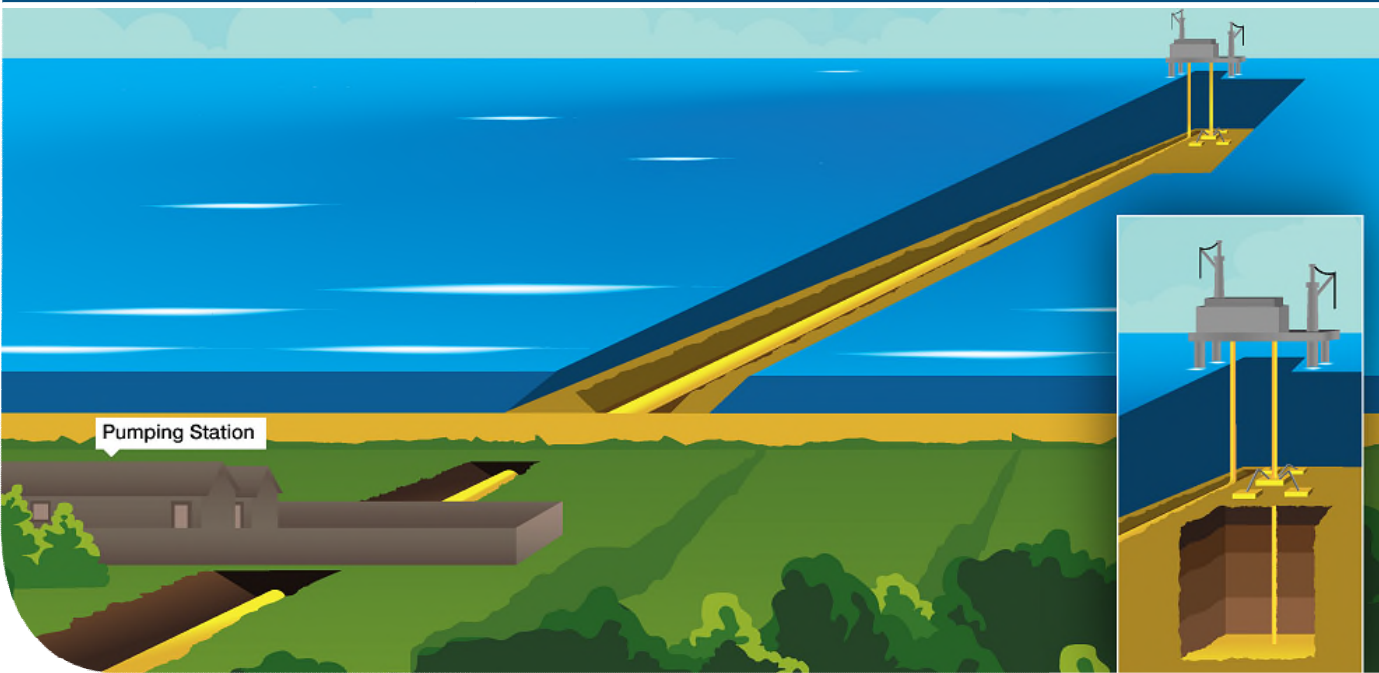




# K32 - Onshore Transport Pump Station & Above Ground Installation - Plot Plan

*Technical Transport*



# Disclaimer

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# Key Words

Key Work	Meaning or Explanation
Carbon	An element, but used as shorthand for its gaseous oxide, CO <sub>2</sub> .
Capture	Collection of CO <sub>2</sub> from power station combustion process or other facilities and its process ready for transportation.
Storage	Containment in suitable pervious rock formations located under impervious rock formations usually under the sea bed.
Transport	Removing processed CO <sub>2</sub> by pipeline from the capture and process unit to storage.
Dense Phase	Fluid state that has a viscosity close to a gas while having a density closer to a liquid. Achieved by maintaining the temperature of a gas within a particular range and compressing it above a critical pressure.
Plot Plans	Plans of the plots of land designated as the sites of the above ground installations associated with the pipeline.

# Executive Summary

This report and the associated K32 Supporting Documentation is one of a series of reports; these “key knowledge” reports are issued here as public information. These reports were generated as part of the Front End Engineering Design Contract agreed with the Department for the Environment and Climate Change (DECC) as part of the White Rose Project. The contents of this K32 report draws on work, which was undertaken by National Grid and which was partly funded under the European Union’s European Energy Programme for Recovery (EEPR).

White Rose seeks to deliver a clean coal-fired power station using oxy-fuel technology fitted with carbon capture storage (CCS), which will generate up to 450WMe (gross) while capturing at least 90% of the carbon dioxide emissions. CCS technology allows the carbon dioxide produced during combustion to be captured, processed and compressed before being transported to storage in dense phase. The dense phase carbon dioxide will be kept under pressure while it is pumped through an underground pipeline to the seashore and then through an offshore pipeline to be stored in a specially chosen rock formation under the seabed. This “key knowledge deliverable” (KKD) reports on the planning of the sites, the “plots”, on which the onshore, above ground installations would be located along the route of the pipeline through which the carbon dioxide would be transported.

Once the carbon dioxide has been captured and compressed at the Oxy-Power plant, it will be transported in dense phase to the Drax PIG Trap: this plant would facilitate the insertion and removal of the PIGs. The second plot is the Camblesforth Multi-junction: the plant on this site would facilitate feed-in pipelines from other carbon dioxide sources. The third plot, sited near Tollingham, would house the first of three Block Valves. Block Valves are used to isolate any segment of the line for maintenance work or to isolate a section in which a leak is detected or suspected. The fourth and fifth plots would also be Block Valves: located near Dalton and Skerne, respectively. The sixth and last plot, near Barmston, is the Pumping Station, which would be required to maintain the pressure of the carbon dioxide within the pipeline for transportation offshore. Half a kilometre after the Pump Station, the pipeline would dip under the North Sea.

# 1 Introduction

National Grid Carbon Limited (NGC) is a wholly owned subsidiary of the National Grid group of companies. Capture Power Limited (CPL) is a special purpose vehicle company, which has been formed by a consortium consisting of ALSTOM, Drax and BOC, to pursue the White Rose CCS Project (the WR Project).

CPL have entered into an agreement (the FEED Contract) with the UK Government's Department of Energy and Climate Change (DECC) pursuant to which it will carry out, among other things, the engineering, cost estimation and risk assessment required to specify the budget required to develop and operate the WR Assets. The contents of this K32 report draws on work, which was undertaken by National Grid, which was partly funded under the European Union's European Energy Programme for Recovery (EEPR). The WR Assets comprise an end-to-end electricity generation and carbon capture and storage system comprising, broadly: a coal fired power station utilising oxy-fuel technology, carbon dioxide capture, processing, compression and metering facilities; transportation pipeline and pressure boosting facilities; offshore carbon dioxide reception and processing facilities, and injection wells into an offshore storage reservoir.

CPL and NGC have entered into an agreement (the KSC) pursuant to which NGC will perform a project (the WR T&S FEED Project) which will meet that part of CPL's obligations under the FEED Contract which are associated with the T&S Assets. The T&S Assets include, broadly: the transportation pipeline and pressure boosting facilities; offshore carbon dioxide reception and processing facilities, and injection wells into an offshore storage reservoir.

A key component of the WR T&S FEED Project is the Key Knowledge Transfer process. A major portion of this is the compilation and distribution of a set of documents termed Key Knowledge Deliverables, which this document represents.

## 2 Purpose

Siting of above ground installations is one the challenges of planning the route of an onshore pipeline to transport liquefied carbon dioxide within the UK. The purpose of this document is to provide an example of the design and planning considerations associated with the choosing of sites at which to locate and install the necessary items of equipment and associated infrastructure; it includes:

- A supporting narrative of the Plot Plans for the onshore transport system to meet the requirements of the development consent order. The Plot Plans are required to mitigate the planning consent risk and were compliant with advice provided by Planning Inspectorate for England and Wales.
- The plans for building plots for all above ground fixed installations, the PIG trap facility at Drax power station, the multi-junction at Camblesforth, the 3 block valves at Tollingham, Dalton and Skerne, and the Barmston pumping facility can be found in the Supporting Documentation.

## 3 Description of the Onshore Scheme

### 3.1 Onshore Scheme Overview

The Onshore Scheme requires a new buried high pressure Cross Country Pipeline of approximately 67 km in length and two connecting pipelines from the Capture and Processing unit at Drax Power Station to the Multi-junction and from the Pumping Station to the Mean Low Water Mark respectively, with a combined total length of approximately 74 km.

The Cross Country Pipeline will have an external diameter of up to 610 mm.

The Local Pipeline connection from Drax PIG Trap to the Camblesforth Multi-junction will have an external diameter of up to 324 mm. Both Pipelines will be buried with 1.2 m of cover (unless at a crossing where the depth would be greater). At watercourse crossings and below public highways the minimum depth of cover will be between 1.7 m and 2 m.

In addition to the Cross Country Pipeline the Onshore Scheme consists of six Above Ground Installations (AGIs) comprising a PIG Trap adjacent to the Capture and Processing unit at Drax Power Station, a Multi-junction to the south of Drax Power Station, three Block Valves at Tollingham, Dalton and Skerne and a Pumping Station to the north of Barmston. The requirements for each are summarised out below.

### 3.2 Above Ground Installation Characteristics

#### 3.2.1 General

The footprint and the layout of all the AGIs have been determined by a number of requirements:

- Operational requirements;
- Environmental constraints; and
- Safety considerations.

All the AGIs will be surrounded by a 1.2 m high post and rail boundary fence and will incorporate a security fenced compound, surrounded by a 2.4 m high black weld mesh security fence, topped by three strands of barbed wire giving a total height of 2.9 m. Internal vehicular access routes will be tarmac and the pedestrian walkways will be paved with concrete. The areas under the pipework will be surfaced with stone chippings.

Landscape proposals have been developed for each of the AGI sites and detailed site specific planting schedules will accompany the application for DCO consent.

### 3.3 Above Ground Installation Temporary Construction Areas

Temporary Construction Areas will also be required for each AGI to facilitate the temporary construction works for that AGI including vehicle parking, materials storage, cabins and welfare facilities. These will be adjacent to each of the respective AGIs and located within the Pipeline Right of Way. Temporary Access roads will also be required to facilitate construction; these are as shown on the relevant drawings.



## 3.4 Preferred Sites

### 3.4.1 Drax PIG Trap

Information gathered during the White Rose CCS Project Route Corridor Study (RCS) and subsequent studies and field surveys being carried out as part of the Environmental Impact Assessment (EIA) were used to inform the site selection process. Considerations included:

- The River Derwent - designated as a Special Area of Conservation (SAC) and also a Site of Special Scientific Interest (SSSI) until its confluence with the River Ouse at Barmby Tidal Barrage;
- Drax Augustinian Priory (Scheduled Monument) near Drax Abbey Farm to the North East of Drax Power Station;
- Undesignated monuments including the site of a moat, ploughed out and existing fishponds and field boundaries associated with Drax Augustinian Priory; a Medieval fishery at Drax; “find-spot” of a brass matrix seal; and the Engine House and Site of Ouse Swing Bridge and trackway to the South of Long Drax;
- A Mineral Safeguarding Area for Brick Clay to the East which includes a narrow band encompassing Drax Abbey Farm;
- Potentially contaminated land uses at Drax Power Station and to the West;
- Several historic and current landfill sites, the largest of which is to the North West of Drax Power Station. An area of woodland on the North East corner of the Drax Power Station site is an historic landfill, an area of mounded ground which is now covered in mature trees;
- The River Ouse;
- Carr Dike and a number of deep well maintained drainage ditches. Pump houses and sluice gates control drainage outfall to the River Ouse;
- Areas within Flood Zone 2 and 3, at moderate to high risk of flooding and within reservoir flood risk area;
- A groundwater Source Protection Zone III (Total Catchment);
- The settlement of Long Drax; and
- The Trans Pennine Trail, the Yorkshire Ouse Walk and National Cycle Network Route 65.
- Following consultation, four potential locations were initially identified (see Figure 3.1). Sites PT1 and PT2 were discounted due to insufficient space, and the location and potential impact on the Scheduled Monument (Drax Augustinian Priory).

Of the other two sites (PT3 and PT4) both had similar constraints. Both Sites are within the setting of Drax Augustinian Priory Scheduled Monument, however, PT3 is further from the boundary of the Scheduled Monument and would be located to the South in association with the proposed new Drax Power Station development. PT4 is closer to the Scheduled Monument and is located away from the main site of the new Drax Power Station.

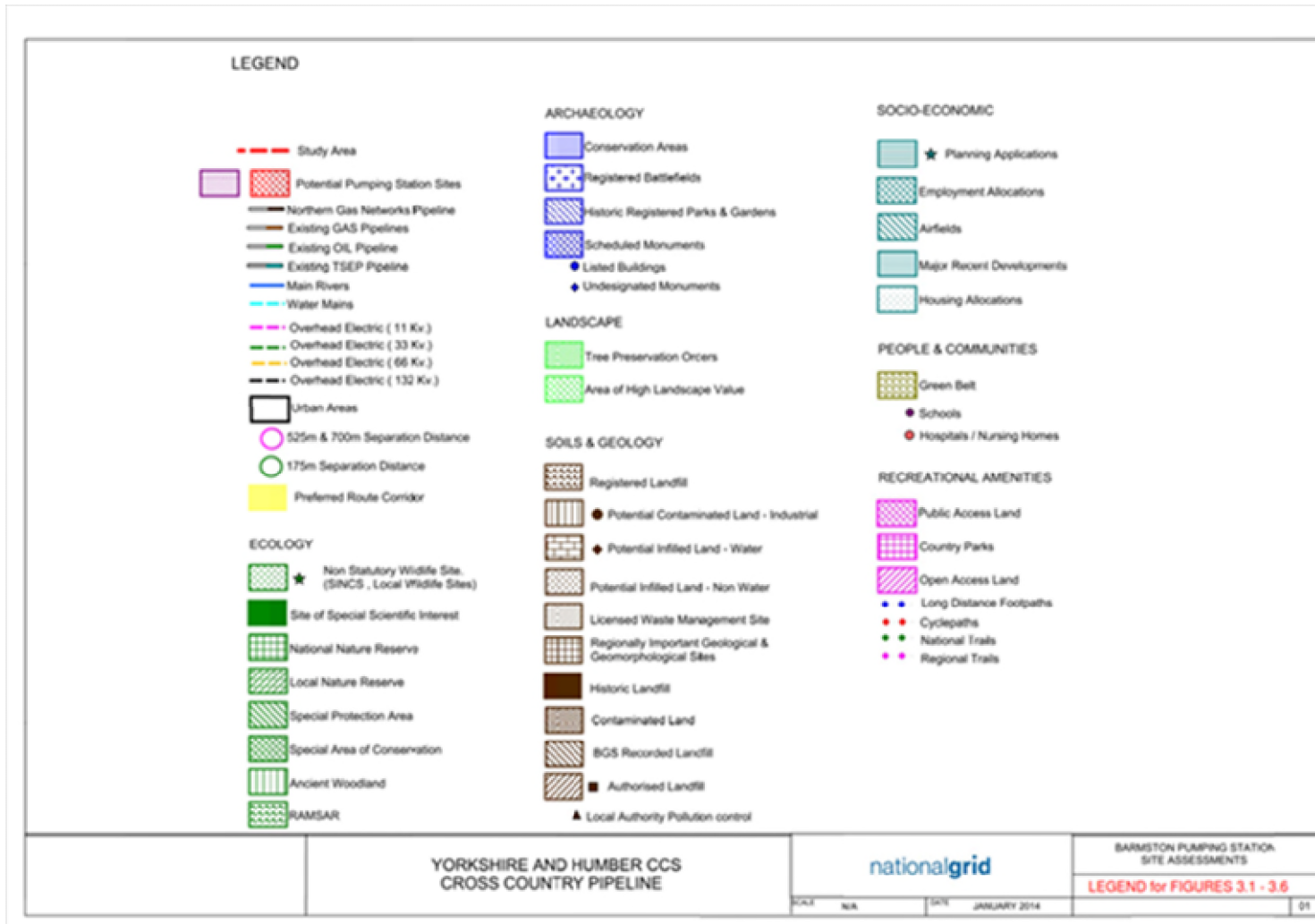
PT3 would be overlooked from residential properties partially screened by existing vegetation and set within the context of the existing Drax Power Station and the proposed new Power Station. PT4 is located closer to residential property however, would not be directly overlooked and views and noise would be attenuated. PT4 would however extend the industrial influence of the development further into the surrounding agricultural landscape.

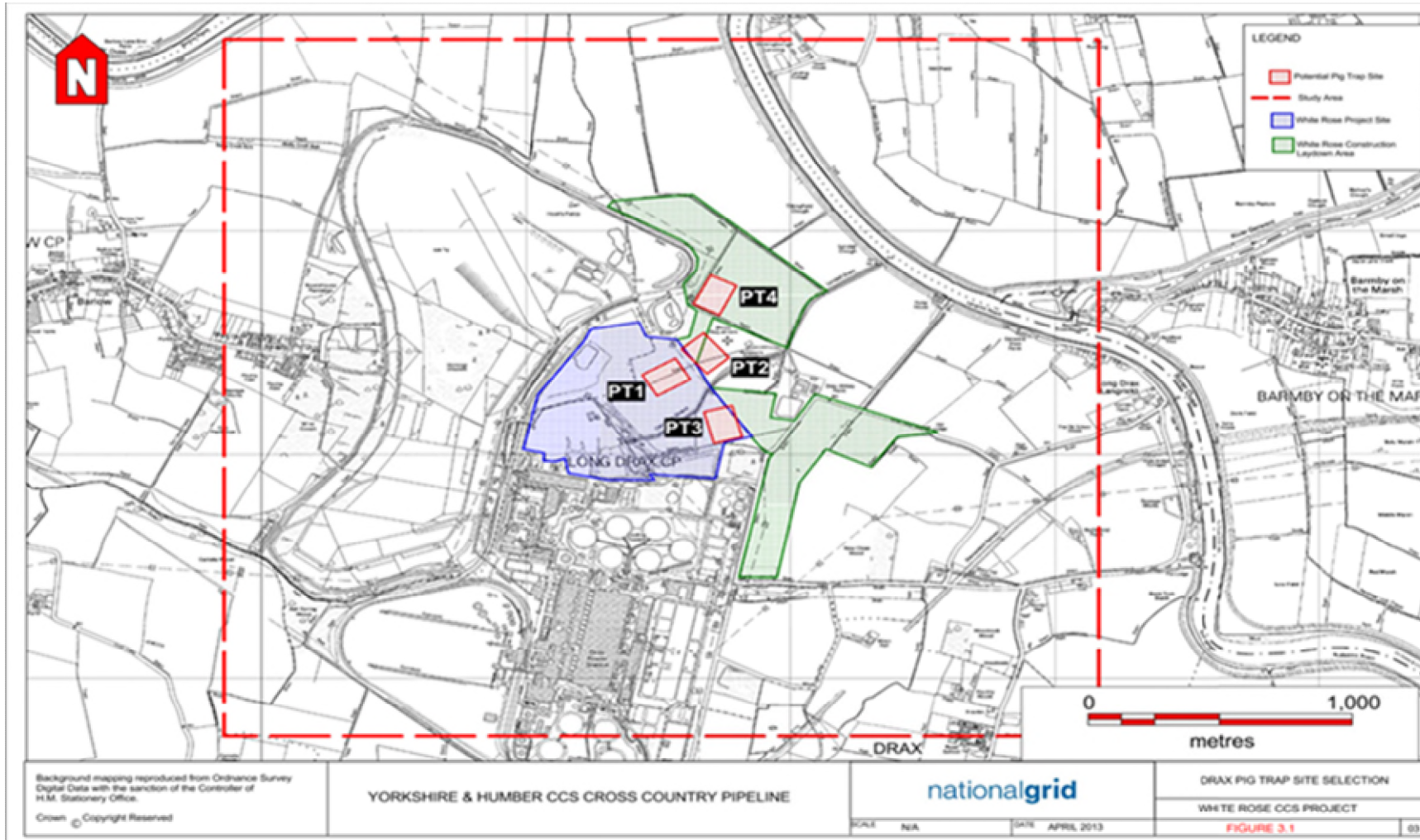
PT3 would require a shorter access to connect to the public highway.

The route of the process pipe to PT4 would cross land used by third parties and alternative maintenance and operation standards would need to be applied. This might require inspection by PIG involving additional PIG trap facilities both within the new Drax Power Station site and National Grid's PIG trap site with the associated increase in land-take, environmental and project cost.

Both sites would be within the proposed new Power Station application area. The location of PT3 is unlikely to present an obstruction although careful planning and coordination of the construction laydown areas, construction access routes and construction programmes would be required.

Taking into account the results of the site selection and appraisal process site PT3 was taken forward to the statutory consultations.





### 3.4.2 Camblesforth Multi-Junction

A site selection process was undertaken to identify and appraise potential locations taking into account the landtake required (3.0 ha), and the need to accommodate a connecting pipeline from the Drax Oxyfuel Combustion Unit and other potential connecting pipelines from future emitters.

The search area for the Multi-junction was determined with regard to the Government's policy in that the infrastructure needed should be located both for the purposes of demonstration and to take account of future demand beyond demonstration. Regard was made to a number of considerations including:

- A location accessible to the Drax Combustion Unit that would not add excessive pipeline cost to the demonstration project phase;
- A location accessible to the Cross Country Pipeline;
- A location that is accessible to connections from other regional emitters;
- Other specific environmental, engineering, technical and socio- economic siting considerations including:
  - avoidance of centres of population;
  - avoidance, where possible, of identified environmental features/
  - designations; and
  - minimisation of complex pipeline crossings of other infrastructure or large geographical features.

The location of the Multi-junction would dictate the length and therefore cost of any interconnecting pipe work to the emissions source and accordingly therefore would influence the commerciality of the demonstration phase as well as the viability of the Project to accommodate future connections.

The search area identified was considered to occupy a central location in the region offering good connectivity to the main Carbon Dioxide emitters. Future pipeline connections from the Aire Valley, the South Humber Bank and Don Valley are viable in this area. Locating a Multi-junction within this search area would mean that subsequent CCS projects could be developed cheaper and more efficiently by virtue of the Cross Country Pipeline and Multi-junction already being in place.

The perimeter to the search area was identified as:

- The River Ouse to the North and East – discounting options to the North of the River Ouse would minimise the number of pipeline crossings of the River facilitating future emitter's connections to the Project;
- The River Aire to the South – Limiting the search area at the River Aire would mean that only future pipeline connections from the South Humber bank area would need to cross the River. Connections from the Drax Combustion Unit and future connections from the Aire Valley would not be affected by the need to cross the River; and
- The A1041, Camblesforth, Drax and Barlow Nature Reserve to the West – the A1041 offers an appropriate boundary to the western boarder of the search area. Siting the multi-junction to the west of this boundary would add additional cost to both the demonstration project and any subsequent connections from the South Humber Bank by introducing a convoluted pipeline route. Similarly, the North Western boundary is taken to be the Barlow Nature reserve adjacent to the new Drax Power Station. Extending the search area further North in this area would restrict pipeline route options for emitters to the South.

Within the search area considerations for locating a Multi-junction, and routeing connections, included:

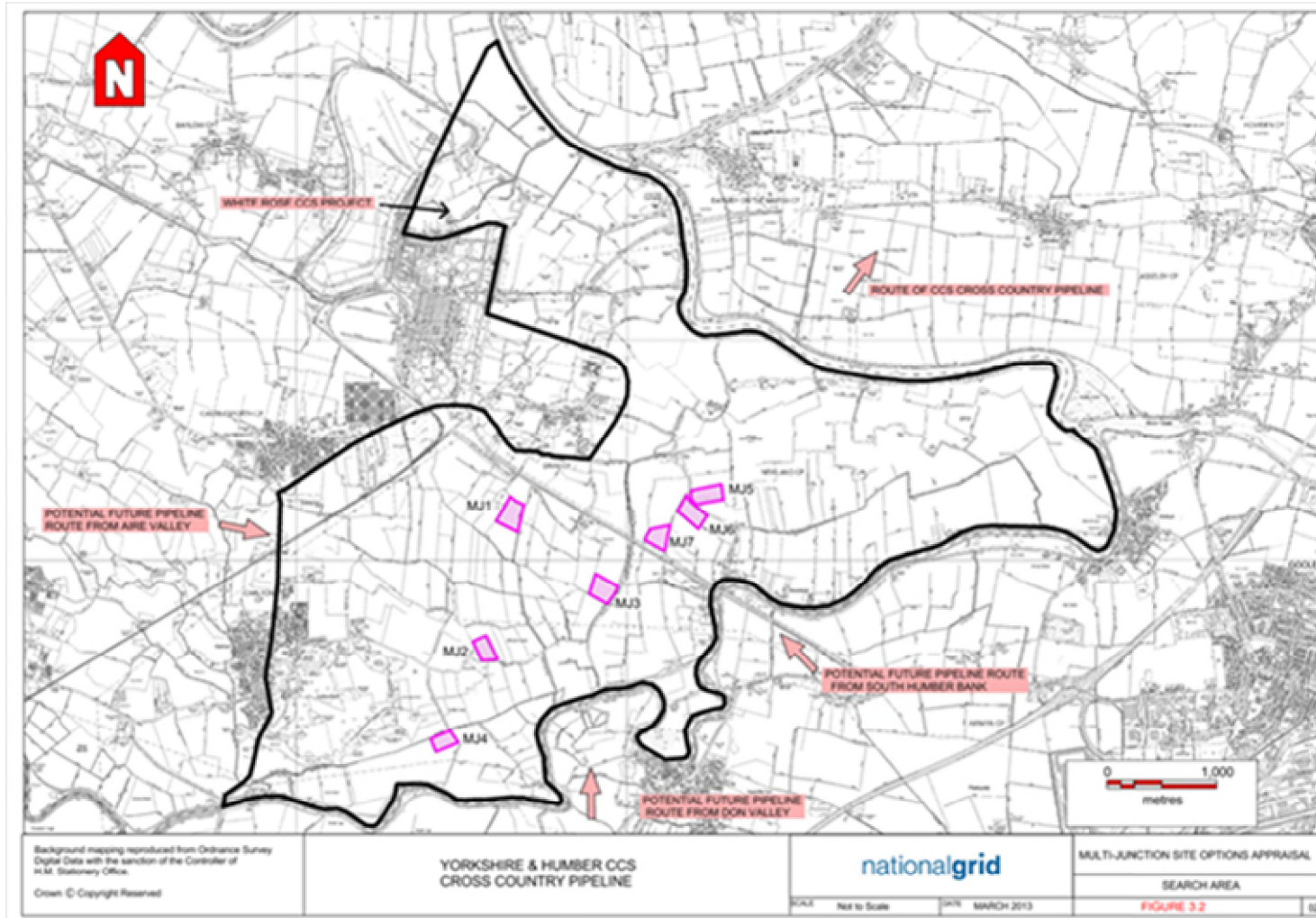
- Eskamhorn Meadows SSSI;
- A number of non-statutory designated nature conservation sites and a Nature Reserve;
- A number of designated heritage assets including both Scheduled Monuments and listed buildings;
- A number of undesignated heritage assets and there is the potential for further undesignated assets to exist;
- Carlton Towers, a manor house surrounded by parkland;
- A geophysical anomaly within a field to the South of the A645. As yet it has not been determined whether this is a natural feature or heritage asset;
- The settlements of Camblesforth, Carlton and Drax; the linear villages of Newland, Little Airmyn; and Long Drax;
- Public rights of way, including the Trans Pennine Trail, the Yorkshire Ouse Walk, the Howden 20 and the National Cycle Network (NCN) Route 62;
- Numerous areas of potentially contaminated land, areas affected by coal mining, and areas of mining instability (although no underground workings have been identified);
- Areas identified as Brick Clay allocations and Mineral Safeguarding Areas;
- Source Protection Zones;
- Watercourses (including land drains), and their associated EA flood zones, and flood defences;
- Road access; and
- Existing National Grid gas pipelines and a water main.

Using the criteria identified in the summarised above, seven potential sites for the Multi-junction were identified (see Figure 3.2).

The comparative analysis identified MJ1 as the most preferable. This Option required a relatively short road access to the A road system avoiding local villages, had good screening potential and good suitability for future pipeline connections.

Options MJ2, MJ3 and MJ4 were considered less favourable principally due to the poor condition of the road access and potential restrictions on HGV access through Carlton village. Options MJ5, MJ6 and MJ7 were considered less favourable due to relatively open nature of the sites as they are overlooked from residential properties and offer limited screening potential; potential restrictions on HGV access through Drax village; and restricted access for future pipelines.

Taking into account the results of the site selection and appraisal process site MJ1 was taken forward to the statutory consultations.



### 3.4.3 Block Valves

#### 3.4.3.1 Tollingham Block Valve

The Preferred Site Option for the Tollingham Block Valve was located to the South East of Holme-on-Spalding-Moor and to the West of Holme Industrial Estate at the former RAF Holme-on-Spalding-Moor air base near Tollingham.

Considerations for detailed siting included:

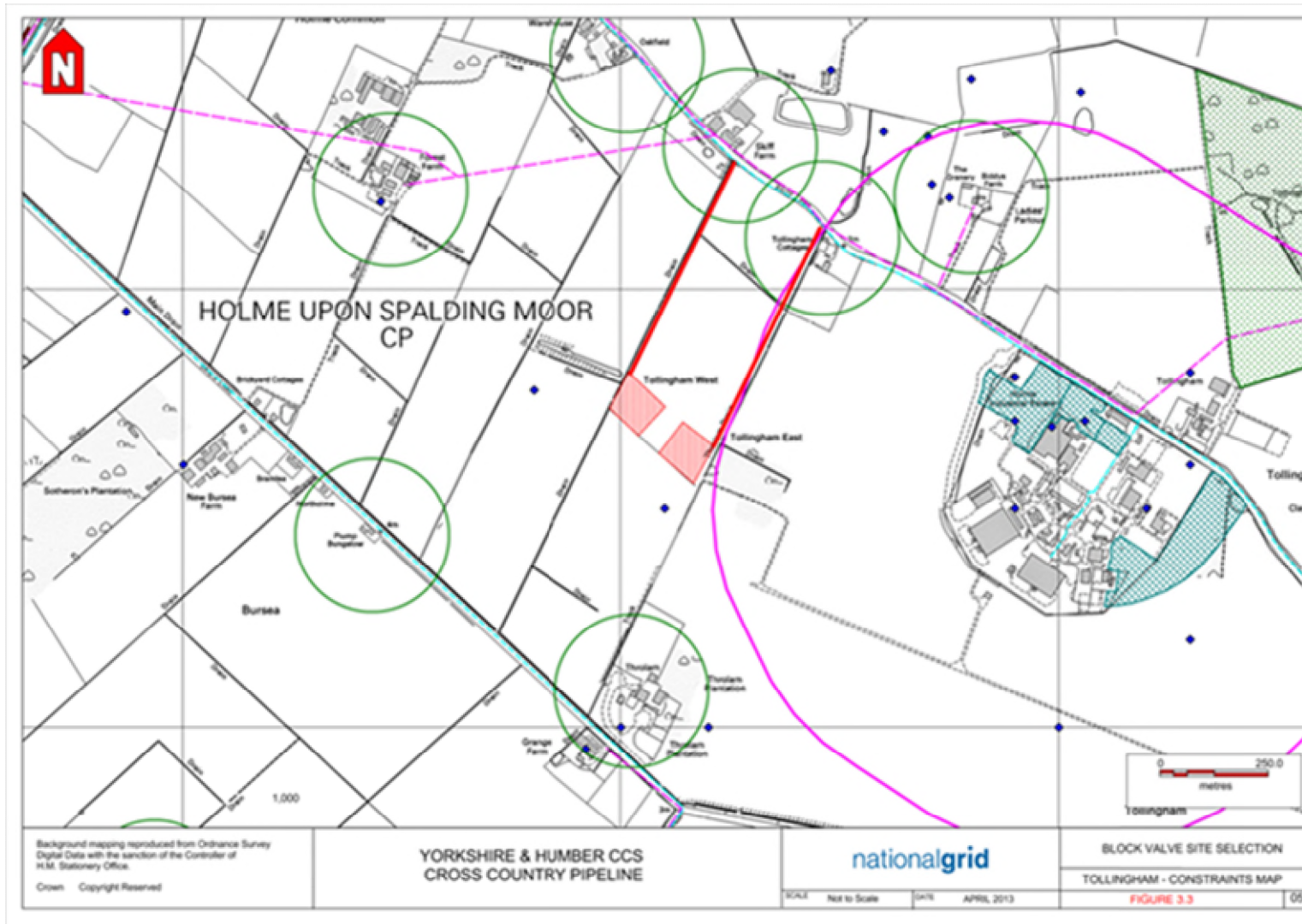
- Undesignated monument records of Romano-British occupation and kilns and the close proximity to the Rascal Moor Roman settlement complex which covers a large area to the South of Skiff Lane and indicates the potential for archaeology;
- A Mineral Safeguarding Area for Sand and Gravel although no active or dormant minerals sites have been identified;
- The location of the former RAF Holme-on-Spalding-Moor airfield, which is identified as potentially contaminated due to historic industrial use and has the potential for unexploded ordnance. The site is currently agricultural land;
- An area of Flood Zone 2, at moderate risk of flooding;
- Port Royal Equestrian and Exhibition Centre, located on Skiff Lane to the South East of Holme-on-Spalding-Moor. This facility provides a venue for equestrian events, competitions and classes and provides livery; and
- Properties located on Skiff Lane to the North East, at Skiff Farm to the North, Holme Industrial Estate to the East and at Throlam to the South.

Two potential locations were identified; both sites having similar constraints (see Figure 3.3). The main distinguishing factors related to:

- Inconspicuous position of the potential block valve and potential for screening;
- Flood risk; and
- Access to the public highway.

Due to the better screening potential afforded to Tollingham East by a mature woodland plantation and hedgerow trees; the potential to mitigate flood risk by careful siting and design; the positioning of the access away from the Skiff Farm access; and the low level of operational traffic, this was identified as the preferred location and was taken forward to the statutory consultation.





### 3.4.3.2 Dalton Block Valve

The preferred Site Option for Dalton Block Valve was located to the South West of Lund.

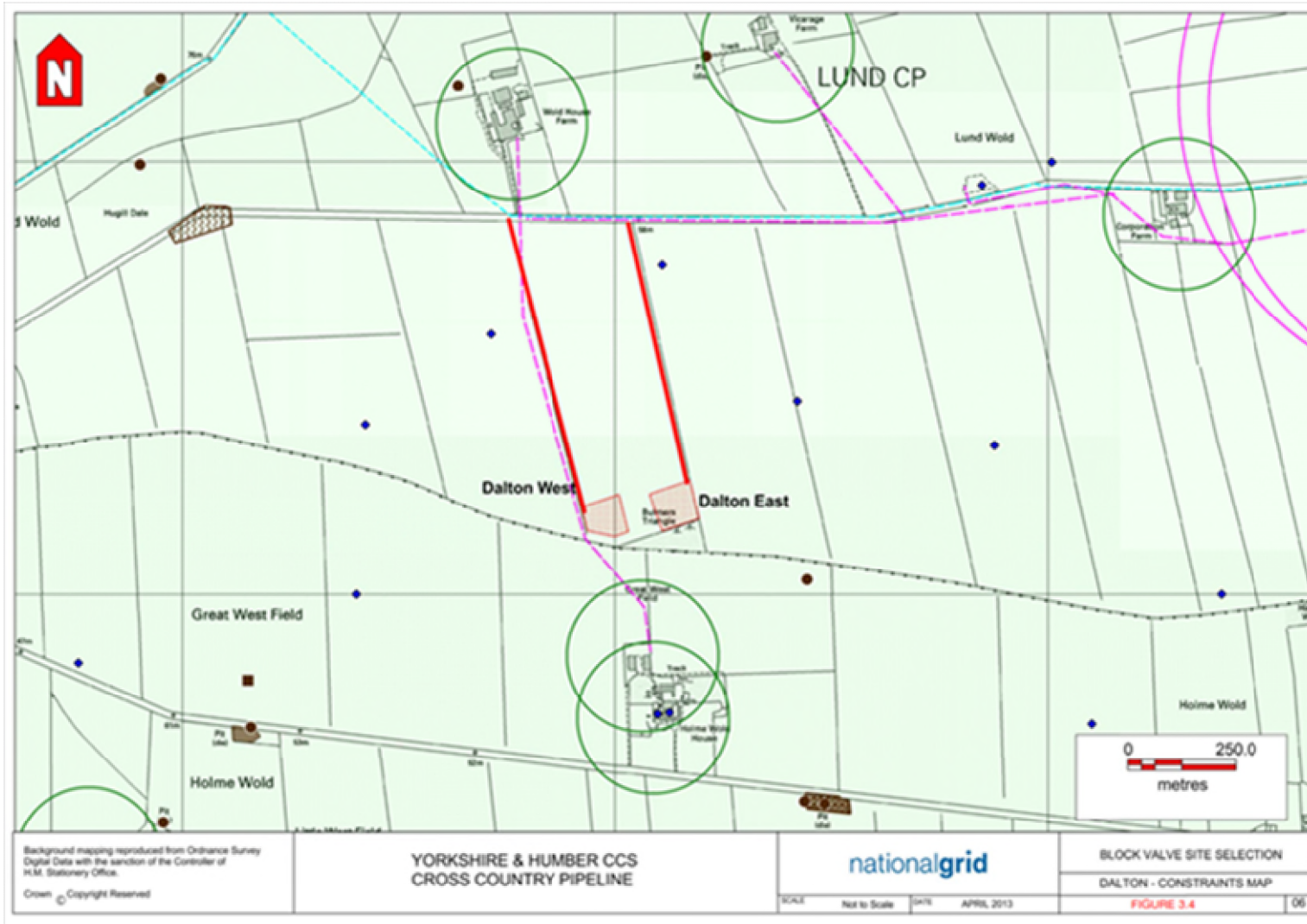
Considerations for detailed siting included:

- Dalton Park Registered Historic Park and Garden, located c.950m to the South;
- An undesignated monument record site at Holme Wold House c. 400m to the South (the Yorkshire Wolds is an area with high potential for archaeology);
- A Mineral Safeguarding Area for Industrial Chalk;
- An area of Flood Zone 3 adjacent to the Bryan Mills Beck; and
- The downward slope to the South to a shallow valley beyond which the ground rises again so that some levelling and cut and fill would be required.

Two potential locations were identified (see Figure 3.4). Both had similar constraints, the main distinguishing factors relating to:

- Inconspicuous position of the potential block valve and potential for screening;
- Flood risk;
- Topography; and
- Access to the public highway.

Due to the better screening potential afforded to Dalton East by a mature woodland plantation and hedgerow, the slightly shallower gradient and shorter access track; and the low level of operational traffic likely to affect the footpath, this was identified as the preferred location for the Block Valve and was taken forward to the statutory consultation.



### 3.4.3.3 Skerne Block Valve

The preferred Site Option for Skerne Block Valve was located to the South East of Skerne.

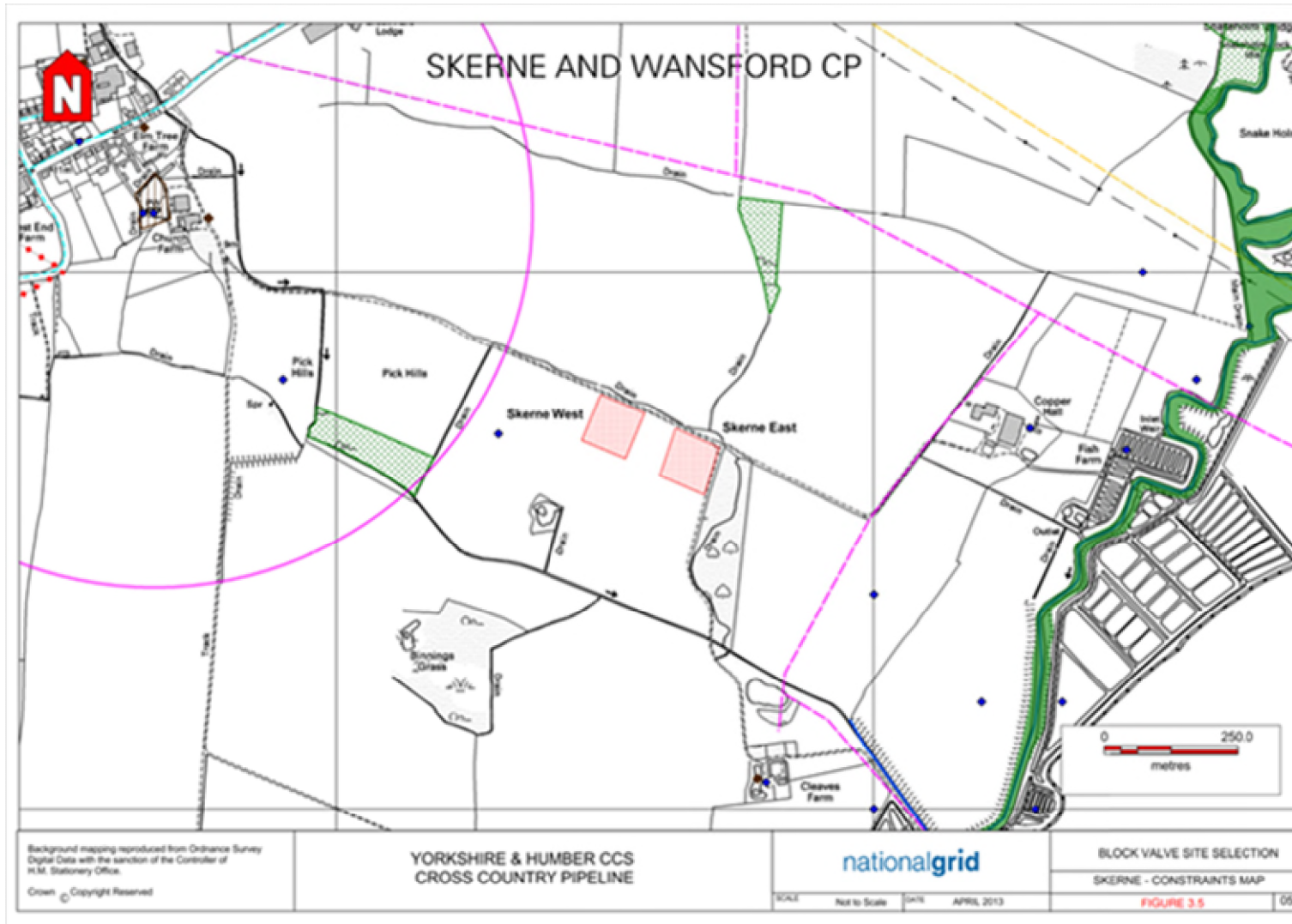
Considerations for detailed siting included:

- The River Hull which flows South East through Wansford, to the East. This forms part of the River Hull Headwaters Site of Special Scientific Interest (SSSI) which is nationally important as the northern most chalk stream system in Britain;
- Two areas of broadleaved woodland, Pick Hills to the West and a triangle of woodland near Copper Hall (Copper Hall Wood) to the North which are non-statutory Local Wildlife Sites (LWS);
- Yorkshire Wildlife Trust's River Hull Headwaters Living Landscape (an area identified by the Wildlife Trust as important for wildlife and with the potential to be enhanced for biodiversity);
- The Grade I Listed Building, Church of St Leonard in Skerne;
- An undesignated monument record site identified as possible Second World War bomb craters;
- A Mineral Safeguarding Area for sand and gravel;
- Units of in-filled land with water near Church Farm;
- Access tracks for fish farms at Copper Hall and Cleaves Farm (Humberside Fisheries). These tracks are also public bridleways and connect to the public highway at Main Street, Skerne, on the eastern edge of the village; and
- The villages of Wansford and Skerne located to the North East and West respectively.

Two potential locations were identified (see Figure 3.5). Both had similar constraints, the main distinguishing factors relating to:

- Access to the public highway; and
- Inconspicuous position of the potential block valve and potential for screening.

Taking into account the better screening potential afforded to Skerne East by a mature woodland plantation; its location in a field corner leaving a field shape that is easier to farm; and the relatively small length of additional track to accommodate access to the site compared to Skerne West, Skerne East was taken forward to the statutory consultation.



#### 3.4.4 Barmston Pumping Station

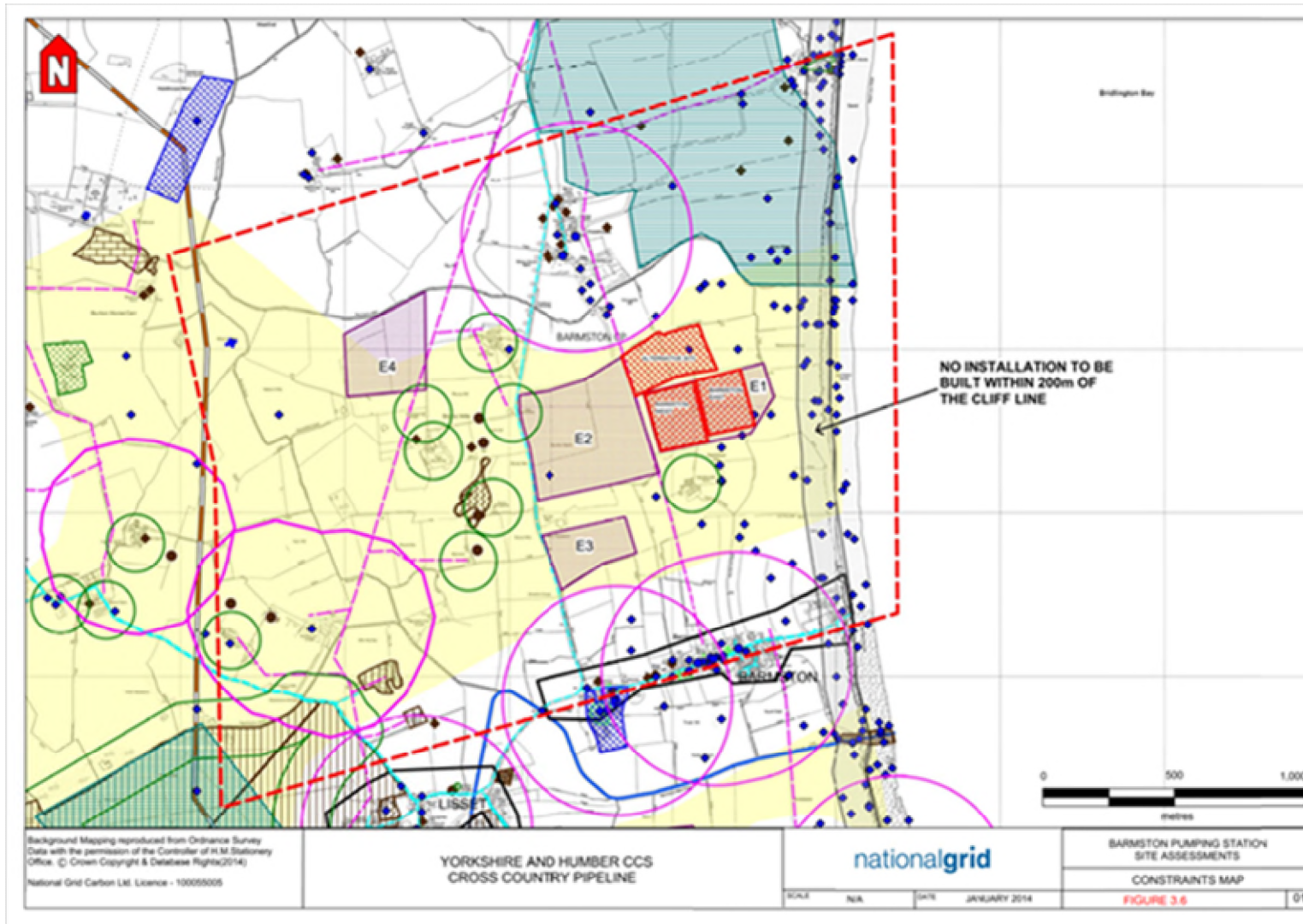
The Preferred Site Option for the Pumping Station was located within arable farmland to the North of Hamilton Hill, approximately 1.5km from Barmston to the South and 1km from Fraisthorpe to the North West.

Considerations for detailed siting included:

- A potential candidate Local Wildlife Site (LWS) noted by the North & East Yorkshire Ecological Data Centre (NEYEDC) c.600m North East;
- Protected species surveys, conducted to date, which indicate the presence of water vole in ditches to the West of the Site Option;
- Woodland and trees to the South which have been identified as having potential to support foraging and commuting bats (confirmation surveys have not yet been completed);
- A number of undesignated monument record sites identified along the south-eastern boundary ranging in age from World War II (WWII) defences to late prehistoric period. These include flint finds. These are indicative of archaeological potential (although no notable features have been identified during geophysical surveys), as well as potential for unexploded ordnance. A WWII pill box (moderate UXO potential) has been identified within the eastern boundary of the Site Option;
- Areas of high UXO potential (minefield and offshore munitions disposal sites) identified immediately to North East. The extent of the onshore area is unclear;
- The relatively flat to gently undulating, open, landscape with limited tree cover allowing views towards the site from the A165 and adjacent properties to the West. An adjacent mature woodland plantation and Hamilton Hill provide screening from properties in Barmston village to the South; and hedgerows interspersed with mature mixed deciduous trees along the northern boundary would provide some partial screening from properties on the edge of Fraisthorpe to the North; but the Site Option is open to the West;
- Rising topography to form a shallow ridge to the East before descending to a drain along the far eastern boundary, this screens views to/from the beach to the East from the western part of the Site Option;
- A Mineral Safeguarding Area for sand and gravel;
- Public footpaths and a permissive path which runs along Sands Road c.300m to the North;
- The beach c. 350m to the East which is a popular recreational resource; and
- Fraisthorpe village which is located approximately 1km to the North West, and Barmston village approximately 1.2km to the South.

The Onshore and Offshore Schemes will join at the Mean Low Water Mark. As the Preferred Siting Option Area for the Pumping Station was to the North of Barmston a landfall location was required in this area. The emerging landfall location evolved through consideration of onshore and offshore environmental and technical constraints, including those identified during previous stages of project development. Two potential locations for a Pumping Station site were identified (see Figure 3.6), both having similar constraints. Taking into consideration the better screening potential afforded to Barmston West by topography, mature woodland and trees; and the shorter access required to connect to the public highway; this site was taken forward to the statutory consultation.

# K32 - Onshore Transport Pump Station & Above Ground Installation - Plot Plan



## 4 Above Ground Facilities

### 4.1 Drax PIG Trap

Pipeline Safety Regulations require that a pipeline must be designed so that it can be maintained and inspected safely. The mechanism for provision of safe maintenance and inspection is by using a Pipeline Inspection Gauge (PIG). The purpose of a PIG trap is to provide a facility to launch and receive PIGs used to clean, gauge and inspect the Pipeline. The facility will also allow the Carbon Dioxide received from an emitter to be analysed, filtered and metered.

Emitters wishing to connect into the Onshore Scheme in future will require a PIG trap within their site, a connecting pipeline, and a further PIG trap located within the Multi-junction at the other end of the connecting pipeline. PIG traps are also required at the Multi-junction and within the pumping station site.

#### 4.1.1 Equipment and Landscaping

The PIG Trap facility provides the connection point between the process pipe (carrying Carbon Dioxide from the Capture and Processing Unit) and the 324 mm local transportation pipeline.

The proposed site is located adjacent to the eastern boundary of the proposed new power station, immediately to the north of the existing Drax Power Station complex and west of New Road (unclassified minor road). The site is currently an arable field.

The Drax PIG Trap will be within a security fenced compound of approximately 0.14 ha within a boundary fence of approximately 0.6 ha in total. The area inside the Security fence will comprise an Instrument Building, above ground pipework and internal vehicular access routes. The Instrument Building and above ground pipework within the security fence will be painted or coated olive green.

A domestic scale wind turbine (at a height of 6.5 m) and a satellite dish (at a height of 4.6 m) will be attached to the Instrument Building. Bulkhead type lighting will also be located on the Instrument Building to allow safe access and egress.

Permanent access to the site will be taken via the new power station internal access roads. The site will be operated remotely therefore the access requirements during operation will be infrequent and normally limited to light goods vehicles. There may be a requirement during the operational lifetime to undertake maintenance works which will require the site to be accessed by Heavy Goods Vehicles (HGV).

Landscaping is proposed around the installation between the security fence and boundary fence. Landscape proposals include woodland planting with tree and shrub species that reflect those already in place around the Drax Power Station site, as well as areas of scrub and species rich grassland or meadow to create more ecological diversity and allow inter-visibility within the site while providing screening from properties and public rights of way to the north east.



#### 4.1.2 Drax PIG Trap Drawing

**Table 4.1: Drax PIG Drawings are provided in K32 Supporting Documents**

Document Number		Title
10-2574	PLN-01-0302	DRAX PIG TRAP LOCATION PLAN
10-2574	GA-01-0306	DRAX PIG TRAP PLANNING ARRANGEMENT
10-2574	GA-01-0307	DRAX PIG TRAP ELEVATIONS (N + E)
10-2574	GA-01-0308	DRAX PIG TRAP ELEVATIONS (S + W)
10-2574	ISO-01-0306	DRAX PIG TRAP 3D VISUALISATION (ISOMETRIC)
10-2574	PLN-01-0303	DRAX PIG TRAP ELEVATIONS (OPERATIONAL SITE)
10-2574	PLN-01-0327	DRAX PIG TRAP PLANTING DRAWING

## 4.2 Camblesforth Multi-junction

The Multi-junction will enable the Capture and Processing Unit to connect into the Cross Country Pipeline. The Multi-junction will also facilitate the connection of multiple pipelines from other regional Carbon Dioxide emitters to the Onshore Scheme in the future. A Multi-junction will comprise a buried manifold (section of pipe to which other pipelines would be connected) and above ground PIG traps to service and maintain the interconnecting pipelines.

### 4.2.1 Equipment

The Camblesforth Multi-junction is required to allow the connection of local pipelines carrying Carbon Dioxide from regional emitters to the Cross Country Pipeline.

Given the Government's Policy that the construction of infrastructure needed to support the provision of CCS technology should be sized and located both for the purpose of demonstration and to take account of future demand the Multi-junction has been designed to accommodate up to four pipeline connections with the potential to serve emitters in the Aire Valley and the South Humber Bank, and the proposed Don Valley Power Project (DVPP).

The proposed Multi-junction has therefore been designed to accommodate up to four incoming pipeline connections (four PIG Traps) as well as one outgoing connection (one PIG Trap). Initially the site will accommodate the connection from the Drax Capture and Processing Unit.

The proposed site is currently part of an agricultural field to the south of the A645 and south east of Wade House Lane (unclassified minor road).

The Multi-junction will be located within a security fenced compound of approximately 1.0 ha within a boundary fence of approximately 3.9 ha in total. The area inside the security fence comprises an Instrument Building, two PIG Traps, above ground pipework, a telecommunications satellite dish (mounted on the Instrument Building) and internal vehicular access. The above ground pipework consists of isolation valves and thermal relief valves. The Instrument Building and above ground pipework will be painted or coated olive green.

A 6.5 m high domestic scale wind turbine will be attached to the instrument building and a 3.4 m high pole mounted telecommunications satellite dish mounted on the Instrument Building. On-site lighting will consist of bulkhead lights fitted to the Instrument Building, only illuminated to allow safe access and egress during night time visits. A new permanent 4 m wide stone wide access road will connect the Multi-junction with the A645 via the north of Wade House Lane. The existing junction between the A645 and Wade House lane will be widened to allow appropriate vehicle splays.

The site will be operated remotely therefore the access requirements during operation will be infrequent and normally limited to light goods vehicles although there may be a requirement during the operational lifetime to undertake maintenance works which will require the site to be accessed by Heavy Goods Vehicles (HGV).

#### 4.2.2 Landscaping

Landscape proposals include native woodland and shrub planting, areas of tussocky grassland and wildflower grassland. The woodland planting is in keeping with the blocks of broadleaf plantation that are characteristic of the landscape. Shrub planting, including willow, is in keeping with areas of scrub found around ponds in the local area.

Hedgerows around the site will tie into existing field boundaries. Hedge banks are proposed to provide suitable habitat for Grey partridge which favour thick vegetation to provide cover while foraging for insects. It is proposed to sow a tussocky grass mix on the hedge banks and in open areas around and within the security fence to provide suitable vegetation cover. Hedgerows will also provide a wind break and habitat for farmland birds as well as a supply of berries, nuts and fruit for other wildlife.

The southern boundary of the site will include a line of standard trees and a group of standard and feathered trees located adjacent to the access road. These will provide immediate screening of the Multi-junction site while other planting becomes established.

The area for future PIG Traps will be sown with a wildflower mix until the additional PIG Traps are constructed.

#### 4.2.3 Camblesforth Multi-Junction Drawings

**Table 4.2: Camblesforth Multi-Junction Drawings are provided in K32 Supporting Documents**

Document Number	Title	
10-2574	PLN-01-0326	CAMBLESFORTH MULTI-JUNCTION LOCATION PLAN
10-2574	GA-01-0316	CAMBLESFORTH MULTI-JUNCTION PLANNING ARRANGEMENT
10-2574	GA-01-0317	CAMBLESFORTH MULTI-JUNCTION ELEVATIONS (N + E)
10-2574	GA-01-0305	CAMBLESFORTH MULTI-JUNCTION ELEVATIONS (S + W)
10-2574	ISO-01-0307	CAMBLESFORTH MULTI-JUNCTION 3D VISUALISATION (ISOMETRIC)
10-2574	PLN-01-0325	CAMBLESFORTH MULTI-JUNCTION ELEVATIONS (OPERATIONAL SITE)
10-2574	PLN-01-0328	CAMBLESFORTH MULTI-JUNCTION PLANTING DRAWING

### 4.3 Block Valves

Block Valves need to be located at approximately 15 – 23 km intervals along the Pipeline. Block Valves enable sections of the pipeline to be isolated for planned maintenance or in the event of an emergency. A Block Valve would be located at the beginning of the onshore Cross Country Pipeline within the Multi-junction site; at PIG traps within emitters' sites, initially the new Power Station at Drax; and at the end of the Cross Country Pipeline at the Pumping Station site.

#### 4.3.1 Equipment and Landscaping

Auxiliary valves and pipework would be provided at each site to allow the Block Valves to be maintained without closing the pipeline. All the Block Valves Plots will be surrounded by a 1.2 m high post and rail boundary fence. The Block Valves and associated equipment will be surrounded by a 2.4 m high weld mesh security fence, topped with three strands of barbed wire giving a total height of 2.9 m.

All the Block Valves will be within a security fenced compound of approximately 0.09 ha within a boundary fence enclosing an area of approximately 0.6 ha in total.

For each Block Valve the area inside the security fence will comprise an Instrument Building, below ground pipework, above ground actuators and internal vehicular access routes. The Instrument Building and any above ground pipework and equipment will be painted or coated olive green.

A 6.5 m high domestic scale wind turbine will be attached to each of the Instrument Buildings and a telecommunications satellite dish at a height of 3.4 m above ground level installed on each site.

Access requirements during operation will be infrequent normally limited to light goods vehicles. There may be a requirement during the operational lifetime to undertake maintenance works which will require the sites to be accessed by Heavy Goods Vehicles (HGV).

Landscape proposals have been developed for each of the Block Valve sites; detailed site specific planting schedules accompany the application for DCO consent.

##### 4.3.1.1 Tollingham Block Valve

The proposed Tollingham Block Valve site is located within the southeast corner of a field south of Skiff Lane (unclassified minor road), west of the former RAF Holme-on-Spalding-Moor airfield. The site is currently flat low lying agricultural land.

A new permanent stone access road will connect the Block Valve with the public highway at Skiff Lane. A new junction with Skiff Lane will allow appropriate vehicle splays.

Landscape proposals include native woodland planting with tree and shrub species that reflect those already existing in the vicinity. The woodland planting will form a visual extension of the existing woodland adjacent to the eastern boundary of the site. A wider area of planting to the north provides screening of the site from Skiff Lane and the properties to the north. Hedge planting around the periphery of the site fits with the existing field boundaries. The northern site boundary includes standard trees to provide a level of

immediate screening while other planting becomes established. The banks of Throlam drain have been left clear of planting.

#### 4.3.1.2 Tollingham Block Valve Drawings

**Table 4.3: Tollingham Block Valve Drawings are provided in K32 Supporting Documents**

Document Number		Title
10-2574	PLN-01-0304	TOLLINGHAM BLOCK VALVE LOCATION PLAN
10-2574	GA-01-0319	TOLLINGHAM BLOCK VALVE PLANNING ARRANGEMENT
10-2574	GA-01-0320	TOLLINGHAM BLOCK VALVE ELEVATIONS (N + E)
10-2574	GA-01-0321	TOLLINGHAM BLOCK VALVE ELEVATIONS (S + W)
10-2574	ISO-01-0308	TOLLINGHAM BLOCK VALVE 3D VISUALISATION (ISOMETRIC)
10-2574	PLN-01-0323	TOLLINGHAM BLOCK VALVE ELEVATIONS (OPERATIONAL SITE)
10-2574	PLN-01-0329	TOLLINGHAM BLOCK VALVE PLANTING DRAWING

#### 4.3.1.3 Dalton Block Valve

The proposed Dalton Block Valve site is located in the south east corner of an agricultural field to the south of Lund Wold Road (unclassified minor road) and north of Holme Wold Road (unclassified minor road). The site is located within and bordered to the south by Bulmers Triangle Plantation. The site slopes down to the south to a shallow valley and some levelling and cut and fill will be required to create a level site.

A new permanent 4 m wide stone access road will connect the Block Valve with the public highway at Lund Wold Road. A new junction with Lund Wold Road will allow appropriate vehicle splays.

The landscape proposals include native woodland planting with tree and shrub species that reflect those already in the vicinity. The woodland planting will tie into the existing plantation to the south east and hedgerows around the site will connect with existing hedgerow boundaries.

#### 4.3.1.4 Dalton Block Valve Drawings

**Table 4.4: Dalton Block Valve Drawings are provided in K32 Supporting Documents**

Document Number		Title
10-2574	PLN-01-0308	DALTON BLOCK VALVE LOCATION PLAN
10-2574	GA-01-0322	DALTON BLOCK VALVE PLANNING ARRANGEMENT
10-2574	GA-01-0323	DALTON BLOCK VALVE ELEVATIONS (N + E)
10-2574	GA-01-0324	DALTON BLOCK VALVE ELEVATIONS (S + W)
10-2574	ISO-01-0309	DALTON BLOCK VALVE 3D VISUALISATION (ISOMETRIC)
10-2574	PLN-01-0324	DALTON BLOCK VALVE ELEVATIONS (OPERATIONAL SITE)
10-2574	PLN-01-0331	DALTON BLOCK VALVE PLANTING DRAWING

#### 4.3.1.5 Skerne Block Valve

The proposed Skerne Block Valve site is located to the southeast of the village of Skerne. The site is within agricultural land bordered to the north and east by the access track to Copper Hall which also accommodates a Public Right of Way. A woodland block is located to the east of the site and a drain which discharges into the River Hull is located approximately 200 m to the south of the site.

A new permanent 4 m wide stone access road will connect the Block Valve with the public highway at Main Street Skerne. The existing track between main Street Skerne and Copper Hall will be developed into an access road from main Street Skerne to the Block Valve entrance gates. The existing junction between the existing access track and main Street Skerne will be modified to allow appropriate vehicle splays.

Landscape proposals include native woodland planting with tree and shrub species that reflect those already existing in the vicinity. The woodland planting will tie into the existing woodland plantation to the east of the site. The hedgerows will fit with the existing field boundaries. The northern boundary of the site includes standard trees these will provide some immediate screening of the site whilst the other planting becomes established. This is in keeping with the surrounding hedgerows that are characterised by mature hedge trees.

#### 4.3.1.6 Skerne Block Valve Drawings

**Table 4.5: Skerne Block Valve Drawings are provided in K32 Supporting Documents**

Document Number		Title
10-2574	PLN-01-0310	SKERNE BLOCK VALVE LOCATION PLAN
10-2574	GA-01-0325	SKERNE BLOCK VALVE PLANNING ARRANGEMENT
10-2574	GA-01-0326	SKERNE BLOCK VALVE ELEVATIONS (N + E)
10-2574	Ga-01-0327	SKERNE BLOCK VALVE ELEVATIONS (S + W)
10-2574	ISO-01-0310	SKERNE BLOCK VALVE 3D VISUALISATION (ISOMETRIC)
10-2574	PLN-01-0322	SKERNE BLOCK VALVE ELEVATIONS (OPERATIONAL SITE)
10-2574	PLN-01-0330	SKERNE BLOCK VALVE PLANTING DRAWING

#### 4.4 Barmston Pumping Station

A Pumping Station is required to maintain the pressure of liquid Carbon Dioxide within the pipeline for transportation offshore and to enhance the volumes of Carbon Dioxide that can be transported by the pipeline for offshore storage should other emitters connect into the Onshore Scheme in the future.

##### 4.4.1 Equipment and Landscaping

The proposed Pumping Station site is located on relatively flat agricultural land approximately 1.3 km to the north of Barmston and 0.75 km to the southeast of Fraisthorpe. The site comprises of approximately 14.7 hectares of land, made up from three agricultural fields, accessed off the A165 Bridlington Road via Sands Road.

The Pumping Station will include two Pump Buildings( sized to house four pumps), an administration building, a workshops, a switch house, a nitrogen/air building, eight Variable Speed Drive (VSD) Units (prefabricated), a substation, and above and below ground pipework and PIG Traps.

A 6.5 m high domestic scale wind turbine will be attached to each of the Instrument Buildings and a telecommunications satellite dish at a height of 3.4 m above ground level installed.

The buildings, above ground pipework and areas of hard standing cover only approximately 17% of the total site area. The remaining 83% of the site will be landscaped, including the creation of a sculpted landform which will enclose the site into the wider landscape setting and in response to views of the site from the A165 and Fraisthorpe.

The site will be accessed from Sands Road which connects with the A165, Bridlington Road. A new junction will connect the access roads with Sands Road which will accommodate the appropriate vehicle splays.

The two Pump Buildings are located in the centre of the site. The buildings are designed in a way which can be constructed in phases as and when they are required. The Pump Buildings house pumping units which will process the Carbon Dioxide from the incoming pipeline and re-pressurise it for onward transportation.

The administration building contains office and welfare facilities for staff and visitors and a control room for maintenance personnel. The building is connected to the site workshop and switch house and has been positioned adjacent to the roadway in the same manner as a modern farmstead.

The nitrogen air building contains compressors, condensers and dryers to process air via the receivers into nitrogen and instrument air for purging, dry gas seals and instrumentation purposes.

A Variable Speed Drive (VSD) is either an electrical or mechanical component, typically housed within a metal clad enclosure. It is required to allow the speed of a pump, and hence its output, to be varied in response to changing flow or pressure requirements. The preferred design solution, either mechanical or electrical VSDs will be defined during the detailed design. Up to eight VSDs will be required.

Provision has been made for up to three transformers and switch gear within the substation enclosure.

Other ancillary buildings include an instrument building and analyser bottle store. A vent stack is located in the centre of the site. This will be 300 mm in diameter and 8 m high.

All the buildings on the site are single storey but have varying heights to suit their engineering requirements.

Internal access routes provide access to the main buildings. The ancillary buildings and above ground pipework is accessed via pedestrian access routes which link to the internal vehicular access routes.

The site will be operated remotely therefore the access requirements during operation will be infrequent normally limited to light goods vehicles.

A soft landscape design will use a range of trees and shrub species, typical of the local landscape character to supplement existing field boundaries and trees. This will include a proportion of native evergreen species to aid year round visual screening and integration of the site. Grass and wildflower species mixes will be reflective of the existing surrounding agricultural landscape and be designed to enhance biodiversity. Species rich grassland and shade /moisture tolerant ground flora will also be sown in key areas to enhance biodiversity at field margins.

#### 4.4.1.1 Barmston Pumping Station Drawings

**Table 4.6: Barmston Pumping Station Drawings are provided in K32 Supporting Documents**

Document Number	Title
10-2574 PLN-01-0340	BARMSTON PUMPING STATION LOCATION PLAN
10-2574 PLN-01-0341	BARMSTON PUMPING STATION Illustrative Site Layout
10-2574 PLN-01-0342	BARMSTON PUMPING STATION PUMPING BUILDINGS A-H
10-2574 PLN-01-0343	BARMSTON PUMPING STATION ADMINISTRATION, WORKSHOP SWITCHHOUSE BUILDINGS
10-2574 PLN-01-0344	BARMSTON PUMPING STATION NITROGEN AIR BUILDINGS
10-2574 PLN-01-0345	BARMSTON PUMPING STATION PROPOSED SITE SECTIONS
10-2574 PLN-01-0350	BARMSTON PUMPING STATION INDICATIVE LANDSCAPE STRATEGY

## 5 Glossary

Abbreviations	Meaning or Explanation
<b>AGI</b>	Above Ground Installations
<b>CCS</b>	Carbon Capture and Storage
<b>CPL</b>	Capture Power Limited
<b>DECC</b>	The UK Government's Department of Energy and Climate Change
<b>EBD</b>	National Grid's European Business Development group.
<b>EEPR</b>	European Energy Programme for Recovery
<b>EIA</b>	Environmental Impact Assessment
<b>FEED</b>	Front End Engineering Design
<b>FEED Contract</b>	Contract made between DECC and CPL pursuant to which WR Project FEED (as defined) will be performed.
<b>KKD</b>	Key Knowledge Deliverable
<b>KSC</b>	Key Sub-Contract
<b>NGC</b>	National Grid Carbon Limited
<b>NGC EPC Sub-contractors</b>	Contractors providing an offer to develop a part of the WR T&S Assets in pursuance of the WR Development Project.
<b>NGC FEED Sub-contractors</b>	Contractors entering into a contract with NGC to carry out a part of the obligations under the KSC.
<b>NGC KSC</b>	Contract made between CPL and NGC pursuant to which that part of the WR Project FEED (as defined) which appertains to the WR T&S assets will be performed.
<b>NGC KSC Deliverables</b>	A number of documents and services, the delivery of which is a contractual obligation under the KSC.
<b>NGC Technical Assurance Team</b>	EBD team responsible for providing independent technical auditing and peer review services to the WR T&S FEED Project.
<b>NGC WR Team</b>	The NGC team established to meet the obligations in the KSC.
<b>PIG</b>	Pipeline Inspection Gauge: a unit, which is inserted into the pipeline, to clean and/or monitor the inner bore surface of the pipe.
<b>PIG Trap</b>	A facility to allow PIGs to be inserted into and removed from the pipeline.
<b>Plot Plans</b>	Drawings outlining the arrangement of plant items and associated features including vehicle parking, materials storage, cabins and welfare facilities and any soft landscaping.
<b>WR</b>	White Rose
<b>WR Assets</b>	All those assets that would be developed pursuant to the WR Project
<b>WR Development Project</b>	A project to develop, operate and decommission the WR Assets which may transpire following the completion of the WR FEED Project.
<b>WR FEED Project</b>	Project to carry out a FEED (as defined in the FEED Contract) with regard to the WR Assets.
<b>WR Project</b>	White Rose CCS Project
<b>WR T&amp;S Assets</b>	That part of the WR Assets which would carry out the carbon dioxide transportation and storage functions of the WR Project and to which the KSC Contract relates.
<b>WR T&amp;S FEED Project</b>	The project to be pursued by NGC in order to meet its obligations under the NGC KSC.
<b>RCS</b>	Route Corridor Study
<b>SAC</b>	Special Area of Conservation
<b>SSSI</b>	Sites of Special Scientific Interest
<b>T&amp;S</b>	Transport and Storage