up to four months.

2.5.14 Standard construction working hours would be 10 hours per day (08:00 to 18:00) from Monday to Saturday, with no works on Sundays or Bank Holidays. There may be the need for some extended working hours for certain activities but this would be subject to agreement with the Local Planning Authority.

2.5.15 There would be the need for continuous (24-hour) working for some activities, due to the need to work continuously on specific construction activities and reduce impacts on third party assets/ statutory undertakers. Such activities include:

- Tunnelling and Horizontal Directional Drilling.
- Pipe pulling at trenchless crossings.
- Pipeline testing.

2.5.16 A number of works would be expected to occur in parallel, however, the exact phasing of the works has yet to be determined. Further details of the construction programme and phasing will be developed for the ES.

Pipeline Construction

Construction site preparation

2.5.17 Following survey of the construction site, including utilities and Unexploded Ordnance (UXO) checks, work would commence to prepare the pipeline corridor. This would include any installation of site fencing, the type of which would be determined based on key factors including security and land use. For example, demarcation fencing may be used in arable fields or where livestock is present, stock fencing appropriate to the type of livestock e.g., cattle, sheep, deer etc. Where the surrounding land is publicly accessible, then requirements would be enhanced for safety and security e.g., 2.4m Heras fencing or similar.

2.5.18 Safe crossing points would be implemented e.g., where a Public Right of Way (PRoW) crosses the working width. Where necessary, a temporary closure and diversion will be put in place and signage provided. An Outline Public Rights of Way Management Plan (PRoWMP) will be developed for submission with the application for development consent, detailing the locations of crossings, closures /diversions and the proposed method for their implementation. A preliminary version of this document is provided in **Appendix 11B**.

2.5.19 The accesses and the need for improvements at these points e.g., visibility splays, bell mouths and widening will be subject to further design and consultation with the appropriate Highways Authority, the outcome of which along with the results of further environmental surveys will inform the required assessments in the EIA. Construction access points are discussed further in the Preliminary Construction Traffic Management Plan (**Appendix 11A**). Where an access point is required along a PRoW, the Outline PRoWMP will consider options including creation of a temporary shared route with users.

2.5.20 Once access is achieved from the highway, the access track would be based on the particular conditions on the access route. This would vary from stripping the topsoil to allow vehicles to run on the subsoil, to use of bog mats or overlaying crushed stone on a geotextile membrane.

2.5.21 Site clearance and localised re-grading would take place. Earthworks would be limited due to the generally gentle undulation of the terrain. Some levelling or cut and fill works may be required on a limited number of steep slopes or banks. Benching (terracing) may be required in a small number of locations where side slopes exist. The earthworks are not expected to require large amounts import. Some limited export and disposal of excavated material may be required, in relation to trenchless crossings and HAGI construction sites. or export of material from the site. All suitable excavated materials would be reused in reinstatement and restoration of ground levels (see Reinstatement in paragraph 2.5.34 to 2.5.36).

2.5.22 The requirements for clearance would be location specific but during the development of the Project a key consideration would be to retain and protect sensitive areas, including habitats and vegetation, where practicable.

2.5.23 Topsoil would be stripped across the required working area and stored at the edge of the works in accordance with industry best practice, to protect topsoil integrity for future reuse during reinstatement. The topsoil bunds would typically be in the order of 2m in height though may be higher subject to ensuring there is no excessive soil compaction and visibility restrictions. Topsoil bunds would be sited to avoid impeding areas of surface water flow and gaps left between bunds to avoid waterlogging.

2.5.24 Other activities likely to be required during site preparation include:

- Site signage, service protection and other site safety requirements;
- Establishment of temporary facilities for site personnel;
- Establishing site environmental management requirements e.g., tree protection fencing and other site-specific pre-commencement activities;
- Development of temporary site drainage, sediment management and any necessary temporary watercourse crossings; and
- Creation of temporary accesses along the working width including opening field boundaries along the route.

Fabrication

2.5.25 Line pipes would be brought to site and stored in stacks prior to deployment along the pipeline route, before being transported to their final location along the route, where they would be placed on wooden supports or skids adjacent to the line of the trench. This process is known as pipe stringing. This process is known as pipe stringing. This process is known as pipe stringing.

2.5.26 Where necessary changes in horizontal direction and vertical profiling would be undertaken by employing cold bending i.e., undertaken at ambient temperature. This would require mobilisation of associated plant on site.

2.5.27 Line pipes would be lifted onto skids and the pipes welded to form a continuous string. A range of techniques for CS pipes, including semi-automatic and manual welding techniques, would be employed along the route. All joints would be tested by Non-Destructive Test procedures. Once tested an anti-corrosion coating would

be applied to the welded joints of steel pipes. Jointing of PE pipes would be undertaken using Butt Fusion or Electrofusion fittings.

Trenching

2.5.28 The pipe trench would generally be dug using mechanical excavators or trenching machines, which would normally straddle the trench. The depth and width would vary with pipeline diameter but would allow a minimum reinstated cover of 1.2m over the top of the pipeline. The subsoil material excavated would be stored separately from the topsoil to avoid mixing.

2.5.29 Dewatering of trenches may be required e.g., in the event that groundwater is present. Groundwater monitoring is to take place as part of ground investigation. The method of dewatering will be dependent on the ground conditions, however it is likely to include the use of mobile pumps.

Pipe laying

2.5.30 Welded pipe sections would be carefully lifted and lowered into the trench in a continuous operation using side booms, excavators or cranes dependent on the size of the pipeline. PE pipes may be lifted into position using lighter lifting equipment or may be pulled into the trench using a winch and rollers or pulled into the ground using trenchless methods. PE pipe may come to site in coils allowing much longer lengths of pipe without joints being necessary

2.5.31 The pipe would generally be laid on bedding material and covered in padding material. This would typically be soft fill from excavated materials and would serve to protect and minimise movement of the pipe. Backfilling would be undertaken using subsoil from the temporary storage areas.

Testing

2.5.32 The internal bore of the pipeline would be cleaned using devices known as pigs which travel along the length of a pipeline test. The pipeline will be hydrostatically pressure tested, using a local water source, agreed and permitted by the Environment Agency and appropriate local authority as required. Disposal of test water would also be undertaken in accordance with the permit.

2.5.33 The pipeline would be further inspected by inspection equipment to ensure it is free of defects e.g., unacceptable dents, flat spots or areas of ovality. Final end to end drying and dew point testing would be undertaken.

Reinstatement

2.5.34 Reinstatement of the working area would be undertaken typically including regrading, subsoil ripping to relieve compaction and removal of debris. Topsoil would be reinstated to the former depth.

2.5.35 Where possible, previous land uses would be re-established e.g., agricultural areas and fencing established in accordance with agreements with landowners and in consideration of the necessary easements. Areas of landscaping and required habitat reinstatement, including tree and hedgerow planting, would be implemented through a landscaping scheme that would be prepared and delivered in accordance with a requirement of the DCO.

2.5.36 Drainage altered during construction would be reinstated and where necessary, new drainage would be laid. All temporary materials such as bog mats, road fill, temporary culverts and geotextile membrane will be removed during the reinstatement works.

Crossing techniques

2.5.37 A Crossing Schedule has been developed to inform the assessment in this PEIR and is shown in **Appendix 2A** and **Figure 2.18**. The Crossing Schedule will be updated and be provided as part of the application for development consent and the draft DCO. A description of open cut installation and trenchless crossing techniques are provided below.

Open cut

2.5.38 Open cut installation involves the excavation of a trench across the feature to be crossed and the installation of the pipeline in the trench. A trench for the largest diameter pipe may be approximately 2.5m deep while crossings of features such as streams may require excavations of approximately 4 – 5m deep. This method is typically used for minor roads, tracks, streams and ditches. The features on the Project that would be expected to be installed using open cut techniques are outlined in the Crossing Schedule in **Appendix 2A**.

2.5.39 Note, open cut installation may also be used for third party utilities, the details of which would be subject to agreement with the utility providers.

2.5.40 At each crossing point it is necessary to install the pipeline beneath the feature being crossed and provide a means of crossing for construction plant and vehicles.

2.5.41 Open cut installation at minor roads would typically involve the following stages:

- Implementation of traffic control measures (subject to agreement with the Highways Authority) to ensure safety and minimise disruption. Works would be undertaken in as short a timeframe as possible, typically five days or less.
- Identification of services and protection as required.
- Cutting of the road surface at the trench edges using a road saw.
- Excavation of the trench to the required depth.
- Installation of the pipe or a construction sleeve for installation of the pipeline at a later data.
- Backfilling of the trench and resurfacing undertaken in accordance with the requirements of the Highways Authority.

2.5.42 Construction plant and vehicles must be able to cross from one side of a road for onward access to the route. This involves tracking major plant across the road for which traffic control measures and service protection would be undertaken as above. The road surface would be protected using rubber matting or similar, or by use of a temporary sacrificial tarmac surface. Measures would be put in place to ensure the highway is clear of debris and any restoration works would be subject to agreement with the highway authority.

2.5.43 The crossing point would be required for the duration of the construction period within the particular section. However, the crossing point would only be in operation when it is necessary to transfer plant or vehicles across. The highway would otherwise remain open to the public as normal for the majority of the time a crossing is in place.

2.5.44 Open cut installation of watercourses would typically be undertaken by one of two methods, either by fluming or damming and subject to the required consents. Fluming would typically include the following stages:

- Steel or plastic pipe is installed along the bed such that the water flows unimpeded through the flume. These would be sized to ensure that the total flow capacity includes any anticipated increase in flow due to wet weather plus a factor of safety.
- Excavation of a trench beneath the flume and the pipeline inserted beneath.
- Backfilling of the trench and removal of the temporary flume.
- Reinstatement of the feature crossed to pre-construction condition.

2.5.45 Damming would typically include the following stages:

- Damming at the proposed crossing location through installation of steel trench sheets, aggregate/sand bags or similar.
- Transfer of flowing water from upstream to downstream using pumps and hoses. Pumps and hoses would be suitably sized to ensure that the total flow capacity includes anticipated increase in flow due to wet weather plus a factor of safety. Note, this may not be necessary in drainage ditches where water flows in either direction.
- Excavation of the trench through the temporarily dammed area and installation of the pipeline.
- Backfilling of the trench and removal of the temporary dam.
- Reinstatement of the feature crossed to pre-construction condition

2.5.46 To maintain access either side of these features, temporary crossing points would be required subject to agreement with the appropriate authorities. This would typically include bridging where larger spans are required, or fluming for smaller features. Bridging would typically be used on features including larger streams and canals (note, this is for access only and the pipeline would still be installed using a trenchless crossing at a canal).

2.5.47 Bridging would include installation of a temporary ‘bailey’ type bridge with support bases on either side, typically aggregate or stone. For canals, the height of the temporary bridge would be in accordance with navigation authority requirements. At the end of the construction period, the bridges and supports would be removed and banks reinstated to pre-construction condition.

2.5.48 For flumed temporary crossing points, these would include sizing and laying of a steel or plastic pipe as described above. To complete the installation of the crossing, a combination of geotextile and fill (e.g., stone, excavated materials) and/or bog mats would provide the surface for plant and vehicles to move over. At

the end of construction, the materials and pipe would be removed and reinstatement undertaken to pre-construction condition.

2.5.49 There would also be the need for crossings of numerous hedgerows on the Project. Crossings of hedgerows would be undertaken in a manner to minimise the working width as far as possible and therefore minimise the impact on hedgerows across the Project. A typical crossing for a 42" pipeline would involve approximately 5m for pipe laying and approximately 4m for plant crossings as opposed to the standard 36m working width, this would vary for smaller diameter pipelines. For further measures to mitigate impacts at hedgerow crossings, please refer to **Section 5.7.**

Trenchless crossing techniques

2.5.50 Trenchless crossings are identified in **Table 2.2 to Table 2.9**. There are a number of methods by which these crossings would be undertaken, the choice of which is determined by a number of factors including the feature being crossed, agreements with third parties regarding asset protection, ground conditions and the length and depth of the crossing. It is not possible to determine which method would be used at each trenchless crossing prior to the establishment of these factors and appointment of the Contractor(s) to undertake the works.

2.5.51 Each trenchless crossing technique is characterised by the need for establishment of an entry and exit site. In order to assess a reasonable worst case, the typical footprint for each type of crossing has been established. **Table 2.12** provides these parameters. Further information on how each topic has undertaken a reasonable worst-case assessment is provided in the topic **Chapters 5 to 18**.

Table 2.12 Typical parameters for trenchless crossing techniques

Trenchless crossing technique	Footprint entry pit (ha)	Footprint exit pit (ha)
HDD	0.3	0.2
Auger bore (guided and unguided)	0.1	0.1
Micro-tunnel	1	0.4
Direct pipe	1	0.4

2.5.52 The layout and equipment at each crossing point would vary but would include site fencing such as Heras fencing (or other types between 2.4m to 3.6m high depending on security requirements) as well as site office, welfare, pipe and equipment laydown, lighting and storage as well as drilling rigs and the ancillary equipment including generators, settlement pits and water treatment facilities. Equipment heights will vary but are typically expected to range between 1m and 4m. Some larger equipment individual elements including cranes are likely to be required during the works.

2.5.53 The length of time a trenchless crossing site would be in use varies depending on the technique, complexity, depth and length of crossing. This may vary between one to six months. Some continuous (24 hour) working may be required as defined in paragraph 2.5.15.

Horizontal Directional Drilling (HDD)

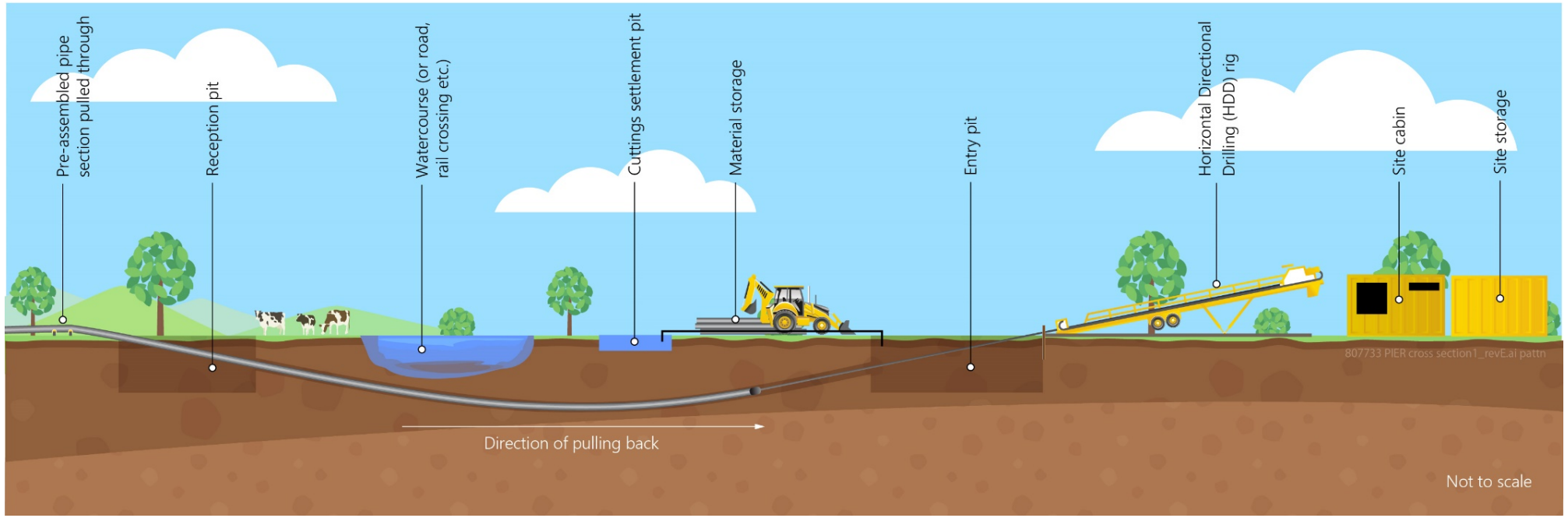
2.5.54 The HDD technique is typically used on longer trenchless crossings. HDD requires creation of an entry and exit pit on either side of the feature to be crossed and guiding a pilot hole along a pre-determined profile beneath the obstacle. **Figure 2.22** provides an illustrative example of an HDD site set-up. The depth of the drilled profile can be set to minimise risk to the obstacle being crossed and maximise protection of the pipeline.

2.5.55 Once the pilot hole is complete the bore is enlarged in stages using reamers (drill heads) in soft ground or hole openers in hard ground to a diameter approximately 1.5 times greater than the diameter of the pipeline to be installed.

2.5.56 Excavation takes place by rotating a cutting head at the front of the drill string and pumping drilling fluid from the surface, through the drill string, to the cutting head During drilling, the bore is supported by drilling fluid which also performs functions such as drill bit cooling, lubrication and as a transport medium for the removal of drill cuttings. Settlement pits are used for the separation of excavated materials and recycling of the drilling fluid.

2.5.57 When the bore has been enlarged to the required diameter the pipeline is pulled through using the drilling rig. A stringing site that is equivalent to the length of the HDD crossing is required to fabricate the product pipeline in a single length allowing the installation operation to be completed without interruption.

Figure 2.22: Illustrative HDD set-up



Auger Boring

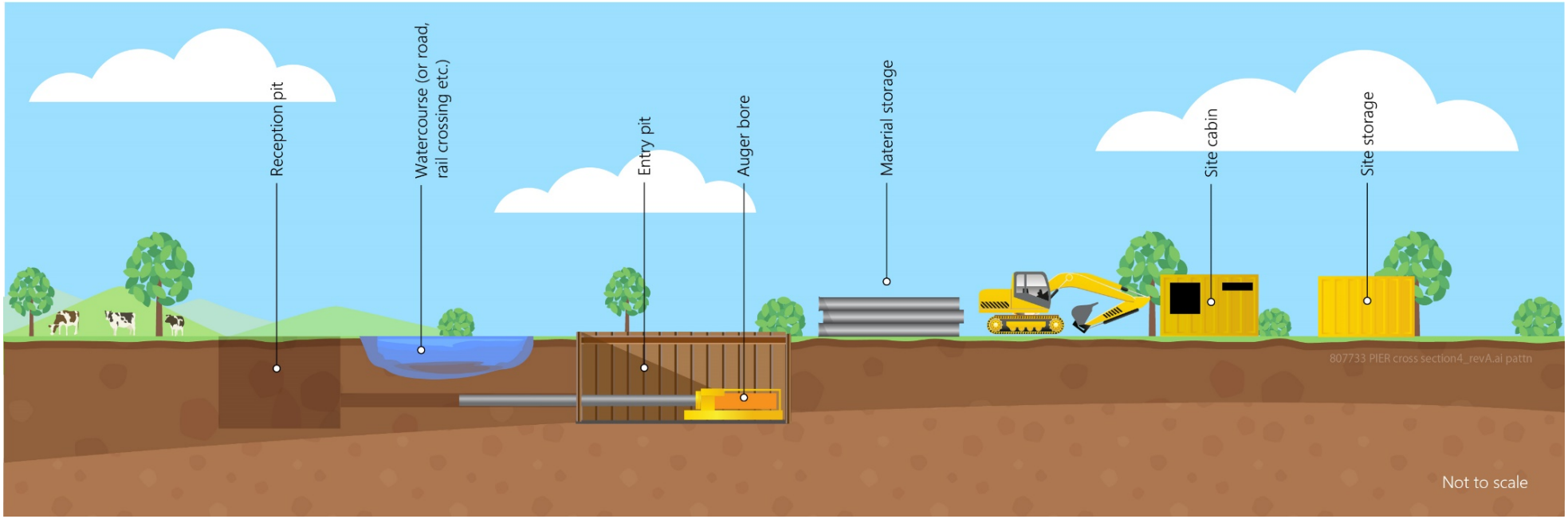
2.5.58 Auger bores are typically used for shorter trenchless crossings. The auger bore process requires the establishment of a drive reception pit and boring the hole under the feature to be crossed. **Figure 2.23** provides an illustrative image of an unguided auger-bore set-up. The pipeline can be simultaneously installed in the bored hole as excavation takes place (uncased). Alternatively, a sacrificial pipe (steel or concrete) the same diameter as the pipeline is installed in the bored hole (cased) as excavation takes place, which is later displaced after the bored hole has been completed.

2.5.59 Excavation takes place by rotating a cutting head at the front of the pipe as it is pushed into the ground. Excavated material is removed from inside the pipe back to the drive pit by helical-wound auger flights inside the pipe.

2.5.60 Following reception of the auger, the cutting head is removed and the pipe is welded and pushed through to the reception pit.

2.5.61 Auger bores can be unguided or guided, each method generally follows the same excavation and pipe installation principles but guided auger boring uses more accurate guidance systems as conditions and the particular crossing may require.

Figure 2.23: Illustrative unguided auger bore set-up



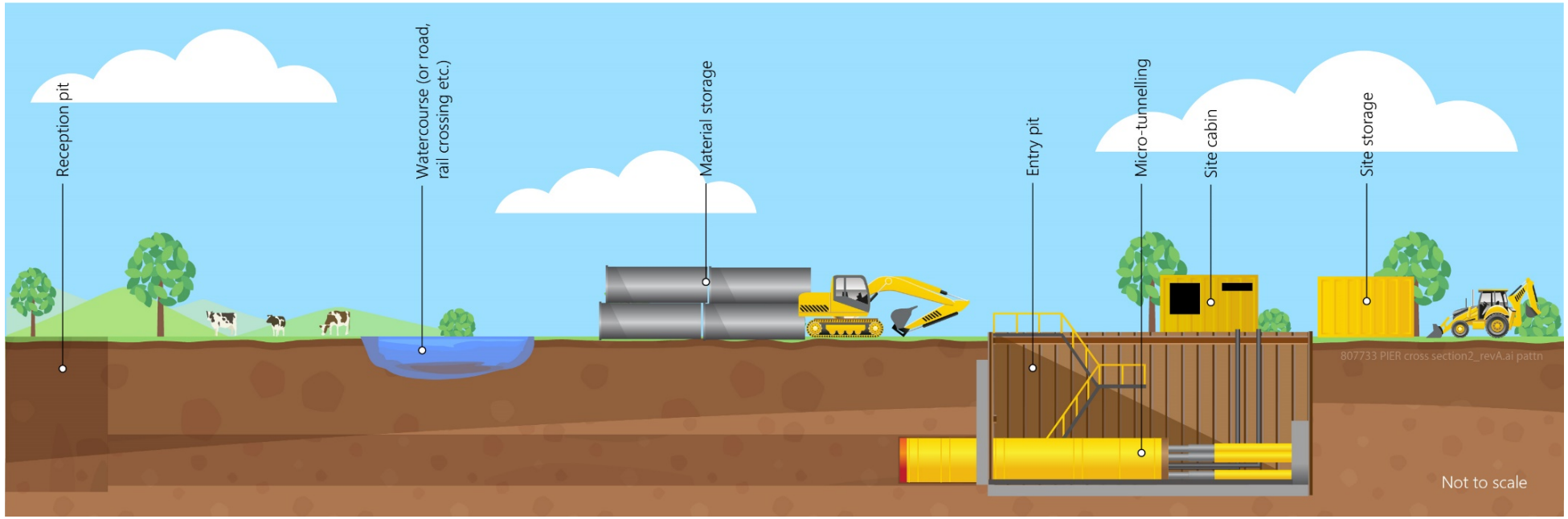
Micro-tunnelling

2.5.62 Micro-tunnelling can be used for short and longer crossings but generally requires a larger footprint including installation of drive and reception pits or shafts. A cutting tool/machine provides the mechanical excavation, generally controlled remotely from an above ground compound. **Figure 2.24** provides an illustrative example of a micro-tunnelling site set-up. There are a range of open and closed face tools/machines including: boring, earth pressure balance and pressurised slurry for use in the appropriate ground conditions. Excavated spoil is transported back to the surface at the drive shaft site for disposal.

2.5.63 A pre-cast concrete pipe is driven in behind the cutting machine using a hydraulic ram or jack placed within the drive shaft. A typical profile arrangement has a shaft at one end and a tunnel profile long radius at the other where the pipe exits and transitions to normal cover.

2.5.64 The line pipes are then welded into a string pipe and gradually pushed or pulled into the casing or, where space is limited, the pipe may be welded at the base of a shaft. Following pipeline installation inside the tunnel, the remaining void between the tunnel and installed pipeline is typically filled with cementitious grout.

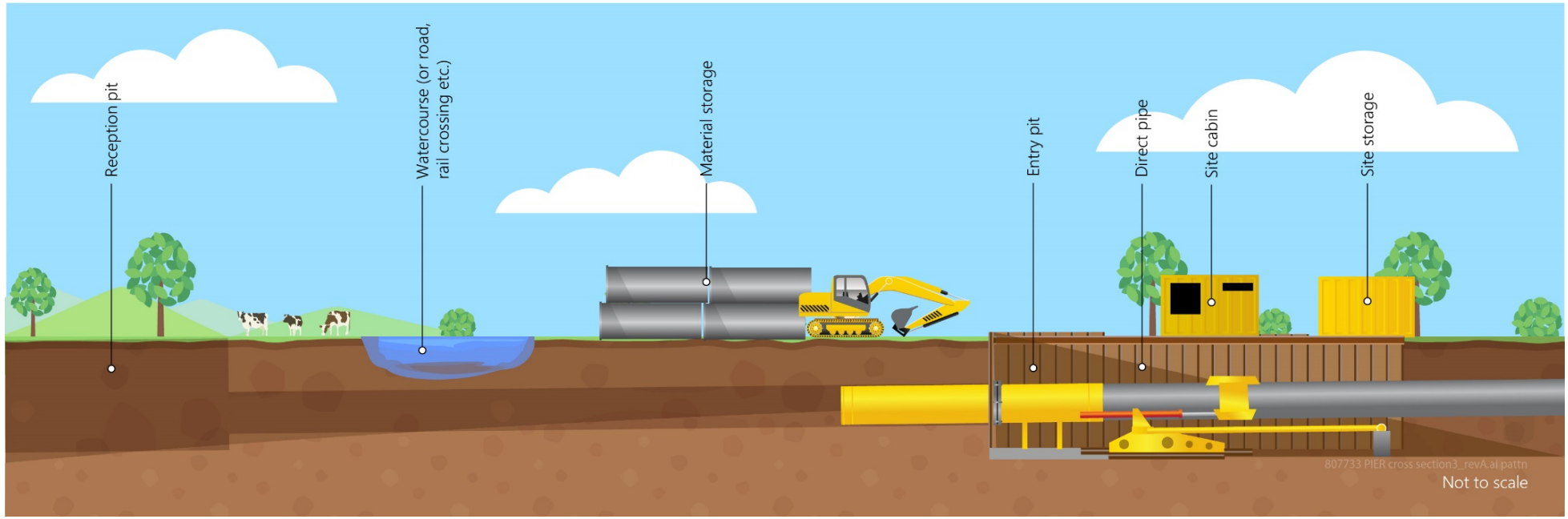
Figure 2.24: Illustrative micro-tunnelling site set-up



Direct Pipe

2.5.65 Direct pipe can be applied to short and longer trenchless crossings. This technique is similar in its method and set up as described for micro-tunnelling. However, the pipeline is installed directly into the ground behind the cutting machine, rather than being installed inside a completed tunnel. **Figure 2.25** provides an illustrative example of a micro-tunnelling site set-up.

Figure 2.25: Illustrative direct pipe site set-up



Compounds

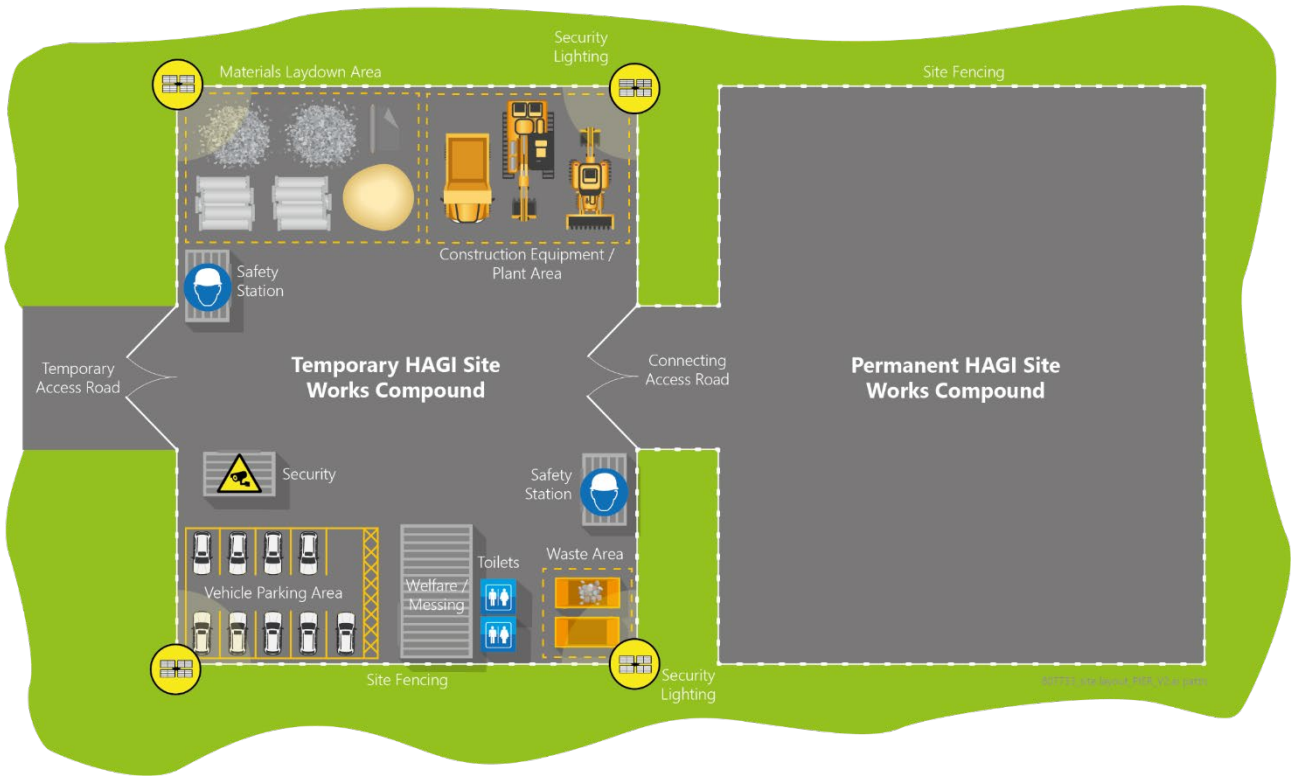
2.5.66 Temporary construction compounds would be established to support the construction of the pipeline and HAGIs. The Preliminary Order Limits include areas identified for temporary compounds, which are located adjacent to the HAGI sites and where applicable, the HAGI options.

2.5.67 The temporary compounds would typically include:

- Secure fencing between 2.4m to 3.6m high and access for plant, vehicles and personnel;
- Hard surfacing and drainage, using Sustainable Drainage Systems (SuDS);
- Temporary connections to utilities;
- Welfare facilities up to two storeys (approximately 6m);
- Vehicle/plant storage and associated fuels;
- Storage for pipes in stacks, equipment and materials; and
- Lighting for the safety of personnel working during the hours of darkness (typically winter months), in the form of task lighting (erected temporarily for a specific task) or lighting maintained for the duration of the use of the compounds. This lighting would only be used whilst work is in progress. Lighting for security purposes may be required and it may be necessary for this to be on for extended periods. Lighting would be installed such that light spill outside the compound near residents and ecological receptors is limited e.g., through considering the height of the columns, lux levels and use of shields etc.

2.5.68 An illustrative compound layout for a HAGI is shown in **Figure 2.26** below.

Figure 2.26: Illustrative compound layout



2.5.69 Once the pipeline has been constructed and reinstated, the temporary compounds themselves will be decommissioned and land reinstated to its former condition. Landscaping would be implemented through a landscaping scheme that would be prepared and delivered in accordance with the DCO.

Above Ground Infrastructure

2.5.70 The construction site for a HAGI would typically include the necessary temporary works area to be co-located for maximum convenience. The temporary works area would be adequate to accommodate all requirements described in the compound description above. The temporary working area is expected to be up to approximately 3ha.

2.5.71 The typical site construction sequence would include:

- Site preparation, including typical activities for pipeline construction described above;
- Earthworks and civils, including establishment of concrete bases for permanent equipment;
- Installation of mechanical equipment and laying and connection of pipes;
- Installation of electrics, I&C and associated kiosk; and
- Testing and commissioning.

2.5.72 Reinstatement of temporary accesses, working areas and landscaping would be undertaken in accordance with a landscape scheme, prepared in accordance with the DCO.

2.6 Operation and Maintenance

2.6.1 The HAGIs would generally be monitored and operated remotely from an Energy Control Centre located off-site. The HAGIs will be operational continuously (24 hours a day). The frequency of periodic maintenance undertaken on-site has yet to be determined but would typically include the following for telemetered sites:

- Planned periods of maintenance every 6 months with a duration of up to 2 days.
- Pipeline inspection operations requiring ten personnel for approximately one week and undertaken every 1 to 5 years, subject to further development for hydrogen pipelines. Inspection operations involve an internal examination of the pipe undertaken by a “pig”, an inline inspection tool, which travels inside the pipeline from one HAGI to the next.
- Infrequent breakdown or urgent visits with access on a 24/7 basis if required.

2.6.2 Pipeline surveillance is undertaken by helicopter, drone and/or vantage surveys so access onto private land is not normally required. This would look for activities such as construction in proximity to the pipeline or potential visible issues such as disturbance to the land. Aerial surveys are typically undertaken every two weeks, but frequency will be determined during further design development and engagement with the Health and Safety Executive. There are some infrequent maintenance surveys (every 2 to 7 years) which may be required and would require access on foot (line walking) over the route of the pipeline, but do not require excavation or other intrusive activities. Landowners would be contacted to make arrangements for this work.

2.6.3 As described above, the inspection of the pipelines is undertaken internally from the inspection facilities at HAGIs with limited access to the buried pipeline route. It is anticipated that no pipeline maintenance would be required where excavation of the pipeline is required unless a defect is identified.

2.7 Decommissioning

2.7.1 The design life of the pipeline and HAGIs is 40 years but it is anticipated that the actual life of the pipeline could extend well over 40 years depending on its condition, as over time parts are likely to be refurbished or replaced through maintenance activities. It is reasonably expected that a statutory framework will be developed and agreed prior to any decommissioning. Similarly, technology and good practice would develop and provide for new ways to undertake the process.

2.7.2 Decommissioning of the Project would likely involve removing the hydrogen and leaving the pipeline in situ and avoiding removal and associated potential environmental effects. This would typically involve rail, road and watercourse crossings being filled with grout and the removal of all HAGIs. The sequence of

decommissioning these elements would be the reverse of the construction sequence (as described in **Section 2.5**) and would likely involve the application of similar construction plant and methods. All materials removed would be reused or recycled where possible or disposed of in accordance with relevant waste disposal requirements. Land would then be restored to its former use.

2.7.3 At the appropriate point in time a Decommissioning Plan will be developed by the Undertaker. The Decommissioning Plan will be a live document which is updated and refined as appropriate. The Plan would address the relevant statutory requirements at the time, any extant commitments with landowners/statutory authorities and take account of any developed technology and good practice at the time of decommissioning.

Above Ground Infrastructure

2.7.4 It is envisaged that HAGIs and Block Valves would be removed by reversing the methods used for installation, with similar levels and types of equipment involved. Temporary decommissioning accesses may be required alongside compounds for the storage of equipment. HAGIs would be disconnected from the local electrical distribution and telecommunication systems, following which all electrical components would be removed. At this point the site buildings and mechanical equipment would be dismantled, disconnected and removed from the HAGI site. For HAGIs and Block Valves, pipework would be removed to surface where it would be backfilled and capped.

2.7.5 Reinstatement of temporary accesses, compounds and landscaping would be undertaken in accordance with a landscape scheme, which would be defined in the decommissioning plan.

2.7.6 The decommissioning of the HAGIs is anticipated to take the same amount of time as construction (6 to 12 months), although this is indicative and may vary.

Crossings

2.7.7 It is envisaged that all rail, road and watercourse crossings would be backfilled with grout left in-situ, the land above would be reinstated to pre-construction conditions.

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