

# Humber Low Carbon Pipelines

Preliminary Environmental Information Report  
Volume II Chapter 3 Consideration of Alternatives  
October 2022

nationalgrid

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# 3. Consideration of Alternatives

## 3.1 Introduction

3.1.1 This chapter sets out the preliminary consideration of reasonable alternatives to the Humber Low Carbon Pipelines Project (the Project) in line with Regulation 14(2)(d) of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (“the EIA Regulations 2017”) (Ref 3.1) which states that an Environmental Statement (ES) should include:

*“A description of the reasonable alternatives studied by the applicant, which are relevant to the proposed development and its specific characteristics and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment.”*

3.1.2 The alternatives that have been considered during the evolution of the Project and design process as presented in Chapter 2: Project Description (Volume II) are set out, up to this stage of Statutory Consultation. The ES for the Project will provide a full description of alternatives considered for the Project.

3.1.3 The consideration of alternatives and design evolution has been undertaken with the aim of avoiding and/or minimising adverse environmental effects, maintaining operational efficiency and cost-effective design solutions, consideration of planning policy and other relevant matters, such as minimising land take as far as practicable.

3.1.4 The objective of the Project is to deliver new onshore pipeline infrastructure. This will transport captured anthropogenic carbon dioxide from the region’s emitters to safe subsea storage and to enable industries to fuel-switch from fossil fuels by supplying low carbon hydrogen.

3.1.5 The Prime Minister’s Ten Point Plan, November 2020 (Ref 3.2) established a commitment to deploy Carbon Capture Use and Storage (CCUS) in a minimum of two industrial clusters by the mid-2020s, and four by 2030 at the latest. This Project has been confirmed by the government as one of the first two such CCUS cluster projects. As Net Zero requires reducing net carbon emissions to zero by 2050, other projects of this nature are not alternatives, they are all necessary, and doing nothing will not achieve Net Zero. Options for carbon capture other than pipeline infrastructure are possible (such as removal from individual sites by vehicle) and may be necessary for more disparate emitters, but removal by pipeline is clearly the most efficient method in a concentrated area of emitters and is in line with the Ten Point Plan, the Net Zero Strategy and the Energy Security Strategy. It would also be possible to cease the emitting activity, but there is insufficient low carbon electricity generation or zero-emitting industrial processes to meet the UK’s needs at present and projected to be for many years.

3.1.6 Consequently, this Chapter does not contain any consideration of a ‘do-nothing’ scenario, non-pipeline transportation, or cessation of emitting activity, on the basis that none of these are considered to be reasonable alternatives to the Project.

3.1.7 The Chapter considers alternatives including:

- Routing configurations and landfall locations; and

- Above Ground Installation (AGI) locations.

3.1.8 The offshore pipeline route is not considered further in this Chapter as it is subject to a separate consent, promoted by bp.

## **3.2 Stage 1: Initial constraints analysis (Ref 3.3)**

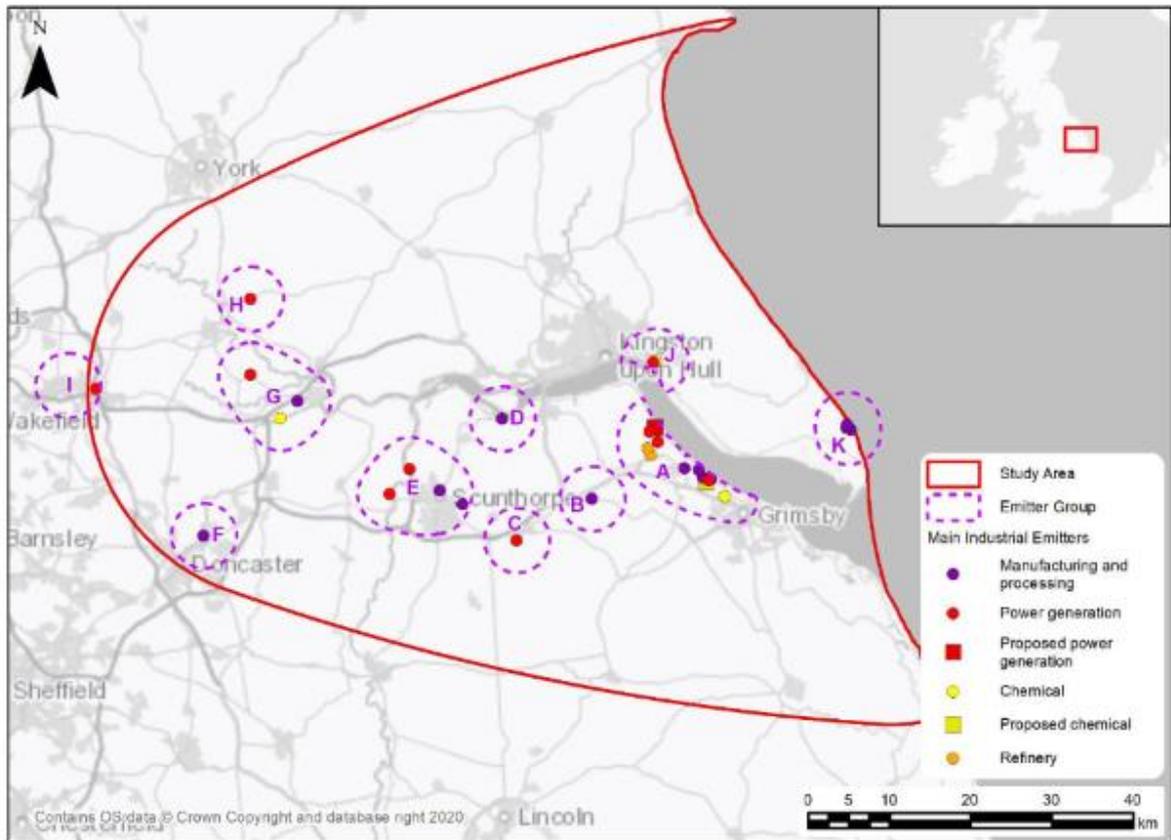
3.2.1 Stage 1 identified constraints within two main study areas (Ref 3.3):

- Study Area 1: a route initially identified for the Yorkshire and Humber Carbon Capture and Storage (YHCCS) Cross Country Pipeline, which was subject to a previous Development Consent Order (DCO) application submitted in June 2014. This DCO application was subsequently refused in 2017 following withdrawal of Government funding (Ref 3.4). Study Area 1 was studied principally to identify any changes to the constraints that were considered as part of the previous application; and
- Study Area 2: this area covered an area to the south of the Humber Estuary and extended down the coast to just south of Theddlethorpe. Study Area 2 included the settlements of Scunthorpe, Barton-upon Humber, Grimsby, Cleethorpes, Louth, and Market Rasen. This Study Area did not relate to a previous application and was therefore substantially larger than Study Area 1.

## **3.3 Stage 2: Pipeline Route Corridor Constraints Study (Ref 3.3)**

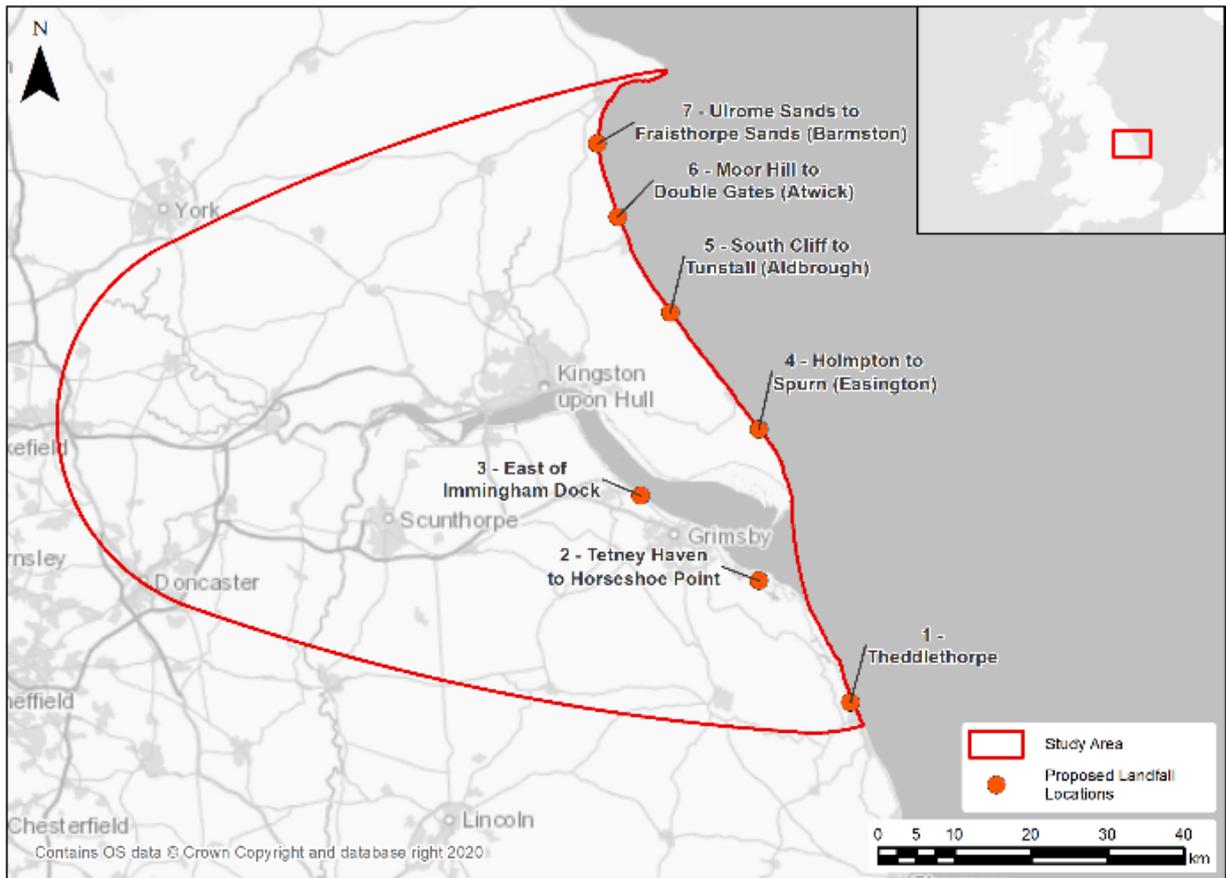
3.3.1 The purpose of the Stage 2 appraisal was to build on the initial constraints analysis work undertaken in Stage 1 and to identify potential route corridors to connect to potential emitters in the Humber Region.

3.3.2 The Stage 2 appraisal identified potential emitters to connect to the pipeline infrastructure. To rationalise the identification of possible pipeline route corridor options, emitters were grouped (connections were identified between the groups, rather than linking to each individual emitter). These emitter groups are shown in Insert 3.1.



### Insert 3.1: Emitter groups (Ref 3.3)

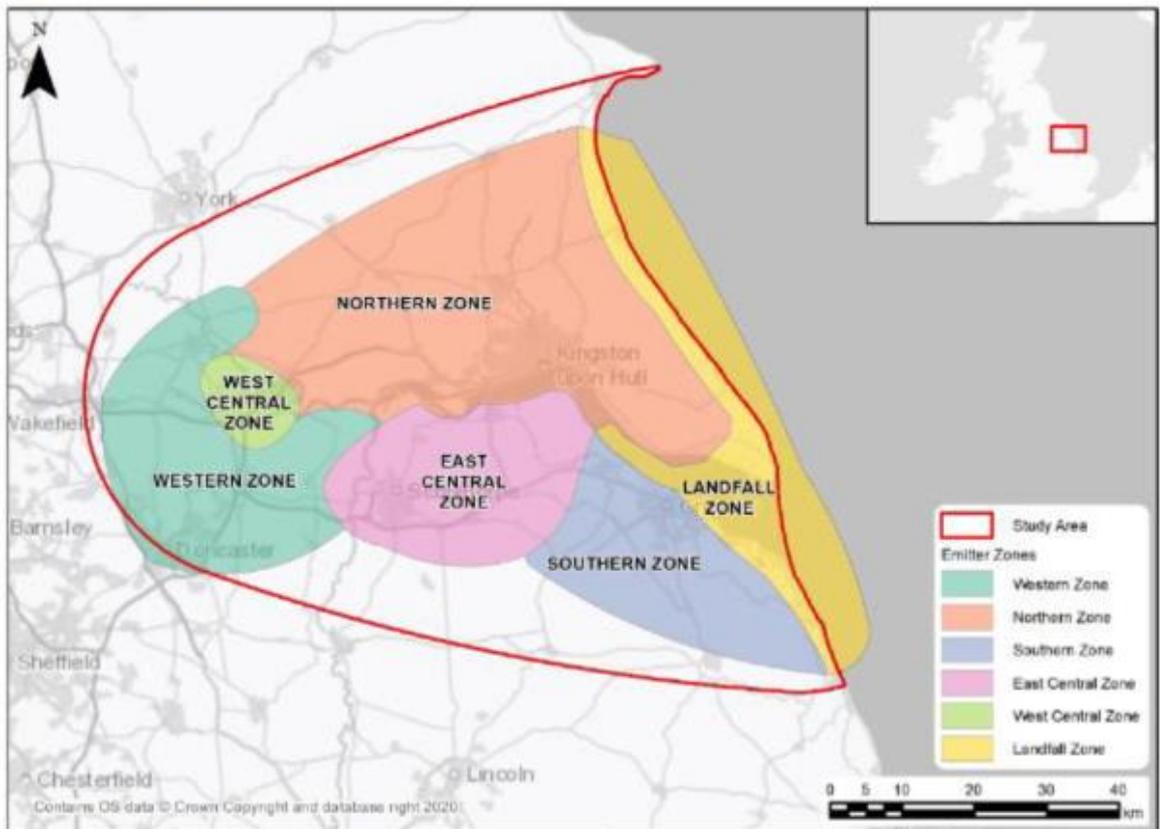
- 3.3.3 Route corridor options were then identified by working backwards from an initial list of seven identified landfall locations towards the emitter groups.
- 3.3.4 The initial list of seven possible landfall locations was as follows and shown in Insert 3.2:
1. Theddlethorpe;
  2. Tetney Haven to Horseshoe Point;
  3. East of Immingham Dock;
  4. Holmpton to Spurn (Easington);
  5. South Cliff to Tunstall (Aldbrough);
  6. Moor Hill to Double Gates (Atwick); and
  7. Ulrome Sands to Fraisthorpe Sands (Barmston).



### Insert 3.2: Landfall areas identified (Ref 3.3)

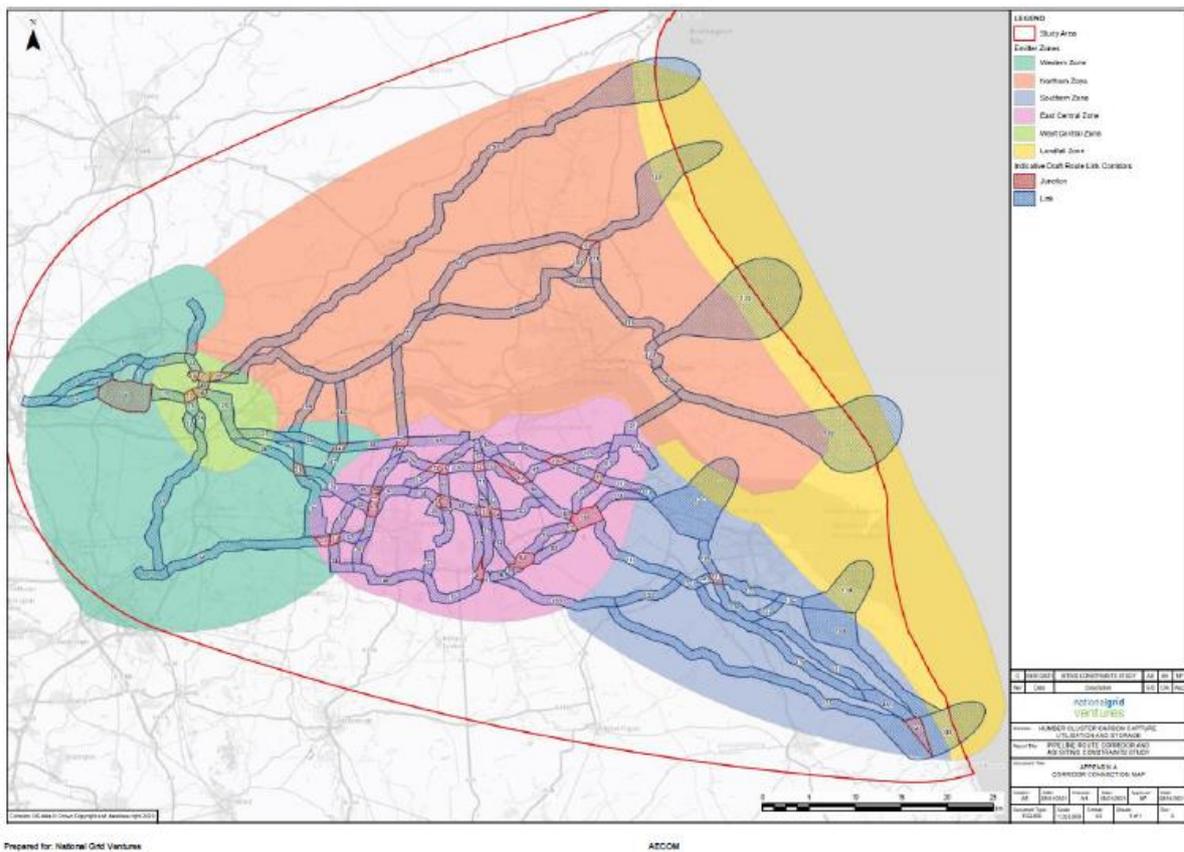
3.3.5 This identification of route corridor options resulted in different routing zones emerging, depending on where emitters were located. These zones were as follows (Insert 3.3):

- West- Central Zone;
- East- Central Zone;
- Northern Zone;
- Southern Zone;
- Western Zone; and
- Landfall Zone.



### Insert 3.3: Routing/emitter zones (Ref 3.3)

3.3.6 These zones allowed for a structured approach to the analysis of potential constraints as each zone was considered in turn. Constraints were identified for each zone, and route corridor options already identified were routed to avoid key environmental constraints wherever possible. For example, key environmental features within the area include the Humber Estuary (which is designated as a Special Area of Conservation (SAC), a Special Protection Area (SPA) and a Ramsar Site) and the Lincolnshire Wolds Area of Outstanding Natural Beauty (AONB). This resulted in the identification of the route corridor connections identified in Insert 3.4 below.



**Insert 3.4: Route corridor option connections (Ref 3.3)**

### 3.4 Stage 3: Humber Low Carbon Pipelines Route Corridor Report (Ref 3.5)

- 3.4.1 Following Stage 1 and 2, a third study was undertaken (Ref 3.5). This report was based on a defined list of potential emitters: Drax, Keadby, British Steel Scunthorpe, Killingholme and Saltend.
- 3.4.2 Further, this report was based on three shortlisted landfall options, Aldbrough, Easington and Atwick. This short-list was derived due to the geographical location of the potential emitters listed above, relative to the landfall locations. The other landfall options were not considered further due to the three shortlisted options being able to provide viable, shorter alternatives.
- 3.4.3 The report involved two appraisal stages, it considered:
  - Package 1 – Main route corridor options i.e. routes providing connections between the potential emitters; and
  - Package 2 – Landfall route corridors i.e. routes from the three shortlisted landfall options to a connection with the main route corridors (set out in Package 1).

#### Package 1 – Main route corridor options

- 3.4.4 At the commencement of the study (Ref 3.5), it was considered that there were two principal ways to connect the potential emitters to the north and to the south of the Humber Estuary (Insert 3.5):

- Configuration A (to the south of the Humber Estuary) was the shortest most direct route. A route that would run between the emitter locations, crossing the Humber Estuary via a new pipeline crossing and then continue from Saltend to a landfall location; and
- Configuration B (to the north of the Humber Estuary), a route that would run between Drax to Killingholme to the south of the Humber. As an alternative to a potential tunnel crossing of the Humber Estuary, a crossing of the Ouse would be undertaken to the east of Goole and additional pipeline infrastructure north of the Humber would connect to Saltend and then to a landfall location.

3.4.5 The initial Configuration A and Configuration B routes are shown in Insert 3.5.



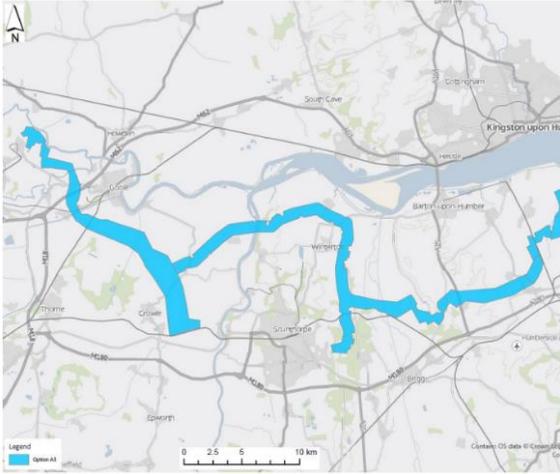
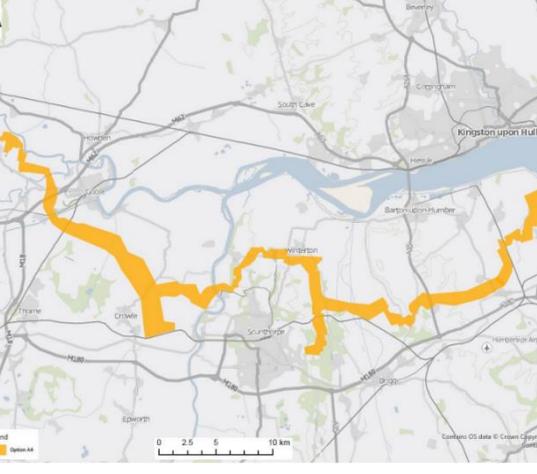
**Insert 3.5: Main route corridor options- Configuration A and Configuration B (Note: the crossing of the River Humber for Configuration A is missing from this map) (Ref 3.5).**

- 3.4.6 The main route corridor options appraisal was undertaken in two parts. In the first part, for Configuration A, two route corridor options were initially taken forward (options A1 and A2) and for Configuration B, four route corridor options were taken forward (B1, B2, B3 and B4). Following this appraisal (Ref 3.5), it was determined that the two options (options A1 and A2) making up Configuration A were to be taken forward to the second appraisal round.
- 3.4.7 Configuration B options were discounted based on environmental, constructability, cost, programme and lands considerations. Configuration B options were between (approximately) 49 km – 53 km longer than the Configuration A options. Therefore, Configuration B options had the potential to result in environmental effects to a greater number of receptors over a larger area, as they would interact with a larger number of

environmental receptors. For example, they would interact with a much larger number of ecological receptors including watercourses and priority habitats. Configuration B also involves two rather than one crossing of the Humber Estuary ecological designations, once under the River Ouse and once under the River Trent. In addition, from a landuse perspective, the longer route also introduces more land interests and crossings.

- 3.4.8 Configuration A options (A1 and A2) were preferred for several of the environment/socio-economic sub-topics including Landscape and Visual, Historic Environment, Water Environment, Soils and Geology, Settlement and Population, Tourism and Recreation, Traffic and Access, and Land Use. Additionally with regards to the feasibility of construction, the River Humber Gas Pipeline Replacement Project was recently constructed close to the proposed crossing of the Humber Estuary for Configuration A using a similar bored tunnel approach. A DCO was granted for the River Humber Gas Pipeline Replacement Project in 2016, supported by a Habitat Regulation Assessment (HRA) that concluded there would not be an adverse effect on integrity of the Humber Estuary SPA and Ramsar as a result of the Project alone and in-combination with other plans and projects. This demonstrates that a tunnel at this location is technically and environmentally feasible.
- 3.4.9 In the second part of the appraisal of the main route corridor options, a review of the initial two Configuration A routes was undertaken to avoid pinch points and impacts on sensitive receptors. This led to Configuration A being developed into three different updated options (A3, A4 and A5).
- 3.4.10 Table 3.1 provides an overview of Options A3, A4 and A5, as detailed within the Route Corridor Report (Ref 3.5).

**Table 3.1: Analysis of main route corridor options Package 1 (Configuration A only)**

Package 1 options	Option A3	Option A4	Option A5
Location			
Length	<p>Approximately 82 km. The option crosses the River Trent north of Garthorpe via Horizontal Directional Drilling (HDD) and the estuary would be crossed via a bored tunnel immediately north of Killingholme Power Station and south of the Saltend Chemicals Park.</p>	<p>Approximately 79 km. The option crosses the River Trent north of Amcotts via HDD and the Humber Estuary would be crossed via a bored tunnel immediately north of Killingholme Power Station and south of the Saltend Chemicals Park.</p>	<p>Approximately 85 km. The Option crosses the River Trent south of West Butterwick via HDD and the estuary would be crossed via a bored tunnel immediately north of Killingholme power station and south of the Saltend Chemicals Park.</p>
Key Environmental constraints	<ul style="list-style-type: none"> <li>• Passes through Humber Estuary Site of Specific Scientific Interest (SSSI)/SAC/Ramsar.</li> <li>• Spring Wood and Far Wood Ancient Woodland are</li> </ul>	<ul style="list-style-type: none"> <li>• Passes through Humber Estuary SSSI/SAC/Ramsar.</li> <li>• Drax Augustinian Priory Scheduled Monument is within the route corridor</li> </ul>	<ul style="list-style-type: none"> <li>• Passes through Humber Estuary SSSI/SAC/Ramsar.</li> <li>• Drax Augustinian Priory Scheduled Monument is within the route corridor</li> </ul>

Package 1 options	Option A3	Option A4	Option A5
	<p>partially within and adjacent to the route corridor section east of British Steel.</p> <ul style="list-style-type: none"> <li>• The corridor section intersects some areas of Priority Habitat including: deciduous woodland (numerous locations throughout route), intertidal substrate foreshore, coastal saltmarsh, mudflats (River Trent Crossing) and lowland heathland (east of British Steel).</li> <li>• Drax Augustinian Priory Scheduled Monument is within the route corridor immediately north of Drax power station.</li> <li>• Heavy Anti-aircraft gunsite Scheduled Monument is within the route corridor south of Winteringham.</li> <li>• There are extensive areas of Flood Zone 2 and Flood Zone 3 within the route corridor (approximately 40%) due to extensive areas of low-lying flood plains surrounding the various rivers that feed into the</li> </ul>	<p>immediately north of Drax power station.</p> <ul style="list-style-type: none"> <li>• There are extensive areas of Flood Zone 2 and Flood Zone 3 within the route corridor (approximately two thirds of the route) due to extensive areas of low-lying flood plains surrounding the various rivers that feed into the Humber Estuary. Flood zones and the crossing of multiple watercourses would be unavoidable (including six main river crossings).</li> <li>• Several priority habitats are within this option: deciduous woodland (numerous locations throughout route), intertidal substrate foreshore, coastal saltmarsh, mudflats (River Trent Crossing) and lowland heathland (east of British Steel).</li> <li>• Capital costs were considered taking into account the length of the corridor (82 km) and the major watercourse</li> </ul>	<p>immediately north of Drax power station.</p> <ul style="list-style-type: none"> <li>• There are extensive areas of Flood Zone 2 and Flood Zone 3 within the route corridor (60%) due to extensive areas of low-lying flood plains surrounding the various rivers that feed into the Humber Estuary.</li> <li>• Flood zones and the crossing of 18 watercourses would be unavoidable (including 14 main river crossings).</li> <li>• Capital costs were considered taking into account the length of the corridor (85km) and the major watercourse crossings (HDD under the River Trent and bored tunnel under the Humber Estuary). On that basis, it was estimated that the costs for Options A3, A4 and A5 would be comparable.</li> </ul>

Package 1 options	Option A3	Option A4	Option A5
	<p>Humber Estuary. Flood zones and the crossing of 13 watercourses would be unavoidable (including six main river crossings).</p> <ul style="list-style-type: none"> <li>Option A3 would involve the crossing of 13 watercourses, which would be unavoidable (including six main river crossings).</li> <li>Capital costs were considered taking into account the length of the corridor (82 km) and the major watercourse crossings (HDD under the River Trent and bored tunnel under the Humber Estuary). On that basis, it was estimated that the costs for Options A3, A4 and A5 would be comparable.</li> </ul>	<p>crossings (HDD under the River Trent and bored tunnel under the Humber Estuary). On that basis, it was estimated that the costs for Options A3, A4 and A5 would be comparable.</p>	

**Summary**

- All three options largely avoid interactions with the key receptor groups of each environmental sub-topic or the alignment of the pipelines could be adjusted through careful routing to avoid interactions or substantially minimise the environmental effects.
- All the options would include a bored tunnel crossing under the Humber Estuary and an HDD crossing under the River Trent which have the potential to impact the internationally designated sites (SSSI/SAC/SPA/Ramsar).
- Following this analysis, it was concluded that all three Configuration A Options (A3, A4 and A5) should be taken forward to Non Statutory Consultation based on the overall balance of environmental, socio-economic, technical and costs considerations.

## Package 2 – Landfall route corridors

- 3.4.11 Package 2 involved identifying possible landfall route corridors connecting to three landfall options (Easington, Aldbrough and Atwick) from both Configuration A and B.
- 3.4.12 A total of 11 options were considered, outlined below (Table 3.2) and in Inserts 3.6 – 3.8.

**Table 3.2: Landfall Route Options**

Option	Connection to Package 1 Configuration	Discounted or Shortlisted?
Easington A (Insert 3.6)	A	<b>Shortlisted- taken forward to Non-Statutory Consultation</b>
Easington B (Insert 3.6)	B	Discounted – based on Configuration A being selected as the preferred main route corridor.
Easington C (Insert 3.6)	A	<b>Shortlisted - taken forward to Non-Statutory Consultation</b>
Aldbrough A (Insert 3.7)	A	<b>Shortlisted - taken forward to Non-Statutory Consultation</b>
Aldbrough B (Insert 3.7)	A	<b>Shortlisted - taken forward to Non-Statutory Consultation</b>
Aldbrough C (Insert 3.7)	B	Discounted – based on Configuration A being selected as the preferred main route corridor.
Aldbrough D (Insert 3.7)	B	Discounted – based on Configuration A being selected as the preferred main route corridor.
Atwick A (Insert 3.8)	A	Discounted- The Atwick A and B options are substantially longer connections to (Package 1) Configuration A (approximately 33 km in length compared to 20 km for Easington A and 16 km for Aldbrough A and B). Therefore, the Atwick options were considered least favourable from an environment, socio-economic, technical and cost perspective as these options had the greater potential to result in environmental effects to a greater number of receptors and greater costs. Atwick options are the least preferred due to the longer route which would introduce more land interests and crossings.

Atwick B (Insert 3.8)	A	Discounted – based on Configuration A being selected as the preferred main route corridor.
Atwick C (Insert 3.8)	B	
Atwick D (Insert 3.8)	B	

**Summary of preferred options – the Route Corridor Report (Ref 3.5) provides a full analysis of options.**

All Atwick options were discounted on the basis of distance, cost and proximity to receptors once Configuration A had been selected.

On balance, from an environment and socio-economic perspective, there are few differentiators between Easington A and the Aldbrough options. Easington A is slightly preferred for the sub-topics of:

- Landscape and Visual due to there being slightly less interaction with receptors than the Aldbrough options;
- Historic Environment due to the proximity of designated heritage assets and the greater potential for impacts on the settings of those heritage assets for the Aldborough options;
- Traffic and Access as it has slightly better access from the trunk road and A/B road network, particularly as it runs parallel to the A1033 and B1455 for most of the route corridor enabling more frequent and shorter connection points along the haul road to the established road network; and
- Planning as it was considered interactions with planned developments could be avoided through careful routeing. The Aldborough options interact with the Yorkshire Energy Park on the northern side of the Humber which had the potential to result in difficulties for the pipelines to be able to be physically routed in the areas to provide a connection at Saltend.

Aldbrough is slightly preferred for the sub-topics of:

- Biodiversity due to their shorter length and general potential for reduced effects whilst the Easington options were less preferable due to their closer proximity to the Humber Estuary;
- Soils and Geology due to the potential for interaction with Geological Conservation Review (GCR) sites at the Easington landfall and shorter length of the Aldbrough options; and

- Settlement, Tourism and Recreation due to fewer residential properties, holiday parks, caravan sites and self-catering facilities in the vicinity.

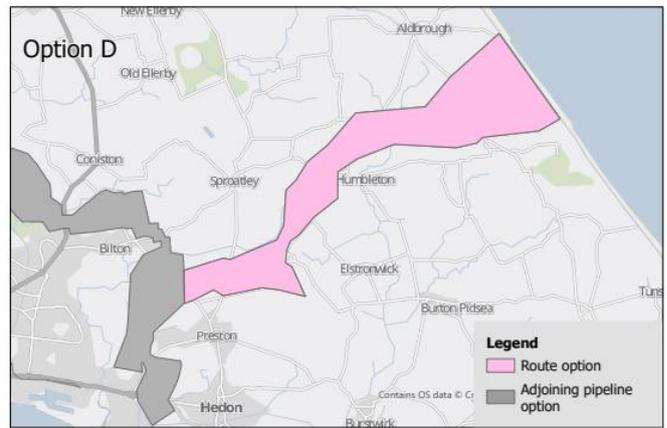
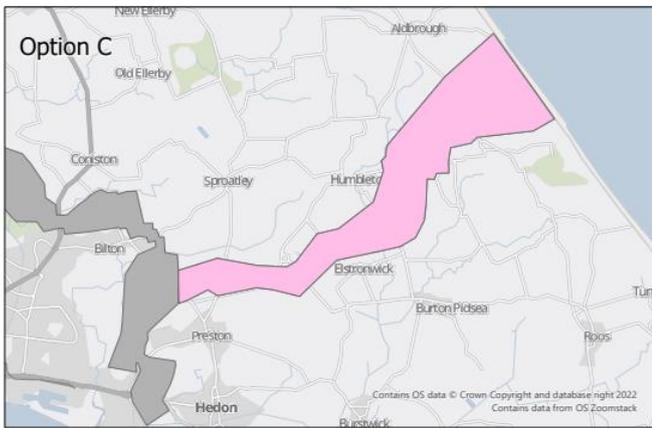
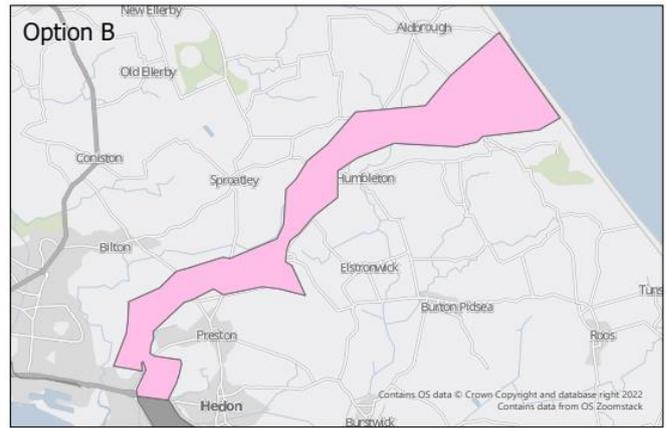
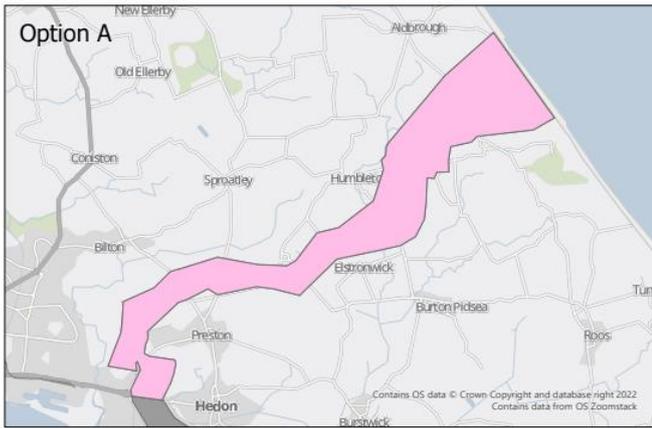
The remaining sub-topics of Water Environment and Land Use were unable to identify any notable differentiators and therefore this leads to a slight preference for the Aldbrough options due to their shorter length.

## Easington Sites



## Insert 3.6: Easington landfall locations

## Aldbrough Sites



## Insert 3.7: Aldbrough landfall locations

## Atwick Sites



### Insert 3.8: Atwick landfall locations

## Summary of Stage 3

3.4.13 The Stage 3 (Package 1 and Package 2) appraisal concluded with the route corridor options that were taken forward to Non-Statutory Consultation in 2021 which are shown on Insert 3.9.



**Insert 3.9: Route corridor options taken forward to Non-Statutory Consultation in 2021**

### 3.5 Stage 4: Preferred route corridor

- 3.5.1 Upon consolidation of feedback from the Non-Statutory Consultation in September - October 2021 (Ref 3.6) and further studies to consider environmental, socio-economic, technical and planning constraints, the preferred route has been identified. The preferred route corridor was initially presented in the Environmental Impact Assessment (EIA) Scoping Report (Appendix 1.1 (Volume II)) and further refined to be reported within this PEIR and consulted on during Statutory Consultation in 2022.
- 3.5.2 The preferred route corridor identified Easington as the final landfall location being taken forward. To arrive at this decision, the Applicant and bp individually and jointly assessed the final shortlist of Easington and Aldbrough landfall locations to identify the main differentiators. These are summarised below.
- 3.5.3 The differentiators favouring Easington are:
- Easington has the greatest execution certainty in terms of cost, schedule and constructability;
  - Easington is an existing industrial complex with multiple landfalls of incoming pipelines. The Tolmount pipeline is an excellent precedent for the Northern Endurance Partnership (NEP) offshore pipeline giving more confidence (and precedent) to what will be a complex scope regardless of location; and

- Easington has a reduced environmental impact on the Holderness Inshore Marine Conservation Zone.

3.5.4 The differentiators favouring Aldbrough are:

- Aldbrough has a marginally lower overall cost; and
- Aldbrough requires less land acquisition and has a slightly reduced offshore environmental effect across a number of constraints due to its shorter pipeline length.

3.5.5 On the basis of the above, the decision was taken to select Easington as the final landfall location.

## **3.6 Consideration of alternatives for AGIs**

3.6.1 The EIA Scoping Report identified preliminary AGI option locations. These have evolved through design development to produce the options presented Statutory Consultation within Table 2.2 within Chapter 2: Project Description (Volume II). Alternative locations for many of the AGIs are therefore still under consideration and will be informed by the responses to the Statutory Consultation.

3.6.2 A confirmed list of AGI locations, along with relevant design parameters, their footprint and maximum heights will be provided within the ES, following Statutory Consultation.

## **3.7 Summary and next steps**

3.7.1 This consideration of alternatives chapter has outlined the work undertaken to date in the development of the Project. The report has outlined the options for the pipeline route, as well as landfall locations and AGIs. Following on from Statutory Consultation planned from October 2022, the route will be further refined based on consultation feedback, and further detailed design. Siting of the Pump Facility at Easington will be undertaken in collaboration with bp.

3.7.2 Final details of the chosen pipeline route and AGI locations (including the Pump Facility at Easington) will be detailed within the forthcoming ES.

## 3.8 References

- Ref 3.1 HM Government (2017) *The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017*. Available at: <https://www.legislation.gov.uk/uksi/2017/572/contents/made> (Accessed: 3 August 2022).
- Ref 3.2 HM Government (2020) *The Ten Point Plan for a Green Industrial Revolution*. Available at: [The Ten Point Plan for a Green Industrial Revolution](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/90121/ten-point-plan-for-a-green-industrial-revolution.pdf) (publishing.service.gov.uk) (Accessed: 3 August 2022).
- Ref 3.3 AECOM (2021) *Humber Cluster Proposed Carbon Dioxide Transportation Pipeline System – Pipeline Route Corridor and AGI Siting Constraints Study*.
- Ref 3.4 Department for Business, Energy and Industrial Strategy (2017) *Application for Development Consent for the Yorkshire and Humber Carbon Capture and Storage Cross Country Pipeline decision notice*. Available at: [EN070001-003920-Secretary of State Decision Letter including the Statement of Reasons.pdf](https://www.planninginspectorate.gov.uk/media/146076/EN070001-003920-Secretary%20of%20State%20Decision%20Letter%20including%20the%20Statement%20of%20Reasons.pdf) (planninginspectorate.gov.uk) (Accessed 4 August 2022).
- Ref 3.5 Arcadis (2021) *Humber Low Carbon Pipelines Route Corridor Report*. Available at: <https://www.nationalgrid.com/our-businesses/national-grid-ventures/humber-low-carbon-pipelines> (Accessed: 4 August 2022).
- Ref 3.6 National Grid Ventures (2022). *Humber Low Carbon Pipelines Project Stage 1 Non- Statutory Consultation Feedback Report* Available at: <https://www.nationalgrid.com/document/146076/download> (Accessed 19 August 2022).

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